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A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

ENVIRONMENTAL STATEMENT
VOLUME 3A: TECHNICAL APPENDICES

July 2020

Volume 3A

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Welsh Government

A40 Penblewin to Redstone Cross Improvements

Traffic Forecasting Report

A40PRC-ARP-HGN-M02-RP-TR-0002

P02 | S3

13/03/20

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 The Project

1.1 Context

1.1.1 In December 2004, the Welsh Government announced the outcome of the A40 West of St Clears study into the consideration of both single carriageway and dual carriageway improvements to the A40 between St Clears and Haverfordwest. This study came about as a result of a number of previous reports that all concluded that the A40 needed improvement.

1.1.2 In February 2017, the Welsh Government appointed Carillion, with Arup and RML (the 'Carillion Team') as their technical and environmental advisors, to develop the design of the proposed A40 Llanddewi Velfrey to Penblewin Improvements up to publication of draft Orders.

1.1.3 Carillion entered liquidation in January 2018. The Welsh Government subsequently appointed Arup, supported by RML, to continue the development of the design up to publication of draft Orders and to support the Welsh Government through the Statutory process.

1.1.4 Further to this, Arup, supported by RML were instructed by Welsh Government in January 2019, to progress all works necessary to facilitate design development, environmental impact assessment and publication of draft Orders for a WS2+1 solution between Penblewin Roundabout and Redstone Cross.

1.2 Project history

1.2.1 In December 2004, the Minister announced the publication of his Addendum to the 2002 Trunk Road Forward Programme (TRFP) and this included two major single carriageway improvement schemes for the A40 west of St Clears. The improvements would use the 2+1 configuration allowing overtaking on the two lane direction, with overtaking prohibited in the one lane direction and would be delivered in the following phases:

a) A40 Penblewin - Slebech Park
b) A40 Llanddewi Velfrey - Penblewin.

1.2.2 The first of these projects, Penblewin - Slebech Park, was completed in March 2011.

1.2.3 In July 2013, Edwina Hart AM CStJ MBE, Minister for Economy, Science and Transport, published a written statement outlining her priorities for Transport. The statement included the following:

"Improving the A40 has been identified as a priority by the Haven Waterway Enterprise Zone Board and I intend to undertake further development of previously proposed improvements."

1.2.4 On 12 November 2014, in providing an update on the closure of the Murco Refinery in Milford Haven, the Minister made an oral Statement in Plenary:

"In terms of transport links, I have instructed my officials to accelerate to the fullest extent possible the programme for delivering improvements at Llanddewi Velfrey."

1.2.5 In June 2015, in a written statement on the A40 Improvement Study the Minister noted *"It is my intention to progress delivery of the A40 Llanddewi Velfrey to Penblewin scheme as soon as possible…"*

1.3 The problems

1.3.1 The following problems have been identified in collaboration with the A40 Llanddewi Velfrey to Penblewin Improvements Scheme and early public engagement for the A40 Penblewin to Redstone Cross Improvements Scheme:

a) The A40 mainline and Redstone Cross Junction is substandard
b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.
c) Occasional convoys of heavy goods vehicles from the ferry ports and slow moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.
d) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.
e) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road.

f) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.

g) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

1.4 Scheme objectives

1.4.1 A number of strategic transport planning objectives have been developed iteratively during the previous A40 Improvement Schemes, and specifically the A40 Llanddewi Velfrey to Penblewin. During the early stages of the A40 Penblewin to Redstone Cross Improvements Key Stage 3, these objectives were refreshed to consider both the strategic and local transport planning aspects for the Redstone Cross Area. The scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (and perceived safety) and reduce the number and severity of A40 mainline collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

1.5 Purpose of this report

1.5.1 This report presents the development of future year traffic forecasts, which provide inputs into the operational, social, economic and environmental assessments for the A40 Redstone Cross to Penblewin Improvements. It provides a description of the methods and assumptions used in preparing the forecasts. Scheme evaluation is undertaken through comparison of a 'Do Something' case against a 'Do Minimum' case (the future year scenario without the proposed improvements).

1.6 Report structure

1.6.1 After this introduction, the report comprises of the following chapters:

Chapter 2 - Model background;

Chapter 3 - Future year highway network;

Chapter 4 - Future year travel demand;

Chapter 5 - Forecast traffic assignments; and

Chapter 6 - Conclusions.

2 Model Background

2.1 Overview

2.1.1 The model used to form the basis of the forecasting work is the A40 Penblewin to Redstone Cross base year transport model which has been validated in accordance with the Department for Transport's WebTAG[1]. The development and validation of the base year model is detailed in the Local Model Validation Report (LMVR)[2] .The Traffic assignments were prepared using SATURN (Simulation and Assignment of Traffic to Urban Road Networks) software version 11.4.07.

2.1.2 The traffic model provides a representation of the highway network within the study area, the traffic using it and the resulting traffic conditions.

2.1.3 Three future years have been defined for the traffic, namely the assumed year of scheme opening, 2022, a design year which is the fifteenth year after scheme opening, in this case 2037, and a 'horizon' year of 2051. The 'horizon' year was chosen as 2051 on the basis that no data is available in the Department for Transport's National Trip End Model (NTEM) beyond this year.

2.1.4 The need for inclusion of variable demand modelling in producing the traffic forecasts was reviewed as part of the base model validation. As noted in the LMVR, it was concluded that because of the strategic nature of the route, most traffic using it travels considerable distances. This, together with the isolated rural nature of the study area means that the scheme is not expected to have an appreciable effect on variable demand model responses such as mode switch, destination choice, trip frequency changes or trip retiming. As such, a traffic assignment based on a fixed forecast demand matrix is considered appropriate for this scheme.

[1] Transport Analysis Guidance, Unit M3.1, Highway Assignment Modelling, Department for Transport, January 2014
[2] A40 Penblewin to Redstone Cross Improvements, Local Model Validation Report, Ove Arup & Partners, December 2019

2.2 Model study area

2.2.1 Given the relatively small scale of time savings that are expected as a result of the A40 Penblewin to Redstone Cross Improvements scheme, the likelihood of traffic switching from alternatives routes onto the A40 corridor once the scheme is completed is expected to be negligible. The study area of the traffic model is therefore confined to the A40 corridor between the Canaston Bridge roundabout and Whitland, as shown in Figure 2.1.

2.3 Zone system

2.3.1 The definition of the study area zone system was based as far as possible on the homogeneity of land uses within zones and the consistency of access points onto the modelled network. It was also designed to be consistent with planning authority boundaries.

2.3.2 The A40 Penblewin to Redstone Cross SATURN model contains a total of 26 zones. The zone system is illustrated in Figure 2.2. Zones are smaller in built up areas around Narberth and Llanddewi Velfrey and larger in rural areas and in areas away from the proposed scheme.

2.4 Modelled time periods

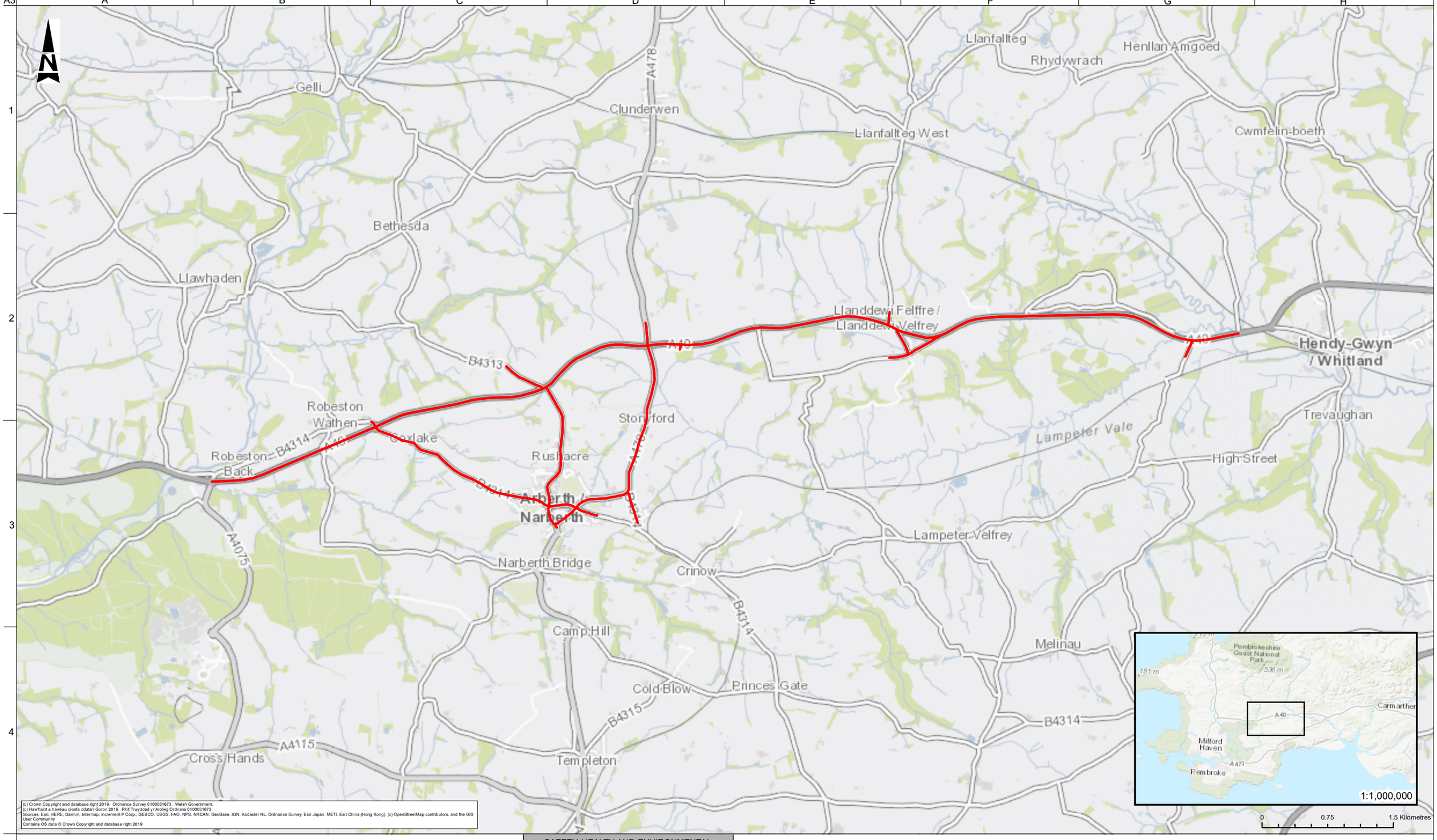
2.4.1 Separate models have been developed for the morning and evening peak hours and an average inter peak hour. The peak hours were identified by analysing the available traffic count data within the study area as outlined in the Initial Traffic and Accident Data Report[3]. The assignment model represents the following time periods:

a) AM Peak Hour – 08:00 to 09:00;

a) Inter Peak Hour – average hour between 10:00 and 16:00; and

b) PM Peak Hour – 17:00 to 18:00.

[3] A40 Penblewin to Redstone Cross Improvements, Initial Traffic and Accident Data Report, Ove Arup & Partners, November 2019



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STUDY AREA

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None

Maintenance / Cleaning

None

Use

None

Decommissioning / Demolition

None

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Project Title

A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client

Llywodraeth Cymru
Welsh Government

Delivery Team

ARCADIS · MOTT MACDONALD · ARUP · RICHARDS PARTNERSHIP

Drawing Title

FIGURE 2.1
STUDY AREA

Suitability

S4 | **SUITABLE FOR STAGE APPROVAL**

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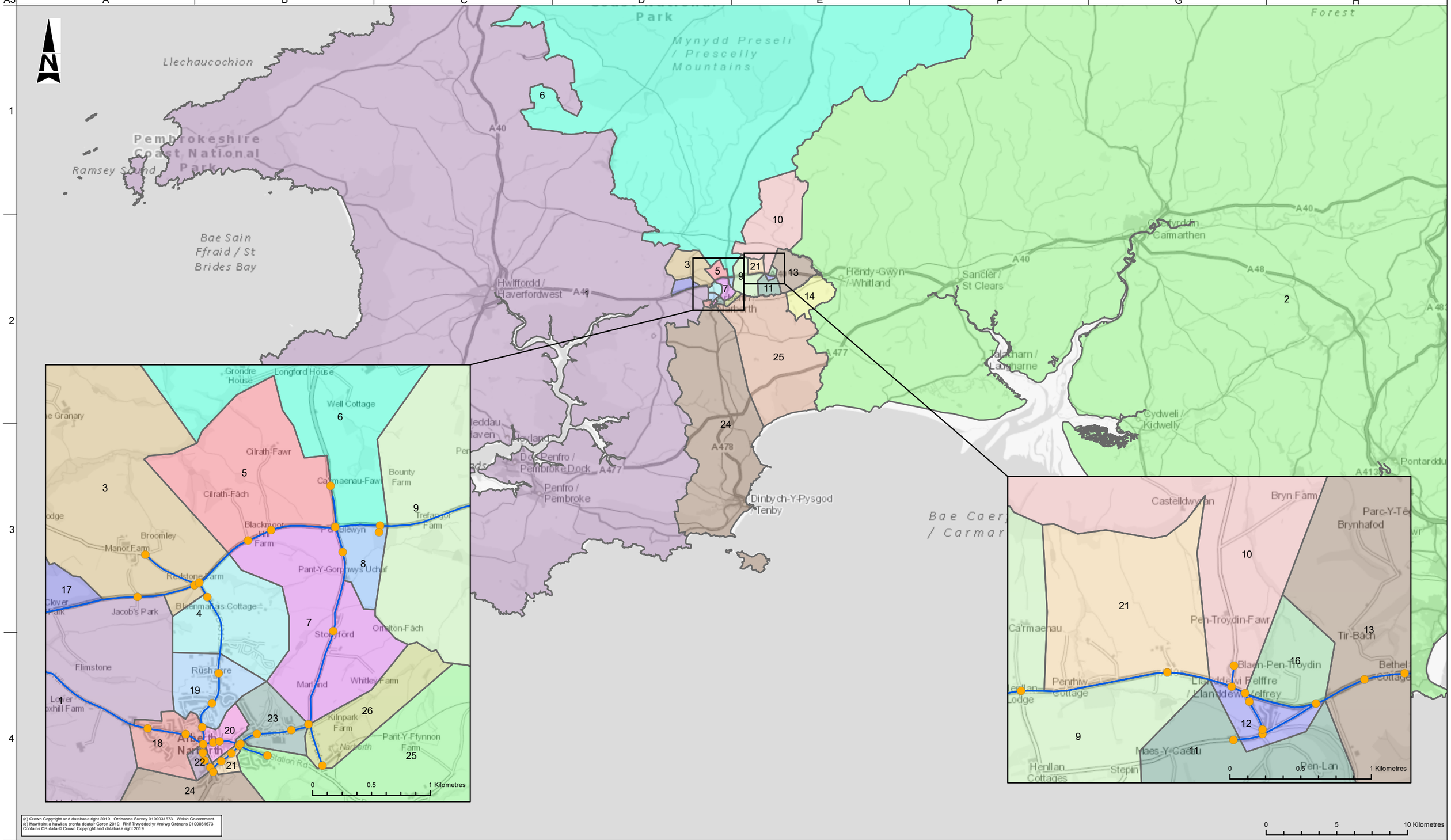

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LEGEND

1 2 3 4 5 6 7 8 9 10 11 12 13 14 16 17 18 19 20 21 22 23 24 25 26

NODES

LINKS

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Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Delivery Team
ARCADIS · MOTT MACDONALD · ARUP · RICHARDS

Drawing Title
FIGURE 2.2
ZONE PLAN

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

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Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
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Name: A40PRC - ARP - VTR - SWI - DR - TR - 0049
(Project | Originator | Volume | Location | Type | Role | Number)

2.5 Annualisation factors

2.5.1 Although traffic modelling is undertaken on representative hourly flows by time period, traffic flow data is often required for longer time periods to inform other aspects of the scheme design and appraisal, such as the environmental assessments and the pavement design.

2.5.2 Annual average daily traffic (AADT) and 18-hour annual average weekday traffic (18-hour AAWT) are the required inputs for air quality and noise assessment respectively. The 18-hour AAWT represents the hours of 06:00 to 24:00 on an average weekday.

2.5.3 The automatic traffic count (ATC) collected as part of the roadside interview (RSI) along the A40 has been used to derive factors to undertake the conversion from modelled hours to daily flows. The additional conversion from the modelled time of year of June / July to annual average traffic conditions was derived from a permanent traffic count on the A40 at Whitland Bypass. That same source was used to derive the conversion factor from AADT to 18-hour AAWT. These factors are given in Table 2.1 below.

Table 2.1 Conversion factors for derivation of AADT and 18-hour AAWT

Conversion	Factor
AM Peak Hour (08:00-09:00) to AM Peak Period (07:00-10:00)	2.556
Average Inter Peak Hour (10:00-16:00) to Full Inter Peak Period (10:00-16:00)	6.000
PM Peak Hour (17:00-18:00) to PM Peak Period (16:00-19:00)	2.572
12 Hour Weekday (07:00-19:00) to 24 Hour Weekday (00:00-24:00)	1.190
Monday-Thursday 24 Hour Average to Monday-Sunday 24 Hour Average	0.989
June / July to Annual Average Daily Traffic	0.970
Annual Average Daily Traffic to 18 Hour Annual Average Weekday Traffic	1.030

2.5.4 Using the factors from Table 2.1, the formula used to calculate the AADT is:

$$AADT = (AM*2.556+IP*6.000+PM*2.572)*1.190*0.989*0.970$$

where AM, IP, PM are the modelled flows by time period.

2.6 User classes

2.6.1 Different types of journey are likely to display different characteristics in terms of trip distribution and growth patterns. For this reason, travel demand in the model was split into the following five user classes:

a) Cars – Employer's Business;
b) Cars – Commuting;
c) Cars – Other Purposes (including leisure, shopping and personal business trips);
d) Light Goods Vehicles (LGVs); and
e) Heavy Goods Vehicles (HGVs).

2.7 Generalised costs

2.7.1 The generalised cost of travel is based on a combination of factors that drivers take into account when choosing routes, mainly time and distance. Generalised cost parameters are used in a SATURN model to represent travellers' value of time and distance, using the following generalised time formulation:

Generalised Time = Time + (PPK/PPM) * Distance + Toll / PPM

where PPM = pence per minute; and

PPK = pence per kilometre.

2.7.2 Values of PPK and PPM can be set universally for the entire model or individually by user class. Where a choice of route exists (as in nearly all cases) these values are used to determine which available route has a lower 'cost' to the traveller. Thus, if the PPK value is high, then low cost routes will be those which minimise distance, and conversely if PPM is high low-cost routes will be those that minimise the travel time.

2.7.3 Transport Analysis Guidance (TAG) Unit A1.3[4] provides monetary values of time, which can be used to derive values of time in an assignment model in terms of PPM. It also provides parameters to calculate fuel costs and non-fuel vehicle operating costs. When added together, the fuel and non-fuel elements give the total vehicle operating costs in terms of PPK for different transport users. Unit A1.3 states that non-fuel vehicle operating costs are only perceived during work time, and so these have been omitted from the overall calculation of generalised costs for commuting and other trips.

2.7.4 The generalised cost coefficients derived from TAG Unit A1.3 for use in the A40 Penblewin to Redstone Cross forecast model are shown in Table 2.2 below. These were derived from the WebTAG databook published in May 2019. The values are expressed in 2010 perceived prices.

Table 2.2 Forecast generalised cost parameter values

	AM Peak		Inter Peak		PM Peak	
	PPM	**PPK**	**PPM**	**PPK**	**PPM**	**PPK**
2022						
Car, Employer's Business	31.95	11.95	32.74	11.95	32.42	11.95
Car, Commuting	21.43	5.56	21.78	5.56	21.50	5.56
Car, Other	14.78	5.56	15.75	5.56	15.48	5.56
Light Goods Vehicle	22.59	13.70	22.59	13.70	22.59	13.70
Heavy Goods Vehicle	22.93	40.49	22.93	40.49	22.93	40.49
2037						
Car, Employer's Business	41.29	9.66	42.31	9.66	41.89	9.66
Car, Commuting	27.69	4.60	28.14	4.60	27.79	4.60
Car, Other	19.10	4.60	20.35	4.60	20.01	4.60
Light Goods Vehicle	29.19	13.08	29.19	13.08	29.19	13.08
Heavy Goods Vehicle	29.63	43.43	29.63	43.43	29.63	43.43
2051						
Car, Employer's Business	53.93	8.80	55.26	8.80	54.71	8.80
Car, Commuting	36.17	4.15	36.75	4.15	36.29	4.15
Car, Other	24.95	4.15	26.58	4.15	26.13	4.15
Light Goods Vehicle	38.12	12.55	38.12	12.55	38.12	12.55
Heavy Goods Vehicle	38.70	44.95	38.70	44.95	38.70	44.95

[4] Transport Analysis Guidance Unit A1.3, User and Provider Impacts, Department for Transport, March 2017

3 Future Year Highway Network

3.1 Overview

3.1.1 This chapter describes the development of the forecast networks used for the Do Minimum and Do Something scenarios. The future year highway networks were developed for 2022 (scheme opening year), 2037 (scheme design year) and 2051 (horizon year).

3.2 The proposed Scheme

3.2.1 The A40 Penblewin to Redstone Cross scheme comprises a new single carriageway of about 1.8km in length, extending from the existing A40 west of Redstone Cross to the A40/A478 roundabout at Penblewin, as shown in Figure 3.1.

3.2.2 The new road would be designed as a wide single 2+1 carriageway, providing two lanes of travel in one direction and a single lane in the opposite direction to provide more opportunities for overtaking than the existing A40 route. The scheme would be constructed on a new alignment to the south of the existing A40. The new alignment is marginally shorter than the existing route by approximately 40 metres.

3.2.3 Access to Redstone Road would be maintained via a new priority junction along the proposed A40 located to the southwest of the existing Redstone Cross junction.

3.2.4 The scheme would connect to an enlarged 6-arm A40/A478 Penblewin roundabout at the location of the existing A40 arm on the west side of the roundabout. A new minor arm would be added to allow access to the re-classified existing A40.

3.3 Do Minimum network

3.3.1 The definition of the Do Minimum network requires the identification of any committed or probable highway schemes within the study area that should be included in the model forecasts.

3.3.2 A review of proposed highway schemes in the study area identified only the A40 Llanddewi Velfrey to Penblewin Improvements scheme as relevant for inclusion within the study area. The A40 Llanddewi Velfrey to Penblewin Improvements scheme was therefore added to the validated base year model network in order to create the future year Do Minimum network. The Do Minimum model network is shown in Figure 3.2.

3.4 Do Something network

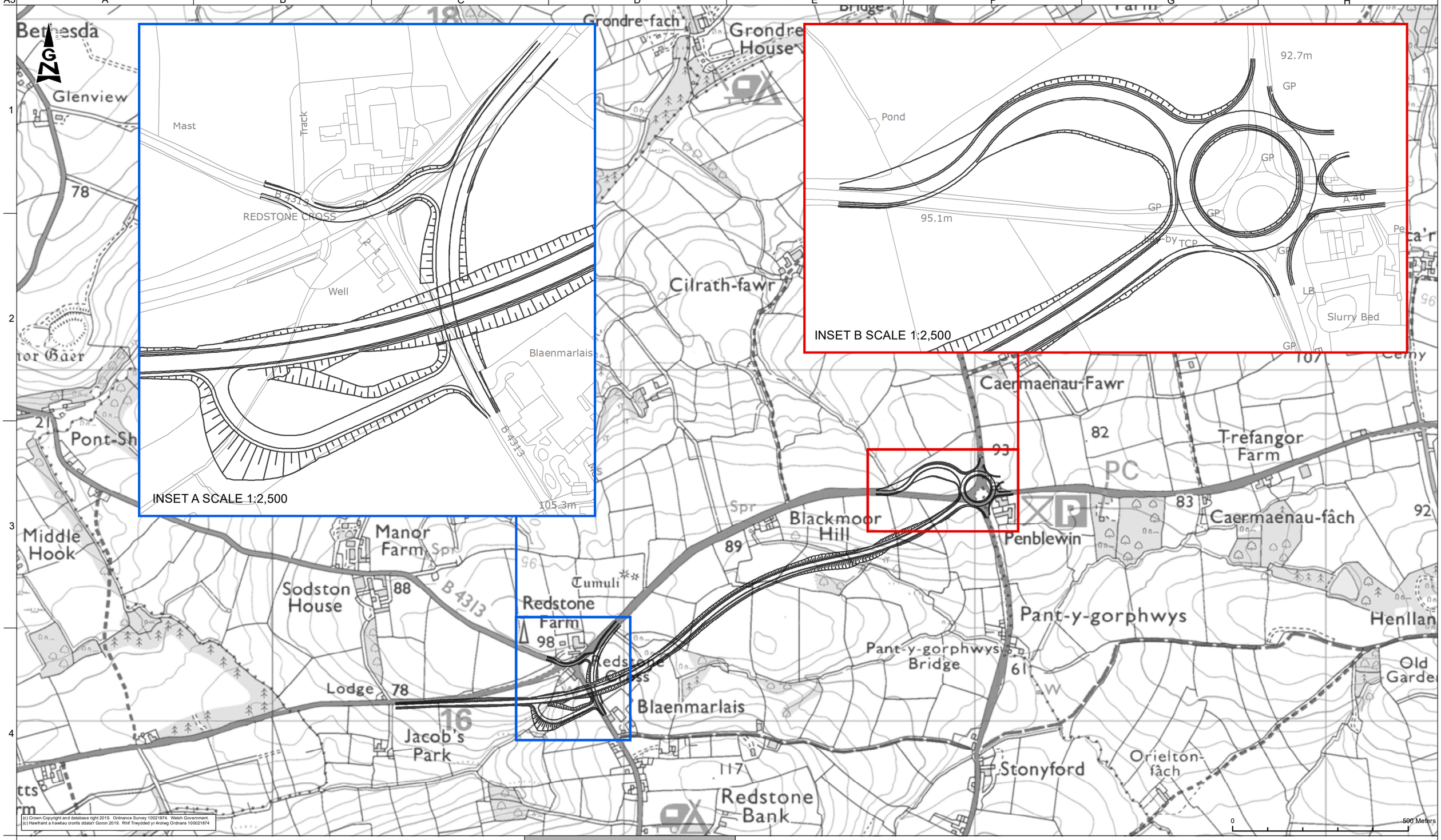
3.4.1 The Do Something network was created by adding the proposed scheme outlined in section 3.2 into the Do Minimum network. Model nodes that were used in the Do Minimum remained in the same location in the Do Something. Several additional nodes were introduced in the Do Something network to represent the scheme and its tie-in points with the existing road network.

3.4.2 The Do Something model network is shown in Figure 3.3.

3.5 Network checks

3.5.1 A detailed review of link distances, speeds and turn saturation flows was undertaken to ensure that the changes between the base network and Do Minimum forecast network correctly capture the inclusion of the A40 Llanddewi Velfrey to Penblewin Improvements scheme.

3.5.2 In the Do Something network the proposed scheme was coded using GIS, with node locations and link distances derived based on an import of the CAD scheme drawings to the GIS software. Link distances along the A40 were checked to ensure that the new scheme was marginally shorter than the existing A40 as shown on the scheme drawings.



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Maintenance / Cleaning
None
Use
None
Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

Drawing Title
FIGURE 3.1
SCHEME DRAWING

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:10,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

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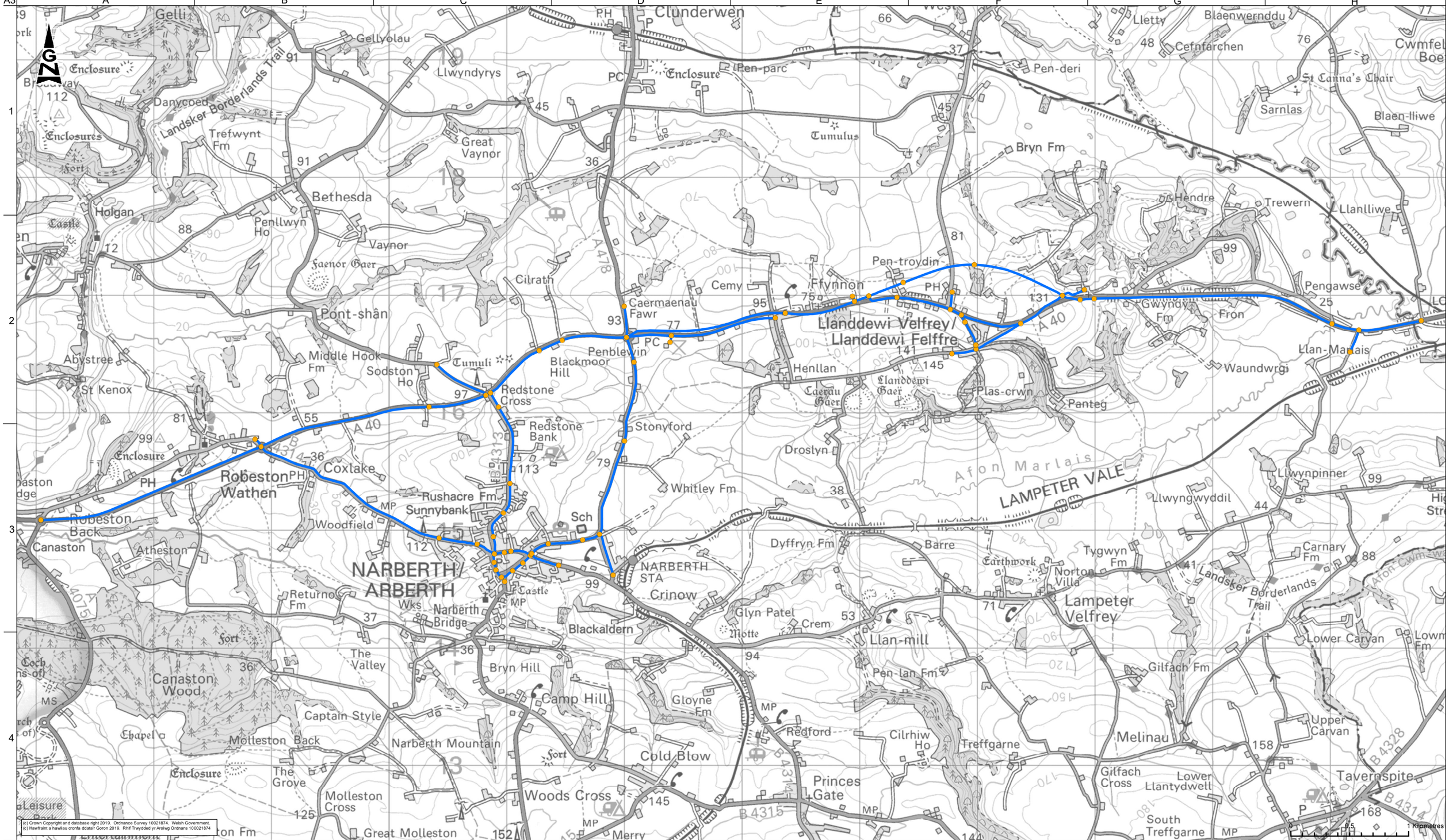
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

- NODES
- LINKS

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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Maintenance / Cleaning
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Use
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Decommissioning / Demolition
None

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Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP

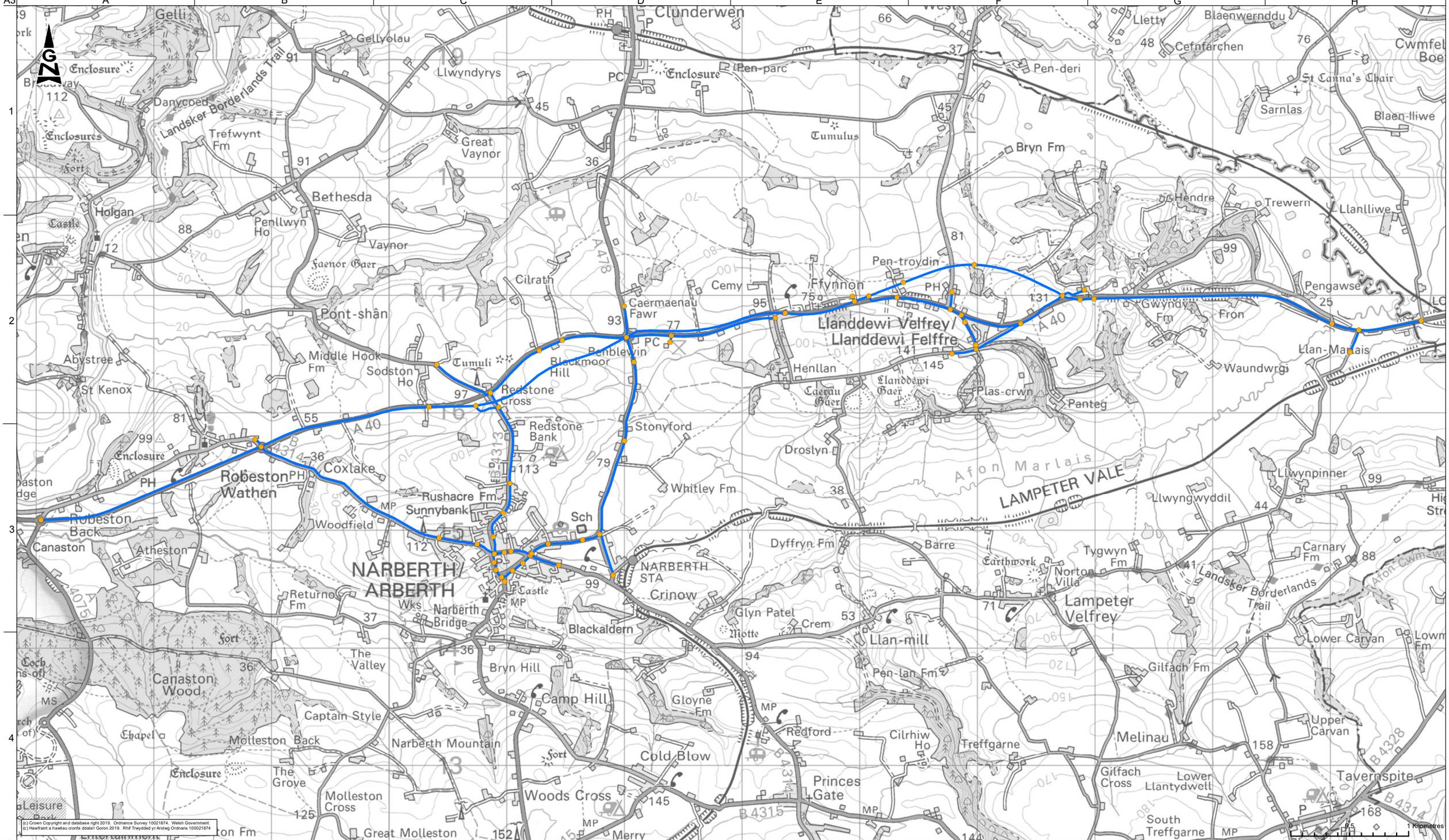
Drawing Title
FIGURE 3.2
DO MINIMUM FORECAST
TRAFFIC MODEL NETWORK

Suitability
S4 | SUTIABLE FOR STAGE APPROVAL

Scale at A3
1:30,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0008
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

- NODES
- LINKS

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

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None

Maintenance / Cleaning

None

Use

None

Decommissioning / Demolition

None

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Drawing Title
FIGURE 3.3
DO SOMETHING FORECAST
TRAFFIC MODEL NETWORK

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3
1:30,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0009
Project | Originator | Volume | Location | Type | Role | Number

4 Future Year Travel Demand

4.1 Overview

4.1.1 The Core Scenario has been developed in line with the principles outlined in TAG Unit M4[5], and are based on:

a) National Trip End Model (NTEM) growth in demand for car traffic, at a suitable spatial level of aggregation;

b) Road Traffic Forecast (RTF) growth in demand for freight traffic;

c) Sources of local uncertainty that are likely to occur; and

d) Appropriate modelling assumptions.

4.1.2 In addition to the Core Scenario, alternative scenarios are required to allow decision makers to understand how scheme performance varies depending on the assumptions made within the assessment. These can include assumptions for high and low growth in travel demand, and optimistic and pessimistic sensitivity tests.

4.1.3 High and low growth scenarios are required to test the impact of uncertainty in projections such as demographic data (population, households and employment), growth in Gross Domestic Product (GDP) and fuel price trends.

4.1.4 Optimistic and pessimistic sensitivity tests may also be used to consider the impact of local uncertainty. This typically depends on whether developments or other planned transport schemes go ahead in the vicinity of the proposed scheme and how much uncertainty is attached to their likelihood of going ahead and size.

4.1.5 Within the study area the effects of local uncertainty are relatively minor and therefore optimistic and pessimistic scenarios were deemed unnecessary, given that high and low growth scenarios already capture uncertainty at a broader scale.

[5] Transport Analysis Guidance Unit M4, Forecasting and Uncertainty, Department for Transport, May 2017

4.2 National trip end model

4.2.1 The National Transport Model (NTM) has been developed by the Department for Transport (DfT) to provide a set of predictions for growth in travel demand at trip end level for a range of different modes of travel: walk, cycle, car drivers, car passengers, bus and train. The results from NTEM are available through an interface called the Trip End Model Presentation Program (TEMPRO). Version 7.2, issued in February 2017, was used to create the forecasts outlined in this report.

4.2.2 NTEM starts from the basis that each one way trip has two ends - an origin and a destination trip end. Trips are categorised as either home based (HB) or non-home based (NHB). NTEM splits these further into 20 trip destination purposes such as work trips, shopping trips, education trips and so on.

4.2.3 Within NTM, Great Britain is broken down into a range of NTEM zones, which are in general a level below district level. Authorities are split further into middle layer super output areas (MSOA).

4.2.4 NTEM is also able to produce datasets for different forecast years and for six different time periods:

a) Weekday AM Peak;
b) Weekday Inter Peak;
c) Weekday PM Peak;
d) Weekday Off Peak;
e) Saturday (all day); and
f) Sunday (all day).

4.2.5 Only one set of growth factors is provided in TEMPRO, representing the central growth case of what is likely to happen to travel demand in the future, based on the assumptions input to NTEM. These are used for the preparation of a Core Scenario.

4.2.6 The factors are based on predicted demographic changes and do not take account of the level of congestion or other factors (such as traffic restraint measures) which may limit the potential for all the demand to use the network without an unrealistic deterioration in travel conditions.

4.3 Development proposals

4.3.1 In line with the approach set out in TAG Unit M4, key development proposals within the study area were identified in order to represent 'pockets of growth' within the forecast traffic assignments.

4.3.2 Government growth projections taken from NTEM and RTF were then reduced accordingly in order to ensure that the overall level of traffic did not exceed the traffic growth data published by the DfT.

4.3.3 A review of Pembrokeshire's Local Development Plan (LDP) was undertaken in order to identify relevant development sites. The LDP was adopted in 2013, with additional more recent documentation available in the form of the Development Sites Supplementary Planning Guidance, which was published in December 2016. The planning horizon of the currently published document is 2021. On that basis it was assumed that the developments identified for inclusion would be completed before the Penblewin to Redstone Cross scheme opens.

4.3.4 Figure 4.1 below shows a map of Narberth highlighting development sites as documented in the adopted LDP. This shows one employment site (in purple), two housing sites (in red) and a retail development (in blue cross hatch).

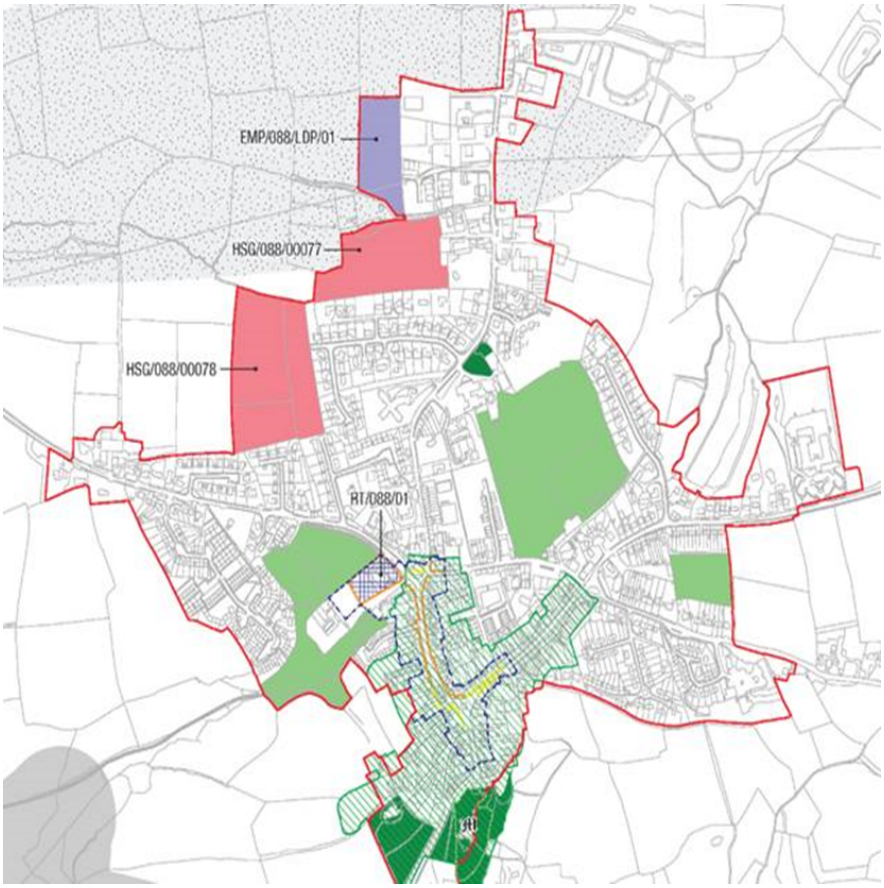


Figure 4.1 Map of development sites around Narberth

4.3.5 The size of the retail development is below the threshold that would warrant its inclusion. Where a specific development is not included in the forecasts the growth in traffic that would be likely to arise from it is instead encapsulated within background growth.

4.3.6 The one employment site and two housing sites have been included in the forecast traffic model. Table 4.1 below lists details of these development sites with regards to their land uses and projected sizes.

Table 4.1 Details of development sites around Narberth

Development ID	Location	Land Use	Size
EMP/088/LDP/01	Rushacre Enterprise Park extension	B1 & B8	1.32 ha
HSG/088/00077	West of Rushacre	C3	58 dwellings
HSG/088/00078	West of Bloomfield Gardens	C3	89 dwellings

4.3.7 The collated information was also used to extract representative car trip rates from TRICS. As part of the trip generation calculations TRICS trip rates were applied to each development to determine total car trip origins and destinations associated with each site.

4.3.8 For the employment site at Rushacre Enterprise Park the exact split of B1 and B8 land uses was not known from the LDP and therefore a 50/50 split was assumed. It was necessary to make an assumption for this because it is only possible to extract TRICS trip rates for B1 and B8 land uses separately.

4.3.9 TRICS trips rates for employment sites are also expressed in terms of Gross Floor Area (GFA) as opposed to the total site hectarage. A plot ratio of 40% was therefore assumed. This is a typical average for employment sites, which means that a GFA of 4,000sqm would be expected per hectare (ha) of site. Therefore, a GFA of 5,280sqm was assumed for the Rushacre Enterprise Park based on its size of 1.32ha.

4.3.10 For the housing sites TRICS trip rates were applied directly to the number of dwellings to derive the total number of car trip origins and destinations associated with both sites.

4.3.11 The trip origins and destinations for all three development sites were then factored down by 10% to account for internal trips, intra-development trips and pass-by trips.

4.3.12 Table 4.2 below shows the resulting car trips associated with each development site calculated using the method outlined in this section. Goods vehicle trips associated with the developments were derived by assuming the split between car and goods vehicles within the existing zones in which the developments were located would be retained. Similarly, the user class proportions applied to the total car trips were taken from the existing traffic in which each development zone was located.

Table 4.2 Car trip end totals associated with new developments (by modelled peak hour)

Development	Time Period	Origin	Destination
Rushacre Enterprise Park extension (EMP/088/LDP/01)	AM Peak	4.5	37.3
	Inter Peak	8.4	7.3
	PM Peak	32.1	2.7
West of Rushacre (HSG/088/00077)	AM Peak	14.2	3.6
	Inter Peak	9.6	9.8
	PM Peak	10.2	19.3
West of Bloomfield Gardens (HSG/088/00078)	AM Peak	21.7	5.5
	Inter Peak	14.7	15.1
	PM Peak	15.6	29.5

4.3.13 The distribution of development traffic was based on the existing traffic within the zones in which each development site was located. For the extension of Rushacre Enterprise Park the distribution of traffic associated with the existing Enterprise Park was used. The distribution of traffic associated with the two housing sites was based on existing residential areas along Redstone Road in the area surrounding each of the development sites.

4.4 Background growth for cars

4.4.1 NTEM was used as the basis for the production of car demand matrices in the three forecast years. The overall level of traffic growth was constrained to NTEM. To achieve this the NTEM growth factors were reduced to take into account the traffic included to represent specific development sites as stated in section 4.3. Where trips associated with development sites exceeded the amount of growth forecast by NTEM across the whole study area, the background growth was capped to prevent negative growth being applied in the wider modelled area, unless the original NTEM data suggested that there would be a decline in overall trip numbers at a county level.

4.4.2 For all model zones except one, NTEM growth factors were derived from the average for the county of Pembrokeshire. The one exception was zone 2, comprising traffic loading to/from the eastern end of the A40 trunk road in the study area. As this route carries a relatively high proportion of strategic long-distance traffic, factors were developed from a weighted combination of destinations based on the trip proportions observed at the A40 Roadside Interview survey. The weights applied are shown in Table 4.3 below.

Table 4.3 A40 (East) trip end proportions

Area	Proportion of Trips
East Pembrokeshire / Carmarthenshire / Ceredigion	64%
Rest of Wales	27%
England / Scotland	9%

4.4.3 TEMPRO was used to extract origin / destination growth factors of demand for the three forecast years from NTEM for the relevant areas in the AM Peak, interpeak and PM Peak time periods for the following user classes:

a) Car – Employers' Business;
b) Car – Commuter trips; and
c) Car – Other trip purposes.

4.4.4 The NTEM factors derived from TEMPRO are shown in Table 4.4 below. These have been adjusted to account for development trips that were included in the forecast matrices separately. The adjusted NTEM factors were used to apply background growth to the base year matrices before adding in the development traffic referred to in section 4.3.

Table 4.4 Adjusted NTEM growth factors from 2019, car trips

Year	Time Period	Purpose	Pembrokeshire		A40 (East)	
			Origin	Destination	Origin	Destination
2022	AM Peak	Employer's Business	1.000	1.000	1.035	1.031
		Commuter	1.000	1.000	1.024	1.028
		Other	1.000	1.000	1.036	1.043
	Inter Peak	Employer's Business	1.000	1.000	1.033	1.032
		Commuter	1.000	1.000	1.029	1.029
		Other	1.000	1.000	1.038	1.045
	PM Peak	Employer's Business	1.000	1.000	1.015	1.034
		Commuter	1.000	1.000	1.001	1.029
		Other	1.000	1.000	1.035	1.040
2037	AM Peak	Employer's Business	1.110	1.109	1.172	1.168
		Commuter	1.111	1.116	1.156	1.159
		Other	1.116	1.118	1.215	1.222
	Inter Peak	Employer's Business	1.112	1.111	1.167	1.166
		Commuter	1.111	1.111	1.150	1.150
		Other	1.120	1.120	1.226	1.233
	PM Peak	Employer's Business	1.100	1.099	1.150	1.169
		Commuter	1.109	1.105	1.127	1.154
		Other	1.109	1.108	1.208	1.212
2051	AM Peak	Employer's Business	1.225	1.228	1.310	1.306
		Commuter	1.224	1.234	1.287	1.291
		Other	1.204	1.209	1.369	1.376
	Inter Peak	Employer's Business	1.216	1.215	1.291	1.290
		Commuter	1.208	1.208	1.260	1.260
		Other	1.197	1.198	1.368	1.375
	PM Peak	Employer's Business	1.209	1.205	1.277	1.296
		Commuter	1.211	1.203	1.241	1.268
		Other	1.194	1.192	1.346	1.350

4.4.5 For the fixed demand approach (i.e. where variable demand modelling is not applied), TAG Unit M4 requires additional global factors to be included to take account of two further variables, income adjustment and fuel price variability. Based on the annual factors provided in the WebTAG Databook[6], the factors from the model base year 2019 to each of the model forecast years are shown in Table 4.5. These factors are already included in the adjusted background growth shown in Table 4.4.

[6] WebTAG Databook, release v1.10.1, Department for Transport, November 2018

Table 4.5 Income and fuel cost adjustment factors from 2019

Year	Income Adjustment Factor	Fuel Cost Adjustment Factor
2022	1.003	1.005
2037	1.036	1.013
2051	1.082	0.096

4.5 Road traffic forecasts

4.5.1 The NTEM does not produce growth factors for goods vehicle trips, and TAG Unit M4 advises that for modelling vehicle types other than cars in highway models, growth factors derived from the Road Traffic Forecasts (RTF18) should be used. This incorporates the Great Britain Freight Model which expands base heavy goods vehicle (HGV) data by modelling the effects of macroeconomic variables and changes in generalised cost, while light goods vehicle (LGV) traffic is projected using a separate time series model related to changes in the Gross Domestic Product and fuel price.

4.5.2 RTF18 provides estimates for the growth in road traffic between 2015 and 2050. Growth between 2050 and 2051 has been extrapolated from the available data, as recommended in TAG Unit M4. Growth factors are given on a regional basis, with Wales comprising a single region. Freight trips for most zones in the model used the NTM factors for the Welsh region, with the exception of trips loading to/from the eastern end of the A40 trunk road. In this case, as with the NTEM factors, a weighted combination of factors for the Wales region and the sum of the England regions was used, based on observations from the A40 roadside interview survey.

4.5.3 The available data gives growth factors for LGVs and HGVs. Based on observed data, the overall HGV factor was calculated from a weighted average of the factors for articulated and rigid heavy vehicles. The resulting factors derived from RTF18 are shown in Table 4.6 below.

Table 4.6 Adjusted RTF18 growth factors from 2019, goods vehicles

Year	Time Period	Purpose	Pembrokeshire		A40 (East)	
			Origin	Destination	Origin	Destination
2022	AM Peak	LGV	1.000	1.000	1.040	1.037
		HGV	0.997	0.997	1.001	1.001
	Inter Peak	LGV	1.009	1.009	1.034	1.039
		HGV	0.997	0.997	1.001	1.001
	PM Peak	LGV	1.012	1.012	1.033	1.040
		HGV	0.997	0.997	1.001	1.001
2037	AM Peak	LGV	1.195	1.195	1.242	1.238
		HGV	1.007	1.008	1.039	1.039
	Inter Peak	LGV	1.207	1.208	1.235	1.240
		HGV	1.008	1.010	1.039	1.039
	PM Peak	LGV	1.210	1.210	1.235	1.242
		HGV	1.016	1.017	1.039	1.039
2051	AM Peak	LGV	1.371	1.370	1.417	1.413
		HGV	1.049	1.049	1.093	1.093
	Inter Peak	LGV	1.383	1.383	1.410	1.416
		HGV	1.050	1.053	1.093	1.093
	PM Peak	LGV	1.386	1.386	1.410	1.417
		HGV	1.059	1.060	1.093	1.093

4.6 Trip matrix total

4.6.1 The forecast trip matrices were developed using the validated 2019 base year trip matrices as its basis.

4.6.2 NTEM factors for the forecast years (including the adjustments for income and fuel cost growth) were extracted using TEMPRO for the three car trip purposes for the relevant time periods as noted in Table 4.4, and applied to the corresponding model zones.

4.6.3 Similarly, the NTM factors given in Table 4.6 were applied to the corresponding model zones for the LGV and HGV user classes.

4.6.4 The resulting growth in the forecast trip matrices is shown in Table 4.7 below.

Table 4.7 Forecast trip matrix totals (in passenger car units)

User Class	2019	2022		2037		2051	
	Trips	Trips	% Growth from 2019	Trips	% Growth from 2019	Trips	% Growth from 2019
AM Peak							
Car, Emp. Business	223	233	+4.5%	259	+16.1%	286	+28.3%
Car, Commuting	863	903	+4.6%	1,004	+16.3%	1,106	+28.2%
Car, Other	965	1010	+4.7%	1,134	+17.5%	1,232	+27.7%
LGV	418	439	+5.0%	521	+24.6%	595	+42.3%
HGV	284	287	+1.1%	293	+3.2%	305	+7.4%
Total	2,753	2,872	+4.3%	3,211	+16.6%	3,524	+28.0%
Inter Peak							
Car, Emp. Business	310	322	+3.9%	358	+15.5%	391	+26.1%
Car, Commuting	279	290	+3.9%	321	+15.1%	349	+25.1%
Car, Other	1,143	1,192	+4.3%	1,343	+17.5%	1,445	+26.4%
LGV	299	312	+4.3%	372	+24.4%	424	+41.8%
HGV	226	228	+0.9%	232	+2.7%	242	+7.1%
Total	2,257	2,344	+3.9%	2,626	+16.3%	2,851	+26.3%
PM Peak							
Car, Emp. Business	323	340	+5.3%	374	+15.8%	410	+26.9%
Car, Commuting	733	764	+4.2%	846	+15.4%	922	+25.8%
Car, Other	1,272	1,338	+5.2%	1,489	+17.1%	1,608	+26.4%
LGV	307	321	+4.6%	381	+24.1%	435	+41.7%
HGV	121	122	+0.8%	125	+3.3%	130	+7.4%
Total	2,756	2,885	+4.7%	3,215	+16.7%	3,505	+27.2%

4.7 Forecasting uncertainty

4.7.1 Traffic forecasts are the key input to predicting the future benefits of the scheme. The accuracy of forecasts decreases in later years of the forecasting period. In transport scheme appraisal, models are used to establish the difference between a Do Minimum and Do Something scenario. In order to do this robustly it is important to understand sources of inaccuracy and associated uncertainty and the impact this may have on the analysis. Uncertainty around input assumptions to the traffic model creates a risk that the scheme will not be as successful as forecast, or that the forecasts will hide some side effects, including some environmental and social impacts which could occur.

4.7.2 An Uncertainty Log is defined in TAG Unit M4[7] as a record of assumptions made in the model that will affect travel demand and supply. The purpose of the Uncertainty Log is to record the central forecasting assumptions that underpin the core scenario and record the degree of uncertainty around these central assumptions. The Uncertainty Log relating to the scheme is given in Table 4.8 below.

Table 4.8 Uncertainty Log

Input	Forecast Year	Core Scenario Assumption	Uncertainty Assumption	Comments
National Uncertainty				
Growth in Demand	2022	NTEM for cars / RTF18 for goods vehicles (Section 0 to Section 4.6)	+ or – 4.33% of base demand	Able to apply quantitative range
	2037		+ or – 10.61% of base demand	
	2051		+ or – 14.14% of base demand	
Local Uncertainty: Factors affecting underlying demand				
Future Land Use and Development Assumptions	All	As described in Section 4.3	Uncertainty relating to this encapsulated within low and high growth forecasts	
Milford Haven Refinery	All	Assumed to remain operational	Encapsulated within low and high growth	Under continued threat of closure
Ferry Services from Fishguard	All	Assumed to continue as currently timetabled	Encapsulated within low and high growth	No changes to ferry services proposed
Level of Tourism	All	Tourism assumed to grow in line with NTEM	Encapsulated within low and high growth	No evidence that tourism is likely to change
Local Uncertainty: Factors affecting supply for transport				
Highway schemes within study area	All	As described in Section 3.3	Due to the limited size of the study area only the A40 Llanddewi Velfrey to Penblewin scheme has been identified.	

[7] Transport Analysis Guidance Unit M4, Forecasting and Uncertainty, Department for Transport, May 2017

5 Forecast Traffic Assignments

5.1 Overview

5.1.1 This chapter presents the Do Minimum and Core Scenario traffic forecast flows and an assessment of the likely future journey times. In addition, traffic forecasts are presented for low and high growth scenarios, which reflect uncertainty in forecast assumptions such as traffic growth projections.

5.1.2 Traffic forecasts have been prepared for three future years, 2022 (scheme opening year), 2037 (scheme design year) and 2051 (horizon year). These cover the three modelled periods of the AM peak hour, the average inter-peak hour and the PM peak hour. In addition, AADT forecasts have been prepared using the factors discussed in section 2.5 of this report.

5.2 Model convergence

5.2.1 Convergence of the transport model is required in order to ensure consistent and robust model results. In particular, there needs to be confidence that any differences reported by the model between a Do Minimum scenario and a Do Something scenario are realistic and the direct result of the proposal, rather than relating to differing degrees of model convergence.

5.2.2 Guidance on the degree of model convergence is given in TAG Unit M3.1[8]. The main measure of the convergence of a traffic assignment is the 'delta' statistic, or %GAP. This is the difference between the costs along the chosen routes and those along the minimum cost routes, expressed as a percentage of the minimum costs. WebTAG recommends a guideline target for the %GAP value of 0.1% or less.

5.2.3 In addition, WebTAG recommends that the proportion of links in which the changes in traffic volumes is less than 1% should be at least 98% for four consecutive iterations before convergence is reached.

[8] Transport Analysis Guidance Unit M3.1, Highway Assignment Modelling, Department for Transport, January 2014

5.2.4 A comparison of the convergence statistics from the Do Minimum scenario in each of the forecast years is given in Table 5.1 below. The equivalent for all the Core Scenario in all forecast years is represented in Table 5.2 below. Comparing these convergence statistics against the LMVR illustrates that the level of convergence achieved in all forecast models is consistent with that achieved in the validated base model and that the convergence for all the forecast scenarios exceeds the requirements set out in WebTAG.

Table 5.1 Model convergence statistics in central growth forecast, Do Minimum scenario

	AM Peak	Inter Peak	PM Peak
2022 Do Minimum			
Number of Iterations	6	6	6
'Delta' Function (%GAP)	0.00	0.00	0.00
Percentage of Links with flow change of <1% - final four iterations	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0
2037 Do Minimum			
Number of Iterations	6	6	6
'Delta' Function (%GAP)	0.00	0.00	0.00
Percentage of Links with flow change of <1% - final four iterations	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0
2051 Do Minimum			
Number of Iterations	6	5	5
'Delta' Function (%GAP)	0.00	0.00	0.00
Percentage of Links with flow change of <1% - final four iterations	99.5 100.0 100.0 100.0	99.2 100.0 100.0 100.0	99.5 100.0 100.0 100.0

Table 5.2 Model convergence statistics in central growth forecast, Core Scenario

	AM Peak	Inter Peak	PM Peak
2022 Core Scenario			
Number of Iterations	5	6	6
'Delta' Function (%GAP)	0.00	0.00	0.00
Percentage of Links with flow change of <1% - final four iterations	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0
2037 Core Scenario			
Number of Iterations	6	6	6
'Delta' Function (%GAP)	0.00	0.00	0.00
Percentage of Links with flow change of <1% - final four iterations	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0	100.0 100.0 100.0 100.0
2051 Core Scenario			
Number of Iterations	6	5	6
'Delta' Function (%GAP)	0.00	0.00	0.00
Percentage of Links with flow change of <1% - final four iterations	100.0 100.0 100.0 100.0	99.5 100.0 100.0 100.0	100.0 100.0 100.0 100.0

5.3 Traffic flows

5.3.1 The forecast Do Minimum and Do Something traffic flows are presented in Appendix A. The figures show that the scheme would result in a significant reduction in traffic volumes along the existing A40 between Penblewin Roundabout and Redstone Cross as a result of through traffic switching to the new section of A40.

5.3.2 For comparison an equivalent figure showing traffic volumes in the base year is included in Chapter 8 of the Local Model Validation Report (LMVR).

5.3.3 A summary of forecast traffic flows on the existing and proposed A40 between Penblewin Roundabout in the modelled peak hours is shown in Table 5.3. AADT flows are quoted in the operational analysis in Table 5.5.

5.3.4 In the design year of the Scheme (2037) 82% of total daily traffic would switch from the existing A40 to the Scheme. In the individual peak periods the level of traffic forecast to switch to the new route varies between 82% and 84%.

Table 5.3 Forecast traffic volumes on A40 between Penblewin and Redstone Cross, Core Scenario

Location	Traffic Flow in Vehicles (Two-way)					
	Do Minimum			Do Something		
	AM	IP	PM	AM	IP	PM
Opening Year: 2022						
Existing A40	1,070	880	1,040	180	160	180
Proposed A40	-	-	-	900	720	860
Design Year: 2037						
Existing A40	1,210	990	1,170	200	180	200
Proposed A40	-	-	-	1,020	810	980
Traffic Model Horizon Year: 2051						
Existing A40	1,350	1,090	1,290	220	200	230
Proposed A40	-	-	-	1,130	900	1,100

5.4 Journey times

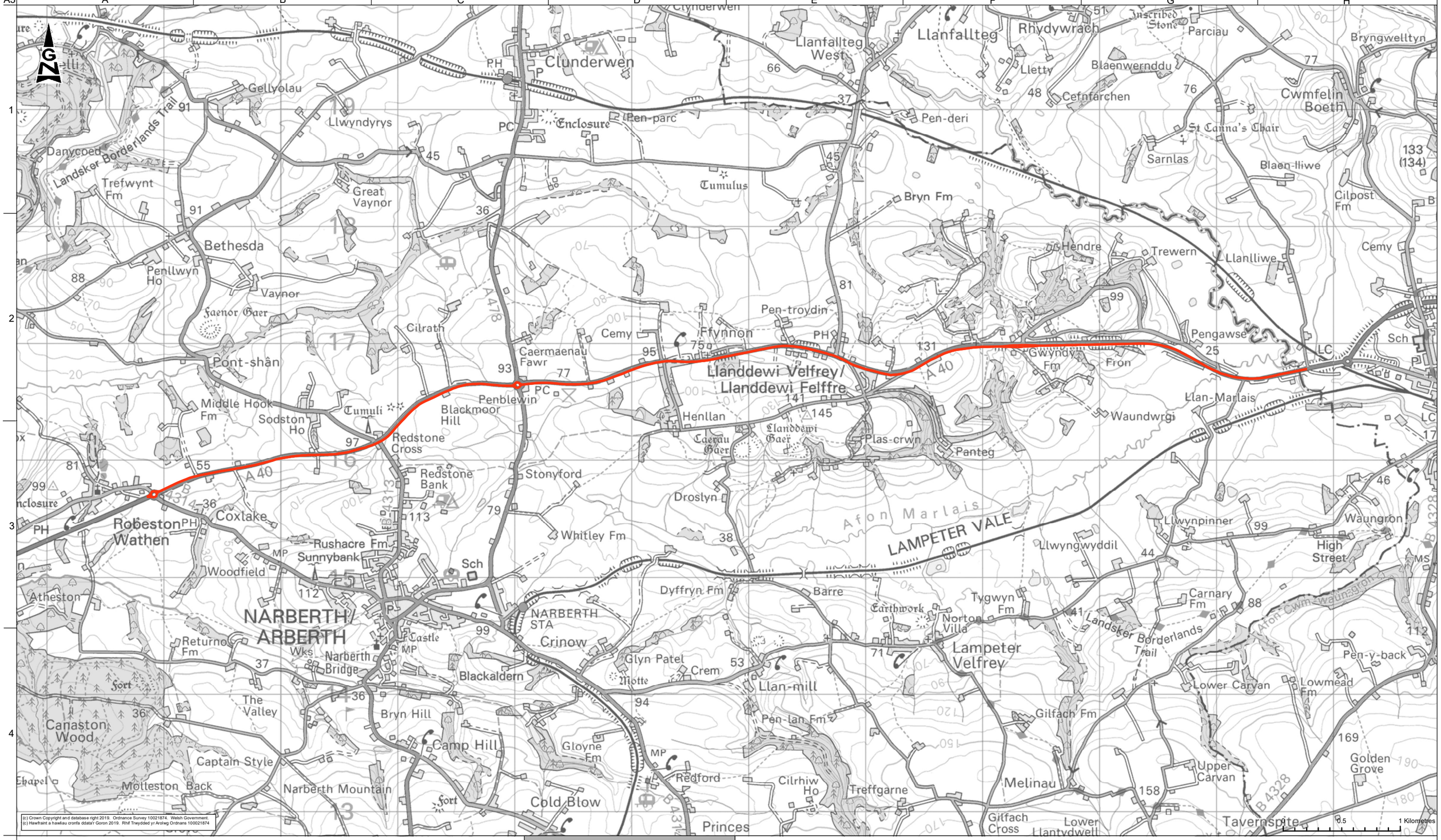
5.4.1 Information on car journey times in the Do Minimum and Core Scenario traffic forecasts was extracted for the full length of the A40 corridor contained in the model network as shown in Figure 5.1. The journey times were analysed in order to ascertain any changes that would result from the proposed A40 Penblewin to Redstone Cross Improvements scheme. The results of the journey time analysis are presented in Table 5.4 below.

Table 5.4 Forecast car journey times along A40 (mins:secs), Core Scenario

Direction		AM Peak	Inter Peak	PM Peak
Eastbound	**Opening Year: 2022**			
	Do Minimum	8:21	8:13	8:20
	Core Scenario	8:18	8:09	8:17
	Time Saving	0:03	0:03	0:03
	Design Year: 2037			
	Do Minimum	8:30	8:20	8:30
	Core Scenario	8:27	8:17	8:26
	Time Saving	0:03	0:03	0:04
	Traffic Model Horizon Year: 2051			
	Do Minimum	8:40	8:26	8:40
	Core Scenario	8:36	8:23	8:35
	Time Saving	0:04	0:03	0:05
Westbound	**Opening Year: 2022**			
	Do Minimum	8:23	8:03	8:14
	Core Scenario	8:09	7:52	8:01
	Time Saving	0:14	0:11	0:13
	Design Year: 2037			
	Do Minimum	8:34	8:09	8:22
	Core Scenario	8:20	7:58	8:09
	Time Saving	0:14	0:11	0:13
	Traffic Model Horizon Year: 2051			
	Do Minimum	8:45	8:15	8:30
	Core Scenario	8:30	8:03	8:18
	Time Saving	0:15	0:12	0:12

5.4.2 Car journey time savings resulting from the scheme are generally small. They are in the order of 3 to 4 seconds in the eastbound direction and 11 to 16 seconds in the westbound direction.

5.4.3 For HGVs the journey times are generally slightly longer as these are affected by a reduced national speed limit of 50mph, which applies to goods vehicles over 7.5 tonnes on single carriageway roads. However, journey time savings for HGVs are broadly of the same scale as those for cars the increase in HGV journey times affects both the Do Minimum and Do Something to a similar degree.



LEGEND

JOURNEY TIME ROUTE

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)
Construction
None
Maintenance / Cleaning
None
Use
None
Decommissioning / Demolition
None

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P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

Delivery Team
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ARUP
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Drawing Title
FIGURE 5.1
JOURNEY TIME ANALYSIS

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3
1:30,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

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A40PRC - ARP - VTR - SWI - DR - TR - 0010
Project | Originator | Volume | Location | Type | Role | Number

5.5 Operational analysis

5.5.1 The Congestion Reference Flow (CRF) of a link, as defined in the Design Manual for Roads and Bridges, is an estimate of the Annual Average Daily Traffic (AADT) flow at which the carriageway is likely to be 'congested' in the peak periods on an average day. For the purposes of calculating the CRF, 'congestion' is defined as the situation when the hourly traffic demand exceeds the maximum sustainable hourly throughput of the link.

5.5.2 The CRF is used to identify 'stress points' in the existing road network. When traffic volumes reach the level defined by the CRF this is defined as a 'stress factor' of 100%. The effect is likely to be one or more of the following:

a) flow breaks down with speeds varying considerably;
b) average speeds drop significantly;
c) the sustainable throughput is reduced; and
d) queues are likely to form.

5.5.3 Where the stress factor lies between 0.85 and 1.00, turbulent traffic conditions are likely to be experienced as congestion starts to build up. This is the consequence of having only a low reserve capacity on the road network during peak hours and therefore the effect small incidents of vehicles braking can have on other road users when stress factors are within this range.

5.5.4 Results of the 'stress analysis' in all three modelled years are shown in Table 5.5 below. The AADT flows quoted in this table have been derived from forecast model outputs using the method reported in section 2.5. The variations in CRF values by year and scenario are the result of fluctuations in the percentage of heavy vehicles and the directional split of traffic.

5.5.5 The results in the table show that the A40 operates below the point at which congestion would be expected to start occurring. Based on this the road is expected to operate under free-flow conditions and journey time reliability issues are expected to be marginal.

Table 5.5 Stress analysis of A40 corridor between Penblewin and Redstone Cross, Core Scenario

Location	Do Minimum			Do Something		
	AADT	CRF	Stress Factor	AADT	CRF	Stress Factor
Opening Year: 2022						
Existing A40	12,300	25,800	0.47	2,100	25,300	0.08
Proposed A40	-	-	-	10,100	25,200	0.40
Design Year: 2037						
Existing A40	13,900	25,900	0.54	2,500	26,100	0.09
Proposed A40	-	-	-	11,400	25,400	0.45
Traffic Model Horizon Year: 2051						
Existing A40	15,200	25,800	0.59	2,700	26,300	0.10
Proposed A40	-	-	-	12,700	25,500	0.50

5.6 Low and high growth

5.6.1 Low and high growth scenarios are required to test the impact of uncertainty in projections of demographic data (population, households and employment), GDP growth and fuel price trends, as well as other contributory factors outlined in the Uncertainty Log in Table 4.8.

5.6.2 As recommended in TAG Unit M4, in order to create the low growth scenario a proportion of the base demand was subtracted from the forecast demand from the Core Scenario. For the high growth scenario, a proportion of base demand was added. The proportion of base year demand that was used to adjust the Core Scenario to create low and high growth scenarios is shown in Table 5.6 below.

Table 5.6 Adjustment of Core Scenario to create low and high growth scenarios

Year	Low Growth	High Growth
2022	-4.3 % of base demand	+4.3 % of base demand
2037	-10.6 % of base demand	+10.6 % of base demand
2051	-14.1 % of base demand	+14.1 % of base demand

5.6.3 Figures showing the forecast traffic flows for the low and high growth scenarios are given in Appendix B and C respectively. A summary of forecast traffic flows on the existing and proposed A40 between Penblewin Roundabout in the modelled peak hours is shown in Table 5.7 for low and high growth sensitivity tests.

5.6.4 Flows generally vary around the Core Scenario by broadly the

percentages shown in Table 5.6, although there is some variation on individual links as a result of localised reassignment.

5.6.5 Under low growth forecasts, in the design year of the Scheme (2037) 82% of total daily traffic would switch from the existing A40 to the Scheme. In the individual peak periods the level of traffic forecast to switch to the new route varies between 81% and 85%.

5.6.6 Under high growth forecasts, in the design year of the Scheme (2037) 83% of total daily traffic would switch from the existing A40 to the Scheme. In the individual peak periods the level of traffic forecast to switch to the new route varies between 82% and 84%.

Table 5.7 Forecast traffic volumes on A40 between Penblewin and Redstone Cross, low and high growth sensitivity tests

Location	Traffic Flow in Vehicles (Two-way)					
	Do Minimum			Do Something		
	AM	IP	PM	AM	IP	PM
Low Growth						
Opening Year: 2022						
Existing A40	1,030	850	990	160	160	170
Proposed A40	-	-	-	860	690	820
Design Year: 2037						
Existing A40	1,100	910	1,060	180	160	180
Proposed A40	-	-	-	930	740	880
Traffic Model Horizon Year: 2051						
Existing A40	1,190	970	1,130	200	180	200
Proposed A40	-	-	-	1,000	800	960
High Growth						
Opening Year: 2022						
Existing A40	1,120	920	1,080	180	160	190
Proposed A40	-	-	-	940	750	900
Design Year: 2037						
Existing A40	1,330	1,090	1,280	210	200	220
Proposed A40	-	-	-	1,120	890	1,060
Traffic Model Horizon Year: 2051						
Existing A40	1,480	1,220	1,450	240	220	250
Proposed A40	-	-	-	1,260	1,020	1,220

5.6.7 Due to the low levels of congestion in the study area journey times only vary marginally between the low and high growth scenarios. For this reason, only the Core Scenario journey times are presented in this report as shown in Table 5.4 in section 5.4.

6 Conclusions

6.1.1 This report describes the development and results of the forecast traffic models for the proposed A40 Penblewin to Redstone Cross improvement scheme.

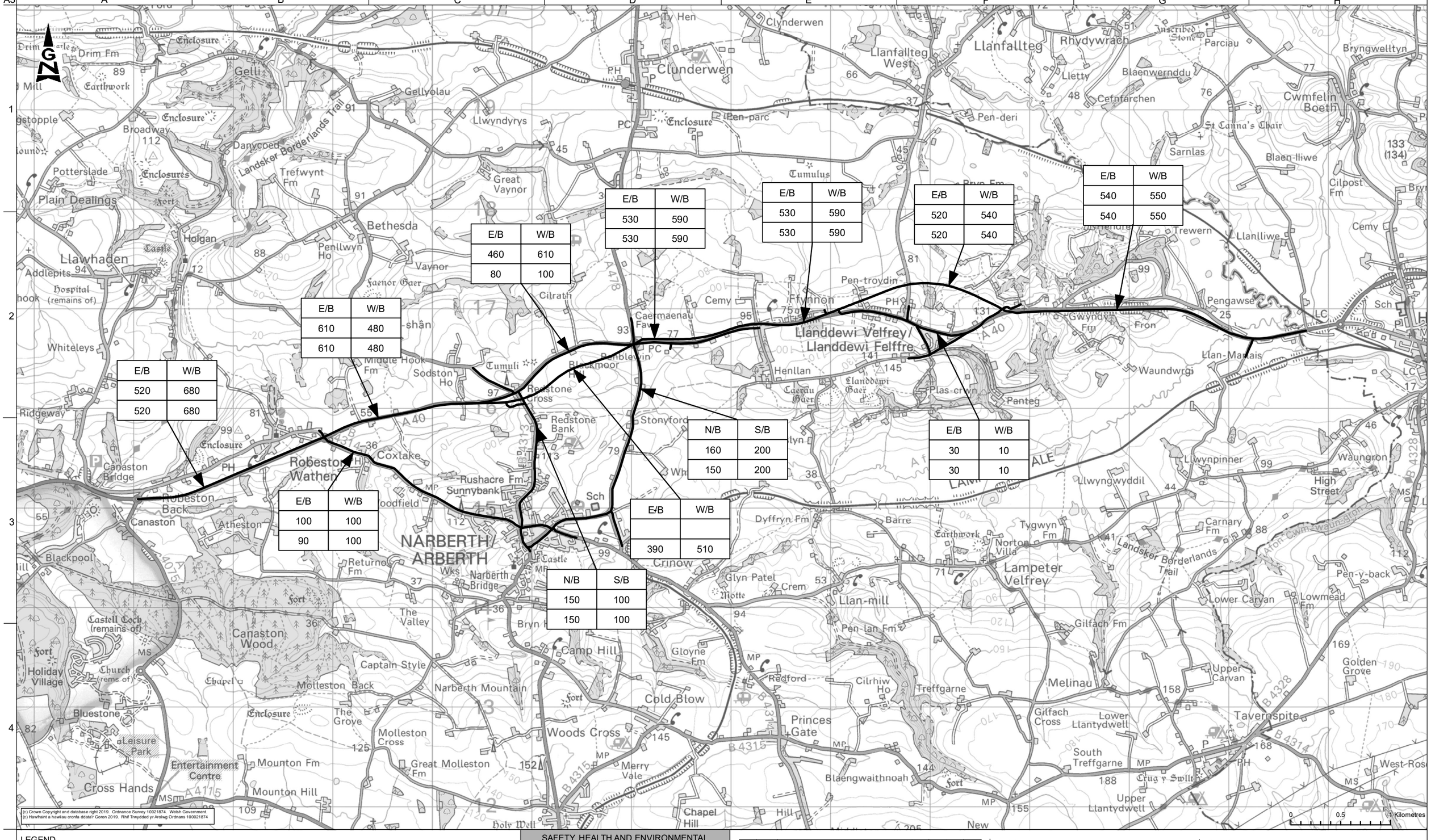
6.1.2 A Do Minimum and Do Something scenario has been developed for the following years:

a) The scheme opening year: 2022;
b) The scheme design year: 2037; and
c) The horizon year beyond which reliable traffic growth projections are not available: 2051.

6.1.3 The proposed scheme is forecast to relieve the existing A40 between Penblewin Roundabout and Redstone Cross significantly, with all through traffic switching to the proposed new road to the south of the existing A40.

6.1.4 Journey time savings resulting from the proposed scheme are between 3 and 16 seconds per vehicle depending on forecast year, time period and direction of travel.

Appendix A – Core Scenario Traffic Flow Figures



E/B	W/B
460	610
80	100

E/B	W/B
530	590
530	590

E/B	W/B
530	590
530	590

E/B	W/B
520	540
520	540

E/B	W/B
540	550
540	550

E/B	W/B
610	480
610	480

E/B	W/B
520	680
520	680

N/B	S/B
160	200
150	200

E/B	W/B
30	10
30	10

E/B	W/B
100	100
90	100

E/B	W/B
390	510

N/B	S/B
150	100
150	100

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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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Welsh Government

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Drawing Title
FIGURE A.1
2022 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

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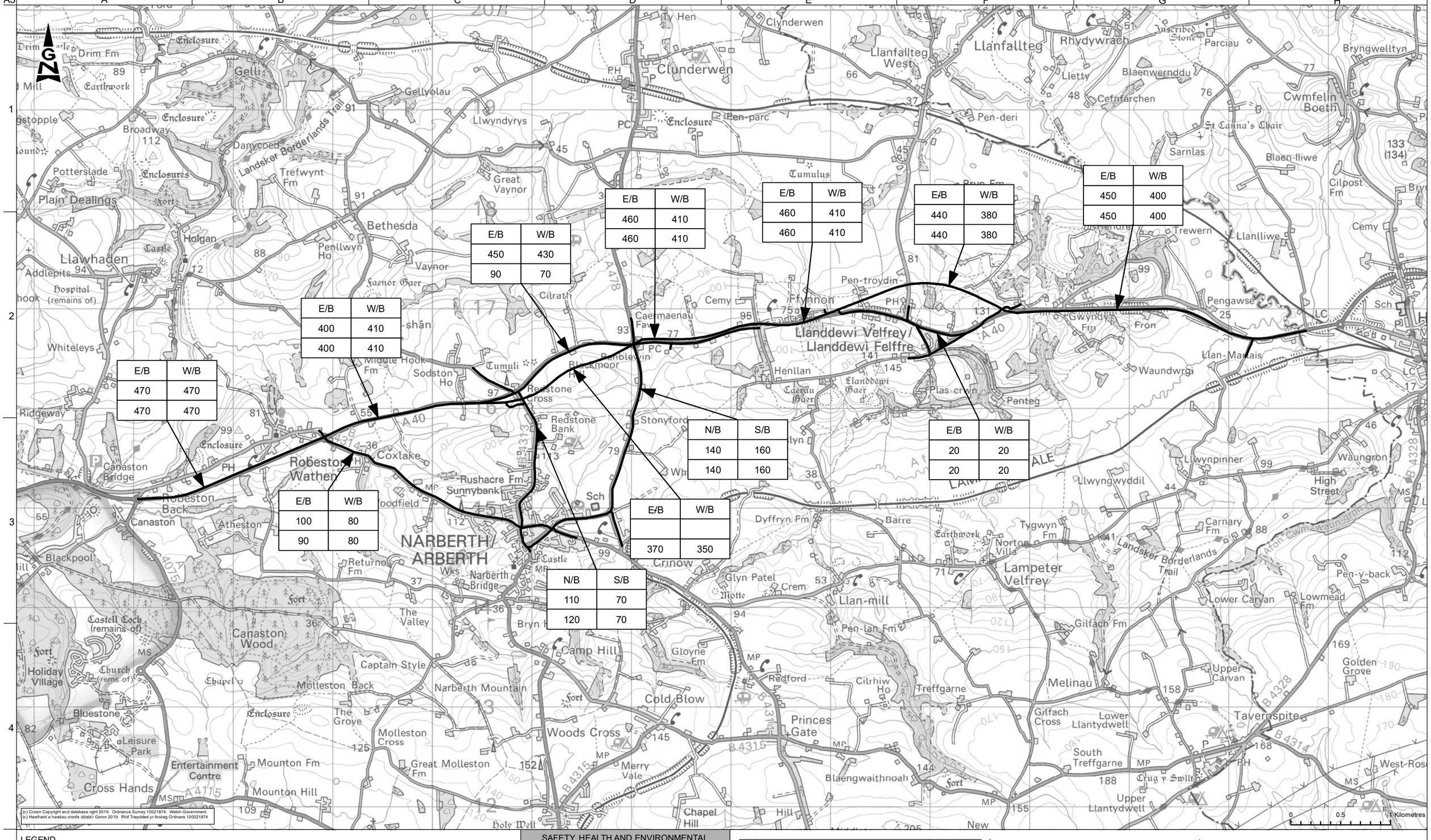

E/B	W/B
450	430
90	70

E/B	W/B
460	410
460	410

E/B	W/B
460	410
460	410

E/B	W/B
440	380
440	380

E/B	W/B
450	400
450	400

E/B	W/B
400	410
400	410

E/B	W/B
470	470
470	470

N/B	S/B
140	160
140	160

E/B	W/B
20	20
20	20

E/B	W/B
100	80
90	80

E/B	W/B
370	350

N/B	S/B
110	70
120	70

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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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FIGURE A.2
2022 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

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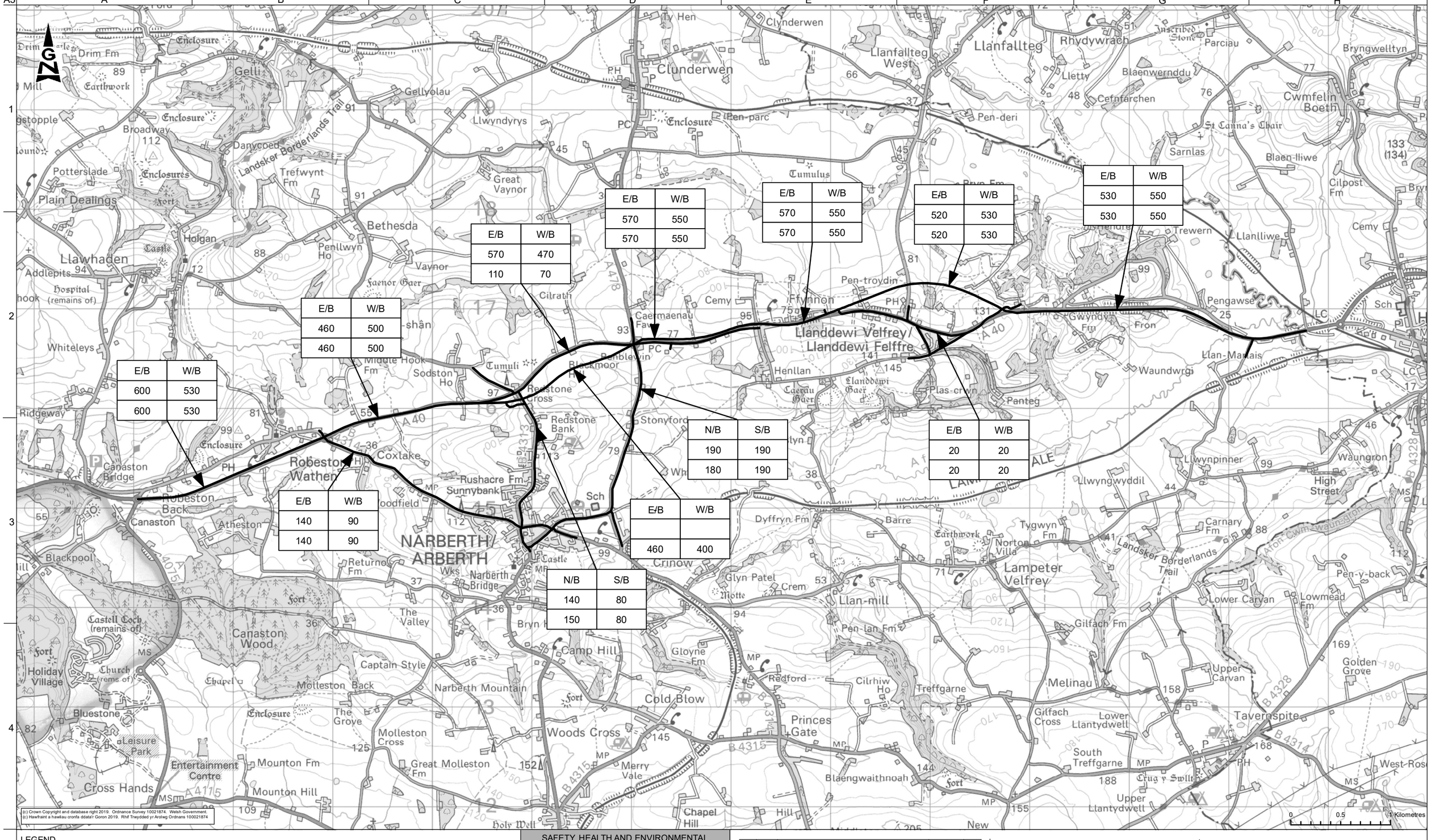
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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Drawing Title
FIGURE A.3
2022 FORECAST
PM PEAK HOUR TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
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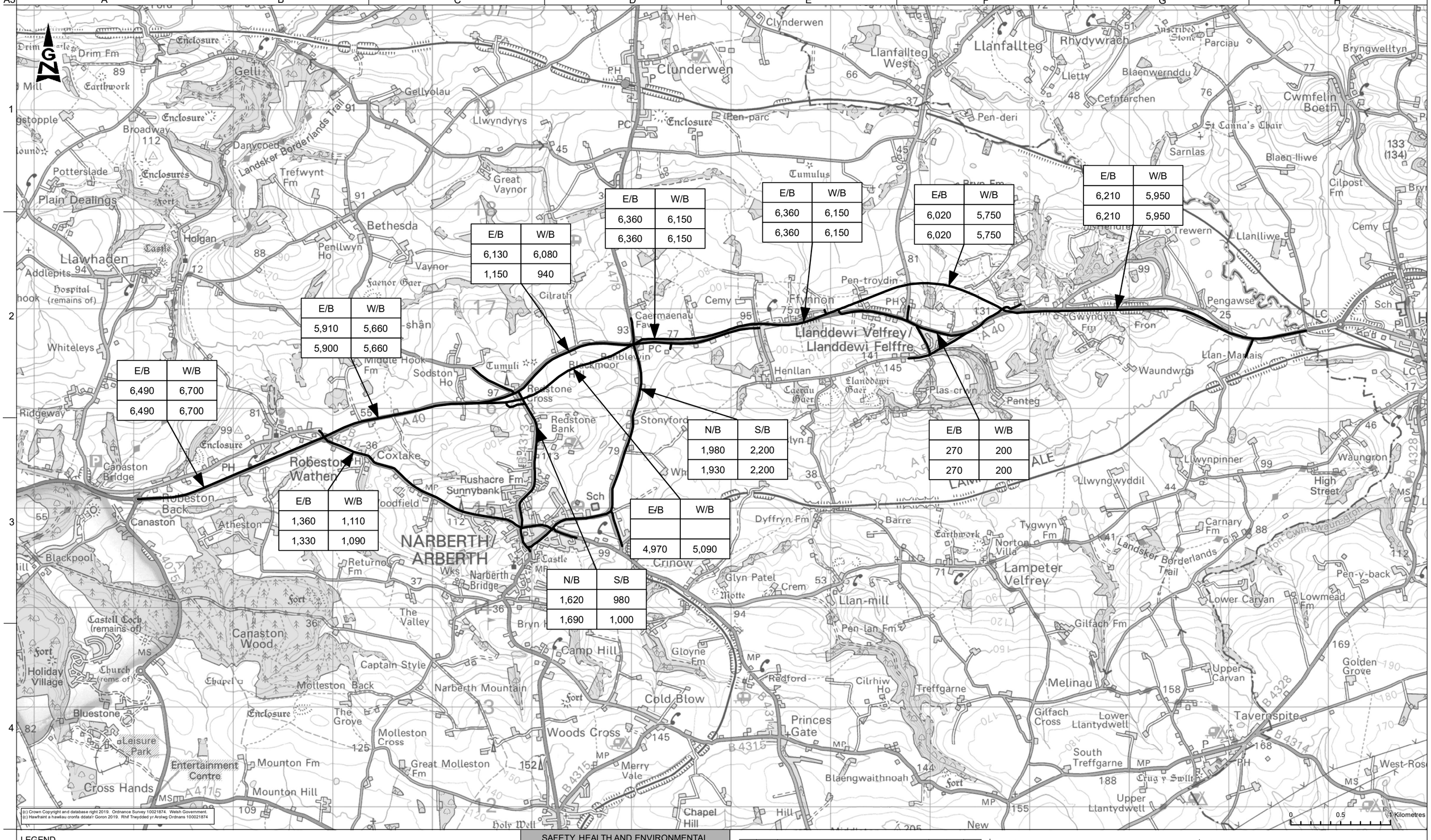
A40PRC - ARP - VTR - SWI - DR - TR - 0013
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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Drawing Title
FIGURE A.4
2022 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

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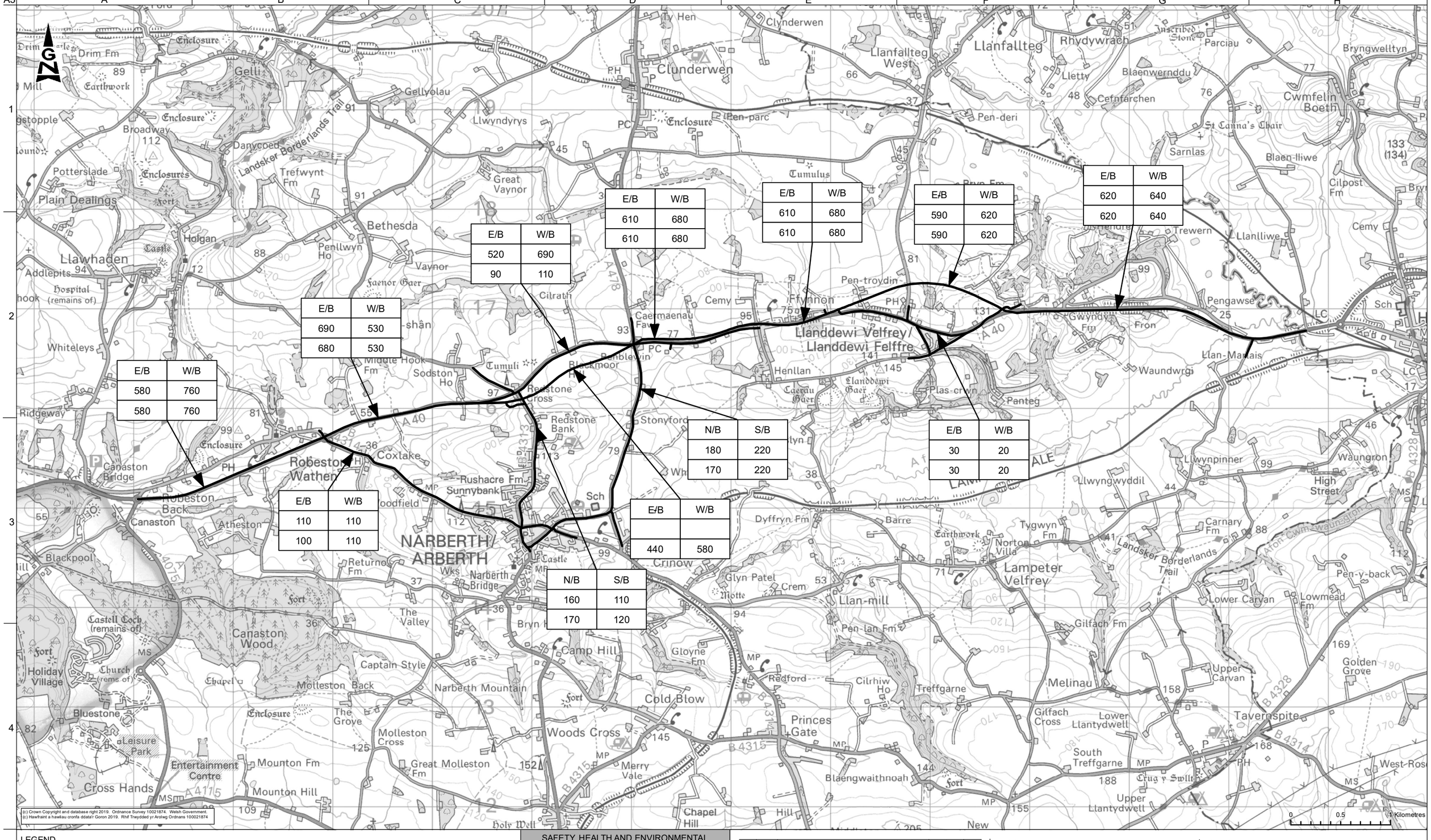
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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Drawing Title
FIGURE A.5
2037 FORECAST
AM PEAK TRAFFIC TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

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P02	KD	PT	TE	GD
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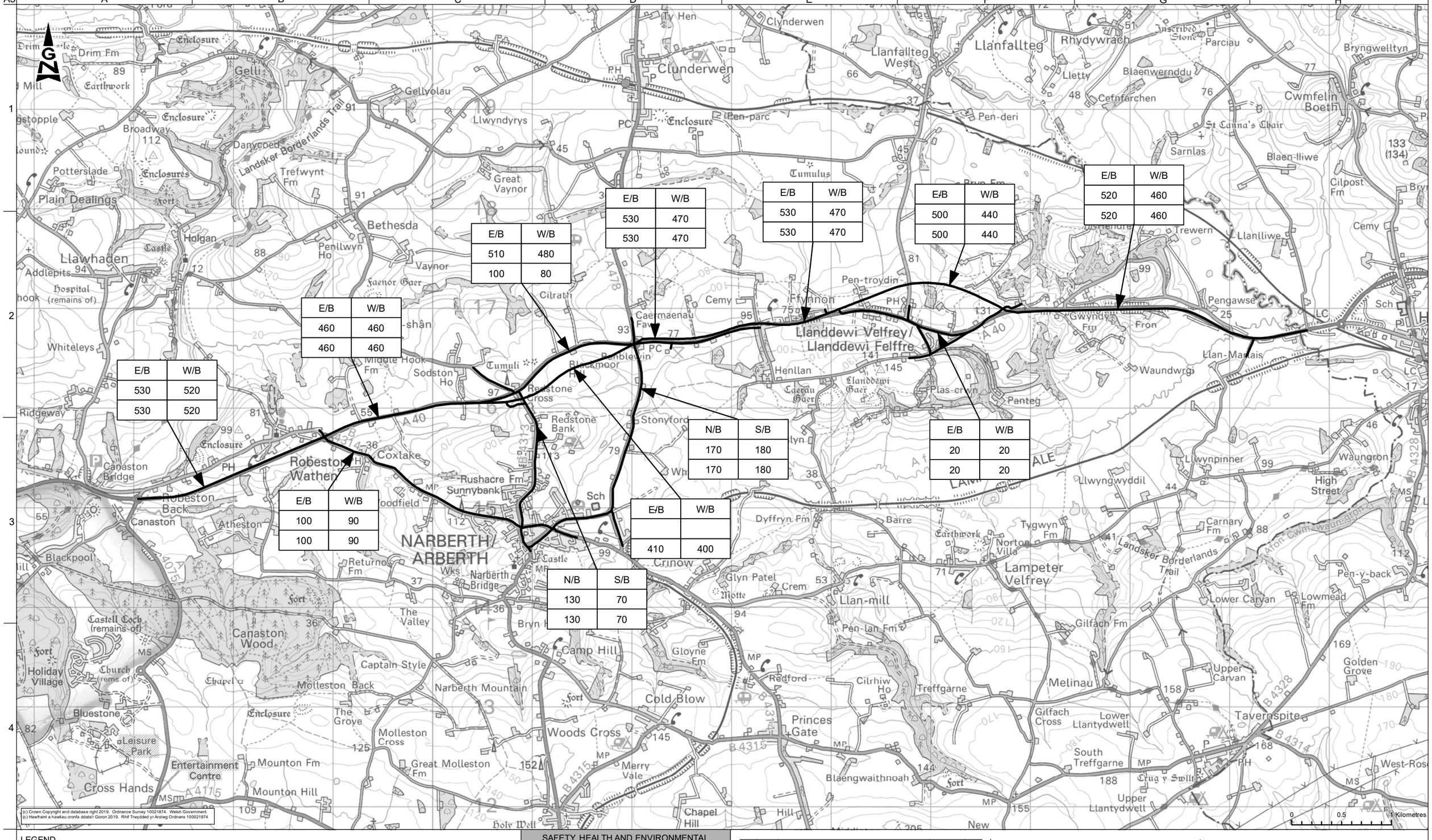
Name
A40PRC - ARP - VTR - SWI - DR - TR - 0015
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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Drawing Title
FIGURE A.6
2037 FORECAST
INTER PEAK TRAFFIC TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
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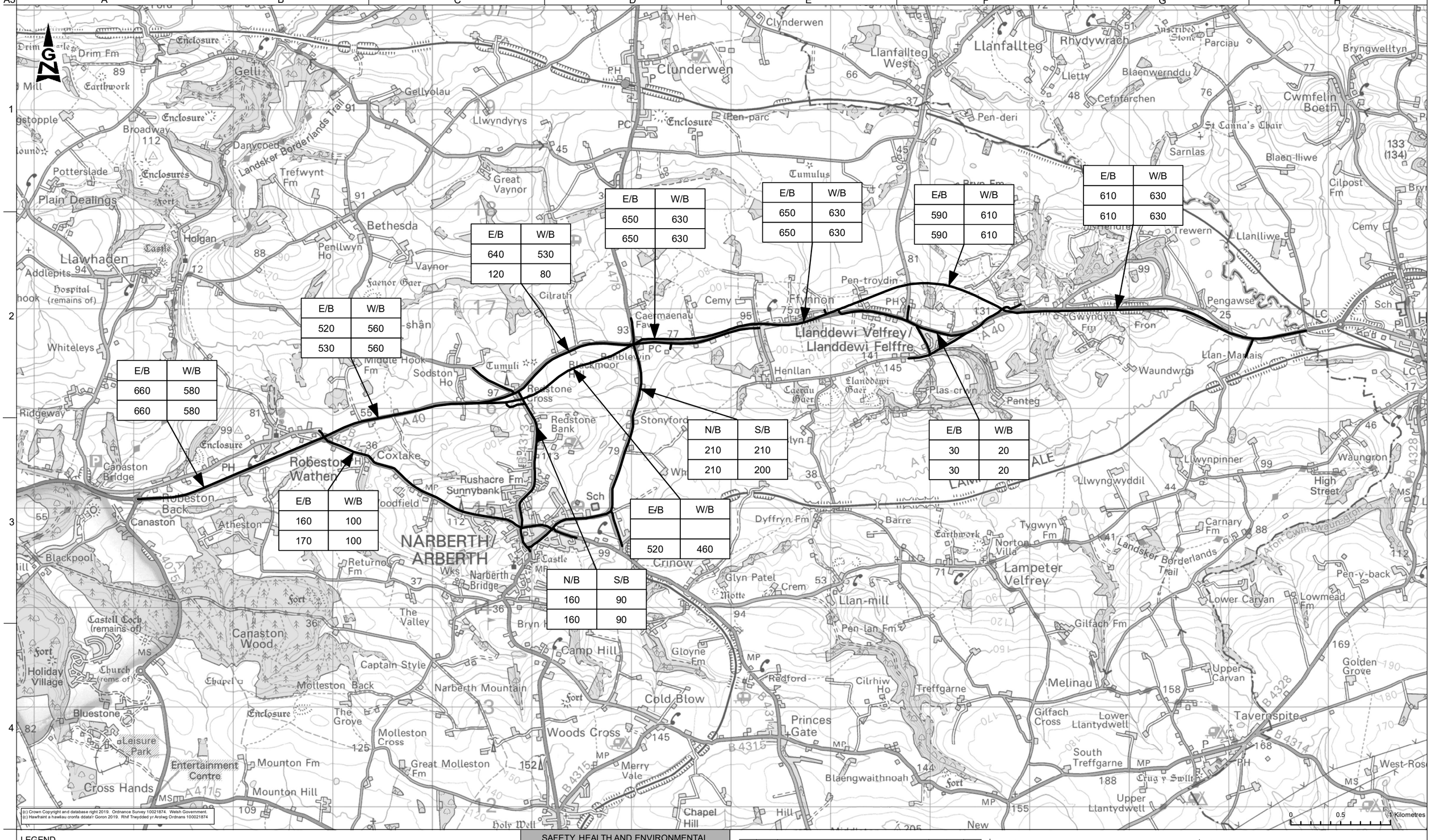
A40PRC - ARP - VTR - SWI - DR - TR - 0016
Project | Originator | Volume | Location | Type | Role | Number



E/B	W/B
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120	80

E/B	W/B
650	630
650	630

E/B	W/B
650	630
650	630

E/B	W/B
590	610
590	610

E/B	W/B
610	630
610	630

E/B	W/B
520	560
530	560

E/B	W/B
660	580
660	580

N/B	S/B
210	210
210	200

E/B	W/B
30	20
30	20

E/B	W/B
160	100
170	100

E/B	W/B
520	460

N/B	S/B
160	90
160	90

LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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Welsh Government

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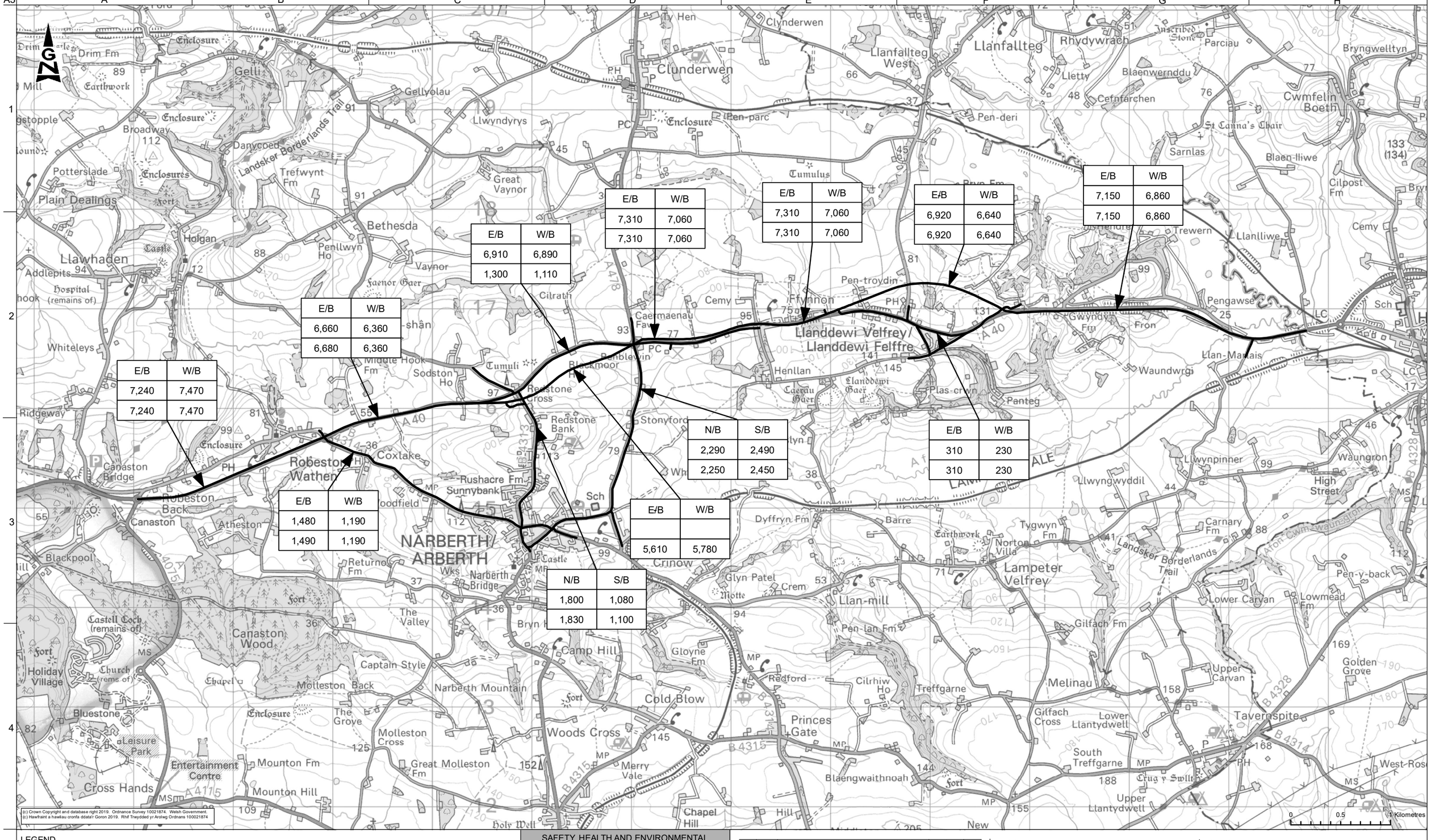
Drawing Title
FIGURE A.7
2037 FORECAST
PM PEAK TRAFFIC TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0017
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

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RICHARDS

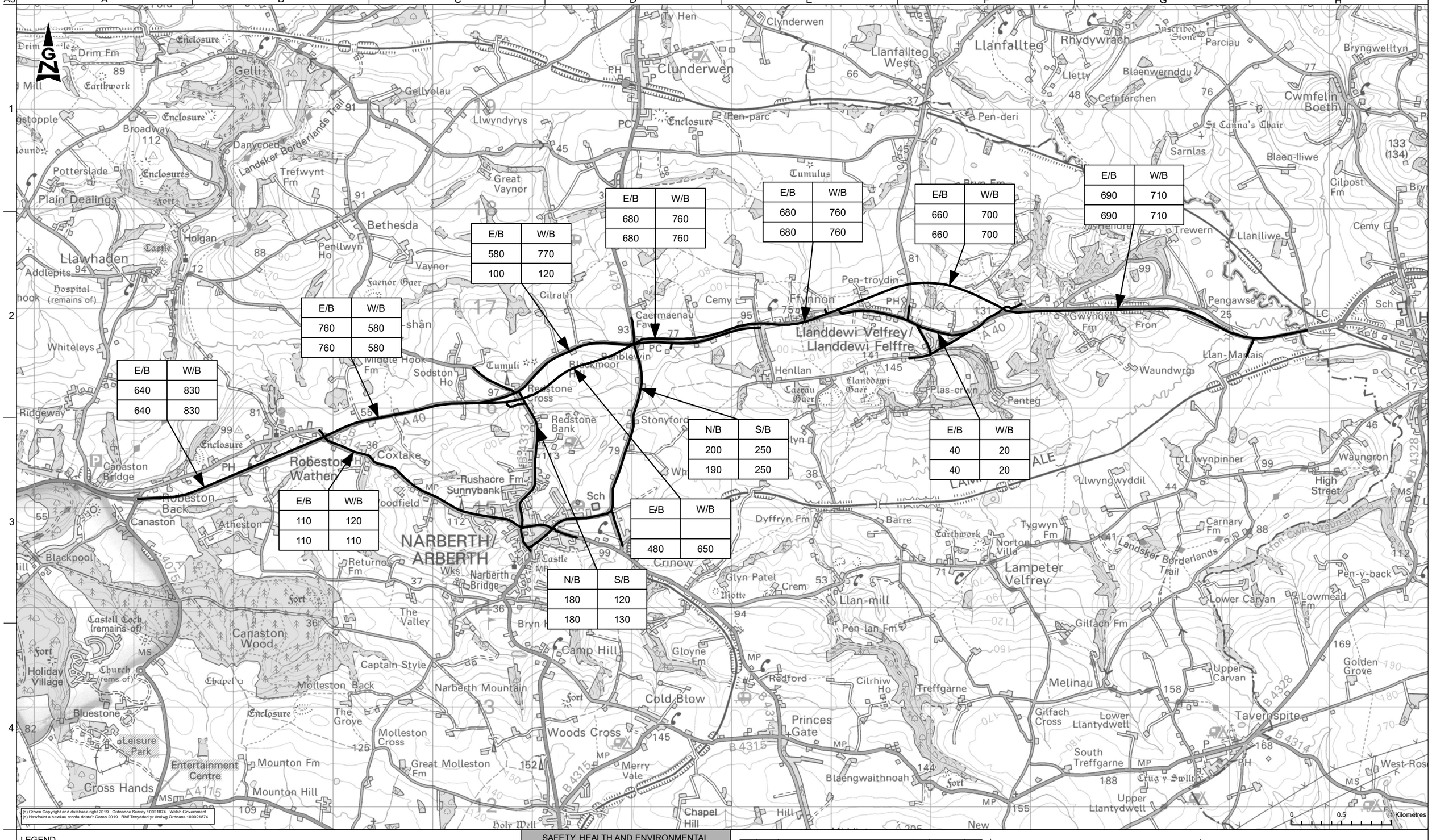
Drawing Title
FIGURE A.8
2037 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3
1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0018
Project | Originator | Volume | Location | Type | Role | Number



E/B	W/B
580	770
100	120

E/B	W/B
680	760
680	760

E/B	W/B
680	760
680	760

E/B	W/B
660	700
660	700

E/B	W/B
690	710
690	710

E/B	W/B
760	580
760	580

E/B	W/B
640	830
640	830

N/B	S/B
200	250
190	250

E/B	W/B
40	20
40	20

E/B	W/B
110	120
110	110

E/B	W/B
480	650

N/B	S/B
180	120
180	130

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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GE

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

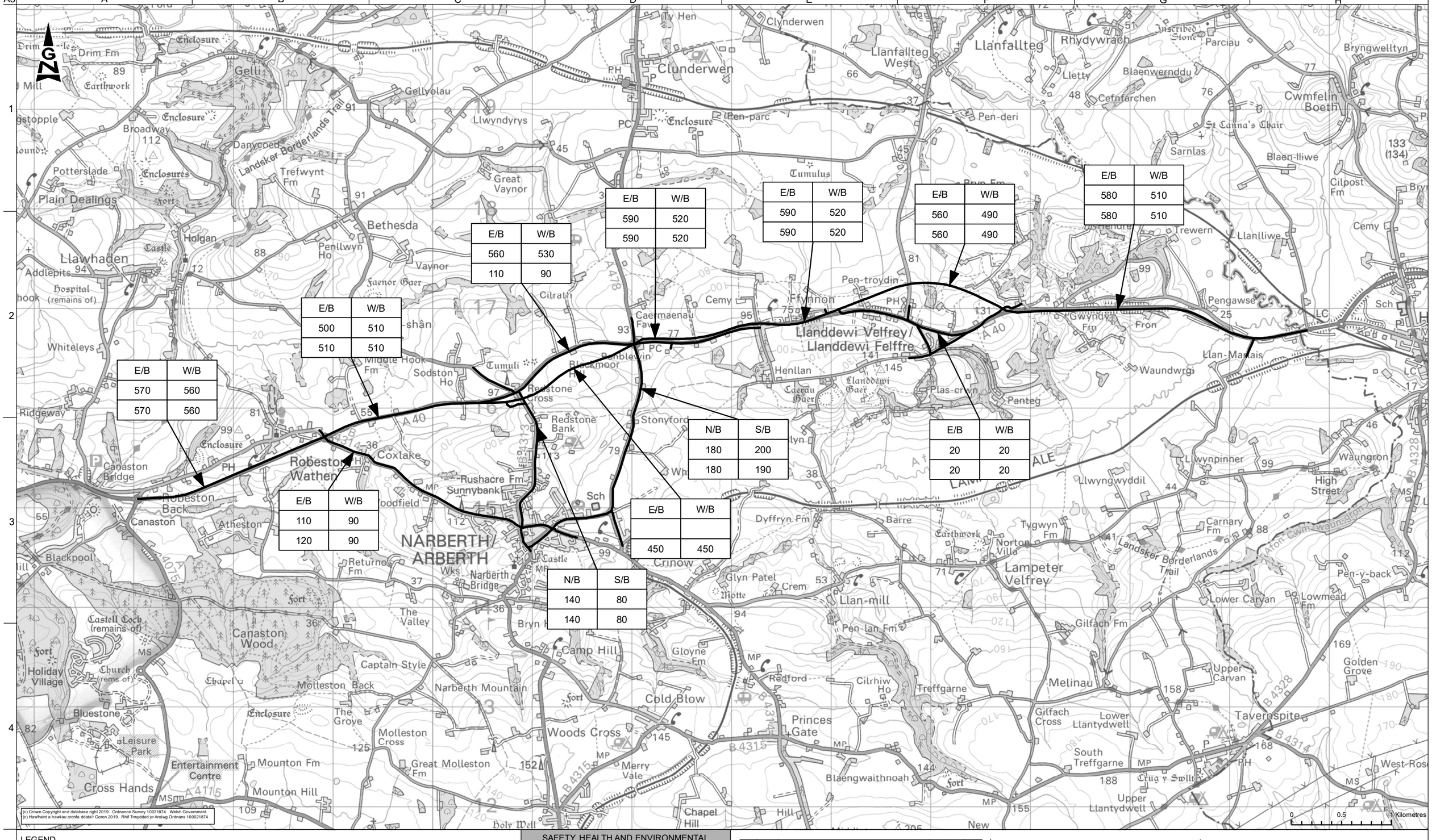
Drawing Title
FIGURE A.9
2051 FORECAST
AM PEAK TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0019
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP

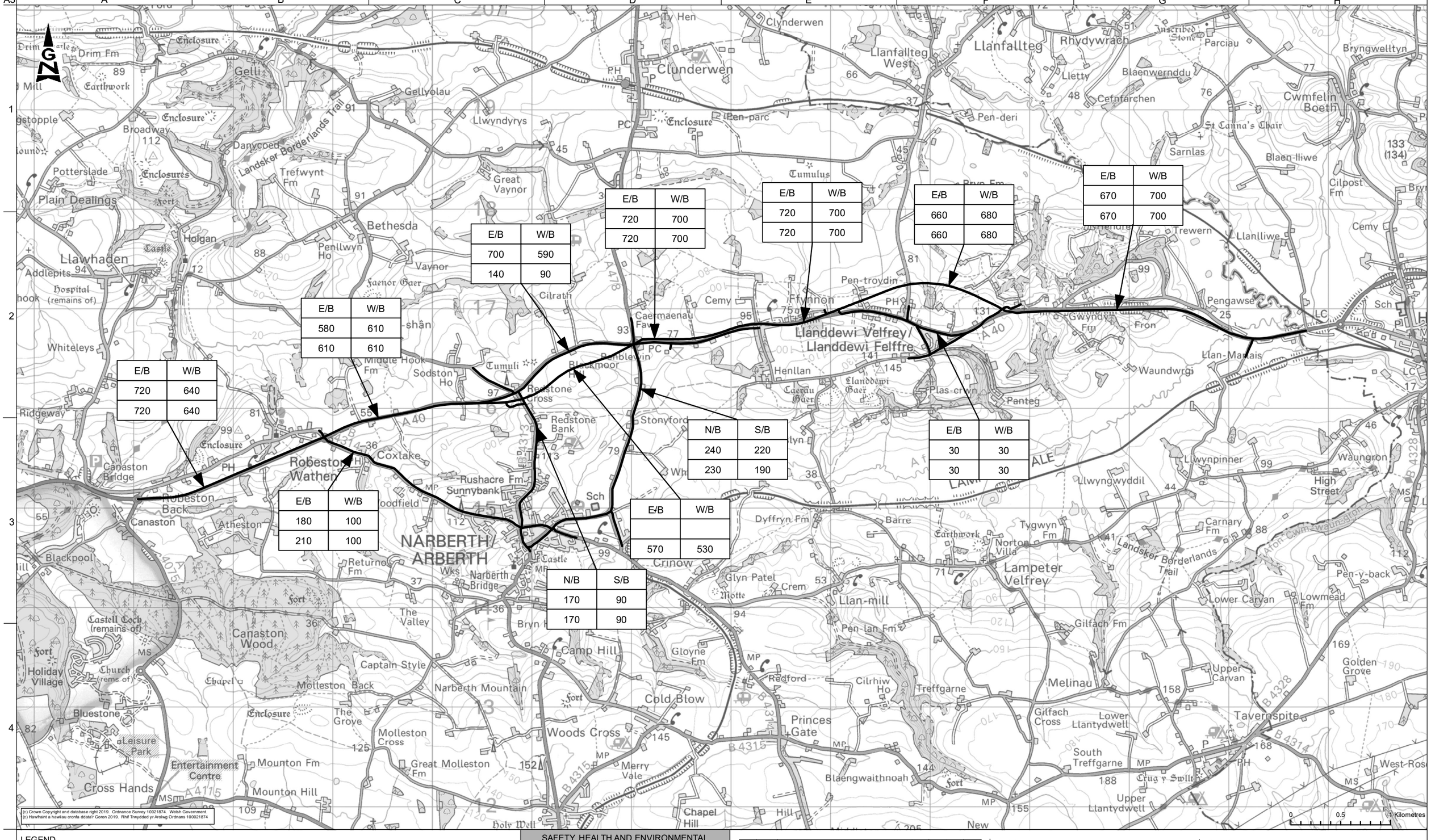
Drawing Title
FIGURE A.10
2051 FORECAST
INTER PEAK TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0020
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

Delivery Team
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MOTT MACDONALD
RICHARDS

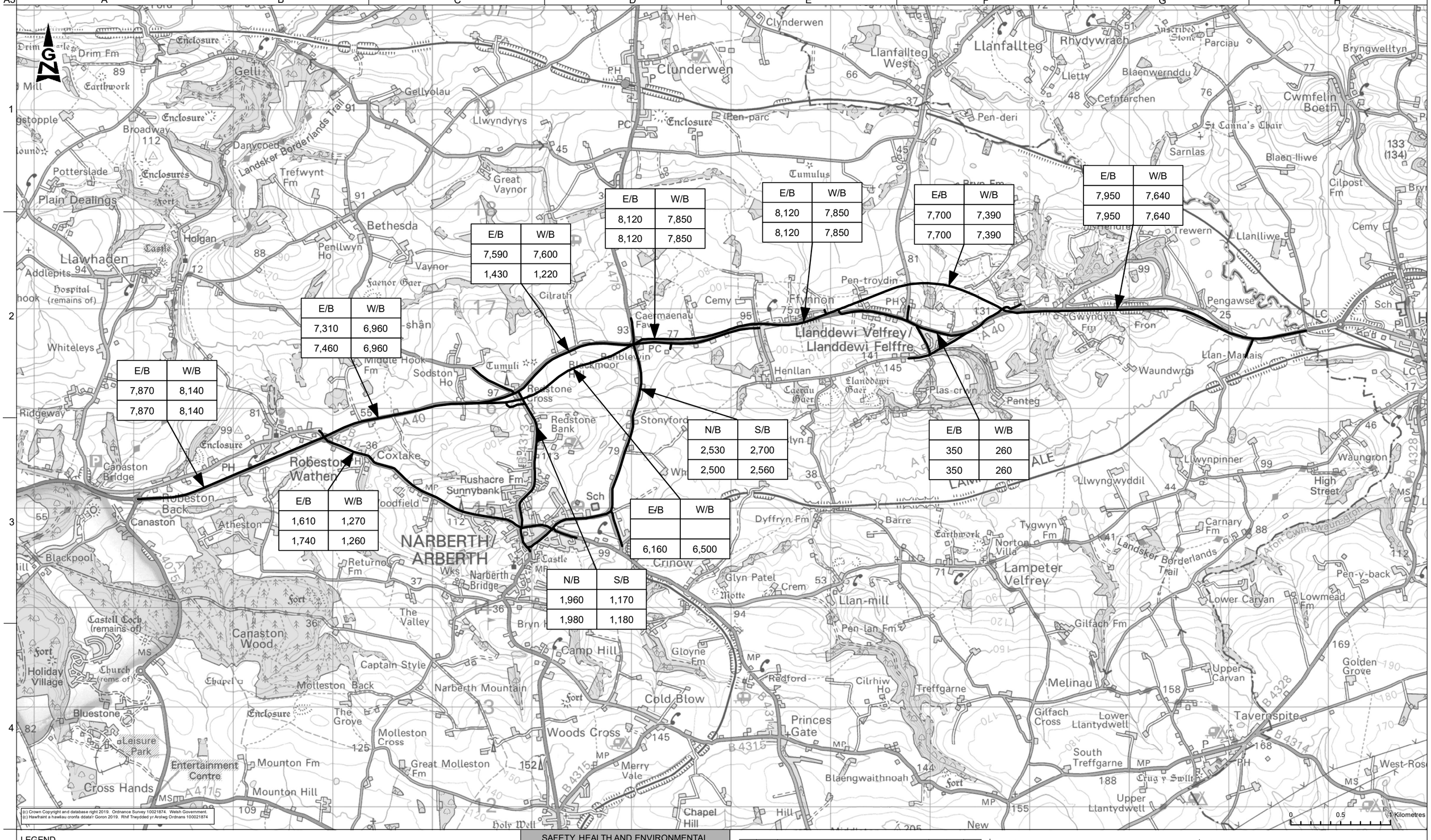
Drawing Title
FIGURE A.11
2051 FORECAST
PM PEAK TRAFFIC FLOWS
CORE SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0021
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO-SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

Delivery Team
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RICHARDS

Drawing Title
FIGURE A.12
2051 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
CORE SCENARIO

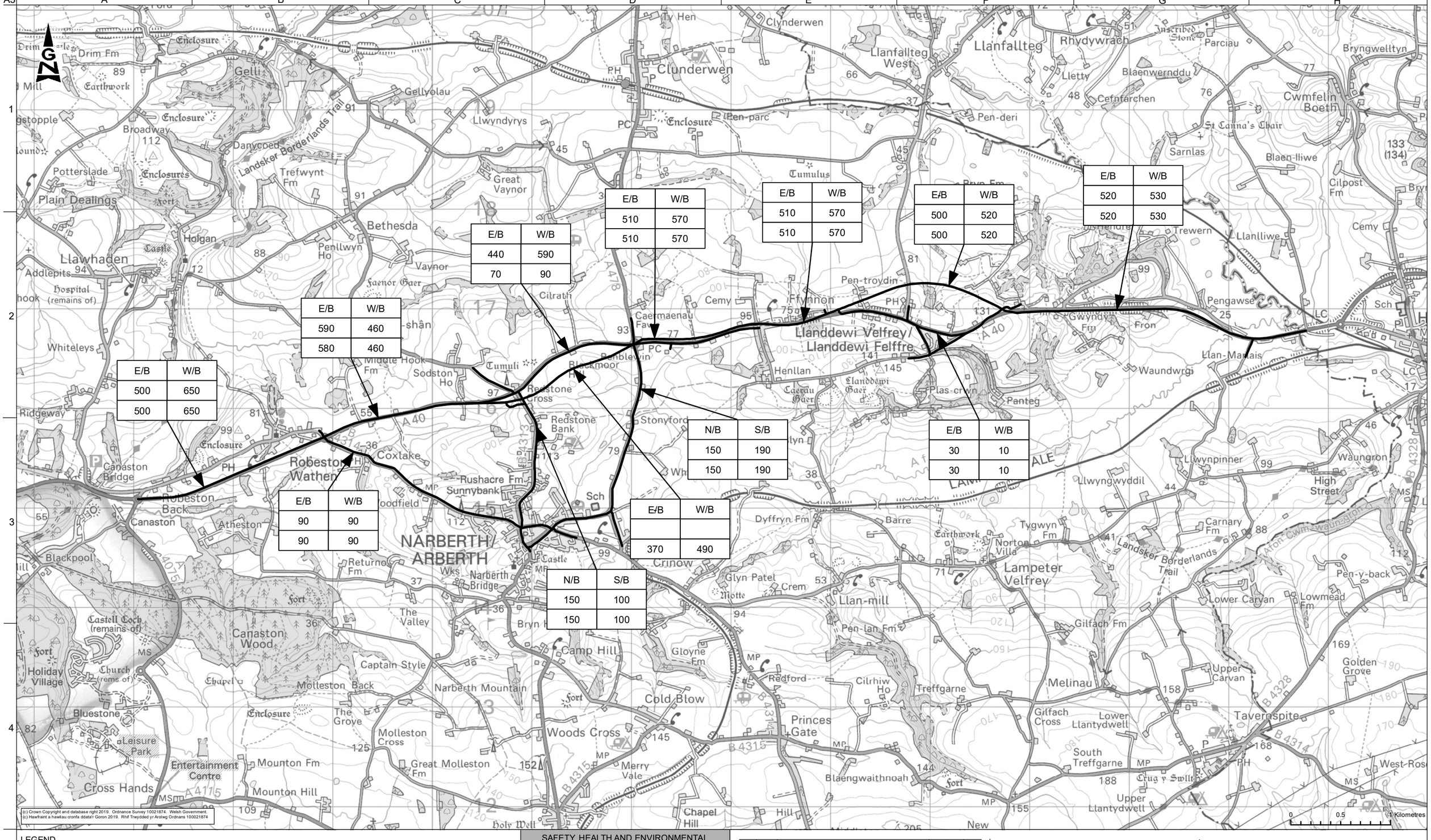
Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3
1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0022

Project	Originator	Volume	Location	Type	Role	Number
A40PRC	ARP	VTR	SWI	DR	TR	0022



E/B	W/B
440	590
70	90

E/B	W/B
510	570
510	570

E/B	W/B
510	570
510	570

E/B	W/B
500	520
500	520

E/B	W/B
520	530
520	530

E/B	W/B
590	460
580	460

E/B	W/B
500	650
500	650

N/B	S/B
150	190
150	190

E/B	W/B
30	10
30	10

E/B	W/B
90	90
90	90

E/B	W/B
370	490

N/B	S/B
150	100
150	100

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0 0.5 1 Kilometres

LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
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RICHARDS

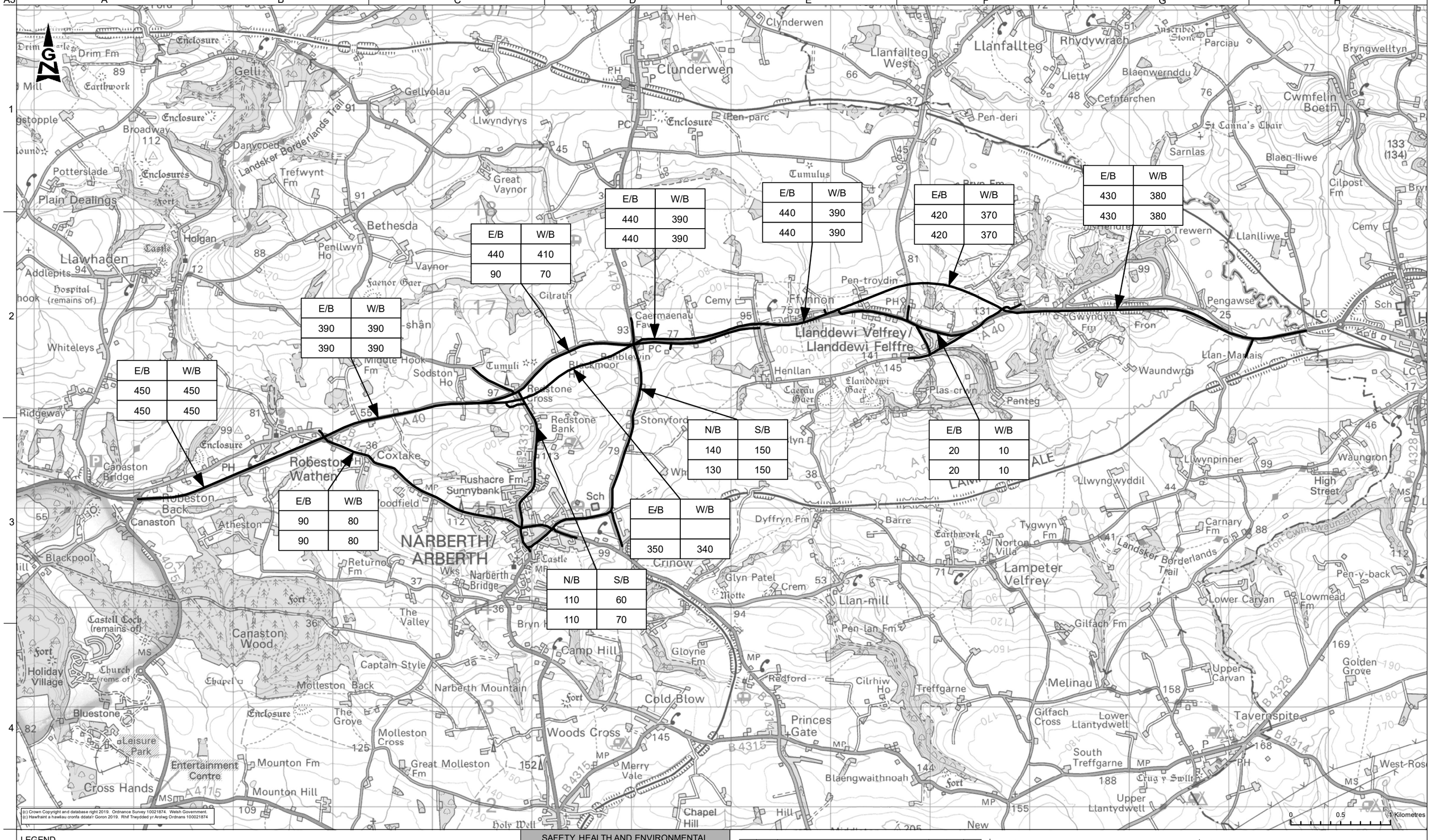
Drawing Title
FIGURE B.1
2022 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0024
Project | Originator | Volume | Location | Type | Role | Number



E/B	W/B
440	390
440	390

E/B	W/B
440	410
90	70

E/B	W/B
390	390
390	390

E/B	W/B
450	450
450	450

E/B	W/B
90	80
90	80

N/B	S/B
140	150
130	150

E/B	W/B
350	340

N/B	S/B
110	60
110	70

E/B	W/B
440	390
440	390

E/B	W/B
420	370
420	370

E/B	W/B
430	380
430	380

E/B	W/B
20	10
20	10

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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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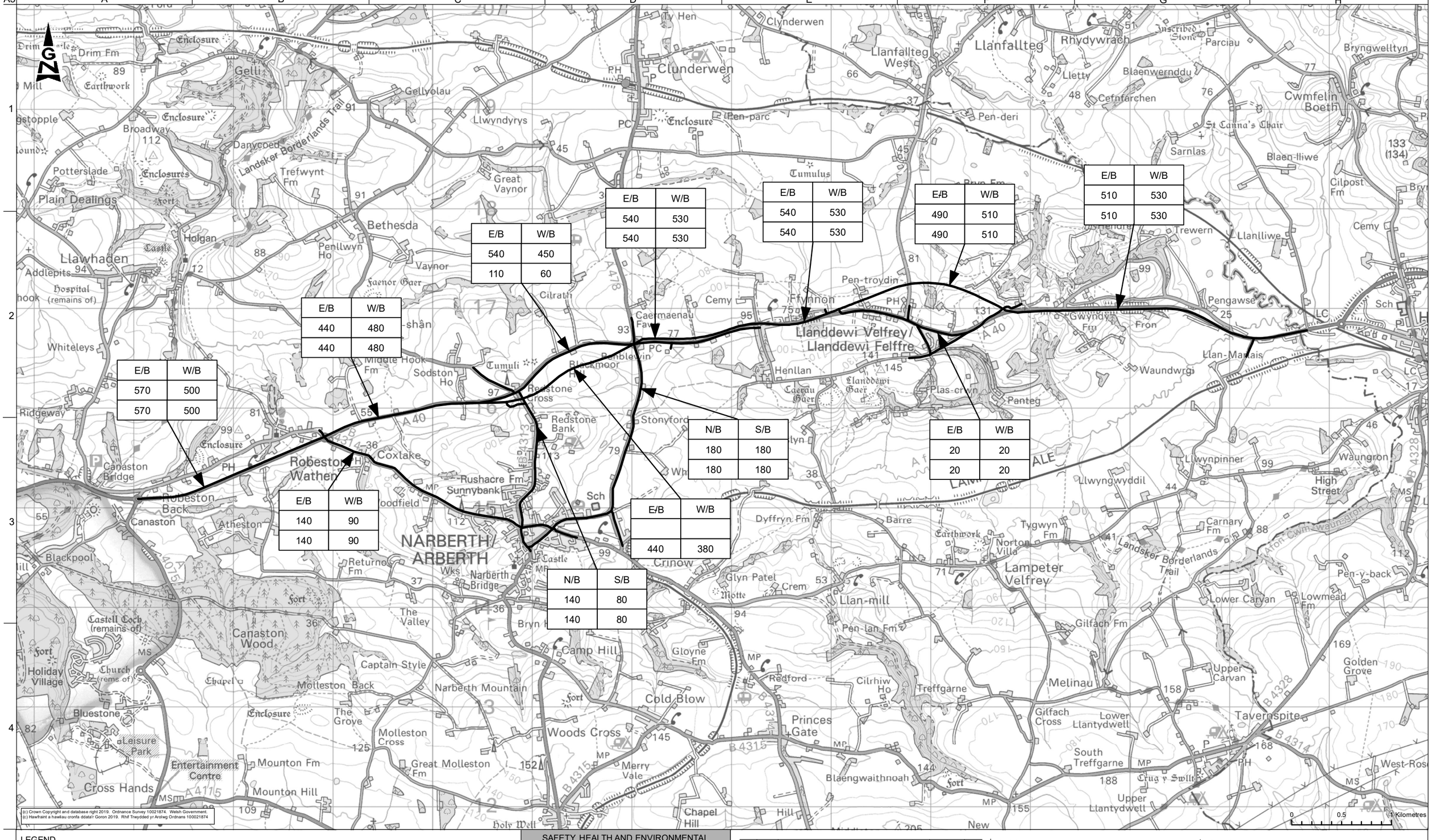
Drawing Title
FIGURE B.2
2022 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0025
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

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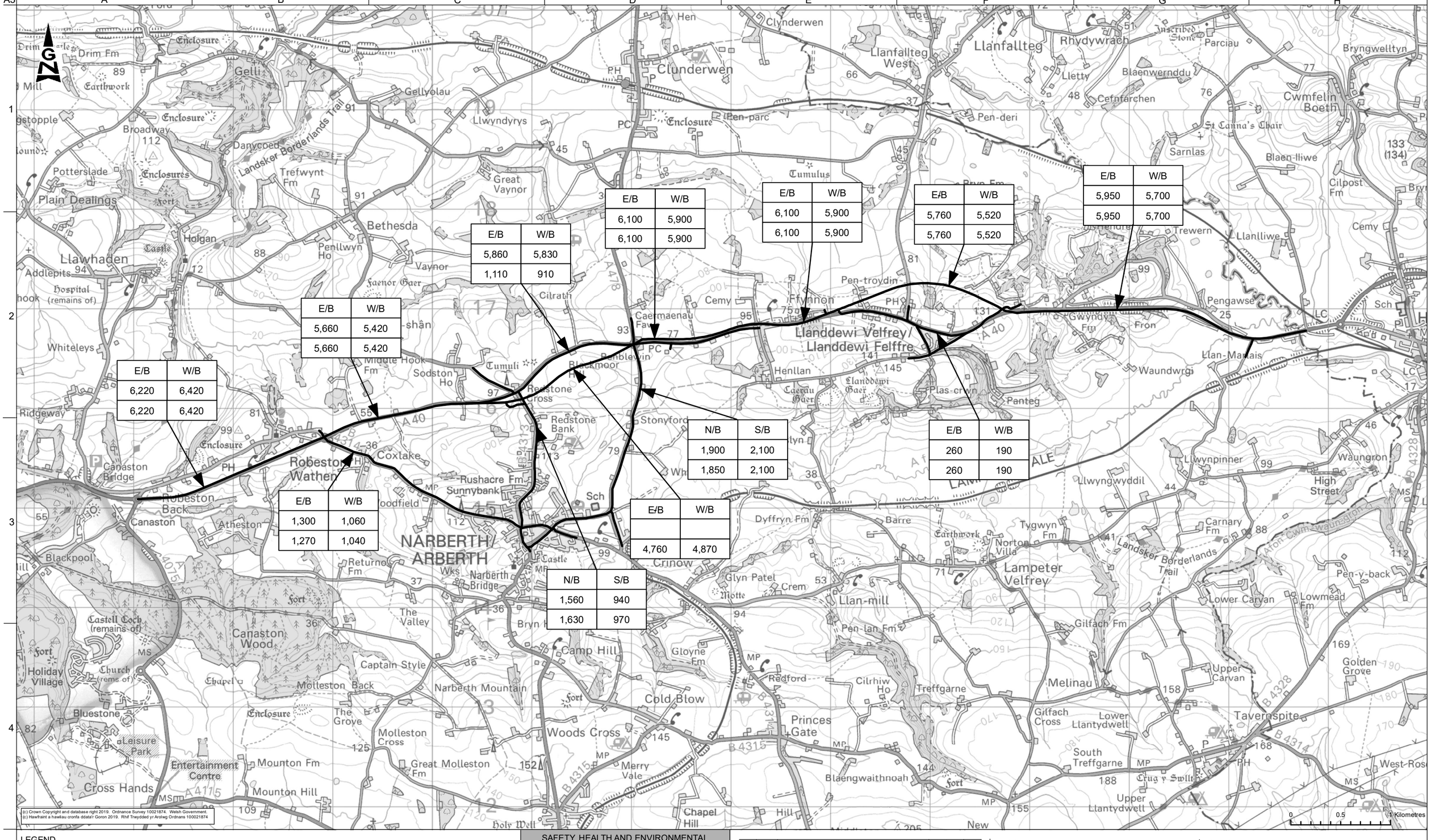
Drawing Title
FIGURE B.3
2022 FORECAST
PM PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0026
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

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MOTT MACDONALD
ARUP
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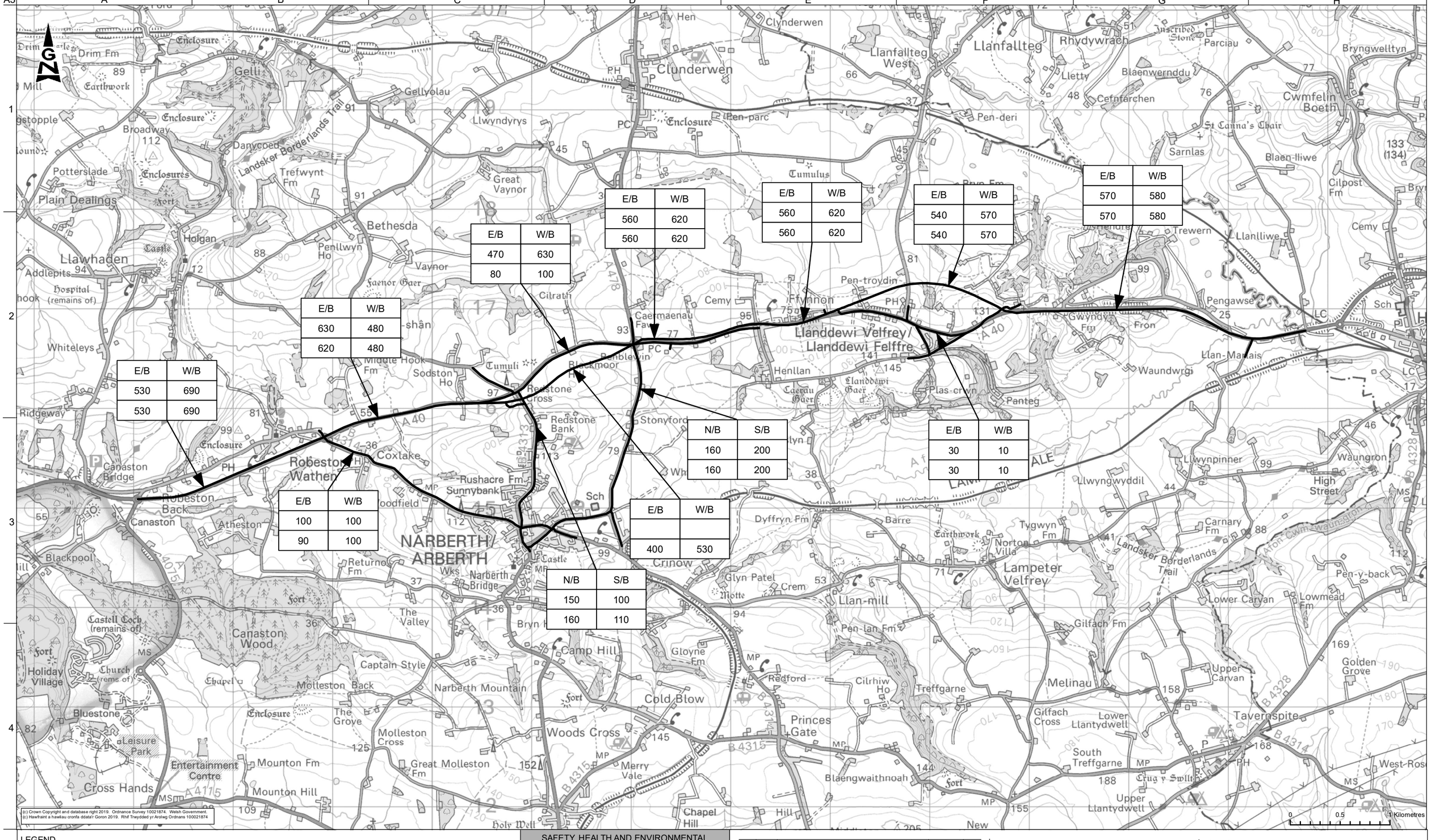
Drawing Title
FIGURE B.4
2022 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3
1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0027
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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MOTT MACDONALD
RICHARDS

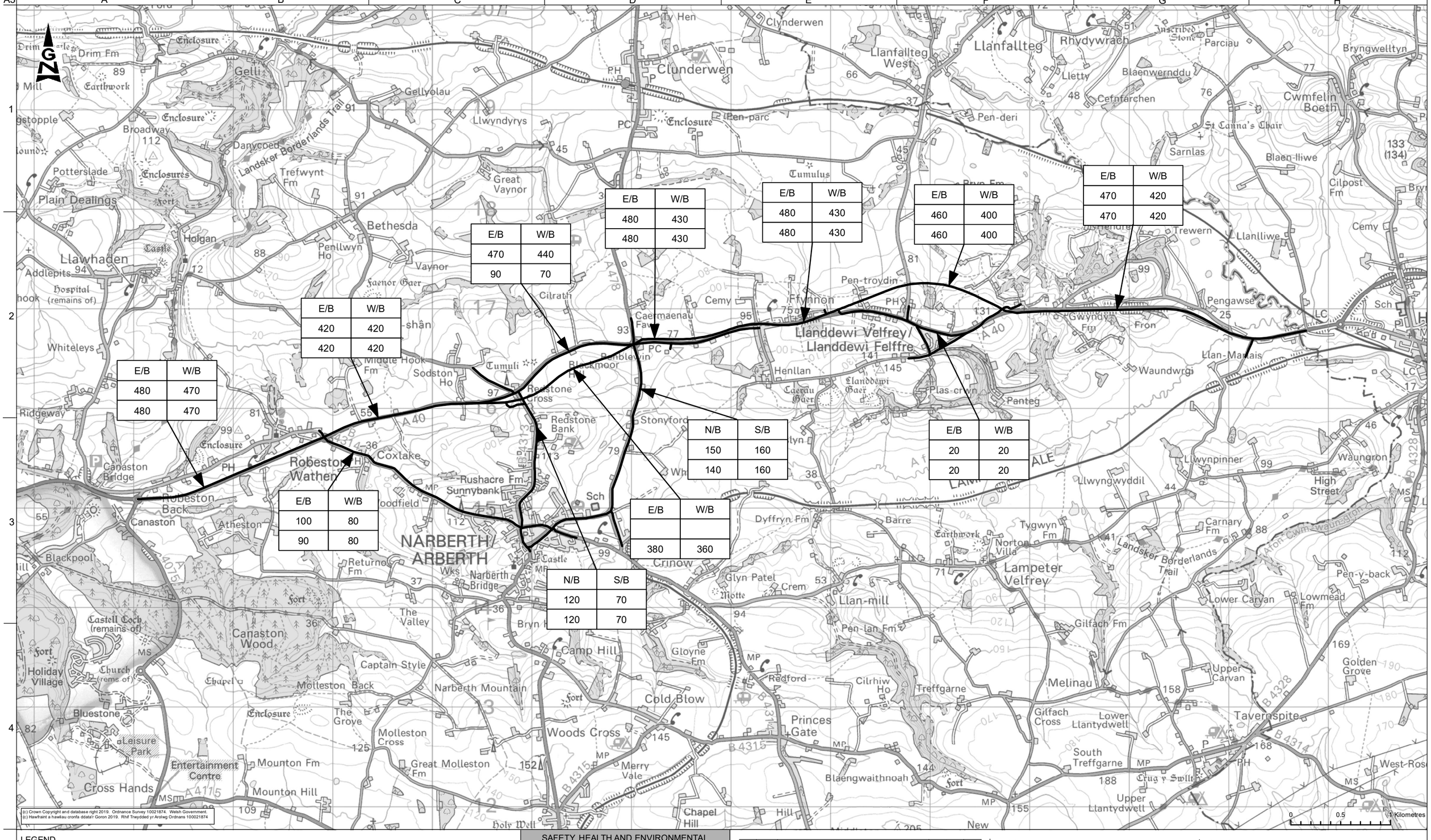
Drawing Title
FIGURE B.5
2037 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0028
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

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RICHARDS

Drawing Title
FIGURE B.6
2037 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0029
Project | Originator | Volume | Location | Type | Role | Number

A3

E/B	W/B
600	530
600	530

E/B	W/B
470	510
470	510

E/B	W/B
580	480
110	70

E/B	W/B
590	580
590	580

E/B	W/B
590	580
590	580

E/B	W/B
540	560
540	560

E/B	W/B
550	580
550	580

N/B	S/B
190	190
190	190

E/B	W/B
20	20
20	20

E/B	W/B
140	90
140	90

E/B	W/B
470	410

N/B	S/B
140	80
150	80

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0 0.5 1 Kilometres

LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
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MOTT MACDONALD
ARUP
RICHARDS

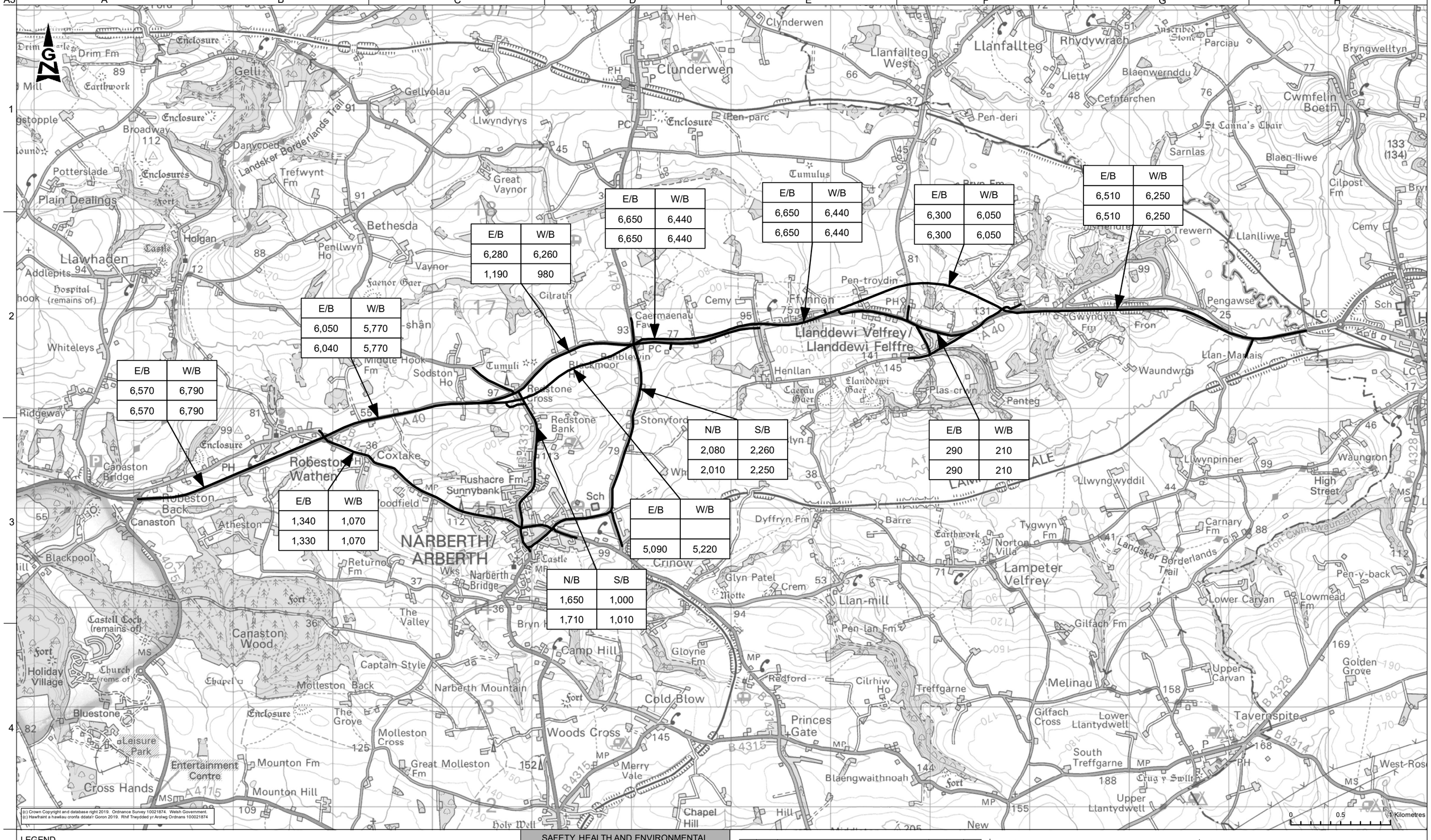
Drawing Title
FIGURE B.7
2037 FORECAST
PM PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0030
Project | Originator | Volume | Location | Type | Role | Number



E/B	W/B
6,280	6,260
1,190	980

E/B	W/B
6,650	6,440
6,650	6,440

E/B	W/B
6,650	6,440
6,650	6,440

E/B	W/B
6,300	6,050
6,300	6,050

E/B	W/B
6,510	6,250
6,510	6,250

E/B	W/B
6,050	5,770
6,040	5,770

E/B	W/B
6,570	6,790
6,570	6,790

N/B	S/B
2,080	2,260
2,010	2,250

E/B	W/B
290	210
290	210

E/B	W/B
1,340	1,070
1,330	1,070

E/B	W/B
5,090	5,220

N/B	S/B
1,650	1,000
1,710	1,010

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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	18/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

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MOTT MACDONALD
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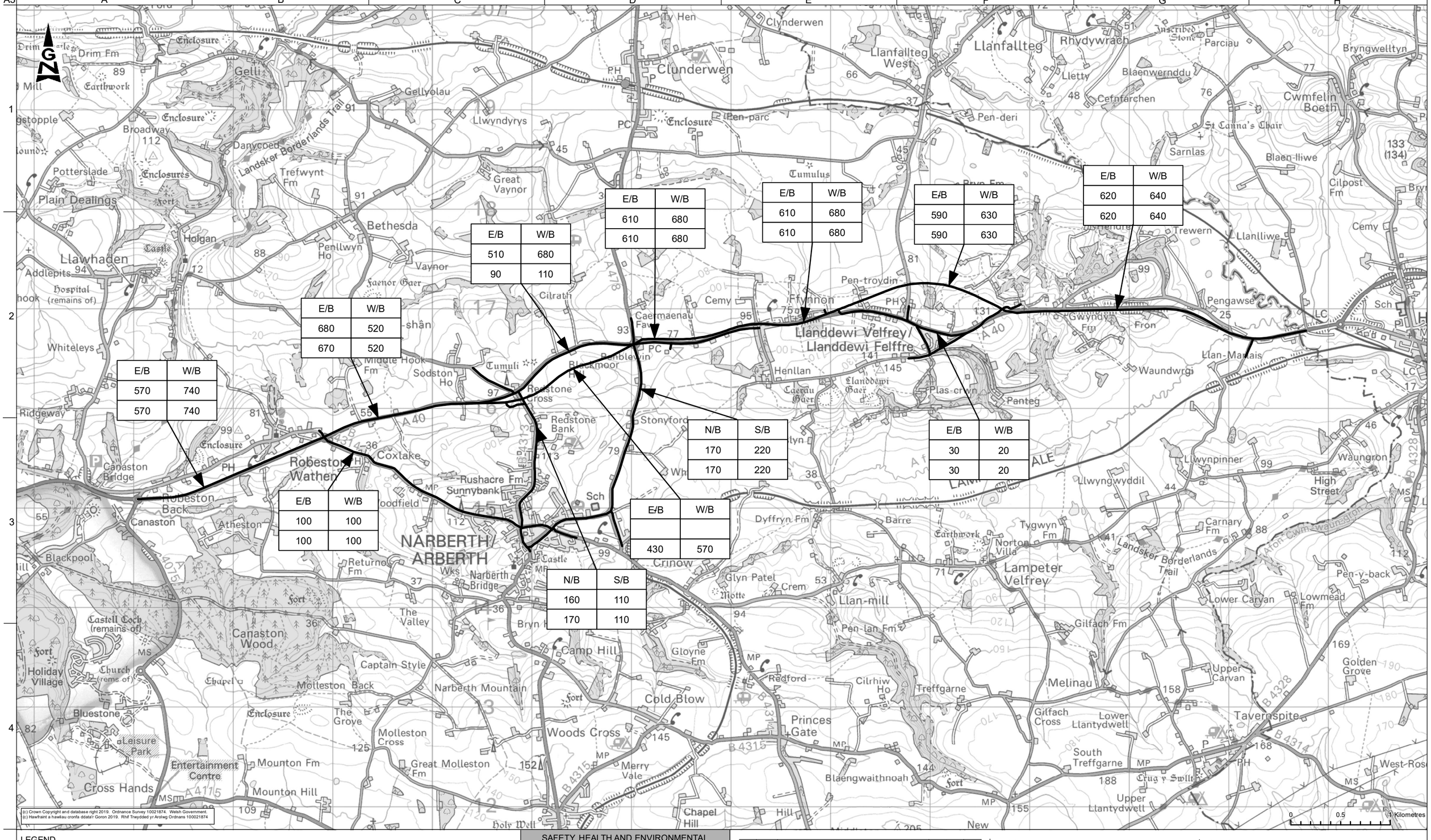
Drawing Title
FIGURE B.8
2037 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 18/12/19	Date 18/12/19	Date 18/12/19	Date 18/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0031
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	05/02/20	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
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MOTT MACDONALD
RICHARDS

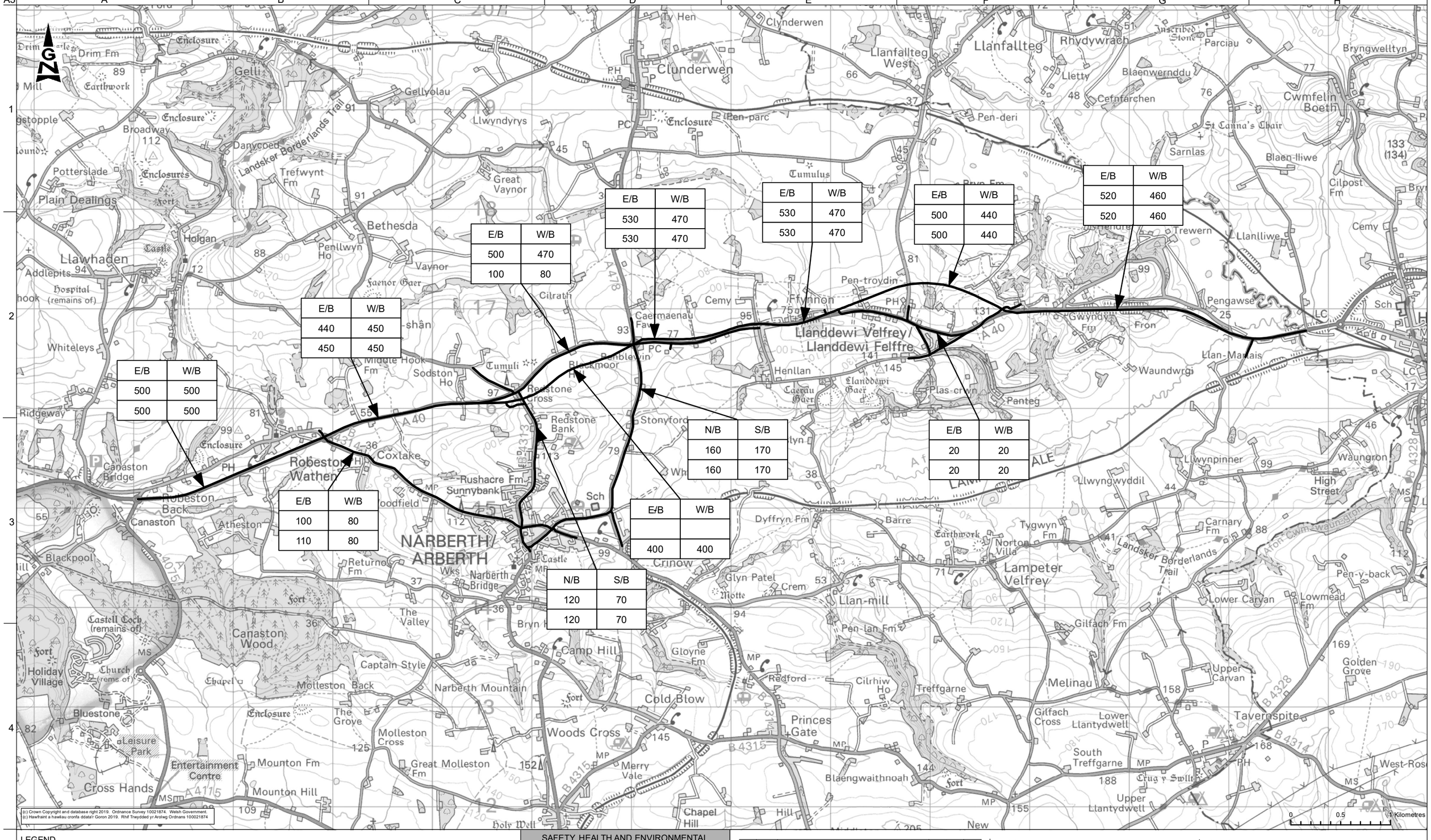
Drawing Title
FIGURE B.9
2051 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 05/02/20	Date 05/02/20	Date 05/02/20	Date 05/02/20

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0032
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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ARCADIS
MOTT MACDONALD
RICHARDS

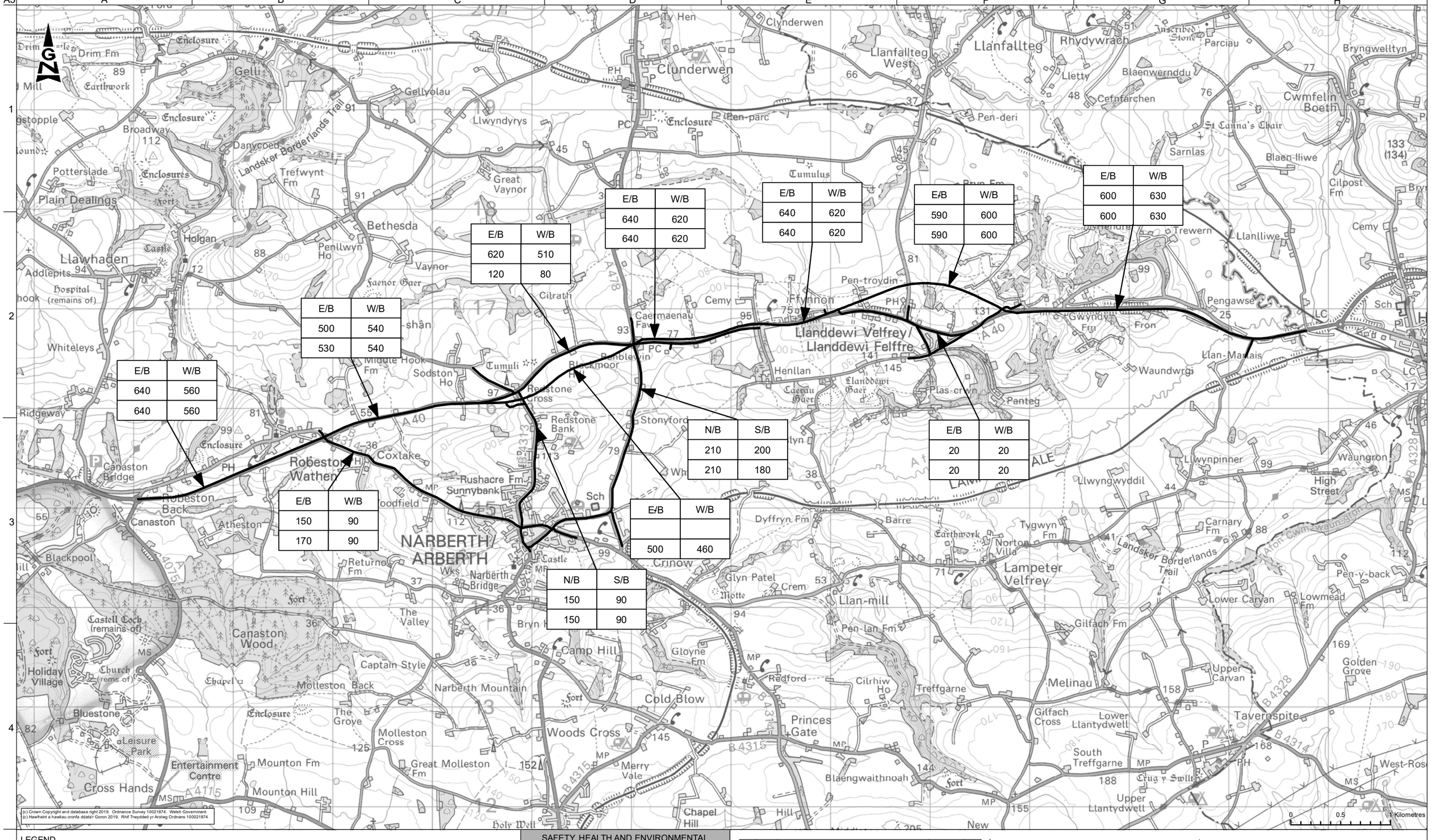
Drawing Title
FIGURE B.10
2051 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0033
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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MOTT MACDONALD
RICHARDS

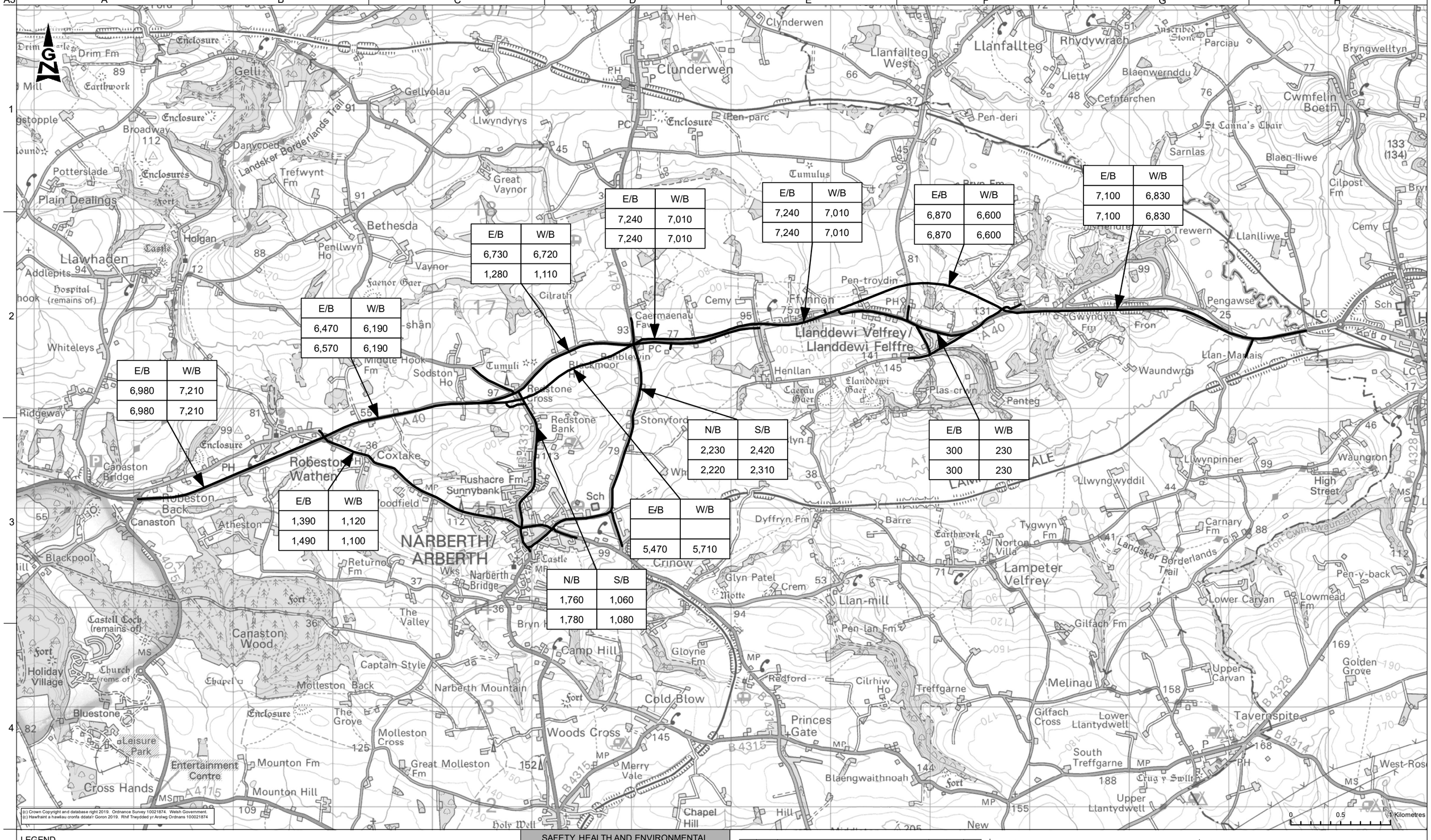
Drawing Title
FIGURE B.11
2051 FORECAST
PM PEAK HOUR TRAFFIC FLOWS
LOW GROWTH SCENARIO

Suitability
S4 | SUITABLE OF STAGE APPROVAL

Scale at A3
1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0034
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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ARCADIS
MOTT MACDONALD
RICHARDS

Drawing Title
FIGURE B.12
2051 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
LOW GROWTH SCENARIO

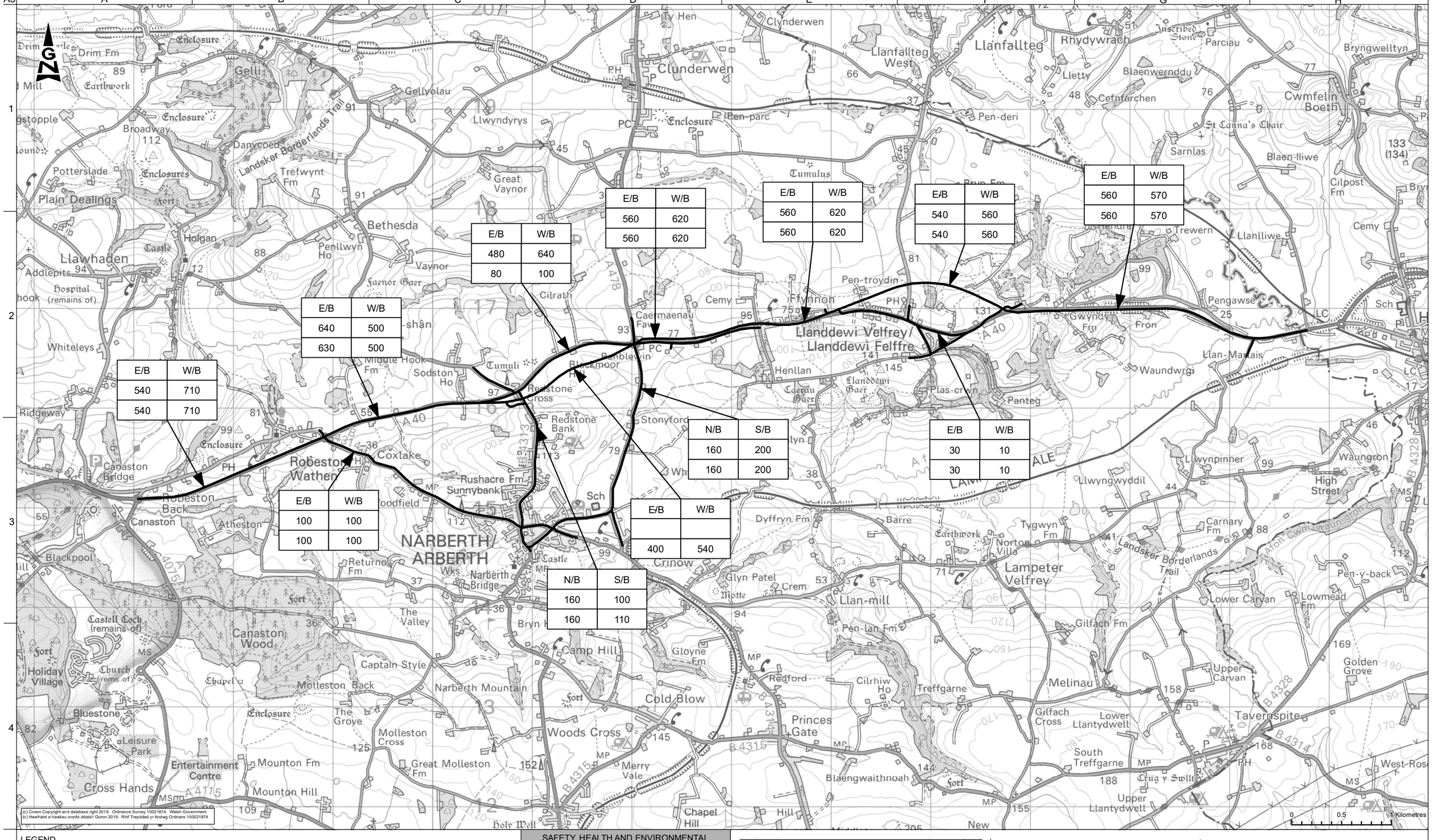
Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0035
Project | Originator | Volume | Location | Type | Role | Number

Appendix C – High Scenario Traffic Flow Figures



E/B	W/B
560	620
560	620

E/B	W/B
480	640
80	100

E/B	W/B
560	620
560	620

E/B	W/B
540	560
540	560

E/B	W/B
560	570
560	570

E/B	W/B
640	500
630	500

E/B	W/B
540	710
540	710

N/B	S/B
160	200
160	200

E/B	W/B
30	10
30	10

E/B	W/B
100	100
100	100

E/B	W/B
400	540

N/B	S/B
160	100
160	110

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0 0.5 1 Kilometres

LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

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ARCADIS
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RICHARDS

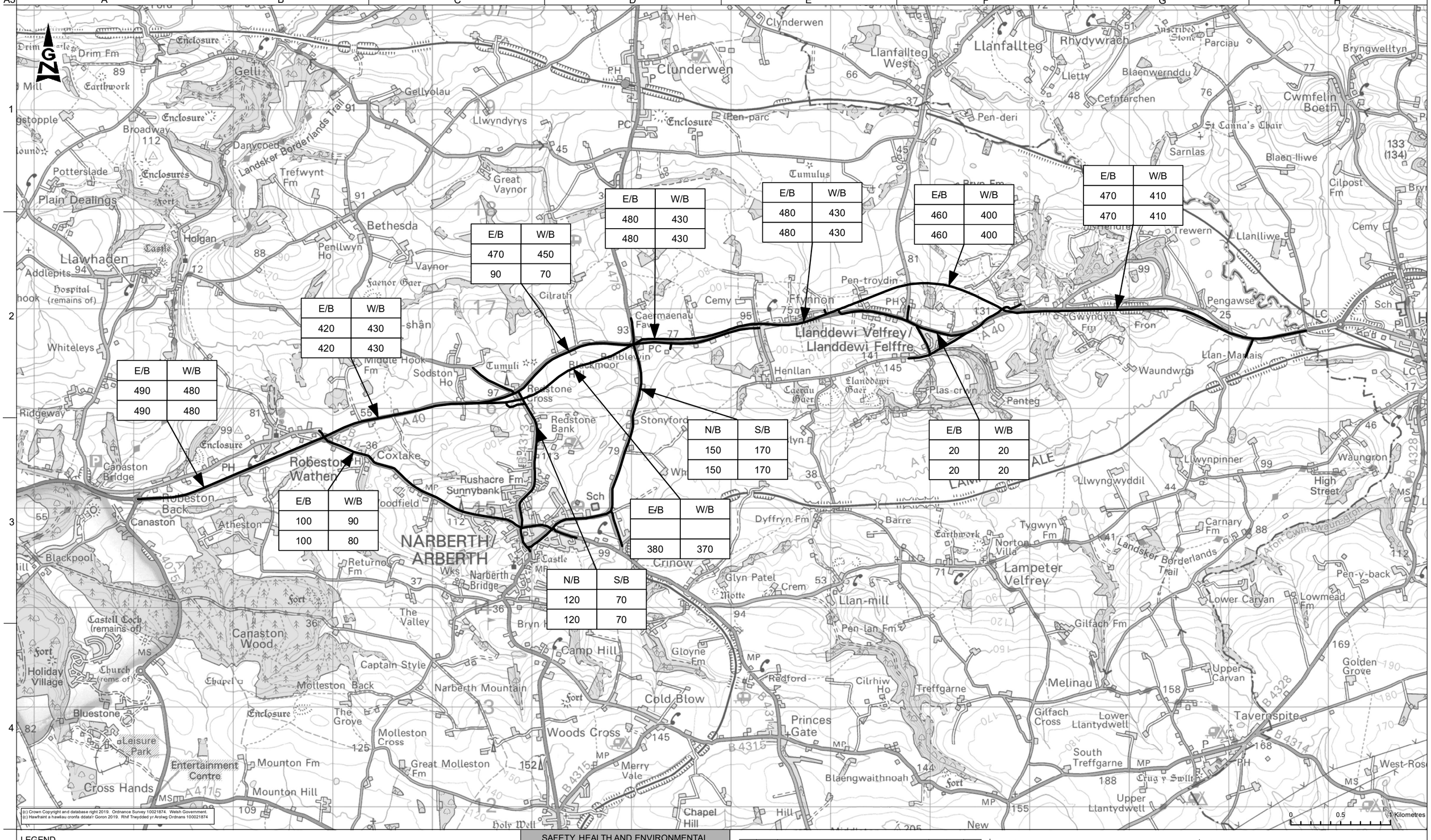
Drawing Title
FIGURE C.1
2022 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0036
Project | Originator | Volume | Location | Type | Role | Number



E/B	W/B
470	450
90	70

E/B	W/B
480	430
480	430

E/B	W/B
480	430
480	430

E/B	W/B
460	400
460	400

E/B	W/B
470	410
470	410

E/B	W/B
420	430
420	430

E/B	W/B
490	480
490	480

N/B	S/B
150	170
150	170

E/B	W/B
20	20
20	20

E/B	W/B
100	90
100	80

E/B	W/B
380	370

N/B	S/B
120	70
120	70

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0 0.5 1 Kilometres

LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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RICHARDS

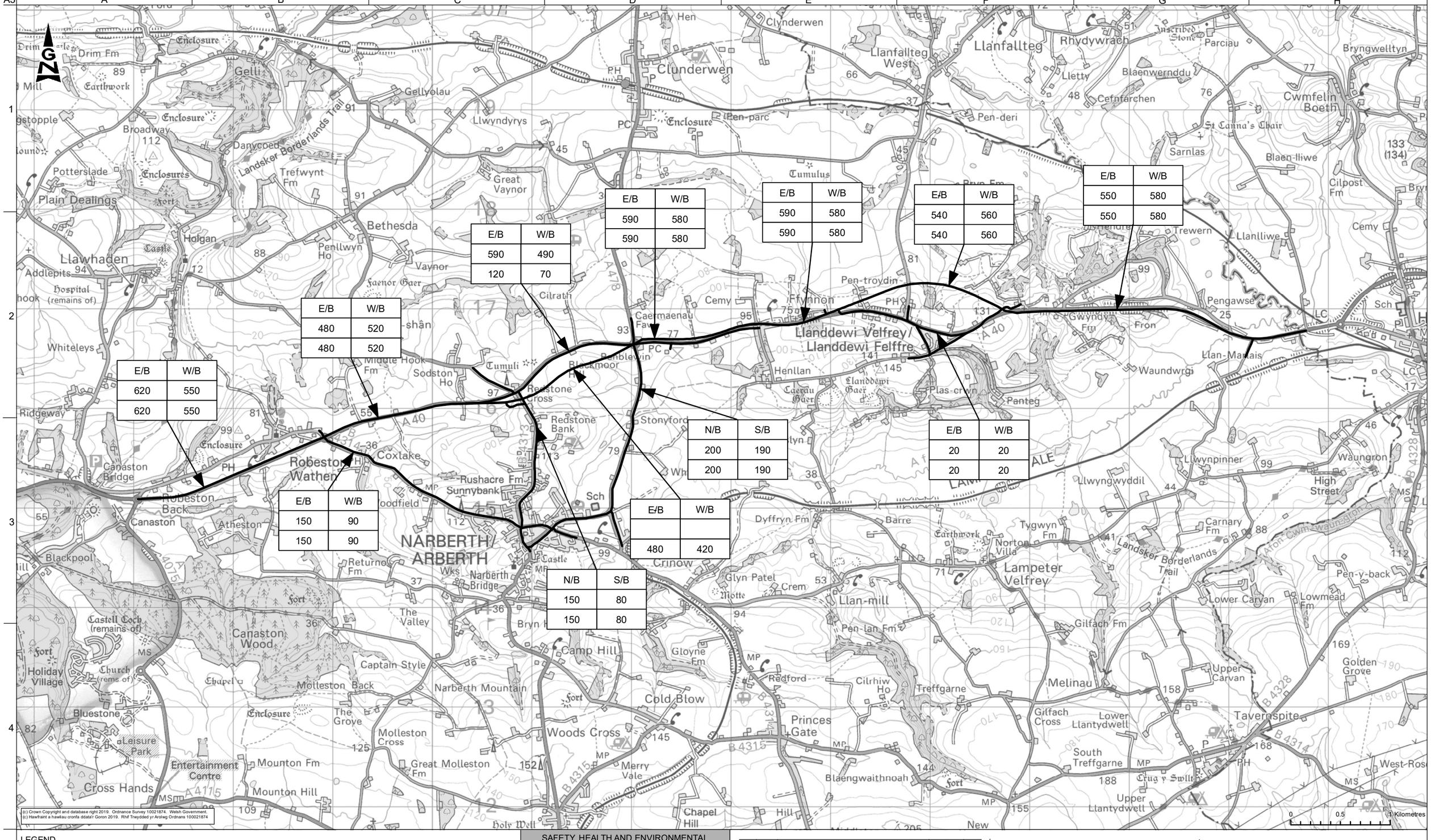
Drawing Title
FIGURE C.2
2022 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0037
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

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RICHARDS

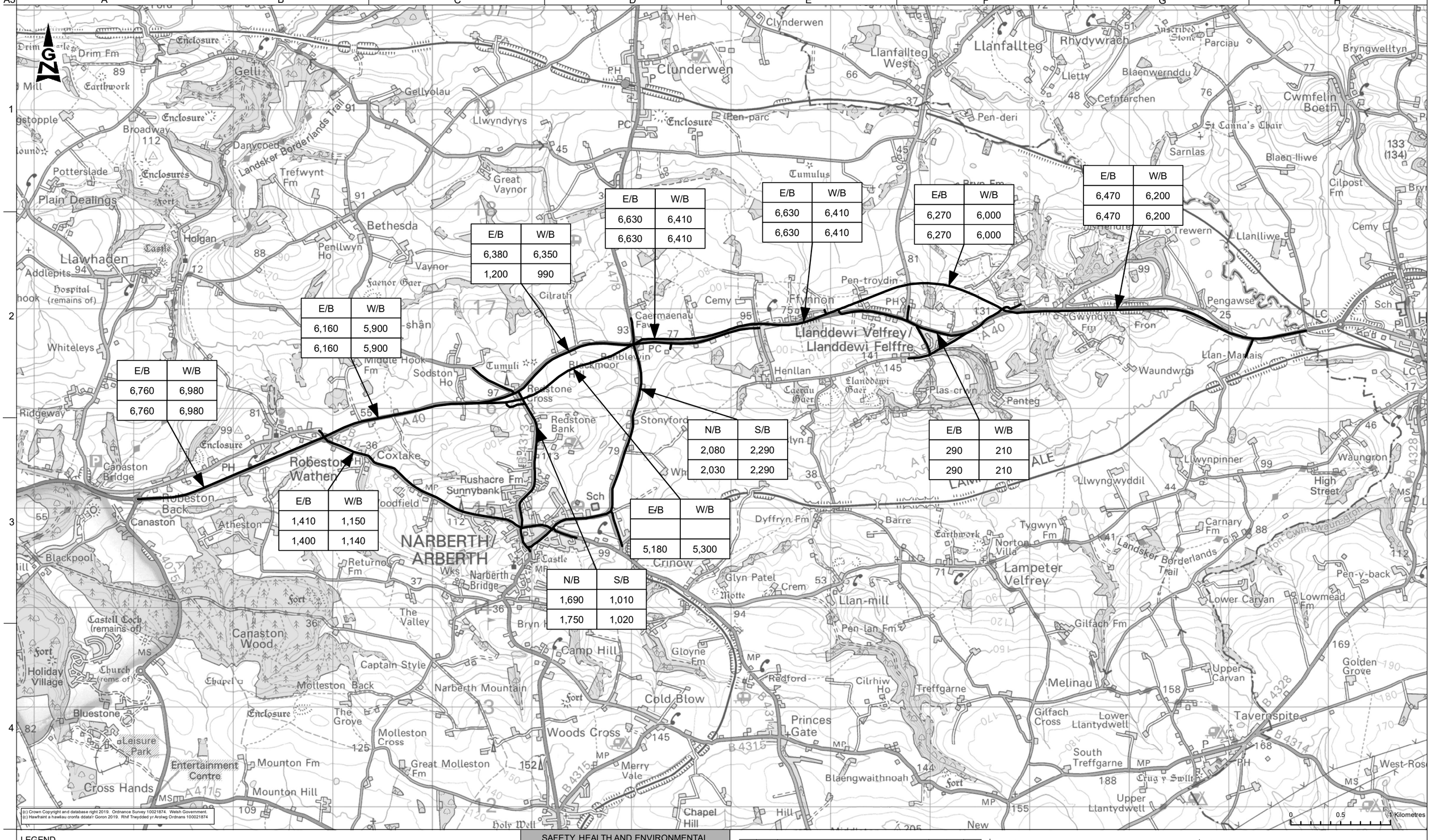
Drawing Title
FIGURE C.3
2022 FORECAST
PM PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0038
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

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RICHARDS

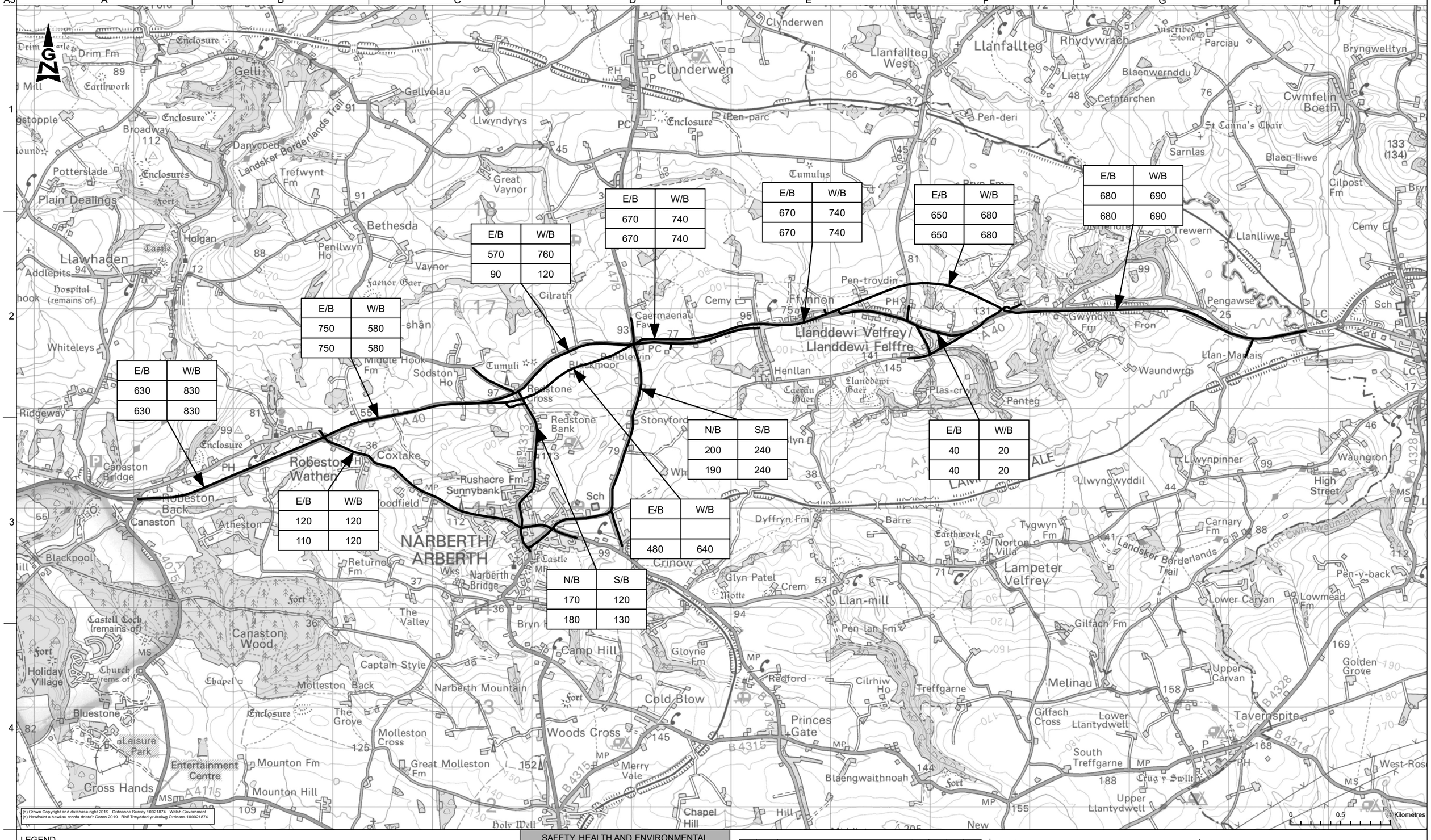
Drawing Title
FIGURE C.4
2022 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0039
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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MOTT MACDONALD
ARUP
RICHARDS

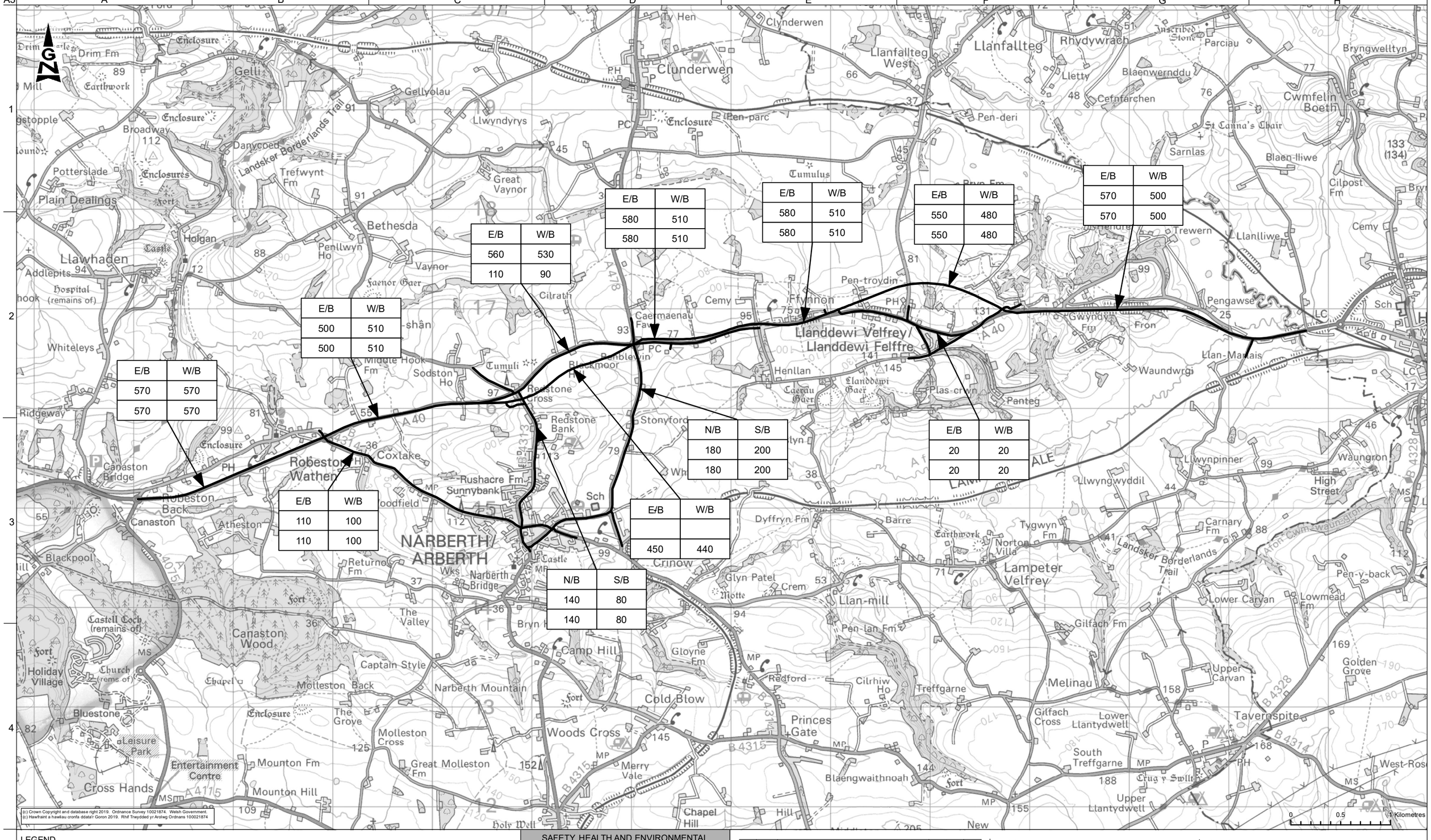
Drawing Title
FIGURE C.5
2037 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUTIABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0040
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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RICHARDS

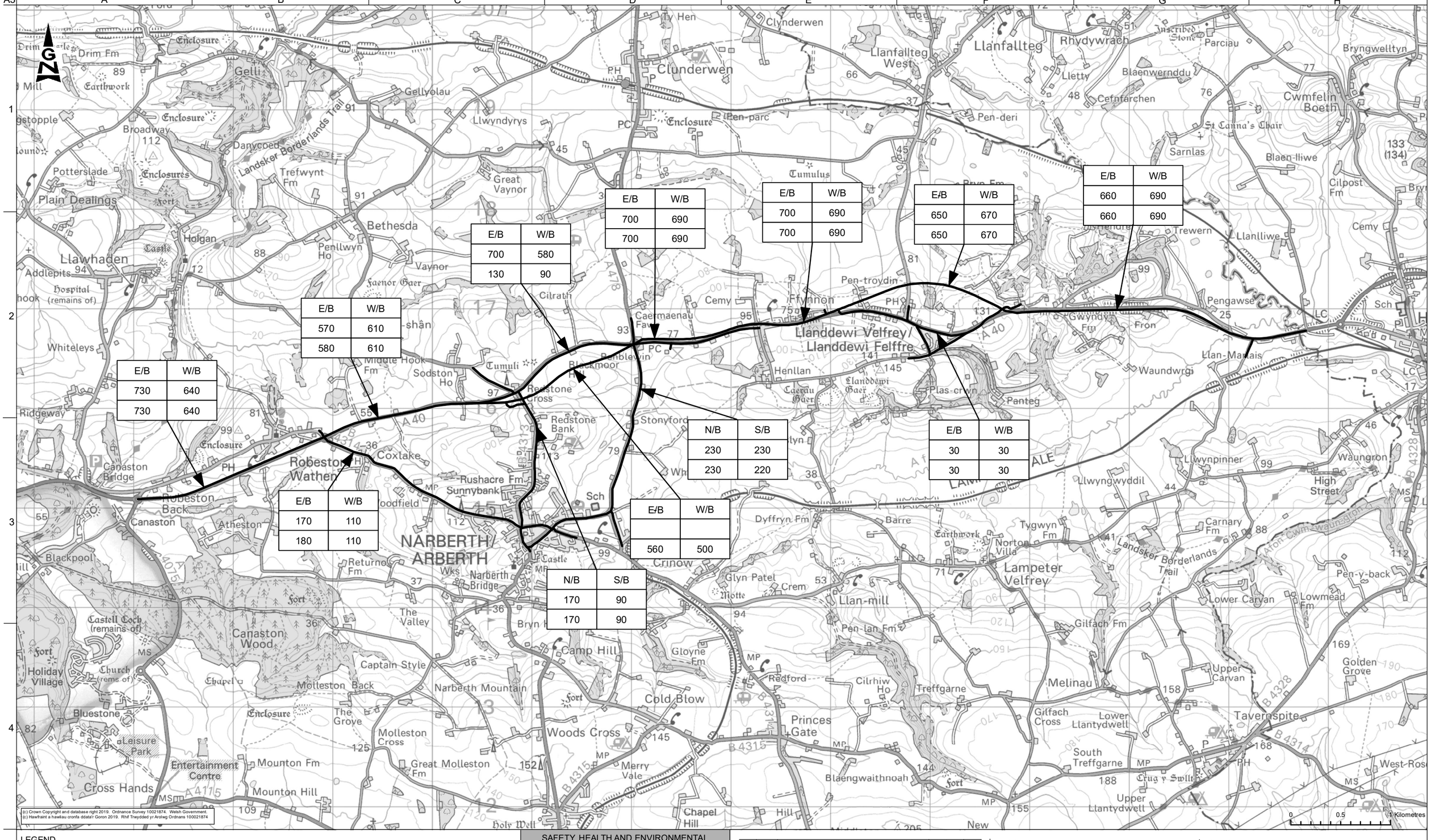
Drawing Title
FIGURE C.6
2037 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

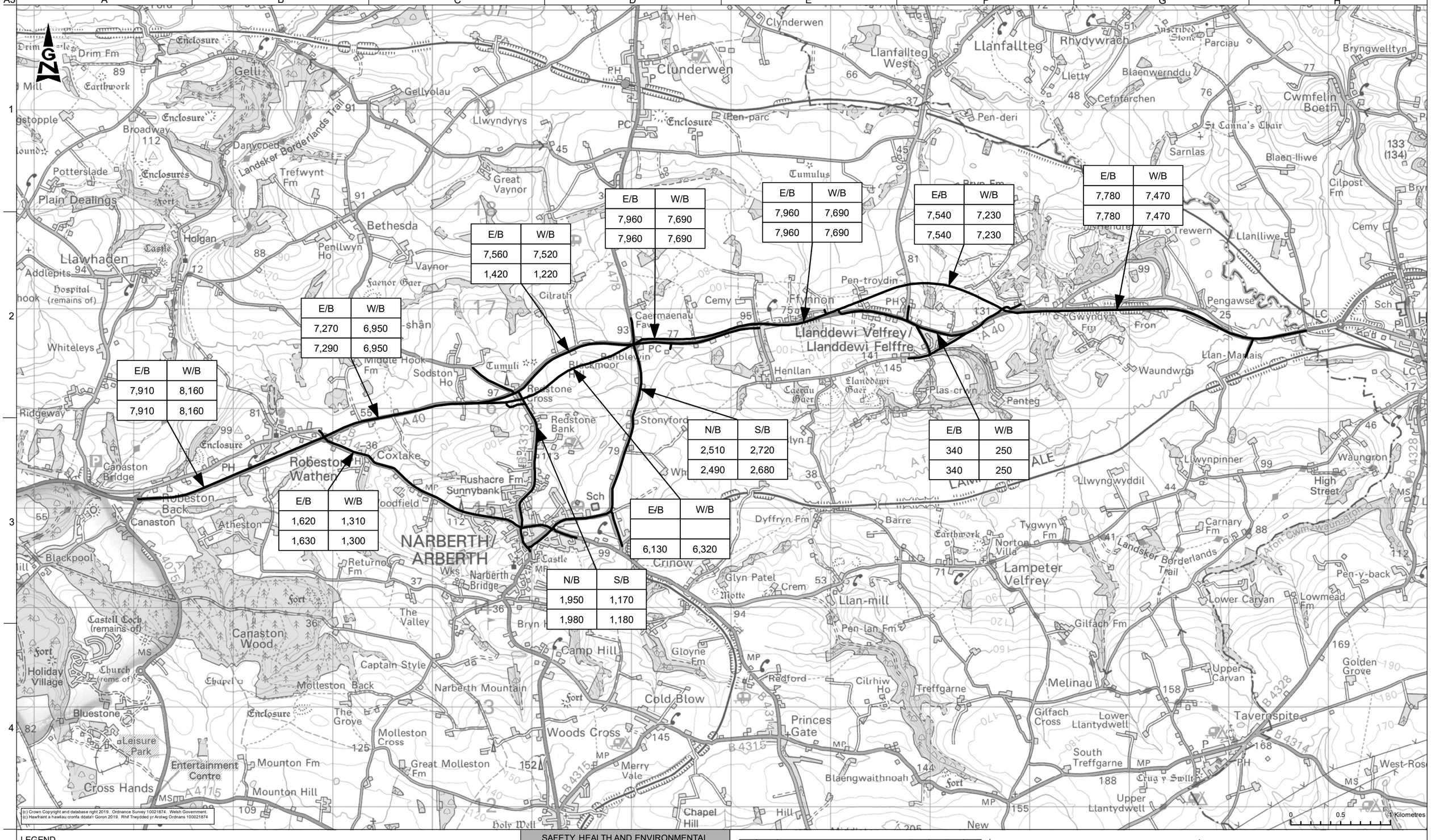
Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0041
Project | Originator | Volume | Location | Type | Role | Number


A3
A
B
C
D
E
F
G
H
1
2
3
4
GZ
E/B | W/B
700 | 690
700 | 690
E/B | W/B
700 | 580
130 | 90
E/B | W/B
700 | 690
700 | 690
E/B | W/B
650 | 670
650 | 670
E/B | W/B
660 | 690
660 | 690
E/B | W/B
570 | 610
580 | 610
E/B | W/B
730 | 640
730 | 640
N/B | S/B
230 | 230
230 | 220
E/B | W/B
30 | 30
30 | 30
E/B | W/B
170 | 110
180 | 110
E/B | W/B
560 | 500
N/B | S/B
170 | 90
170 | 90
Llanfallteg
Llanfallteg West
Rhydywrach
Clunderwen
Clynderwen
Llanllwni
Llanllwni Fm
Llanllwni Mill
Llanllwni Ho
Llanllwni Chapel
Llanllwni Sch
Llanllwni Cemy
Llanllwni Fm



LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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MOTT MACDONALD
RICHARDS

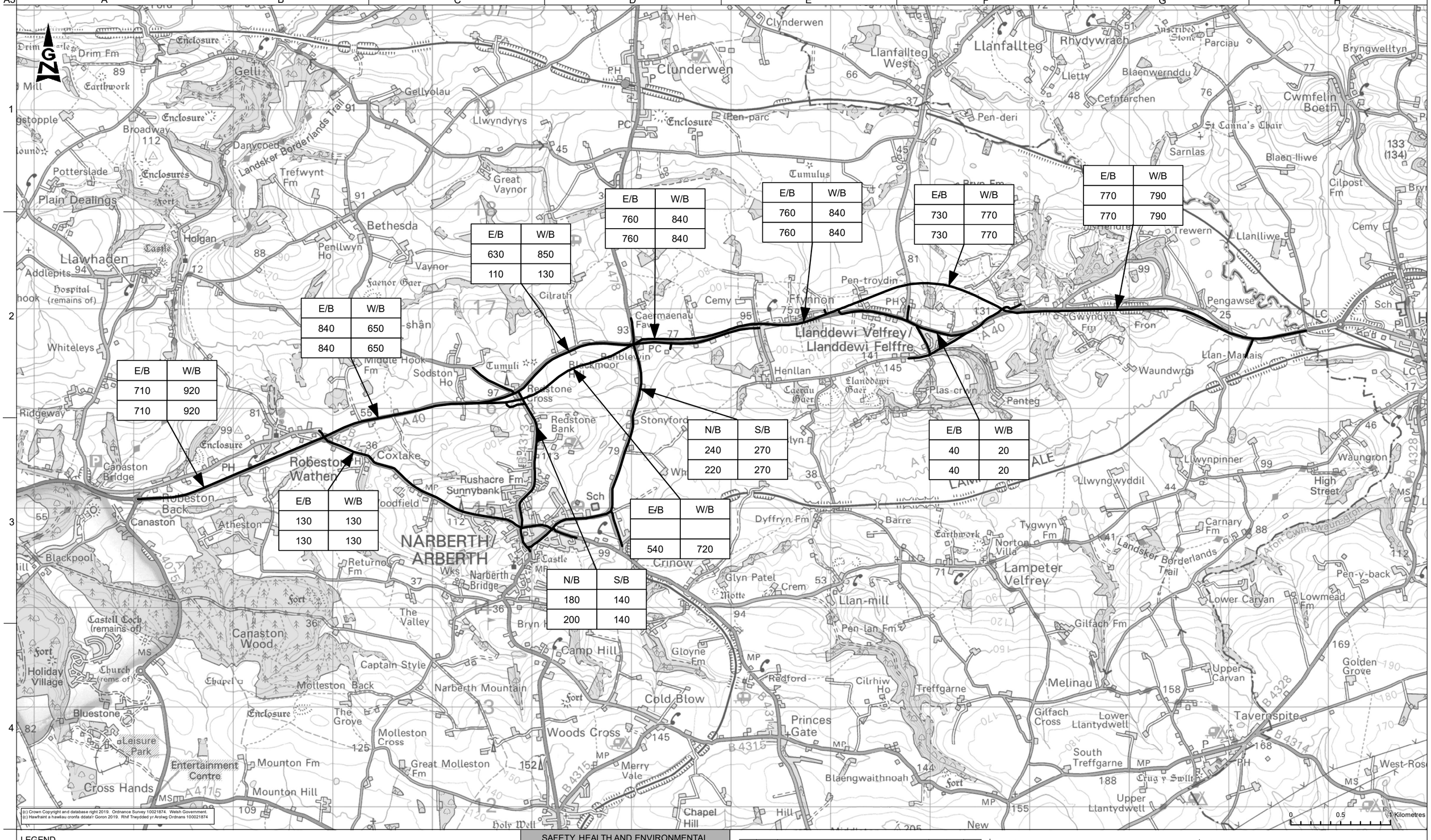
Drawing Title
FIGURE C.8
2037 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0043
Project | Originator | Volume | Location | Type | Role | Number



E/B	W/B
760	840
760	840

E/B	W/B
760	840
760	840

E/B	W/B
730	770
730	770

E/B	W/B
770	790
770	790

E/B	W/B
630	850
110	130

E/B	W/B
840	650
840	650

E/B	W/B
710	920
710	920

N/B	S/B
240	270
220	270

E/B	W/B
40	20
40	20

E/B	W/B
130	130
130	130

E/B	W/B
540	720

N/B	S/B
180	140
200	140

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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

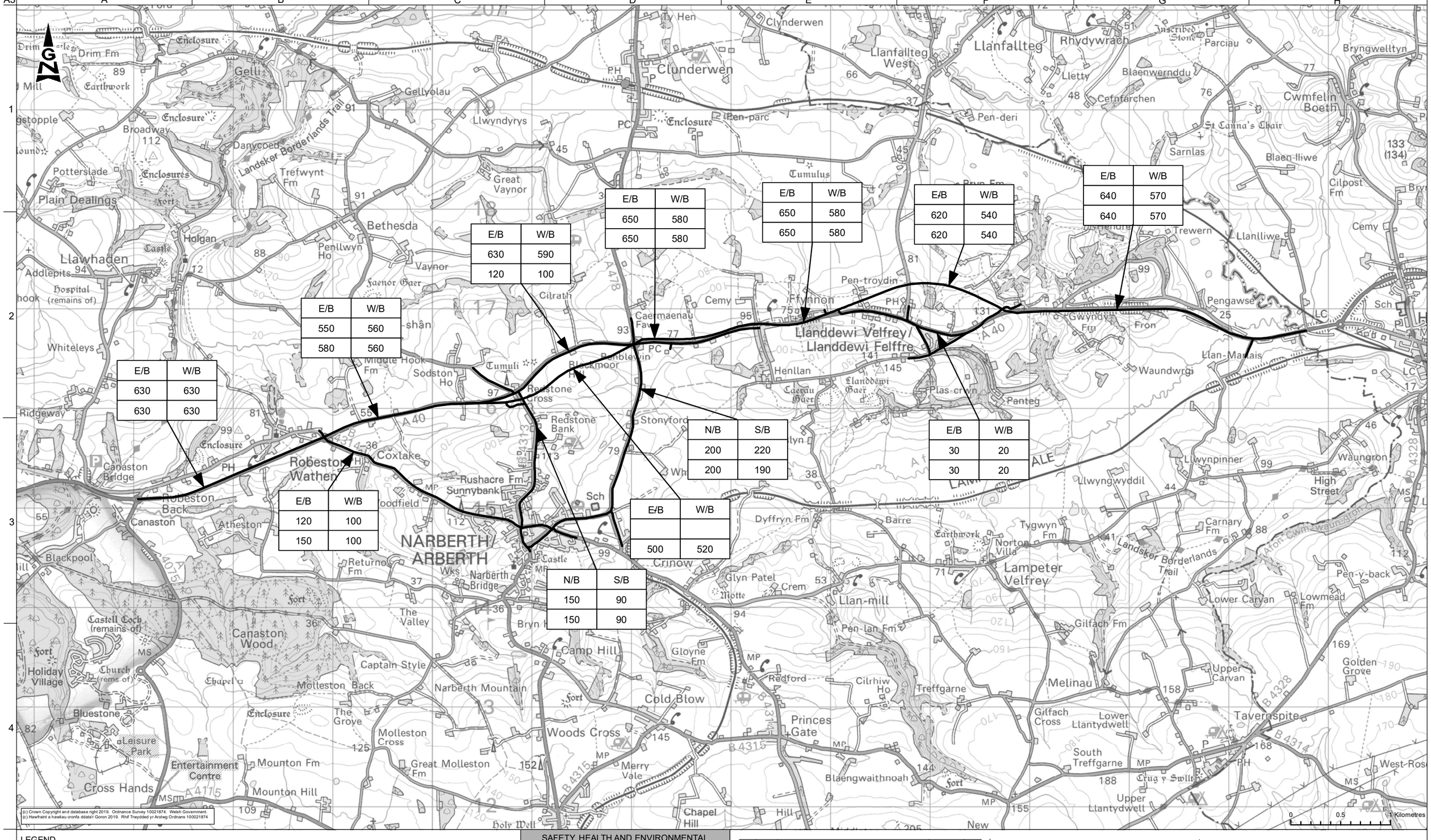
Drawing Title
FIGURE C.9
2051 FORECAST
AM PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0044
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER HOUR)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER HOUR)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

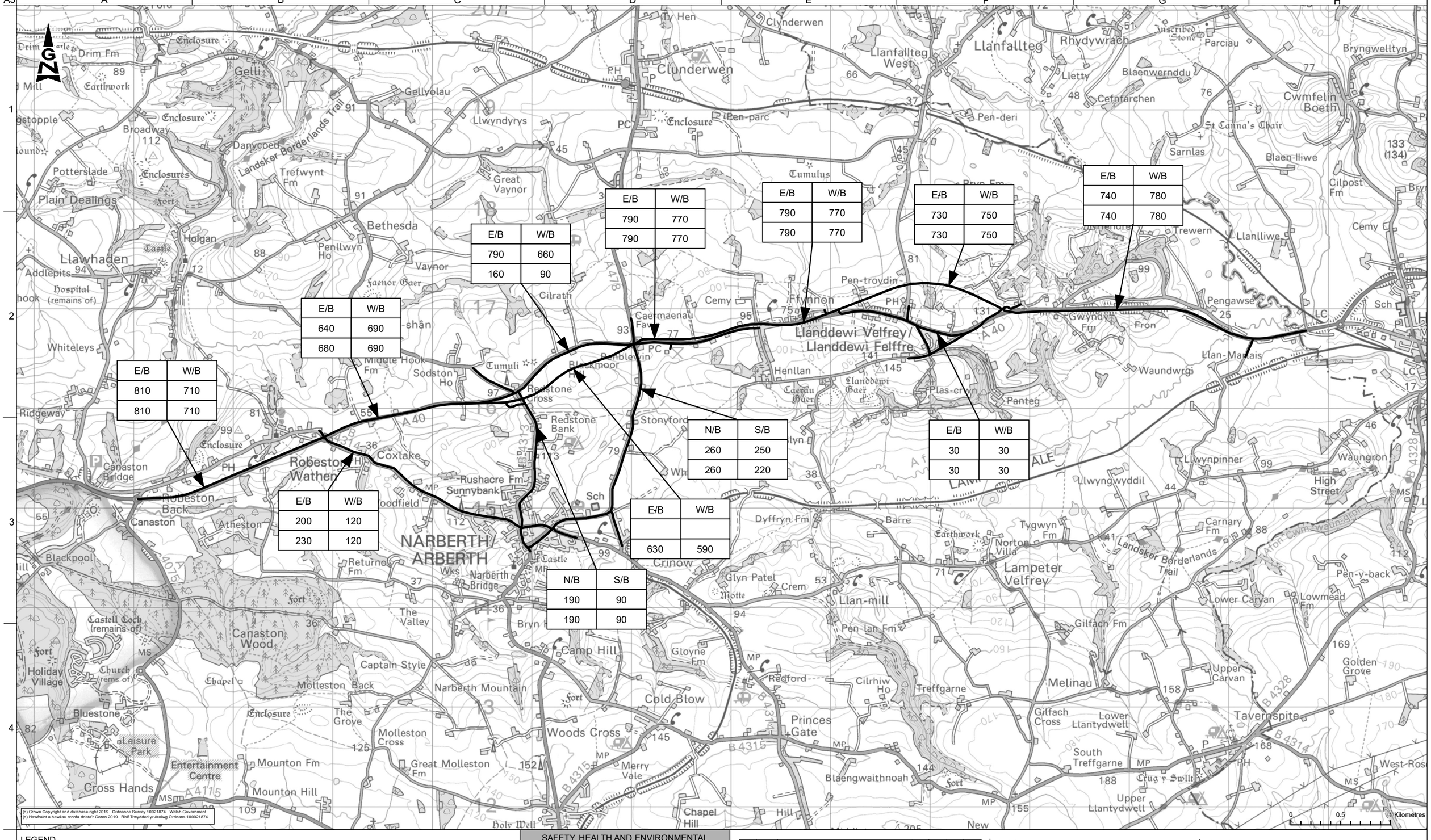
Drawing Title
FIGURE C.10
2051 FORECAST
INTER PEAK HOUR TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0045
Project | Originator | Volume | Location | Type | Role | Number


A3
A
B
C
D
E
F
G
H
1
2
3
4
GZ
Clynderwen
Llanfallteg
Llanfallteg West
Rhydywrach
Clunderwen
Gelli
Gellyolau
Llwyndyrys
Pen-parc
Pen-deri
Llety
Blaenwernddu
Cefnfarchen
Parciau
Cwmfelin Boeth
Bryngwelltyn
St Canna's Chair
Sarnlas
Blaen-lliwe
Cilpost Fm
Cemy
Trewern
Llanlliwe
Pengawse
Fron
Gwynfa Fm
Llanddewi Velfrey/ Llanddewi Felffre
Pen-troydin
Ffynnon
Caermaenau Fawr
Penblewin
Blackmoor
Henllan
Llanddewi Gaer
Caerau Gaer
Plas-crwyn
Panteg
Waundwrgi
Llan-Mair
Llwynpinner
Waungron
High Street
Llwyngwyddil
Tygwyn Fm
Norton Villa
Lampeter Velfrey
Landsker Borderlands Trail
Carnary Fm
Pen-y-back
Lowmead Fm
Lower Caryan
Gilfach Fm
Golden Grove
Upper Caryan
Melinau
Treffgarne
Cilrhiw Ho
Radford
Llan-mill
Pen-lan Fm
Glyn Patel
Motte
Crem
Crinow
Dyffryn Fm
Barre
Earthwork
Princes Gate
Woods Cross
Cold Blow
Gloyne Fm
Camp Hill
Narberth Mountain
Captain Style
Molleston Back
Molleston Cross
Great Molleston Fm
The Grove
Mounton Fm
Mounton Hill
Entertainment Centre
Cross Hands
Leisure Park
Bluestone
Holiday Village
Castell Coch (remains of)
Canaston Wood
Church (rems of)
Chapel
Enclosure
Fort
Holy Well
Chapel Hill
Hill
New
Gilfach Cross
Lower Llantydwell
South Treffgarne
Upper Llantydwell
Craig y Swllt
Taverspite
West-Ros
Aron Cwm-waun-gron
Inscribed Stone
Tumulus
Tumuli
Ty Hen
Great Vaynor
Vaynor
Faenor Gaer
Citrath
Penllwyn Ho
Bethesda
Danycoed
Broadway
Potterslade
Plain Dealings
Addlepits
Hospital (remains of)
Llawhaden
Holgan
Trefwynt Fm
Landsker Borderlands Trail
Enclosures
Whiteleys
Ridgeway
Middle Hook Fm
Sodston Ho
Redstone Cross
Redstone Bank
Stonyford
Coxtake
Robeston Wathen
Robeston Back
Canaston Bridge
Canaston
Atheston
Blackpool
Rushacre Fm
Sunnybank
Woodfield
Narberth Bridge
Narberth/ Arberth
Returno Fm
The Valley
Bryn H
Sch
Castle
Wks
MP
PC
PH
P
LC
MS
Fort
Tumuli
Enclosure
Drim Fm
Earthwork
Mill
Gstopple
Round
Broadway
Danycoed
Potterslade
Plain Dealings
Addlepits
Hospital (remains of)
Llawhaden
Holgan
Castle
Penllwyn Ho
Bethesda
Trefwynt Fm
Landsker Borderlands Trail
Enclosures
Fort
Whiteleys
Ridgeway
Middle Hook Fm
Sodston Ho
Redstone Cross
Redstone Bank
Stonyford
Coxtake
Robeston Wathen
Robeston Back
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Atheston
Blackpool
Rushacre Fm
Sunnybank
Woodfield
Narberth Bridge
Narberth/ Arberth
Returno Fm
The Valley
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Sch
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LC
MS
Fort
Tumuli
Enclosure
Ty Hen
Great Vaynor
Vaynor
Faenor Gaer
Citrath
Penllwyn Ho
Bethesda
Danycoed
Broadway
Potterslade
Plain Dealings
Addlepits
Hospital (remains of)
Llawhaden
Holgan
Trefwynt Fm
Landsker Borderlands Trail
Enclosures

A3

E/B	W/B
8,760	9,060
8,760	9,060

E/B	W/B
8,130	7,750
8,440	7,750

E/B	W/B
1,790	1,420
2,080	1,410

E/B	W/B
8,430	8,450
1,620	1,350

E/B	W/B
8,980	8,690
8,980	8,690

E/B	W/B
8,980	8,690
8,980	8,690

E/B	W/B
8,520	8,180
8,520	8,180

E/B	W/B
8,790	8,450
8,790	8,450

N/B	S/B
2,840	3,030
2,780	2,750

E/B	W/B
380	280
380	280

E/B	W/B
6,870	7,370

N/B	S/B
2,110	1,270
2,180	1,270

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0 0.5 1 Kilometres

LEGEND

E/B	W/B	DIRECTION
x	x	DO MINIMUM TRAFFIC FLOWS (VEHICLES PER DAY)
x	x	DO SOMETHING TRAFFIC FLOWS (VEHICLES PER DAY)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P02	19/12/19	FIRST ISSUE	KD	PT	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

Drawing Title
FIGURE C.12
2051 FORECAST
ANNUAL AVERAGE DAILY TRAFFIC FLOWS
HIGH GROWTH SCENARIO

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A3 1:35,000

Rev	By	Chkd	Appd	Auth
P02	KD	PT	TE	GD
	Date 19/12/19	Date 19/12/19	Date 19/12/19	Date 19/12/19

Name
A40PRC - ARP - VTR - SWI - DR - TR - 0047
Project | Originator | Volume | Location | Type | Role | Number

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Pre-CEMP

A40PRC-ARP-EAC-SWI-RP-LE-0016

P04 | S4

24/06/20

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Appendices

Appendix A

Site Waste Management Plan Checklist

1 Introduction

1.1.1 This is the Pre-Construction Environmental Management Plan (Pre-CEMP) for the A40 Penblewin to Redstone Cross Improvements (referred to hereafter as 'the Scheme').

1.2 The Scheme

1.2.1 To maximising overtaking opportunities to relieve the problems identified in Section 2.3, a 1.76km length of the A40 Trunk Road would be improved with two lanes provided in one direction. This will allow overtaking in one direction, leaving a single lane in the opposite direction. The overtaking provision will alternate so that both eastbound and westbound traffic can overtake.

2.1.1 The Scheme would commence approximately 550 metres west of Redstone Cross (Chainage (Ch) 0.00.), where the existing ascending A40 passes Sodston Lodge. The Scheme would leave the line of the existing A40 at Sodston Lodge and draw gradually to the south. At approximately Ch.400 the road would cross a small wooded watercourse on an embankment up to 4 metres high. It would then begin to descend on a gentle gradient for about 1km, entering a cutting up to 7 metres deep through the Redstone ridge at Ch.500. To the north side of the Scheme would be properties at Redstone Cross and to the south the Blaenmarlais Care Home. The B4313 Redstone Road would cross the A40 on a proposed bridge at Ch.570 and then join the detrunked A40 on the east side of Redstone Cross. The detrunked existing A40 road would be a local road extending from Redstone Cross to Penblewin roundabout.

2.1.2 From Ch. 570 to Ch 800 the Scheme, still descending, would transition from cutting to embankment and continue the gentle left-hand curve to cross a small watercourse at around Ch.860. Here the Scheme would gradually transfer from cutting to embankment to cross lower-lying land occupied by woodland. The embankment would continue eastwards, crossing a further two minor watercourses, with the Scheme entering a shallow right-hand bend which would continuing to Ch.1,450. At Ch.400 the embankment would cease, and the Scheme would continue east in a cutting up to 8m deep as it commences the climb towards Penblewin Roundabout at Ch.1760, which is roughly at ground level.

1.2.2 A general arrangement plan of the proposed route is shown on Drawing A40PRC-ARP-HML-SWI-DR-D-0002.

1.2.3 Further details on the project scheme are included in the Environmental Statement Volume 1, Chapters 1 and 2[1].

1.3 Purpose of this report

1.3.1 This document is a Pre-Construction Environmental Management Plan (Pre-CEMP). It identifies the control measures which will be implemented in order to avoid and reduce impacts during construction that will be adopted during the construction phase in order to manage the environmental impact of the works. This Pre-CEMP will form the basis of the detailed CEMP which is expected to be produced by the appointed contractor and it will be more targeted and specific to the proposed works.

1.3.2 The appointed Contractor will be contractually required to develop the CEMP in accordance with the measures identified in the Pre-CEMP.

1.3.3 At the construction stage, the Pre-CEMP will be revised and updated into the CEMP by the appointed Contractor(s) and will include updates following pre-construction surveys, detailed design and construction method statement. The CEMP will be updated should any of the following occur:

- modifications to the design of the Scheme;
- changes in external factors (for example, regulations or standards);
- requirements requested by environmental statutory bodies;
- unforeseen circumstances and changes during construction stage;
- failings in environmental performance identified by routine inspections;
- new findings such as protected species or habitats; and
- unknown archaeological finds.

1.3.4 The appointed contractor's CEMP will be issued to Statutory Bodies for comment/review prior to any construction commencing on site.

1.4 CEMP

1.4.1 As part of the design process, an Environmental Impact Assessment

[1] Arup Environmental Statement (2019), A40 Penblewin to Redstone Cross Improvements ES Volume 1 - Chapter 1: Introduction, and ES - Chapter 2: The Project

(EIA) has been undertaken. As part of the EIA, environmental control measures have been incorporated into the design of the Scheme.

1.4.2 The purpose of a CEMP is to ensure that environmental control measures and procedures are implemented and monitored to reduce the potential environmental impacts during construction.

1.4.3 The CEMP is a "live" document which is constantly developed and updated throughout the design and construction stages. The CEMP will be revised during the construction period to take account of any changes in design and changes in external factors such as regulations and standards.

1.4.4 Towards the end of the construction period, the CEMP will be refined by the appointed Contractor(s) into a Maintenance Environmental Management Plan (MEMP) which will contain essential environmental information needed by the body responsible for the future maintenance and operation of the Scheme.

1.4.5 In implementing the CEMP, Contractor(s) shall provide details of site personnel and specialist advice required to manage and implement environmental mitigation including but not limited to; ecologist, a landscape architect, an arboriculturalist, and archaeologist etc.

1.4.6 The key aims of the CEMP are to:

- Allow transparent monitoring of environmental commitments made through the detailed design stage. The CEMP will include a register of commitments detailing responsibilities and target dates of implementing and achieving commitments;
- Demonstrate how construction activities will properly integrate the requirements of environmental legislation, policy, good practice, environmental regulatory authorities and statutory stakeholders;
- Identify the key staff responsible for implementing environmental control, communicating the commitments set out in the CEMP and identifying training requirements as necessary;
- Incorporate the Contractor(s)'s Environmental Management System (EMS), which will include procedures for change control;
- Include procedures for dealing with emergencies and non-compliances and communication of these to the relevant environmental regulatory authorities and statutory stakeholders;
- Act as a vehicle for transferring key environmental information from the CEMP into the MEMP for operational management. This will include details of the short and long-term management requirements and any operational monitoring commitments;

- Ensuring that environmental design and mitigation made through the detailed design stage are achieved, or are in the process of being achieved by the Contractor(s), during the construction stage; and
- Provide a review, monitoring and audit mechanism to implement environmental control measures and how any necessary corrective action will take place.

1.4.7 The CEMP will include the following:

- Register of Environmental Commitments and Actions (REAC) including actions and target dates for completion/achievement, monitoring and reporting procedures;
- Details on site management procedures such as hold points at which construction work shall cease until the Environmental Manager agrees that work can proceed;
- Latest baseline information gathered as part of any pre-construction surveys and monitoring;
- Any licences or consents required (if applicable);
- Information and commitments made as part of any public consultation (if required) and consultation following the completion of the EIA;
- Details of communication procedures with statutory authorities, non-statutory authorities, interest groups and the public;
- Review, monitoring and change control procedures during construction.

1.5 Assumptions of the Pre-CEMP

1.5.1 This Pre-CEMP is based on the information available at the time of writing. It is assumed that the Pre-CEMP will be developed into the CEMP by the appointed Contractor(s).

1.5.2 It is assumed that the CEMP will be updated regularly by the Contractor(s) during construction. Events that will likely trigger a need to update the CEMP are identified in Section 1.3.3.

1.5.3 It is assumed that a number of Contractors (including specialist contractors and sub-contractors) may be appointed during construction. All site construction staff, including sub-contractors, will be required to comply with the CEMP throughout the entire construction stage of the Scheme.

1.5.4 It is assumed that any failings in environmental management will be corrected through regular site monitoring and site audits, undertaken by

the Contractor's Environmental Manager.

1.6 Incident Response Planning

1.6.1 The Contractor(s) will develop a Pollution Incident Response Plan which identifies the procedures for the event of a pollution incident during construction. The procedures will be in accordance with the guidance set out in GPP21 Incident Response Planning[2].

1.6.2 All environmental incidents and accidents will be recorded and reported to the Contractor(s)'s Site Foreman and the Project Manager. Following a review of the incident, the Contractor's Environmental Manager will instigate an appropriate change in procedures where necessary.

1.6.3 The appropriate equipment required to implement these procedures shall be made available by the Contractor(s) and stored within the Contractor(s)' compound.

Pollution Incident Response Plan

Response Plan

1.6.4 A pollution incident response plan will be designed for every construction compound. The plan will set out the actions to be taken in the event of a pollution incident and identify the pollution control equipment and the control devices and where they should be located.

[2] Natural Resource Wales et al. GPP 21: Pollution Incident Response Plans, July 2017. Available at: https://www.netregs.org.uk/media/1436/gpp-21-final.pdf

1.6.5 The Response Plan would contain the following external and internal contact information:

a) The external contacts list contains 24 hour contact details for organisations that may need to be involved during or after an incident, including:

Organisation	Named Contact	Telephone Number
Emergency services		
Natural Resource Wales (NRW) local office		
Pembrokeshire Council		
Local Water Company		
Health and Safety Executive		
Local Health Care Provider		
Specialist clean up contractor		
Chemical suppliers and manufacturers		

b) The internal contacts list will reflect the organisational structure and response procedures the Contractor has in place (including out of hours contacts).

Organisation	Named Contact	Telephone Number
Main Contractor Representative		

c) Chemical and waste inventory: an up-to-date record of all substances stored on site would be maintained together with an estimate of the likely quantities stored and product data sheets. The location of drums, containers or bulk storage vessels used for storing potentially polluting chemicals would be identified on the site plan. The inventory would be made accessible to emergency responders.

d) Pollution prevention equipment inventory. This would include equipment and materials on site to deal with pollution incidents (for example spill kits, drain mats/covers, pipe blockers, absorbents) and contact details of staff trained in the use of specialist equipment (where relevant).

e) Site plan showing access routes and meeting points for emergency services; areas or facilities used to store raw materials, products and wastes; watercourses located within or near the site; and site drainage.

1.6.6 Key actions for the response plan would include:

a) stop the works immediately;

b) contain the spillage to avoid escalation of the problem (refer to Pollution Control Hierarchy);

c) notify the Environmental Manager immediately and any other key staff;

d) evacuate staff if necessary;

e) call for emergency services if necessary;

f) implement pollution control equipment;

g) document the cause of the incident and the action take;

h) replace pollution control equipment where required.

Practice

1.6.7 Staff will be trained in the procedures which they must to follow if there is a pollution incident, in particular:

a) where the personnel protective equipment and pollution control equipment is stored;

b) how to use the equipment; and

c) the location of pollution incident response plan.

1.6.8 In the development of the pollution incident response plan, drafts will be sent to NRW, and/or PCC, as relevant, for comment, including advice on when to notify the regulators of a spill.

1.7 Report structure

1.7.1 The structure of pre-CEMP comprises the following chapters:

a) Roles and Responsibilities (Chapter 2)

b) Control of Construction Practices (Chapter 3)

c) Outline Site Waste Management Plan (Chapter 4)
d) Outline Materials Management Obligations (Chapter 5)
e) Outline Pollution Prevention and Control Management Plan (Chapter 6)
f) Outline Ground and Surface Water Management Plan (Chapter 7)
g) Outline Air Quality Management Plan (Chapter 8)
h) Outline Noise and Vibration Management Plan (Chapter 9)
i) Outline Biodiversity Management Plan (Chapter 10)
j) Outline Arboricultural Method Statement and Tree Protection Plan (Chapter 11)
k) Outline Written Scheme of Investigation (Chapter 12)

2 Roles and Responsibilities

2.1.1 This section of the Pre-CEMP identifies the roles and responsibilities of those involved in environmental management during construction.

Project Manager

2.1.2 The Project Manager will act on behalf of the Client, with responsibility for managing construction of the Scheme within the agreed environmental constraints in conjunction with all other necessary management processes.

Contractor(s)

2.1.3 It is assumed that a number of Contractor(s) (including specialist contractors and sub-contractors) will be appointed during construction of the Scheme.

Environmental Manager

2.1.4 An Environmental Manager will oversee the implementation of CEMP including environmental control measures, mitigation and procedures. The Environmental Manager will be appointed by the Contractor prior to the enabling works and will implement the control measures during the Enabling works and main construction.

2.1.5 The Environmental Manager shall monitor, measure and review the environmental performance of the construction activities.

2.1.6 The Environmental Manager will host regular internal and external meetings, undertake audits to review the operation and effectiveness of the CEMP. The results shall be reported by the Environmental Manager at monthly construction progress meetings and used to update the CEMP.

2.1.7 The Environmental Manager will be responsible for the implementation of other environmental management plans as indicated, (but not limited to those) in this Pre-CEMP

3 Control of Construction Processes

3.1 Training, Awareness and Competence

3.1.1 The Contractor(s) will set out a programme of training to enable all site personnel to be aware of the potential risk to the environment during the construction progress.

3.1.2 The Environmental Manager will set out a series of induction courses for all site personnel including sub-contractors. The induction courses shall ensure all site personnel (including any new personnel) are aware of the environmental risks which have the potential to happen during construction. The inductions will inform the construction team on how to identify relevant environmental risks on site, record actions taken to protect the environment and implement best practice to minimise pollution.

3.1.3 Environmental Awareness Toolbox Talks will be delivered by the Environmental Manager on a regular basis. These will provide an update to the site team on any relevant environmental issues as the construction progresses.

3.1.4 Selected members of the site management team including the Construction Site Foreman and Environmental Manager will be given practical training in the use of the spill kits, appropriate PPE, clean-up procedures and the appropriate disposal and recycling plans.

3.2 Environmental Inspection, Monitoring and Reporting

3.2.1 The Environmental Manager will prepare a monthly environmental report to be tabled at the monthly site progress meetings. This report will monitor the implementation of the CEMP and review the ongoing site monitoring and inspections.

3.2.2 The monthly reports will be circulated to the Employer and the Contractor(s) for consultation and review.

3.3 Internal Communications

3.3.1 All staff and Contractor(s) will be informed of the content and location

of the CEMP and associated management plans and method statements. Method Statements will be used to communicate specific environmental requirements as appropriate.

3.3.2 The Environmental Manager will have responsibility for communicating any changes and updates in policy, procedure, best practice guidance and legislation.

3.3.3 The Contractor(s) will have responsibility for maintaining internal communication, including changes to material on display.

4 Outline Site Waste Management Plan

4.1 Introduction

Purpose

4.1.1 The purpose of the outline Site Waste Management Plan (SWMP) is to set out proposals for the identification, segregation, handling and storage of different types of wastes identified as arising from the works. These wastes (by quantity/type/chemical composition/EWC code, etc.) will be recorded and their disposal route, including the place of their final disposal shall be reported in the CEMP.

4.1.2 The aim of using a SWMP is to minimise the amount of waste produced due to activities as a result of the project, minimising environmental impacts and maximising cost savings. The Client shall take all reasonable steps to ensure all waste from this site shall be dealt with in accordance with the waste duty of care in section 34 of the Environmental Protection (Duty of Care Regulations 1991 (b) and materials will be handled efficiently, and waste managed appropriately.

4.2 Regulatory Framework

Definition of Waste

4.2.1 Waste is defined in Article 3 (1) of the Waste Framework Directive (2008/98/EC) and means…."any substance or object …. which the holder discards or intends or is required to discard". All waste that falls within the scope of this definition will be recorded in the SWMP. "Holder" means "the producer of the waste or the natural or legal person who is in possession of it". It rests, in the first place, with the producer or holder of a substance or object to decide whether it is being discarded and is waste.

4.2.2 Waste is widely defined and includes excess unwanted materials, effluents, unwanted surplus substances arising from the application of any process and any substance or article which is broken, worn out, contaminated or otherwise damaged. Waste becomes controlled by legislation when it is discarded by the holder. Materials being returned to the company stores or supplier for credit are not considered as waste. Materials sold for re-use or re-cycling are still classified as waste and

subject to all the statutory controls, including Duty of Care.

4.2.3 Waste can cease to be waste once it has achieved 'Final Recovery'. This is when the waste material (in the view of the Regulator) has been incorporated into a final product.

Legislation and Guidance

4.2.4 A list of relevant current legislation and guidance is given below:

a) Control of Pollution (Amendment) Act 1989
b) Environmental Protection Act 1990
c) The Controlled Waste (Registration of Carriers and Seizure of Vehicles) (Amendment) Regulations (1998)
d) Environmental Protection (Duty of Care) Regulations 1991
e) Environment Act 1995
f) Landfill (England and Wales) Regulations 2005
g) Hazardous Waste Regulations 2005
h) The Environmental Permitting (England and Wales) Regulations 2016
i) Site Waste Management Plans Regulations 2008 (have now been revoked)
j) Waste Minimisation in Construction – Site Guide, CIRIA Special Publication 133 (1997)
k) Waste Management – the Duty of Care, Code of Practice (2018)
l) Landfill (England and Wales) Regulations 2011
m) The Waste (England and Wales) (Amendment) Regulations 2012
n) The Well-being of Future Generations (Wales) Act 2015
o) National Policy: Planning Policy Wales (Edition 10), December 2018
p) National Policy: Towards Zero Waste, One Wales: One Planet 2010 (Welsh Assembly Government, 2010)
q) Technical Advice Note 21: Waste, 2014
r) WRAP Cymru Delivery Plan: 2011-15 For a World Without Waste
s) Carriage of Dangerous Goods and Use of Transportable Pressure Equipment (2009)
t) EU Waste Framework Directive 2008/98/EC
u) CL:AIRE - The Definition of Waste: Development Industry Code of Practice Version 2, 2011

4.2.5 Further guidance can be found in ES Chapter 16: Materials.

4.3 Waste Arisings

Waste Forecasting

4.3.1 In order to identify the types of waste generated by the Scheme the construction programme will be divided into the following key activities that have the potential to generate waste:

a) Site clearance
b) Earthworks
c) Construction / Installation of pavement and bridge

Waste Types

4.3.2 The key waste streams produced on site can be classified as:

a) INERT – waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater. Examples of inert wastes are rocks, concrete, mortar, glass, uncontaminated soils and aggregates.
b) NON-HAZARDOUS – any waste that is neither hazardous nor inert is non-hazardous. Examples of non-hazardous wastes include timber, paper and cardboard.
c) HAZARDOUS – waste that is harmful to human health or the environment (for example, pollution of watercourses) and displays one or more of the hazardous properties listed in Annex III of the EU Waste Framework Directive 2008/98/EC (explosive, flammable, poisonous, toxic, ecotoxic, carcinogenic, mutagenic, corrosive, infectious substances).

4.3.3 The waste generated during construction is to be assigned a European Waste Catalogue code[3]. A list of potentially relevant codes is provided in Table 1 below, however the contractor will need to confirm any further relevant codes in the SWMP. These codes are to be provided on

[3] 2014/955/EU – List of Waste (LoW) – Replaces 2000/532/EC (as amended), also known as the European Waste Catalogue or EWC

each waste transfer note that would accompany every movement of waste from the site.

Table 1 List of Waste Categories for Construction Wastes

17 Construction and demolition wastes (including excavated soil from contaminated sites)
17 01 Concrete, bricks, tiles and ceramics
17 01 01 Concrete
17 01 02 Bricks
17 01 03 Tiles and ceramics
17 01 06* Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances
17 01 07 Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02 Wood, glass and plastic
17 02 01 Wood
17 02 02 Glass
17 02 03 Plastic
17 02 04* Glass, plastic and wood containing or contaminated with dangerous substances
17 03 Bituminous mixtures, coal tar and tarred products
17 03 01* Bituminous mixtures containing coal tar
17 03 02 Bituminous mixtures other than those mentioned in 17 03 01
17 03 03* Coal tar and tarred products
17 04 Metals (including their alloys)
17 04 01 Copper, bronze, brass
17 04 02 Aluminium
17 04 03 Lead
17 04 04 Zinc
17 04 05 Iron and steel
17 04 06 Tin
17 04 07 Mixed metals
17 04 09* Metal waste contaminated with dangerous substances
17 04 10* Cables containing oil, coal tar and other dangerous substances
17 04 11 Cables other than those mentioned in 17 04 10
17 05 Soil (including excavated soil from contaminated sites), stones and dredging spoil
17 05 03* Soil and stones containing dangerous substances
17 05 04 Soil and stones other than those mentioned in 17 05 03
17 05 05* Dredging spoil containing dangerous substances
17 05 06 Dredging spoil other than those mentioned in 17 05 05
17 05 07* Track ballast containing dangerous substances
17 06 Insulation materials and asbestos–containing construction materials
17 06 01* Insulation materials containing asbestos
17 06 03* Other insulation materials consisting of or containing dangerous substances
17 06 04 Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05* Construction materials containing asbestos
17 08 Gypsum – based construction material
17 08 01* Gypsum–based construction materials contaminated with dangerous substances
17 08 02 Gypsum–based construction materials other than those mentioned in 17 08 01

17 Construction and demolition wastes (including excavated soil from contaminated sites)
17 09 Other construction and demolition wastes
17 09 01* Construction and demolition wastes containing mercury
17 09 02* Construction and demolition wastes containing PCB (for example PCB–containing sealants, PCB–containing resin–based floorings, PCB– containing sealed glazing units, PCB–containing capacitors)
17 09 03* Other construction and demolition wastes (including mixed wastes) containing dangerous substances

Estimated Waste Arisings

4.3.4 The estimated waste arisings during the various project activities are presented in Table 2 below (as presented in Chapter 16 of Arup's Environmental Statement)[4]).

Table 2 Summary of Waste Arisings

Project Activity	Waste arisings from the project	Quantities of waste arisings	Additional information on waste arisings
Site clearance	Vegetation surface strip, kerbs, trees, traffic signs, lighting etc.	Quantities not available at this stage	Likely to be a combination of locally recycled, disposal at an inert or non-hazardous landfill site.
Earthworks	Excess Topsoil	5,000m^3	All excavated topsoil to be reused in earthworks and landscaping
	Surplus excavated material (acceptable and unacceptable materials).	Nil	It is assumed that all site won materials are suitable for reuse.
Installation of manufactured products	No significant waste generated.	No significant waste arisings.	
Operation of the road	No significant waste arisings.	No significant waste arisings.	

*Please note that these figures are based on the estimates made at the current preliminary design stage.

4.4 Management of Waste

Waste Hierarchy

4.4.1 Construction waste generated from the scheme will be managed according to the principles of the waste hierarchy which ranks waste management options according to environmental impact. The waste

[4] Arup Environmental Statement (2019), A40 Penblewin to Redstone Cross Improvements, Chapter 16: Materials (Ref. PRC-ARP-EAC-SWI-RP-LE-0011).

hierarchy indicates "waste prevention" as the best outcome for the environment and "disposal" as the least favoured.

4.4.2 The SWMP will set out how waste will be managed throughout each stage of the project. Prior to the commencement of site development, the Contractor will identify suitable waste management contractors and investigate opportunities to recycle other materials.

Prevention

4.4.3 The Contractor will ensure that waste is prevented where possible by using less material in design and manufacture and only ordering quantities of material required.

4.4.4 The SWMP will record identified measures to be implemented to prevent and minimise the quantity of waste produced during the project. The following measures have been identified as ways of preventing and minimising the quantity of waste produced during this project:

a) Using the material in design and manufacture;
b) Keeping products for longer; re use; and
c) Using less hazardous materials.

4.4.5 The Materials Management obligations (see Section 3 of this document) include the requirement for a Materials Management Plan (MMP) which would be prepared as part of the CEMP, setting out the procedure for managing the materials and identifying how the materials will be managed in order to minimise the amount of waste generated.

Re-use

4.4.6 The Contractor will ensure that any waste generated on site will be segregated and re-used where possible in accordance with the waste hierarchy and in accordance with applicable waste regulations (The Waste (England and Wales) (Amendment) Regulations 2012, The Site Waste Management Plan Regulations 2008, CL:AIRE - The Definition of Waste: Development Industry Code of Practice V2 2011). The materials that have the potential to be re-used on site have been identified to include earthworks materials. Re-use is subject to confirmation of materials requirement at the next design phase. Re-usable materials will be identified on site and removed for storage and re-sale. The SWMP will detail the estimated quantities of waste

material and the opportunities for reuse, recycling, recovery or disposal.

Recycling

4.4.7 Any recyclable materials will be removed from site for processing in licenced facilities. Recycling facilities in the vicinity of the Scheme location will be identified by the Contractor. Only appropriately qualified and licensed waste management facilities would be used as a requirement of this SWMP. There is potential for the available sites for recycling, reprocessing and disposal to change and it is the responsibility of the Contractor to evaluate the waste management market and identify suitable options.

Recovery

4.4.8 Opportunities for the recovery of waste generated by the scheme will be considered by the Contractor. Recoverable materials will be removed from site for processing in licenced facilities.

Disposal

4.4.9 Any waste that cannot be prevented, re-used, recycled or recovered, will be disposed of in a responsible manner. It is not anticipated that there will be a large amount of waste associated with the Scheme.

4.4.10 Details on requirements for waste transportation (including consignment notes in line with Duty of Care) are provided in paragraph 4.4.22 below.

Storage of Waste

4.4.11 Under the Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations, it is a criminal offence for anyone who is not registered as a waste carrier to transport controlled waste.

4.4.12 All waste carriers to be used on the Contract should hold a carrier's licence. Confirmation will be obtained from the NRW that all carriers' registrations are currently valid, and the evidence filed in the Contract Filing System. This will be carried out by the Contractor, who is considered to be the waste producer in this instance.

4.4.13 At the site compounds the waste will be stored in an appropriate, clearly

labelled container. The Waste Champion will maximise the recycling opportunities and ensure that waste streams are separated to facilitate this.

4.4.14 Hazardous waste will be sufficiently described by the Contractor (or their consultants) to waste contractors to enable them to comply with any labelling etc. requirements under the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations.

4.4.15 All materials brought to site will be stored and handled appropriately to minimise unnecessary wastage. Any site welfare facilities will be equipped with sufficient waste disposal containers for their needs, including recycling containers for plastic and cans.

4.4.16 Any sewage from welfare facilities and site toilets that is stored on site (i.e. tanks); will be collected and disposed of by licensed carrier.

Waste Management Options

4.4.17 It is proposed that all materials arising from construction would be managed in accordance with the waste hierarchy defined within the Waste Framework Directive.

4.4.18 Site clearance would include clearing existing trees, safety barriers, concrete kerbs, lighting columns, and traffic signs. The materials would be segregated and appropriately reused and/or recycled wherever possible. Materials that cannot be reused or recycled will be segregated and disposed of at an appropriate waste handling facility.

4.4.19 Earthworks estimates predict a balance of the majority of earthworks materials. If removal of materials from site is required, the location for the disposal of these materials is likely to include a combination of local recycling facilities and disposal at an inert or non-hazardous landfill site. It is anticipated that a local recycling facility would be favoured.

4.4.20 It is proposed that all materials/arisings from construction should, if possible, be re-used on site in accordance with the waste management hierarchy defined within the waste framework directive. There may be some waste associated with the works which cannot be re-used on site. This may include waste generated from any existing drainage infrastructure which would be replaced. The export of excess construction materials may have an impact on sites receiving the

material. The facilities to which material would be taken are likely to be established recycling facilities or landfill sites and are therefore considered to have a low to medium sensitivity. The quantities of waste are to be reused where possible and so the magnitude of impact on waste receptors is deemed to be negligible or minor.

4.4.21 Construction would include milling the surface of the existing pavement at the tie-ins with the existing highway. The surface planings shall be re-used where possible, which would result in no impact on material resources. Should the planings are assessed to be hazardous then further assessment will be undertaken for appropriate treatment or disposal.

4.4.22 In general, based on anticipated waste arisings the following processes should be set for the management of waste:

a) Each waste stream is identified, and appropriate storage and disposal measures provided in line with Duty of Care;
b) Wherever practical, waste will be re-used or recycled;
c) A diversion from landfill percentage rate or re-use/recycling target will be set in line with Highways England targets;
d) Only when all other routes are exhausted will waste be sent to landfill, accompanied by a Pre-Treatment Confirmation Form;
e) Targets for re-use and recycling will be recorded at the start of the contract on the Waste Targets and Monitoring Form and monthly progress towards this monitored;
f) The site registers with the NRW as a producer of hazardous waste and obtains a premises code for use on all Consignment Notes;
g) The waste is segregated, secured, labelled and disposed of safely and completely;
h) Waste Transfer Notes are correctly completed for each consignment of inert or non-hazardous waste;
i) Hazardous Waste Consignment Notes are correctly completed for each consignment of hazardous waste.

4.5 Implementation

Training

4.5.1 A training regime focused on the provisions of the SWMP would be implemented for all relevant members of the construction team, to ensure their competence in carrying out their duties on the scheme.

4.5.2 Any SWMP training would be additional to the mandatory training requirements on site Health and Safety.

4.5.3 A general site induction should be developed to introduce all site personnel to the main provisions of the SWMP, important environmental controls associated with the construction of the scheme and effective delivery of the SWMP (for example, waste storage arrangements, waste segregation at source). A full register of induction attendance would be maintained on site.

4.5.4 Toolbox talks and method statement briefings should be given to the construction teams as work proceeds and would cover the types of wastes produced at each key build stage, and the SWMP controls related to specific activities undertaken during the works. A full register of toolbox talks and method statement briefing attendance would be maintained on site.

4.5.5 All training records ware to be maintained and filed on site. The records would include the content of the training courses (induction and toolbox training), record of attendance and schedule of review.

4.6 Compliance with SWMP

Monitoring

4.6.1 Monitoring of the SWMP would principally be achieved through the completion of the waste management data sheets, which will detail waste arising and subsequent reuse recycle and disposal, and regular inspections of the works areas by the Contractor to ensure that the provisions of the SWMP and control measures outlined in relevant method statements are being implemented. In addition, the Contractor's waste targets will be monitored to confirm compliance and any documentation relating to waste sent to landfill will be monitored for compliance with the Duty of Care.

4.6.2 Duty of Care paperwork documenting the movements of waste from the site (Waste Transfer Notes for Inert and Non-Hazardous Waste and Hazardous Waste Consignment Notes) and the registered carriers' details would be retained.

Review

4.6.3 During the construction process, the SWMP would be reviewed as often as necessary or at least once every three months to ensure that the plan accurately reflects the progress of the scheme in terms of waste estimates and targets. As part of the review, the Contractor must record the following:

a) The types and volumes of waste produced;

b) Identify on the plan the work area where the waste was removed from;

c) The types and volumes of waste that have been:

   i. re-used (and whether this was on or off site);

   ii. recycled (and whether this was on or off site);

   iii. sent for another form of recovery (and whether this was on or off site);

   iv. sent to landfill; or

   v. otherwise disposed of; and

d) The location where the waste produced has been sent to.

Report

4.6.4 The contractor should review and report on the performance of the SWMP periodically during the construction phase. This would include confirmation that the plan has been monitored on a regular basis to ensure compliance with the provisions of the SWMP, that the plan was updated accordingly and that any deviations from the plan would be explained. The Contractor would continue to report on the performance of the SWMP on an annual basis throughout the construction period.

4.6.5 In addition to the above, the report would include a comparison of the estimated quantities of each waste type against the actual quantities of each waste type, performance against the scheme standards, as proposed by the Contractor at the start of the scheme, and an estimate of the cost savings achieved by and costs incurred in completing and implementing the plan.

Site Waste Management Plan Checklist

4.6.6 A Waste Summary Table should be completed for each waste material leaving or entering the site. All supporting documentation will be kept

in the Contract Filing System.

4.6.7 An example checklist of actions that should be completed at the appropriate time in the contract is included in Appendix A.

5 Outline Materials Management Plan

5.1 Introduction

5.1.1 The key to reducing waste lies in the efficient and legally compliant management of materials. The following are examples of onsite procedures will be followed to reduce potential waste being generated from the storage, handling and use of materials.

Receipt of materials

5.1.2 The Contract Head, as part of the contract management planning activities, shall assign responsibility for the storage and control of materials arriving on the contract.

5.1.3 Upon delivery, materials shall be checked against the delivery note and the purchase order to ensure that they conform to requirements before they are incorporated into the Works.

5.1.4 Any comments / qualifications resulting from accepting or rejecting a delivery are clearly detailed on the delivery note before signing.

5.1.5 Where goods are rejected as unsatisfactory or non-conforming they shall be set aside and clearly identified as ‘not for use’ and will be returned to the supplier. Purchasing Teams should be made aware of rejection detail and any on-going quality issues with suppliers / materials. The non-conformance report system shall be utilised to report and monitor unacceptable materials.

5.1.6 Where required under the terms of the contract, subcontractors shall operate a suitable quality system designed to ensure that any materials are adequately inspected / verified on receipt for compliance with the specification.

Handling, Storage and Preservation

5.1.7 Adequate consideration shall be given to the material storage locations on the contract. When determining storage locations, the following shall be considered:

a) To prevent wastage and damage as well as making the contract safer and easier to manage good housekeeping shall be maintained.

b) All materials shall be stored in a manner that minimises environmental pollution and wastage. This includes protection from adverse situations likely to cause contamination (weather events). (See Pollution Prevention and Control Management Plan in Section 1 & Section 6 of this document).

c) To protect susceptible material from contamination; pallets, packaging or blocking pieces shall be used. Loose materials shall be stored in bunkers, containers or separate piles, so that no inadvertent mixing between different grades of types occurs.

d) Where necessary, materials will be stored so that 'stock rotation' is in effect.

e) Storage location shall be positioned / located to minimise the handling and moving of material around sites and contracts. This will reduce the level of safety risk, damage and in turn increase efficiency.

f) When lifting or moving materials, appropriate slings chains, forks, lifting appliances, transport and mechanical protection will be used. Loads shall be adequately secured in transit. At all sites, particular attention shall be given to the safety, obstruction or inconvenience to the public and third parties.

g) All materials shall be handled, stored and protected in accordance with manufacturers / supplier's recommendations.

Use of Materials within the Contract

5.1.8 The Contractor shall ensure that materials are treated and used as set out in the Materials Management Plan which would be prepared as part of the CEMP and, at the completion of the works, shall complete all lines of evidence in relation to suitability for re-use, certainty of use and quantity required in the CL: AIRE Materials Management Plan form which will be submitted to the Qualified Person along with all supporting information.

5.1.9 All materials shall be prepared, fixed and used in accordance with the manufacturers / suppliers' recommendations. A request for this information should be clearly communicated to the Supply Chain Function.

5.1.10 Where manufacturer / supplier recommendations are not available materials shall be handled, stored, fixed, used and protected by a

method which will avoid damage, deterioration or loss.

5.1.11 Where traceability of materials is required, the Contract Head shall ensure that this is carried out by means of physical location, labelling/marking and/or contract records. The level of traceability required shall be identified within Contract Management Plans and supporting quality inspection regimes.

5.1.12 Any material becoming unacceptable is to be clearly identified and disposed of safely. The non-conformance report system shall be utilised to report and monitor unacceptable materials.

5.2 Material Resources to be Used

5.2.1 A variety of different materials will be required for the construction phase of the scheme. The scheme would be designed to prevent, where possible, the generation of waste materials and the import of construction materials by re-using or recycling the available existing materials along the scheme.

5.2.2 Where possible, site won materials would be re-used for the earthworks, however, some materials would be unsuitable for re-use and other materials cannot be sourced on site and would need to be imported.

5.2.3 Earthworks estimates predict a requirement of earthworks materials of some 63,000m^3. This is from an approximate cut of 70,000m^3 and fill of 133,000m^3. The location for the source of these materials may include a combination of local facilities and site-won.

5.2.4 A summary of the predicted material resources use as detailed in Chapter 16 of Arup's Environmental Statement is presented in Table 3 below.

Table 3 Summary of materials resource use

Project Activity	Material resources required for the project	Quantities of material resources required	Additional information on material resources
Earthworks	Topsoil	Some 9,000 m³*	Sourced from site
	General fil for embankments – primary or secondary / recycled materials	120,000m³ *	Sourced from site and local suppliers
	Capping	8,000m³ *	Sourced from local suppliers
Installation of pavement	Type 1 subbase	10,000m³*	Sourced from local suppliers
	Base, binder, and surface course. Primary or Secondary / Recycled materials	16,000m³*	Sourced from local suppliers
Structures	Concrete	5,500m³*	Local batching plants
Installation of manufactured products	Drainage, kerbs, trees, traffic signs, lighting etc.	Various quantities relative to road length and necessary safety measures	To be established local/national suppliers
Operation of the road	No significant material resources required.	No significant material assets required	

* Please note that these figures are based on estimates made at the current preliminary design stage

5.3 Construction Mitigation Measures

5.3.1 Wherever possible, site-won material resources should be re-used in construction. Site-won material resources would only be re-used on site if assessed as being suitable for re-use without causing unacceptable impacts on the end users and the environment. A specification for acceptable material to be used in construction would be developed, in accordance with the Specification for Highway Works (SHW)[5]. A specification would set material testing requirements for construction to confirm whether the proposed materials, such as recycled aggregates, meet the requirements for geotechnical and geo-environmental purposes. These geo-enviromental requirements have been developed

[5] Manual of Contract Documents for Highways Works (MCHW), Volume 1 Specification for Highway Works (SHW).

in line with the CL:AIRE Code of Practice.

5.3.2 Materials would be sorted and/or processed, and where necessary treated, before reuse or disposal. This would limit the overall quantities disposed to landfill and maximise disposal to the most appropriate waste stream. The pre-treatment of waste material prior to disposal to landfill is a requirement of the waste regulations. By minimising the quantity of materials/waste arisings to be disposed offsite the associated vehicle movements would be minimised.

5.3.3 Due to the relatively simple nature of the construction processes involved and the small number of different types of potential surplus materials preparation and use of a SWMP is likely to be an effective approach to the mitigation of potential effects.

Table 4 Summary of mitigation measures

Project Activity	**Potential impacts associated with material asset use/ waste management**	**Description of mitigation measures**	**How the measures would be implemented, measured and monitored**
Site clearance.	Waste disposal.	Identify opportunities for reuse, recycling, recovery.	Materials to be sorted, and where practical disposed to recycling facilities. Site SWMP to implement, measure and monitor.
Earthworks.	Use of primary assets. Waste disposal.	Reuse of materials in earthworks. Limit disposal, traffic and movements.	Design to maximise the earthworks balance. SWMP to implement, measure and monitor.
Pavement planings.	Waste disposal.	Possible reuse in access tracks.	Design to maximise the materials balance. SWMP to implement, measure and monitor.

5.4 Supporting Documentation

5.4.1 The following provides a list of the expected documentation requirements by the Contractor to support the completion of an MMP for the scheme:

a) Earthworks Strategy;
b) Land Contamination Management Strategy;
c) Remediation Strategy including a verification plan;
d) Earthworks Specification;
e) Cut/Fill requirements and earthworks movements plan;

f) Design Statement;
g) Qualified Person Declaration;
h) Verification Report;
i) Proforma MM;
j) Soils Management Plan;
k) Logistics Plan;
l) Materials Management Plan Form and Contingency Arrangements Plan;
m) Evidence of regulatory approvals for proposed works.

5.4.2 The other supporting documentation referenced will be prepared separately and references incorporated into the MMP as regulator agreement is obtained. The outline MMP shall be reviewed and updated during detailed design of the Scheme.

6 Outline Pollution Prevention and Control Management Plan

6.1 Introduction

Purpose

6.1.1 Measures for minimising pollution risks to prevent pollution incidents occurring as a result of the proposed construction activities are required. This pollution control and prevention plan has been developed to manage these risks.

6.1.2 The purpose of the plan is to identify the main risks of pollution occurring on the site, to identify and implement appropriate pollution prevention measures, and to reduce the effects of any pollution incidents that may occur. The plan should be read in conjunction with the outline Ground and Surface Water Management Plan (Section 7 of this document).

6.1.3 As the detailed design progresses, the Plan shall be reviewed and updated accordingly. The final Pollution Control and Prevention Plan would be agreed with NRW and approved by PCC prior to the start of construction.

6.1.4 The plan shall be implemented throughout the construction process of the scheme and all construction staff would be required to follow its provisions.

Legislation and Best Practice

6.1.5 Pollution control shall be carried out in accordance with the following:

a) Health and Safety at Work Act. 1974.
b) Control of Substances Hazardous to Health Regulations 2002.
c) Control of Pollution Act 1974.
d) Control of Pollution (Amendment) Act 1989.
e) Control of Major Accident Hazards 1999.
f) Environmental Protection Act 1990.
g) Noise and Statutory Nuisance Act 1993.
h) Town and Country Planning Act 1990.

i) Noise Emission in the Environment by Equipment for Use Outdoors Regulations 2001.

j) Environmental Noise Regulations 2006.

k) Control of Pollution (Oil Storage) (England) Regulations.

l) BS5228-1 :2009 - Part 1 – Noise.

m) BS5228-2 :2009 - Part 2 – Vibration.

n) Water Resources Act 1991.

o) Water Industry Act 1991.

p) Groundwater (England and Wales) Regulations 2009.

q) Environmental Permitting Regulations 2010 (Amended 2013).

r) Salmon and Freshwater Fisheries Act 1975.

s) Contaminated Land (Wales) Regulations 2006.

t) Environment Agency Pollution Prevention Guidelines Construction and demolition sites (PPG 6) 2012 [Withdrawn 2015 but considered good practice].

u) Guidance for Pollution Prevention.

Responsibilities

6.1.6 For the purpose of the outline Pollution Control and Prevention Plan, the key roles are set out in Table 5 below. Additional roles and responsibilities will be developed as the detailed design progresses.

Table 5 Responsibilities details

Name	Position/Responsibilities	Contact Details
	Welsh Government Project Manager	
	Site Manager	
	Environmental Manager	
	Environmental Clerk of Works	

6.2 Pollution Risk Assessment

Identification of Potential Pollutants and Contaminated Areas

Pollutants

6.2.1 It is anticipated that the following pollutants may arise from the construction operations:

a) Plant fuels and lubricating oils.
b) Detergents and degreasers.
c) Cement and concrete.
d) Silty water (surface water/ sediment run-off from works).
e) Sewage.
f) Herbicides.
g) Emissions to the atmosphere of fumes and dust.
h) Noise and vibration (from construction operations).
i) Light.

6.2.2 Under the Control of Substances Hazardous to Health (COSHH) Regulations assessments will be carried out on all hazardous substances which are intended for use on the project.

6.2.3 All new substances brought onto site will be dealt with through the implementation of the COSHH procedures.

Contaminated Areas

6.2.4 Details of land contamination are included in Chapter 6 of Arup's Environmental Statement. The study area is in a rural setting and comprises agricultural land, grazing pastures and local landowner properties.

6.2.5 A provisional search carried out as part of Arup's PSSR[6] for the scheme showed no farm buildings to be on the proposed realignment; however, there are three farms along the present-day alignment: Pen-blewin Farm, Blackmoor Hill Farm and Redstone Farm. There is also an inactive garage present 2m to the south of Redstone Cross junction (Redstone Forge Garage). This is likely to be a repair workshop without fuelling activities taking place.

6.2.6 The potential sources of contamination include localised spillages from the garage, farming machinery, fuel storage or waste storage. This is unlikely to impose a significant risk.

6.2.7 The historical maps show that the existing A40 has been aligned approximately along the present-day alignment since before 1888.

[6] Arup Supplementary Preliminary Sources Study Report (2017), A40 Llanddewi Velfrey to Penblewin Redstone Cross Improvements (Ref. A40LVP-ARP-HGT-J01-RP-C-0001)

6.2.8 There is the potential to encounter made ground associated with the construction of the A40 although this is unlikely to pose a significant risk.

6.2.9 There is also the potential for unknown historic quarrying and infilled land in the vicinity of the alignment with the associated risk of contamination if these have been infilled.

Construction Mitigation

6.2.10 The absence of the requirement for mitigation is based on the following:

a) The environmental management of the construction activities will be undertaken in line with this outline Construction Environmental Management Plan and as such will not have an impact on identified receptors.

b) Any discharge to surface water bodies would only be carried out with appropriate approval from NRW, following monitoring and if needed, treatment to ensure it is of acceptable quality.

c) The re-use of site won or import of materials to the scheme will be managed by a verification system applied via the Specification for Highway Works, Series 600 – Earthworks, and only materials found suitable for use, assessed in terms of potential effects on human health and the water environment, would be acceptable for construction works.

6.2.11 In addition, the available soil and groundwater chemical testing results could be used to inform health and safety risk assessments for the construction works. The groundwater chemical testing results can be found in Appendix 6.4 Ground Investigation Report of the Environmental Statement.

6.2.12 The applied environmental management best practice would include the following considerations:

a) Adoption of a watching brief for identification of potential contamination. The discovery of any unexpected contaminated land would require appropriate measures to limit the risk to construction workers and controlled waters.

b) Dust control measures to ensure that dust generation and off-site migration is minimised. This may involve dust suppression measures during excavation works, wheel washing facilities and conveyance of materials in covered wagons.

c) Water impacted by chemical contamination and/or cement would require the application of mitigation measures before discharge.

Measures may include bunding around working areas to contain any overspill, the use of settlement lagoons, settlement tanks and/or silt busters.

d) Water with high concentrations of suspended solids can arise from dewatering excavations, exposed ground, stockpiles, plant and wheel washing, site roads and disturbance of watercourse beds. Sediment control measures and dust suppression techniques would be implemented where work is to be undertaken adjacent to or within a watercourse. Disposal of silty water would be undertaken in accordance with current best practice and measures developed and agreed with NRW prior to commencement of the works. This is in addition to the approval requirements with respect to the quality of the discharge water to the river.

e) Environmental monitoring in accordance with the obligations set out within this document shall be undertaken through the construction period to ensure that environmentally sound working practices are adopted and maintained. NRW may require environmental sampling, particularly in relation to surface water and groundwater quality and shall be consulted regarding monitoring programmes.

f) All contractors would have a briefing on environmental protection measures to protect the water environment during site induction training. This would highlight the methods and working practices employed.

Pollution Prevention Planning

Deliveries and Vehicles on Site

6.2.13 Deliveries to site can be a common cause of pollution, either from the delivery vehicle itself causing dust and noise pollution, or from the delivered materials themselves e.g. spillages of hazardous substances such as fuel or oil.

6.2.14 The contractor will control this potential hazard through careful planning and organisation of all site deliveries. The following hazards which may result in a pollution incident will be reviewed:

a) Site access routes for deliveries will be clearly signed to prevent nuisance.

b) Designated areas for deliveries.

c) Ensuring designated areas are as far away from watercourses and drains as possible.

d) Restricting delivery times to site – between 9am and 4pm to minimise noise and traffic disruption to neighbours.

e) 20 mph speed restriction thorough the site to minimise dust (as well as for Health & Safety).

f) Haul roads to be damped down during dry weather to minimise dust nuisance (see outline Air Quality Management Plan in Section 8 of this document).

g) One-way system instigated through all delivery areas to minimise reversing alarm nuisance (as well as for Health & Safety).

h) Where possible turning circles will be provided at the end of site access roads to eliminate the need for wagons to reverse and hence reduce the usage of reversing alarms (see outline Noise and Vibration Management Plan in Section 9 of this document).

i) All suppliers will be made aware of the delivery requirements when material orders are placed.

j) Gatemen located at all entrances to site to direct delivery vehicles to the correct area.

k) Store man located at all storage areas to oversee all delivery operations and ensure correct off load and storage of materials.

l) Store man will check all containers and drums etc. on delivery, to ensure they are not damaged or leaking.

m) Once off loaded all materials will be stored in an appropriate manner.

n) All hazardous materials will be off loaded directly to the safe storage area.

o) When practical, road vehicles should be segregated from the construction site to minimise the risk. Wheel washing facilities should be considered. However, road sweepers can often be a more sustainable and cost-effective measure to implement.

p) Bunds and drip trays will be checked daily and emptied as regularly to ensure that maximum effectiveness of the drip trays is maintained.

Excavations

6.2.15 Excavations can increase the risk of pollution on site by:

a) Generating excessive dust.

b) Producing silt and silty water.

c) Spreading contaminated soils.

d) Exposing contaminated soil/ materials.

e) Encouraging rain water or contaminated run-off to collect in the excavation.

6.2.16 In general, all excavations are expected to accumulate water and

therefore it is necessary to plan in advance how excess water will be treated and disposed of. The following approaches will be reviewed:

a) Where possible cut off trenches will be used to reduce the amount of surface water run-off entering the excavation, thereby reducing the amount of contaminated water to be disposed of.

b) The amount of topsoil stripped at any one time will be minimised in order to reduce silt transportation.

c) Vegetation corridors will be maintained along the sides of watercourses to act as a buffer strip and prevent suspended solids entering the watercourse.

d) Watercourses will be protected with silt traps to prevent run-off silt from entering them.

e) Silt traps will be inspected and maintained regularly and records kept.

f) Prior to undertaking any excavation works the history of the site/ areas will be reviewed so that potential areas of contamination can be identified and treatment or specialist removal arranged.

g) All members of the ground works team will be briefed on what to look for when working in potentially contaminated ground, and what to do if contamination is found.

h) If the site is contaminated or a working area with anything other than silt, then the water must be tested prior to removal from the excavation.

i) If the water proves to be contaminated then it will need to be taken off-site for disposal.

j) Any water to be pumped from an excavation can only be done so when a “Permit to Pump” has been issued.

k) Where possible a sump will be dug in the corner of the excavation. A perforated pipe surrounded by clean stone will be placed in the sump and the head of the pump placed inside the perforated pipe. This may not eliminate all the silt from the water to be pumped, but it should reduce the level of suspended solids within the water.

l) The pump will be supervised at all times to ensure that leaks are spotted immediately and to stop the pump before it sucks up the last dregs of the water, as this is likely to contain high levels of silt.

m) Any silt in the pumped water needs to be settled out prior to discharge into any sewer or watercourse.

n) Permission to discharge the settled water into a watercourse must be obtained from the NRW.

o) Permission to discharge the settled water into a sewer must be obtained by the local sewerage provider. Please note that there are certain locations within the site boundary where the material is

"colloidal" therefore, this will not naturally settle out and will require the application of flocculant and potentially a coagulant. Prior to using any chemicals to settle out water, the Environmental Clerk of Works must be consulted.

p) The contractor shall contact NRW and/or PCC at the start of the project to determine if there is requirement of:
    i. Permission to extract / dewater on site.
    ii. Permission to discharge anything to surface waters or groundwater.
    iii. To use silt traps settlement tanks or lagoons etc.

6.2.17 The contractor will ensure all necessary consents and permits are in place prior to works commencing with sufficient notice provided to the regulatory body.

Site Design

Location and Layout of Construction Compounds

6.2.18 Site compounds and car-parks will be located away from all surface water features and watercourses and outside of the floodplain.

6.2.19 Water pollution, storage of fuels, oils, wheel wash facilities, drainage and surface water run-off are detailed in the outline Ground and Surface Water Management Plan (Section 7).

Fire Plan

6.2.20 Action to be taken in the event of fire:

a) Raise the alarm
b) Call the Fire Brigade
c) On hearing the alarm, the area must be evacuated immediately and staff to assemble at the Muster point.
d) Visitors, clients and contractors to be escorted to the same assembly point.
e) Turn off generators, compressors and other powered equipment.
f) Turn off heat producing equipment and shut cylinder valve.
g) Attack fire with the equipment if it is safe to do so.
h) Obey instructions from the Office Fire Marshall or supervisory staff.

i) Do not re-enter the working area until told it is safe to do so. If necessary, inform others who may be affected by effects of the fire (nearby properties etc.).

6.2.21 The capacity of the construction surface water management system will be sufficient to contain within the site boundaries the water rejected by a fire truck, avoiding direct spillage of potentially contaminated material into the natural watercourses within the SSSI.

Pollution Control Options

Pollution Hierarchy

6.2.22 This section identifies the options that may be used to manage a pollution incident. The options are presented in the order of the preferred response.

6.2.23 Preferred response in order of priority:

a) Contain at Source
b) Contain close to the Source
c) Contain on the Surface
d) Contain in the Drainage
e) Contain on or in the watercourse

Spill Response Plans

6.2.24 The most likely causes of a pollution incident would involve:

a) spillage of oils or chemicals;
b) a discharge of sediment-laden water or other pollutant into a watercourse; or
c) firewater run-off.

6.2.25 Pollution control equipment would be appropriate for the location of the site and the chemical/substance targeted. For example, absorbent materials such as sand, spill granules, absorbent pads and booms will be kept at each site compound, on plant working near water courses and particularly at refuelling areas and where fuel or oil is stored.

6.2.26 Following a pollution incident, used pollution control equipment (for example, spill kits) would be disposed of appropriately and new/replacement equipment would be provided.

6.2.27 Some of the key actions that would be included in the action plans are as follows:

a) Priority action plan to be implemented when possible:
   i. Stop at source or as close as possible from the source (especially prior to the drainage system).
   ii. Stop pollutant spreading by using oil booms, Terram wrapped barriers, hay bales as applicable.
   iii. Trace impacts further downstream to establish extent of pollution.
   iv. Review the activity that caused the pollution prior to restarting work.

b) Action plan to be implemented when it is impossible to contain the spill at source and it has entered a watercourse:
   i. Stop the flow at point of discharge
   ii. Stop the flow spreading
   iii. Dam the flow with earth/sand/polythene/absorbent material;
   iv. Divert the flow from drains/watercourses where possible;
   v. Black off drains with drain covers or sandbags
   vi. Check the site drainage plan- where will spill end up?

Discovery of Contaminated Land

6.2.28 The following will need to be adhered to in relation to encountering previously unidentified ground contamination and asbestos during construction works:

a) Ensure personnel involved in the earthworks are briefed on the likely nature and type of soils that could indicate the presence of contamination (e.g. asbestos, discolouration, oils, odours, ash and clinker materials).

b) If such material is encountered, the Environmental Manager would be immediately contacted to inspect the material.

c) Testing of the material will be undertaken and the material will not be re-used or removed until the results of the tests have been reviewed.

Training

6.2.29 All personnel must attend a site induction before commencing work on the site. The induction will discuss the Pollution Control and Prevention Plan and also include key environmental issues on the project including

the sensitivity of the watercourses, contamination, asbestos and air quality management. The briefing will emphasise the methods and working practices employed for protection, including emergency procedures for reporting and dealing with environmental incidents.

a) All staff will receive relevant training on environmental issues throughout the construction of the project.
b) All method statements will include an environmental section and any specific pollution control and prevention information.
c) Drills of this emergency response plans will be carried out regularly to ensure understanding.

Monitoring, Review and Reporting

6.2.30 In accordance with the Environment Agency's Guidance for Pollution Prevent (GPP) and Pollution Prevention Guidelines (PPGs)[7] (although revoked they still maintain relevant as best practice guidance until updates are made available), as well as relevant construction industry guidance including CIRIA, best practice measures to prevent pollution will be implemented during the construction of the scheme.

6.2.31 Should a situation arise where our proposed mitigation is not adequate, this plan will be reviewed. It will also be reviewed quarterly by the Environmental Manager to ensure it is up to date and accurate.

6.2.32 Specific monitoring requirements will be detailed. Nominated staff will carry out regular site inspections to control measures are in place and adhered to during the works.

6.2.33 Any instances of pollution or spill will be reported immediately to the Environmental Manager who will investigate and communicate investigation's conclusions to the project team to aid continuous improvement and to prevent reoccurrence of the event.

6.2.34 Records will be produced to show compliance with our Pollution Control and Prevention Plan, including inspections records, site plans and progress reports

6.2.35 Surface water monitoring will be undertaken to demonstrate no adverse effects on water quality during construction works. An appropriate monitoring schedule and programme will be agreed with NRW.

[7] NetRegs, Guidance for Pollution Prevention (GPPs) – Full list, n.d. Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/ (Accessed 05/03/2020)

7 Outline Ground and Surface Water Management Plan

7.1 Introduction

Purpose

7.1.1 The purpose of this outline Ground and Surface Water Management Plan is to set out the construction measures to prevent the risk of pollution and contamination to ground and surface water. The contractor will manage risk in accordance with best practicable means which include general site management procedures, and control and measures to mitigate any effects of potential adverse effects caused by the construction works.

Scope of the Outline Ground and Surface Water Management Plan

7.1.2 This section is based on the information available at the outline design stage. As the detailed design progresses, the plan would be reviewed and updated accordingly. The outline Ground and Surface Water Management Plan would be developed in consultation with Natural Resources Wales (NRW) and would be agreed prior to the start of construction. The plan should be line with GPP and PPG guidance[8].

7.1.3 The final Ground and Surface Water Management Plan (GSWMP) will consider all drainage required during the construction phase and will reference all industry and regulatory pollution prevention guidelines. It shall describe the design of each element of surface water management system required to manage surface water run-off during construction and potential risks to surface waters. This shall include consideration of temporary storage and settlement requirements to manage sediment load of waters. The GSWMP shall define the water quality criteria to ensure any discharge to receiving watercourses meets regulatory requirements.

7.1.4 With regard to groundwater, the GSWMP shall consider all activities to be undertaken during the construction phase that may require groundwater control through pumping. The GSWMP will reference all

[8] Guidance for Pollution Prevention (GPP) – Full list, NetRegs. Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

relevant industry and regulatory pollution prevention guidelines. The GSWMP shall consider excavations within borrow pits, structures required for managing groundwater in areas of cut and excavations required for subsurface structures/utilities that may encounter shallow groundwater. The GSWMP shall define the nature and approach for groundwater management following its abstraction, including monitoring to determine the acceptability of chemical and physical quality with respect to discharge to the surface water system.

Responsibilities

7.1.5 Competent managers and key team members will be appointed to work on this plan and support it along the project duration. Additional roles and responsibilities will be developed as the detailed design progresses.

Table 6 Responsibilities details

Name	Position/Responsibilities	Contact Details
	Welsh Government Project Manager	
	Principal Contractor Environmental Manager	
	Site Manager	
	SHE Manager	
	Environmental Manager	
	Environmental Clerk of Works (ECoW)	

Consents

7.1.6 The treatment of waters arising from construction activities, including point source discharges resulting from the treatment of materials regulated by mobile plant licence will require regulation by the NRW. An application for an environmental permit (Discharge Consent) will be submitted prior to works commencing. The permit will regulate the discharge of treated contaminated waters to ground, via re-injection (or possibly soakaway). A separate environmental permit will be required for each location.

7.1.7 An abstraction licence will be in place for de-watering operations on site. A separate licence may be required for each location or activity. An impoundment of water in any watercourse or abstraction exceeding 20 cubic metres a day will be controlled by means of an NRW consent

(Abstraction Licence).

7.1.8 Construction works carried out over, under or near a main river, or in a flood plain or flood defence will require a Flood Risk Activity Permit. A permit will be required for each location.

7.1.9 An Ordinary Watercourse Consent is required for all works carried out over, under or near an ordinary watercourse. Ordinary watercourses include non-main rivers and all ditches, drains, cuts, culverts, dikes, sewers (other than public sewers) and passages through which water flows. The consenting authority for this scheme will be PCC.

7.2 Mitigation Measures

General Measures

7.2.1 Temporary surface water management systems will be installed early in the construction sequencing and carefully managed to prevent localized flooding or pollution of surface and groundwater from silt and other contaminants.

7.2.2 In areas where potentially contaminated land has been identified, specific mitigation measures will be designed to manage and contain potential contamination. Detailed method statements will be prepared for works in these areas.

Induction of site personnel

7.2.3 All personnel will attend a site induction before commencing work on site. The briefing will emphasise the sensitivity of the watercourses, surrounding habitat and methods and working practices employed to protect the water environment.

Emergency Response Planning

7.2.4 An emergency response plan will be developed in accordance with the new replacement Guidance for Pollution Prevention (GPP) 21: Pollution incident response planning[2] for producing emergency pollution incident response plans to deal with accidents, spillages and fires. The plan will be communicated to all personnel. Emergency spill control equipment such as spill kits, oil booms and absorbent materials, will be held at appropriate locations on site and within site compounds.

Climate Change Resilience Planning

7.2.5 The contractor should consider the potential impacts of extreme weather events during construction. To ensure resilience of the scheme to such extreme weather events, the contractor should use a short to medium-range weather forecasting service from the Met Office or other approved weather forecast provider to manage climate-related risks and inform programme management and impact mitigation measures. The contractor should register with the NRW's Floodline Warnings Direct service.

7.2.6 The contractor's Environmental Management System (EMS) should consider all measures deemed necessary and appropriate to manage extreme weather events and should specifically cover training of personnel and prevention and monitoring arrangements.

Mitigation Measures Forming Part of the Scheme Design

7.2.7 The design philosophy of the carriageway drainage includes a series of mitigations to ensure that flood risk in not increased in the vicinity of the scheme and to ensure that soluble and suspended pollutants in carriageway run-off are reduced to acceptable levels prior to discharge to groundwater or local watercourses.

7.2.8 A CEMP will be required during the construction stage to detail the procedures and methods that must be followed to minimise the potential environmental effects of construction activities. The CEMP would also describe the procedures in the event of an environmental emergency such as a fuel or chemical spillage.

7.2.9 A robust surface water drainage system should be provided to ensure discharge from the scheme does not increase flood risk elsewhere up to and including the 1 in 100 annual probability rainfall events, allowing for climate change effects. If online improvements are proposed, consideration must also be given to the ability of existing drainage systems to receive any additional flows. In sections where offline improvements are proposed, consideration must be given to the provision of new drainage systems that provide sufficient attenuation and restrict the rate and volume of discharge to a rate agreed with PCC as the Lead Local Flood Authority (LLFA).

7.2.10 Isolated sections of the scheme are identified to be at risk of surface water flooding due to natural depressions in topography and overland flow paths, typically associated with the watercourses that are crossed by the scheme. In order to protect the proposed route alignment, consideration should be given to maintaining these overland flow paths and localised raising of ground levels to mitigate the potential impact of surface water flooding on the highway and to its users.

7.2.11 Any widening of existing highway culverts must maintain hydraulic capacity and, where possible, explore opportunities to provide betterment.

7.2.12 Any new crossings of watercourses should strive to provide clear span bridges where practicable. Alternatively, any new culverts must maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB LA 113 guidance, and be sensitive to ecological requirements.

7.2.13 Surface water run-off from highway schemes typically contains high levels of sediment and hydrocarbons that can pollute surface water and groundwater features through direct migration or via the surface water drainage system. A robust treatment system will therefore be required. Little is known regarding existing drainage arrangements and water treatment provision. The works may provide an opportunity to provide betterment. Multi-stage proposals that maximise passive treatment using Sustainable Drainage Systems (SUDS) would be considered.

7.2.14 Areas of exposed sediment deemed at risk of erosion during heavy rainfall or flood inundation should be protected using either temporary measures (e.g. sheeting) or semi-permanent measures (e.g. coir matting) until vegetation is able to establish on these surfaces. The use of temporary or semi-permanent measures would vary based on the planned construction in that area. For example, the flood bund, once constructed, should be protected with semi-permanent erosion control until vegetation is established, whilst areas excavated for the haul road/laydown areas may only be exposed for a short period during construction and would therefore only require temporary erosion control.

Silt Pollution

7.2.15 Pollution can be caused by the discharge of suspended solids into a watercourse. Pollution from suspended solids is most likely to occur from pumping out excess rain water from accumulations as a result of seepage or rainfall, or from uncontrolled rainwater run-off from the work site into an adjacent watercourse.

7.2.16 To avoid silt pollution, wherever possible, the Contractor shall implement a series of methods to manage sediment run-off and eliminate the likelihood of producing silt and silty water.

7.2.17 Given the varying nature of the watercourses, topography and local hydrology across site and activities being carried out each section of the scheme, the following sediment control measures will be reviewed and the most appropriate approaches adopted. As the works progress it will be necessary to adapt the measures implemented and review effectiveness. The measures put in place will also need to be regularly maintained.

a) The hazards of silt pollution will be emphasised in the Site Induction.

b) No water will ever be pumped directly into a watercourse.

c) All water pumped into a watercourse must be treated first to settle or remove suspended solids.

d) The minimum area of topsoil will be stripped at any one time.

e) The spread will be 'lipped' or bunded as it crosses a watercourse to prevent direct run-off. In addition, where considered appropriate silt fencing will also be installed.

f) A 5-metre buffer strip of vegetation will be left on either side of a watercourse if possible to provide a barrier and treatment area.

g) Straw bales and spill kits will be stored at all sensitive receptors, in supervisor vehicles and machine cabs (where appropriate).

h) All pumping operations will be carried out under the Permit Procedure.

i) Water will be pumped at low volume and treated as necessary.

j) A settlement tank and straw bales will be used if the quantity of water justifies this.

k) Care will be taken to avoid soil erosion of river and stream banks.

l) Settlement lagoons will be constructed. However, given the limited working area available it will be necessary to carefully

consider the locations of these and whether other methods would be more practicable.

m) Silty water can be disposed of by pumping to grassland, to sewer or to a watercourse after sufficient treatment and with consent from the sewer undertaker/ statutory body. The correct permissions and consents must be obtained prior to disposal.

n) Wheel washing will be carried out in a designated area of hard standing, at least 10 m from any surface water at the site compound.

o) Any run-off generated will be collected in a sump where conditions permit. If the construction of a sump is not an option, other measures will need to be put in place.

p) Settled solids from the sump water will be removed regularly and appropriately disposed of.

q) Where possible sump water will be recycled and re-used, potentially for damping down the haul road where necessary.

r) Excess water will be discharged into the foul sewer (permission will be sought from the sewerage provider) or removed from site in a tanker for authorised disposal.

s) Any facilities used to control silt will be correctly installed and will be regularly checked and maintained.

t) Concrete washout will not be dispersed onto the natural ground and will be dealt with in accordance with the Environment Agency guidelines for dealing with concrete washout.

u) Where none of the above measures can be implemented (due to the nature of the sediment particles) Silt busters will be installed and the use of flocculant reviewed. A flocculant supplier (Goldcrest) will be consulted and discussions held with NRW/ PCC to confirm they are in agreement with the approach adopted. Nothing hazardous will be discharged into controlled waters. Please note that care does need to be taken when using flocculant and the appropriate blocks installed in accordance with the guidance provided by the supplier.

Drainage

7.2.18 It is essential that all drainage routes on the site are identified and that the contractor knows where they lead and/ or outfall, in order to prevent pollution incidents occurring which remain undetected until adverse impacts are sustained and clearly visible (e.g. a fish kill).

7.2.19 All pollutants must be stopped from entering the drainage system and the contractor should ensure this through the careful planning and organisation of all site operations. The following guidelines will be

reviewed:

a) Permission must be sought from NRW or local sewerage provider in order to discharge anything except for clean uncontaminated surface water to a drain or watercourse.

b) All drainage on site will be identified by type and where appropriate colour coded using spray paint.

c) Drains will be checked to see if they have existing protection, such as oil interceptors or silt traps.

d) Existing protection measures will be inspected and repaired, emptied or cleaned, as necessary prior to the commencement of any works.

e) Drains and their associated protection measures will be checked regularly and maintained throughout the contract, as well-maintained drains will also reduce the risk of flooding.

f) Potential pollutants which could enter the drains will be identified and reported.

g) Drains at risk from spills, contamination or misuse will be identified and protected when “risky activities” are being undertaken and no other location to carry out such activities is possible e.g. re-fuelling areas, concrete mixing and washout areas etc. Any additional requirements / control measures detailed in permits / authorisations will be strictly adhered to and recorded. Such information will include the locations of Spill kits and emergency procedures will be available at regular location either via workforces’ vehicles or at site emergency points.

h) If drains are flushed during the contract, the contractor will ensure that the water used to flush the pipes is classified as “dirty” and is not allowed to enter a watercourse without undergoing appropriate treatment first.

i) Water supplies and underfield drainage adversely affected by the scheme will be replaced or repaired where possible to maintain the current condition of the farmland.

j) Section-specific incident response plans will also include measures to avoid the pollution of the drainage systems and emergency procedures in the event of an incident occurring.

k) In the event of a spillage/ accident/ emergency, the contractor will try and stop any pollutants from entering the drainage network. Clay drainage seals will be available in each section to cover drains to avoid any run-off discharging into the drainage network. NRW and/ or DCWW will be immediately notified if surface water drains, local sewers or foul water drains are affected.

l) Emergency spill kit boxes will be stored at the main compound

m) Any pollution incident will be reported to NRW via the Incident Hotline.

n) Records of any incidents and subsequent actions will be maintained.

7.2.20 Water with a higher risk of contamination, including groundwater pumped out of excavations during concrete pouring, will be contained and treated using appropriate measures such as coagulation of sediments, dewatering and pH neutralisation prior to discharge. There are various proprietary package treatment plants available that can provide these measures. Contaminated water that cannot be treated on site will, if necessary, be pumped to a suitably licenced tanker before being exported off site for treatment at an appropriately permitted facility.

7.2.21 All water pumped from excavations will be pumped via a pipe and gravel sump in order to prevent silt being agitated from the base of the excavation and to provide rudimentary filtration to the water prior to abstraction. For low volume pumping, water will either be pumped into a vegetated area remote from surface water drainage or into a small attenuation lagoon prior to being directed into the drainage system. For high volume pumping (0.052m3/s or above) water will be passed through an attenuation tank with a capacity of not less than 8m3. The outlet from the tank could be placed directly into site drainage, provided the water is free from silt contamination.

Materials

Stockpiles and Exposed Ground

7.2.22 Exposed ground and materials stockpiled on site, such as topsoil, hardcore and sand, can pollute water with silt and the air with dust. The contractor will ensure that all stockpiles on site are well managed and maintained and where appropriate seeded if to be left in position for more than six months. Where appropriate, the following measures will be implemented:

a) Stockpiles will be located well away from watercourses, ditches and drains.

b) Where possible stockpiles will be located on level ground.

c) Slope stability of the stockpiles will be checked and maintained.

d) Stockpiles will be covered (or damped down) to prevent the material from drying out and causing dust.

e) Run-off from stockpiles will be controlled so as not to enter drains or ditches etc. If necessary, silt fencing will be installed and

settlement lagoons to ensure the integrity of all watercourses and ditches is maintained.

f) Silt fencing will be used around the base of stockpiles to prevent suspended solids from escaping.

g) Contaminated material will be stockpiled on an impermeable surface, in a bunded area, at least 10m away from the nearest watercourse and will be covered to prevent contaminated run-off.

h) Any run-off from a contaminated stockpile will be legally disposed of.

i) Where possible works will be phased to reduce stockpiling.

j) Top soiling and seeding of finished slopes will be carried out as soon as possible as work progresses to establish grass at the earliest opportunity, which will help to minimise run off problems.

k) Any stockpiles of topsoil / subsoil which will remain for a reasonable length of time will be seeded, to bind the material together preventing both dust and surface water run-off.

l) Where feasible the main earthmoving activities will be undertaken during the late spring and summer months.

Oil Storage, Use and Refuelling

Storage

7.2.23 Oil must not be stored in high risk areas, including:

a) Where there is a risk or damage from impact e.g. from site traffic.

b) Within 50m of a spring, well or borehole.

c) Within 10m of a watercourse, ditch or drainage channel.

d) Where spilt oil could enter open drains or through loose fitting manhole covers.

e) Where spilt oil could soak into unmade ground and pollute groundwater.

f) Where a spill could run over hard ground and enter a watercourse.

g) Areas that are at risk from flooding.

7.2.24 Appropriate locations will be designated within each section where materials including oil and diesel can be appropriately stored. Although the Oil Storage Regulations are applicable in England, they are still adopted as best practice in Wales.

7.2.25 In order for the tank storage system to operate correctly the following points need to be considered:

a) Are all valves, filters, gauges, pipes, taps etc arranged so that oil is caught within the secondary containment system (SCS)?
b) Is the flexible draw-off pipe fitted with a nozzle at the delivery end that closes automatically when not in use?
c) Are all taps, valves, flexible hoses and pumps through which oil can be discharged, located within the SCS?
d) Are all taps and valves, where oil could escape, kept locked shut when not in use?
e) Is the primary oil container in good condition and doesn't look likely to burst or leak?
f) Is the pump set fitted with a check valve in the feed line to prevent tank drain down in the event of damage to the pump or feed line?
g) Is the fill pump situated within the SCS?
h) Is the SCS and its ancillary pipework protected from damage caused by collision or impact?
i) Is the SCS capacity 110% of the capacity of the primary tank?
j) Is the SCS impermeable to oil and water?
k) Does the SCS have any drain down valves?
l) Can the SCS provide maximum containment at all times?
m) Is accumulated oil / water removed regularly from the SCS?
n) Is the tank clearly labelled with product type and maximum capacity?

7.2.26 Oil and lubricants will be stored within the confines of a bund, and where possible the bund will be covered to prevent rainwater collecting, alternatively an appropriate drainage system will be put in place.

7.2.27 Where the site deploys a generator and external fuel tank set to provide electricity, the units will be contained within a single adequate bund /provided as a proprietary single self-bunded unit.

7.2.28 There will be a nominated person to oversee deliveries to ensure correct storage etc in each section; they will be recorded. These individuals will also be responsible for cleaning up any minor spills.

Refuelling

7.2.29 All refuelling of plant will be undertaken by a nominated trained person in predetermined areas, with an impermeable surface, located well away from any watercourse.

7.2.30 The fuel bowsers will carry the necessary pollution control kits to deal with any emergency spills and leaks. In a similar manner, any servicing of plant will only be carried out in designated areas.

7.2.31 A fuel bowser will be used for refuelling on the spread. The bowser driver will be responsible for ensuring that drip trays are used for all refuelling of mobile plant and ensure that no refuelling takes place within 10m of a watercourse.

7.2.32 The refuelling bowser and the Supervisor's vehicle will be equipped with a "Grab Pack" spillage control kit and personnel will be trained in their use as part of the Site Induction.

7.2.33 Fuelling up of the bowser is restricted to the designated area within the site compound.

7.2.34 Regular monitoring of fuel storage should be recorded. Any storage that is being carried out in key areas will also be recorded.

Cement, Concrete and Grout

7.2.35 Cements, concrete and grouts are highly alkaline and corrosive and can cause serious pollution to the ground and watercourses.

General Concrete Work

7.2.36 Neither wet or dry concrete / cement will be allowed to enter watercourses: -

a) Concrete and cement mixing will be carried out on an impermeable designated area.

b) Designated area will be located at least 10m away from a watercourse or drain. If this is not possible alternative measures will be put in place to ensure that environmental receptors are protected.

c) Concrete quantities will be accurately calculated in order to minimise concrete wastage.

d) However, any excess concrete will be allowed to dry and will be used, if possible, as inert rubble on site.

e) Designated concrete wash-out areas will be created for drivers to wash out their delivery wagons.

f) Water from the washout areas will be stored and the suspended solids allowed to settle out.

g) Where possible the settled water will be re-used for mixing concrete and washing out.

h) Excess washout water will either be discharged to the foul sewer (with permission from the local sewerage provider) or disposed off-site by a registered waste carrier. All concrete washout areas will be clearly demarcated on site.

Working with Concrete in Water

7.2.37 Activities such as concrete pouring for foundations and abutments, as well as washout of vehicles/equipment would create water contaminated with concrete. This water should be collected and pumped to an appropriate treatment solution, of water before it is returned to the surface water management system. Treatment may need to include a carbon dioxide adjustment system to neutralise high pH cement laden water and settlement of sediments to remove fines from wash waters. Settlement units use gravity to remove fines and can be combined with coagulants or flocculants to treat higher volumes of water. Any residual material (i.e. solids) from this process should be, where possible, re-used onsite under a Materials Management Plan or otherwise transported to an appropriately licenced waste facility

7.2.38 Where it is necessary to work with concrete in water, concrete mixes will be specified and those which minimise pollution risks used (see Environment Agency Pollution Prevention Guidelines - Works and Maintenance in or Near Water - PPG 5[9]).

7.2.39 The first thing to do when working with concrete in water is to divert the flow of water away from the working area or by damming upstream and over-pumping the water beyond the working area.

7.2.40 The inlet to the pump will be screened. Loose cement and/or concrete will be removed prior to the return of the watercourse to its original course.

7.2.41 Tools and equipment will not be cleaned in the watercourse. Should it be necessary to clean tools and equipment on site, this will be done well away from watercourses. Washout water will not be poured away into watercourses or surface drains or disposed of in any way as to cause/permit a discharge into a watercourse.

[9] Natural Resource Wales et al. Guidance for Pollution Prevention – Works and maintenance in or near water: GPP 5. Available at: https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017

7.2.42 If concrete has to be sprayed, sheeting will be used to cover the water surface and the open faces of the structure to prevent deposits of concrete dropping into the water. The area will be thoroughly cleaned before removing the sheeting.

7.2.43 In the event of release of concrete into a watercourse, all measures will be taken to stop further ingress of material. Flow will be diverted, and straw bales placed appropriately.

Watercourse Monitoring

7.2.44 During works, the Site Manager will regularly check river levels and the three-day weather/flood risk forecasts. Works in or near watercourses should be suspended when out-of-bank river flows are forecast and plant moved to a position of safety. Following a flood event any temporary works in watercourses or their floodplains will be checked for integrity prior to commencing works.

Sewage

Site Offices

7.2.45 Sewage will either drain to the public foul sewer with consent from the local sewerage undertaker or to a cesspit / effluent tank, from where it will be collected and disposed of by a registered waste carrier (will be verified with the NRW).

Site Toilets

7.2.46 The tanks within portable toilet facilities will be emptied regularly. Sewage from portable facilities will be disposed by a registered waste carrier (a copy of their Waste Carriers Licence will be provided and verified by the NRW).

7.2.47 These details will be included in relevant the Pollution Strategy Documents (where portable toilets are located within the strategy area).

7.2.48 Waste transfer tickets for all movements of sewage / foul water will be retained on site and kept on records.

8 Outline Air Quality Management Plan

8.1 Introduction

Purpose

8.1.1 The purpose of the outline Air Quality Management Plan (AQMP) is to set out the management of dust, air pollution, odour and exhaust emissions during the construction works. The contractor will manage dust, air pollution, odour and exhaust emissions in accordance with best practicable means (BPM), which include the following:

a) reference to the general site management and good housekeeping procedures (relevant to limiting dust and air pollution);

b) controls and measures to control or mitigate the effect of potential adverse effects caused by the construction works; and

c) dust and air pollution monitoring measures to be employed during construction of the project.

Scope of the Outline Air Quality Management Plan

8.1.2 This is an outline AQMP which will be developed by the Contractor as the detailed design progresses.

8.1.3 The scope of the plan will comprise:

a) Best practical means for site management;

b) Measures to limit emissions from construction plant and vehicles

c) Measures to limit pollution from transportation, storage and handling of materials;

d) Measures to manage dust from Haul roads;

e) Measures to limit dust pollution from excavations and earthworks activities;

f) Measures to limit dust pollution from drilling activities; and

g) Measures to limit dust pollution from processing, crushing, cutting and grinding activities.

Responsibilities

8.1.4 For the purpose of the outline Air Quality Management Plan, the key roles are set out in Table 7 below. Additional roles and responsibilities will be developed as the detailed design progresses.

Table 7 Responsibilities details

Name	Position/Responsibilities	Contact Details
	Welsh Government Project Manager	
	Site Manager	
	Principal Contractor Environmental Manager	
	Environmental Manager	
	Environmental Clerk of Works	
	Public Liaison Officer	

8.2 Air Quality Management

Legislation and guidance

8.2.1 The contractor will reference, as appropriate, national/industry standards and codes of best practice and guidance when developing the AQMP including the following:

a) BS6069: Part 2 1983, ISO 4225-1994, Characterisation of air quality (British Standards Institute, 1983);

b) Guidance on the assessment of dust from demolition and construction - Institute of Air Quality Management (IAQM, 2016 - Version 1.1);

c) Local Air Quality Management Policy Guidance LAQM PG(16) (Defra 2016);

d) Local Air Quality Management Technical Guidance LAQM TG(16) (Defra 2016); and

e) Design Manual For Roads and Bridges Volume 11, Section 3, Part 1 Air Quality (Highways Agency, 2007).

General

8.2.2 Obligations for the contractors in relation to using best practicable means to prevent or counteract the effects of any nuisance are set out in the sections below:

a) Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;

b) Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager;

c) Display the head or regional office contact information; and

d) Develop and implement a dust management plan, which will include measures to control other emissions, approved by the local authority.

Site management

a) Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken;

b) Make the complaints log available to the local authority when asked; and

c) Record any exceptional incidents that cause dust and/or air emissions, either on-site or off-site and the action taken to resolve the situation in the log book.

Site maintenance

a) Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as possible;

b) Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site.

Construction plant and vehicles

8.2.3 Measures will be implemented by the contractor to limit emissions from construction plant and vehicles, including the following, as appropriate:

8.2.4 The contractor will operate construction plant in accordance with the manufacturer's written recommendations;

a) All vehicles and plant will be switched off when not in use;

b) Vehicle and construction plant exhausts should be directed away from the ground and be positioned at a height to facilitate appropriate dispersal of exhaust emissions;

c) On plant likely to generate excessive quantities of dust beyond the site boundaries, enclosing, shielding or provision of filters will be employed. Items such as dust extractors, filters and collectors on drilling rigs and silos will be used;

d) The movement of construction traffic around the site will be kept to the minimum reasonable for the effective and efficient operation of the site and construction of the scheme;

e) Construction plant will be located away from site boundaries which are close to sensitive receptors where reasonable and practicable;

f) Site access points will be designed to avoid queuing traffic;

g) The use of diesel or petrol-powered generators will be reduced by using mains electricity or battery powered equipment where reasonable and practicable;

h) All non-road mobile machinery will use ultra-low sulphur tax exempt diesel where available and machinery with power outputs of over 37kW will be fitted with appropriate exhaust after-treatment from approved Energy Saving Trust list (achieving filtration efficiency of over 85%);

i) Cutting and grinding operations will be conducted using equipment and techniques which incorporate appropriate dust suppression measures;

j) Vehicle, plant and equipment maintenance records will be kept on site and these will be made available to the employer's representative upon request;

k) A maximum speed limit of 15mph will be imposed and signposted on surfaced haul roads and work areas, and a 10mph speed limit will be imposed and signposted on un-surfaced haul roads and work areas;

l) Vehicles entering and leaving the site must be covered to prevent escape of materials during transport;

m) A Construction Logistics Plan should be produced to manage the sustainable delivery of goods and materials; and

n) A Travel Plan should be implemented, which supports and encourages sustainable travel (public transport, cycling walking and car-sharing).

Transportation, storage and handling of materials

8.2.5 Measures will be implemented by the contractor to limit pollution due to the transportation and storage of materials, including the following, as appropriate:

a) Materials deliveries or loads entering and leaving the construction site will be covered by a fixed cover or sheeting appropriately fixed and suitable for the purposes of preventing materials and dust spillage. This will apply to the transport of materials by road, rail or waterway;

b) Vehicles transporting materials within or outside the construction site will not be overloaded;

c) Stockpiles and mounds will be kept away from sensitive receptors, watercourses and surface drains and sited to take into account the predominant wind direction;

d) Stockpiles and mounds will be at a suitable angle of repose and avoid sharp changes in shape to prevent material slippage;

e) Materials stockpiles will be enclosed or securely sheeted or kept watered by the contractor;

f) Surfaces of long-term stockpiles, which give rise to a risk of dust or air pollution, will be stabilised or be covered with appropriate sheeting;

g) Fine dry material will be stored inside buildings or enclosures;

h) Mixing of large quantities of concrete or bentonite slurries will be undertaken in enclosed or shielded areas;

i) The number of handling operations for materials will be kept to the minimum practicable;

j) Materials handling areas will be maintained to constrain dust emissions and appropriate measures such as watering undertaken to reduce or prevent escape of dust from the site boundaries; and

k) Mixing of grout or cement-based materials will be undertaken using a process suitable for the prevention of dust emissions.

Excavations and earthworks activities

8.2.6 Measures by the contractor to limit dust pollution from excavations and earthworks activities will include the following, as appropriate:

a) Topsoil will be stripped as close as reasonably practicable to the period of excavation or other earthworks activities to avoid risks associated with run-off or dust generation;

b) Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable;

c) Hessian, mulches and trackifiers will be used where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;

d) The cover will only be removed in small areas during work and not all at once;

e) Drop heights from excavators to vehicles involved in the transport of excavated material will be kept to the minimum practicable to control dust generation associated with the fall of materials;

f) Suppressing dust emissions by spraying with water or using other appropriate measures;

g) Compacting deposited materials, with the exception of topsoil, as soon as possible after deposition; and

h) Soiling, seeding, planting or sealing of completed earthworks will be undertaken by the contractor as soon as reasonably practicable following completion of the earthworks.

Drilling activities

8.2.7 Measures by the contractor to limit dust pollution associated with drilling activities will include the following, as appropriate:

a) On plant likely to generate excessive quantities of dust beyond the site boundaries measures such as enclosing, shielding or provision of filters will be employed. Items such as dust extractors, filters and collectors on drilling rigs and silos will be used, as appropriate;

b) Where appropriate dust will be extracted at source to prevent exposure of workers to excessive dust inhalation;

c) Where drilling is used for the purposes of excavating within rock, the exposed surfaces will be watered to limit dust emissions as necessary;

d) Materials used such as cements or pulverised fuel ash, will be stored in accordance with the requirements of for materials storage to prevent them becoming an airborne hazard; and

e) Mixing of grout or cement based materials will be undertaken using a process suitable for the prevention, as far as reasonably practicable, of dust emissions.

Processing, crushing and grinding activities

8.2.8 Appropriate measures will be used by the contractor for any processing, crushing, cutting and grinding activities as required to limit dust pollution. Permits will be sought for concrete crushing and batching plant operations as required.

Monitoring

8.2.9 The contractor will implement inspection and monitoring procedures to assess the effectiveness of measures to prevent dust and air pollutant emissions. Relevant local authorities will be consulted regarding the monitoring procedures to be implemented which will include the following measures, as appropriate:

a) Regular site inspections will be carried out to monitor compliance with the Dust Management Plan (inspection results will be recorded, and inspection log will be made available to the local authority, when asked).

b) Daily on-site and off-site inspections where receptors (including roads) are nearby, monitoring of dust and recording of inspection results (log to be made available to the local authority when asked).

c) The frequency of site inspections by the person accountable for air quality and dust issues on site will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

d) Liaising with the local authority to determine if instrumented monitoring of dust is required.

e) Reference to inspection and maintenance schedules for construction vehicles, plant and machinery.

f) Inspection procedures relating to the level of trafficking, use and condition of haul routes.

9 Outline Noise and Vibration Management Plan

9.1 Introduction

Purpose

9.1.1 The purpose of this outline Noise and Vibration Management Plan is to set out measures for the Contractor to control and manage noise and vibration from machinery and construction.

9.1.2 The effects of noise and vibration from construction sites will be controlled by introducing management and monitoring processes to ensure that best practicable means (BPM) are planned and employed during construction.

Scope of the Outline Noise and Vibration Management Plan

9.1.3 As part of the contractors' detailed CEMP, a noise and vibration management plan will be prepared and will set out these processes. The plan will include management and monitoring processes to ensure as a minimum:

a) Integration of noise control into the preparation of method statements;

b) Ensuring proactive links between noise management activities and community relations activities;

c) Preparing details of site hoardings, screens or bunds that will be put in place to provide acoustic screening during construction, together with an inspection and maintenance schedule for such features;

d) Developing procedures for the installation of noise insulation or provision of temporary re-housing and to ensure such measures are, where required, in place as early as reasonably practicable;

e) Preparing risk assessments to inform structural surveys of buildings and structures which may be affected by vibration from construction;

f) Developing a noise and vibration monitoring protocol including a schedule of noise and vibration monitoring locations and stages during construction of the scheme when monitoring will be undertaken;

g) Preparing and submitting Section 61 consent applications;

h) Undertaking and publishing all monitoring required to ensure compliance with all acoustic commitments and consents; and

i) Implementing management processes to ensure ongoing compliance, improvement and rapid corrective actions to avoid any potential non-compliance.

Responsibilities

9.1.4 For the purpose of the outline Noise and Vibration Management Plan, the key roles are set out in Table 8 below. Additional roles and responsibilities will be developed as the detailed design progresses.

Table 8 Responsibilities details

Name	Position/Respomsibilities	Contact Details
	Welsh Government Project Manager	
	Site Manager	
	Principal Contractor Environmental Manager	
	Environmental Manager	
	Environmental Clerk of Works	
	Public Liaison Officer	

9.2 Measures to Reduce Potential Noise and Vibration impacts

Best Practicable Means

9.2.1 The Control of Pollution Act 1974 and the Noise and Statutory Nuisance Act 1993 contain powers to control noise emission and to require the employment of the best practicable means for preventing or counteracting the effect of noise.

9.2.2 Well defined noise control procedures will be implemented for all construction plant equipment and all site activities. The contractor will comply with BS 5228: Noise and vibration control on construction sites and open sites[10]. Noise control measures will include:

[10] BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Parts 1 and 2 (British Standards Institution, 2014)

a) Noisy equipment will be located at furthest practicable distance from properties with provision of temporary screening where possible to reduce construction noise impacts at properties. The contractor will identify optimum positions for noisy equipment and screening to minimize disruption.

b) In order to reduce construction vibration impacts at properties, vibratory rollers will not be used within 100m of properties during operation (200m for start-up/run down) unless further risk assessment and monitoring can demonstrate no likely adverse effect due to vibration. The contractor will undertake further risk assessment prior to works and/or vibration monitoring at the start of works within the stipulated distances to confirm no adverse effects due to vibration.

c) Low noise road surfacing will be used on the new A40 alignments to reduce operational noise impacts by at least 3dB compared with a typical 1.5mm texture depth HRA surface.

d) All plant and machinery will have effective silencers fitted and kept in good condition.

e) Areas of traffic movement will be designed to minimise reversing alarm use principally by the use of one-way systems.

f) Natural features and buildings will be used to minimise noise from operations where practical

g) Noise levels can be predicted from knowledge of the type and number of plant to be used for various activities.

h) The activities listed will not necessarily occur continuously or simultaneously but in stages with peaks of activity separated by periods of relative inactivity.

i) Noise from standard construction plant is of short duration therefore impact is minimised.

j) Occasionally 24hr. operations will be necessary but discussions will take place with the local Environmental Health Officer before such operations begin.

k) Baseline noise levels will be established and monitored throughout the construction works.

l) Where there is expectation of considerably more noise than the baseline, consideration for applying to the Council for a Section 61 Consent will be given, whereby the Council approves working methods and noise mitigation measures (Note Section 61 Consent only applies to nuisance and doesn’t consider disturbance to ecology). Further details on Section 61 Consent are given in section 6.2.2 below.

m) Construction activity will normally be confined to 07.00-19.00 hours, Monday to Friday and 07.00-13.00 hours on Saturdays

during the summer. During winter, construction activities will normally be confined to 07:30-17:30, Monday to Friday.

n) As the requirement for Sunday working and/or night working cannot be ruled out, discussions will take place with the local Environmental Health Officer before such operation begins.

o) All activities which have the potential to cause vibration issues will be identified and receptors (particularly local residents) will be informed of activities such as blasting.

p) During the construction phase, haul roads will be maintained and kept as smooth as possible and maintain them to reduce vibration impacts caused by heavy plant movement.

q) Where practicable anti-vibration mountings should be fitted to rotating / impacting equipment.

9.2.3 If situations arise where despite the implementation of BPM, the noise exposure exceeds the criteria defined in this Noise and Vibration Management Plan (NVMP), the contractor may offer:

a) Noise insulation; or ultimately

b) Temporary re-housing.

Section 61 Consents

9.2.4 The contractor will seek to obtain consents from the relevant local authority under Section 61 of the Control of Pollution Act 1974 for the proposed construction works, excluding non-intrusive surveys. Applications will be made to the relevant local authority for a Section 61 consent at least 28 days before the relevant work is due to start or earlier if reasonably practicable.

9.2.5 Details of construction activities, prediction methods, location of sensitive receivers and noise and vibration levels will be discussed with the relevant local authority, or authorities, both prior to construction work and throughout the construction period. Prediction, evaluation and assessment of noise and vibration as well as discussion between the employer's representative and its contractor and the relevant local authority will continue throughout the construction period.

9.2.6 Unless otherwise agreed with the relevant local authority, noise levels will be predicted in accordance with the methods set out in BS 5228 – 1.

9.2.7 All construction noise levels will be predicted or measured at a distance

of 1m from any affected eligible facade, which must have windows to bedrooms or living rooms.

9.2.8 Annex A of BS 5228-1 provides a flow diagram demonstrating the process of a Section 61 application.

9.2.9 The employer's representative and/or the contractor will seek to agree with local authorities a common format and model consent conditions for Section 61 applications or any dispensations and variations to an existing consent.

9.2.10 The application for a Section 61 consent will require noise (and where appropriate vibration) assessments to be undertaken and BPM measures set out to manage noise associated with construction of the scheme. The contractor will submit the assessment initially to the employer's representative for review, prior to submission to the relevant local authority.

9.2.11 The contractor will carry out noise (and vibration where appropriate) predictions for Section 61 applications.

9.2.12 In the event that works for which Section 61 consent has been applied for have to be rescheduled or modified (e.g., method or working hours) for reasons not envisaged at the time of submitting the Section 61 consent application, the contractor will apply for a dispensation or variation from the appropriate local authority, before commencing those works, at the time specified within the Control of Pollution Act 1974.

9.2.13 The dispensation will be sought by means of an application to vary the agreed matters, setting out the revised construction programme or method and the relevant noise calculations.

Noise insulation and temporary re-housing policy

9.2.14 Welsh Government/employer's representative will implement a noise insulation and temporary rehousing policy. The policy is intended to provide additional protection to residents in the event that it is not practicable to mitigate airborne noise, or reduce their exposure to it, to levels that are tolerable during certain intensive construction phases.

9.2.15 The contractor will submit a noise insulation/temporary rehousing

appraisal at least six months prior to starting that phase of work on site or such time appropriate to the scale and nature of the works. It is essential that the assessment is carried out early enough so that noise insulation can be installed before the start of the works predicted to exceed noise insulation or temporary re-housing criteria.

9.2.16 Typically, a noise insulation package will include secondary glazing, an alternative method of ventilation and, on certain aspects, venetian blinds.

9.2.17 The contractor will use BPM to minimise the extent to which noise insulation work or temporary re-housing of occupiers of dwellings adjacent to the works needs to be considered.

9.2.18 Notwithstanding the measures set out in this NVMP and any Section 61 consents, noise insulation or temporary re-housing will be offered to qualifying parties when:

a) noise levels are predicted or measured by the contractor to exceed the relevant trigger level defined in Table 9 at that property for at least ten days out of any period of fifteen consecutive days or alternatively 40 days in any six-month period;

b) the property complies with all other requirements of the Noise Insulation (Amendment) Regulations 1988;

c) the property is lawfully occupied as a permanent dwelling; and

d) in respect of insulation, noise insulation does not already exist that is of an equivalent standard to that which would be allowed for under the Noise Insulation (Amendment) Regulations 1988.

Table 9 Noise thresholds for noise insulation/temporary re-housing

Day	Time (hrs)	Average period T	Noise insulation trigger level LpAeq,T(dB)*/**	Temporary re-housing trigger level LpAeq,T(dB)*/**
Monday-Friday	07:00-08:00	1 hr	70	80
	08:00-18:00	10 hrs	75	85
	18:00-19:00	1 hr	70	80
	19:00-22:00	1 hr	65	75
Saturday	07:00-08:00	1 hr	70	80
	08:00-13:00	5 hrs	75	85
	13:00-14:00	1 hr	70	80
	14:00-22:00	1 hr	65	75
Sunday and public holidays	07:00-22:00	1 hr	65	75
Any day	22:00-07:00	1 hr	55	65

*The Scheme construction sound only. Trigger levels are defined as 1m in front of the closest facade of a habitable room.
**Where the current ambient noise level is greater than the noise insulation trigger level:
a) the ambient noise level shall be used as the noise insulation trigger level, and
b) the ambient noise level +10dB shall be used as the temporary rehousing trigger level.

9.2.19 Welsh Government/employer's representative will develop and seek to agree with local authorities a noise insulation and temporary rehousing policy that will set out all roles, responsibilities and actions required in respect of these measures.

9.2.20 Welsh Government/employer's representative will consider at its discretion applications supported by evidence for noise insulation or temporary rehousing from occupiers who may have special circumstances. Special circumstances could include night workers, those working in home occupations, local businesses or buildings that provide community facilities requiring a particularly quiet environment and those with a medical condition which will be seriously aggravated by construction noise and provide noise insulation or temporary rehousing where it is demonstrated that this is necessary.

Monitoring

9.2.21 Monitoring will include physical measurements and observational checks/audits.

9.2.22 The contractor will undertake and report noise and vibration monitoring, including real time noise and vibration monitoring, as is

necessary to ensure and demonstrate compliance with all noise and vibration commitments, the requirements of this Pre-CEMP and any Section 61 consent(s).

9.2.23 Regular on-site observation monitoring and checks/audits will be undertaken to ensure that BPM is being employed at all times. The site reviews will be logged and any remedial actions recorded. Such checks will include:

a) hours of working;
b) presence of mitigation measures, equipment (engines doors closed, airlines not leaking, etc.) and screening (location and condition of local screening, etc.);
c) number and type of plant;
d) construction method; and
e) where applicable, any specific Section 61 consent conditions.

9.2.24 The monitoring and compliance assurance process will be set out in the contractors' noise and vibration management plan, as part of their CEMP.

9.2.25 The Section 61 applications will include a detailed description of the monitoring and monitoring locations proposed for the particular works covered by the consent application.

10 Outline Biodiversity Management Plan

10.1 Introduction

Purpose

10.1.1 The purpose of the Outline Biodiversity Management Plan is to set out appropriate measures to protect the biodiversity of the site with special attention to specified biodiversity resources, as identified in Chapter 8 the Environmental Statement. The Outline Biodiversity Management Plan will:

a) Specify measures that will be implemented during construction to ensure that impacts on sensitive biodiversity resources are avoided or reduced;

b) Outline principles for the monitoring and maintenance of the above features.

10.1.2 If significant new biodiversity information comes to light, then the plan should be revised accordingly by the scheme ecologist. This outline plan will be superseded by a final Biodiversity Management Plan which will elaborate on the information presented herein.

Scope of the Outline Ecological Biodiversity Plan

10.1.3 Management measures for potential water quality, water pollution and noise and vibration impacts are addressed in other sections of the Pre-CEMP and are not repeated here. These include measures relating to Pollution prevention and control management.

10.1.4 The contractor will be responsible for producing a CEMP during the detailed design stage of the scheme and agreed with Statutory Environmental Bodies prior to construction.

10.1.5 The following important receptors will be considered and protected through the implementation of the detailed CEMP (as referenced in Chapter 8 of the Environmental Statement):

a) Statutory designated sites including Special Areas of Conservation (SAC) and Site of Special Scientific Interest (SSSI);

b) Habitats including the Section 7 priority habitats lowland deciduous woodlands and hedgerows as well as watercourses (tree and hedgerow root protection is considered within the

Outline Arboricultural Method Statement and Tree Protection Plan).

c) Protected and notable species (including bats, dormice otters, breeding birds, reptiles, badger and Section 7 mammals).

10.1.6 Where reasonably practicable, biodiversity mitigation will be provided via the embedded engineering design and implemented by the contractor within the works.

10.1.7 Species or habitat management plans will be prepared by the Contractor.

10.1.8 The contractor will, where reasonably practicable, reduce any habitat loss within the land provided for the scheme by keeping the working area to the minimum required for construction of the Scheme.

Responsibilities

10.1.9 Contractor – to ensure effective management of the works in line with their Employer's, legal and any other requirements/agreements regarding invasive species. Also, to ensure any requirements are communicated on to sub-contractors.

10.1.10 Site agents – to provide information on programme and timing of works, and issue to the Environmental advisor.

10.1.11 Environmental Manager – responsible for liaising with all parties and ensuring that they are aware of the requirements of this control plan. The environmental manager shall report the results and progress to the project management team and employer's site representative.

10.1.12 Subcontractors – to undertake works in accordance with the control plan.

10.1.13 Operatives – to follow any instruction from the project management team and conduct works in accordance with method statements.

10.1.14 The key responsibilities for biodiversity related issues on this site will be provided and set out in the detailed CEMP by the contractor in the format below.

Table 10 Responsibilities Details

Name	Position/Responsibility	Contact Details
	Welsh Government Project Manager	
	Principal Contractor Environmental Manager	
	Environmental Clerk of Works	
	Ecological Consultant	
	Site Manager	

10.2 Methods to reduce potential impacts on biodiversity

Habitat Translocation and Habitat Protection

10.2.1 Woodlands - the species rich soil from the lowland deciduous woodland (W8 NVC community) and area of wet woodland (W6 NVC community) that will be cleared to accommodate the works is to be translocated to areas to be identified during detailed design and managed appropriately. Early identification of donor and receptor sites and careful soil handling with limited periods of soil storage. Areas of retained woodland adjacent to the works area will be adequately protected using standard best practice protective fencing/hoarding.

10.2.2 Hedgerows – the species rich soil from hedgebanks that will be cleared is to be translocated to areas to be identified during detailed design and managed appropriately. Early identification of donor and receptor sites and careful soil handling with limited periods of soil storage. Areas of retained hedgerows adjacent to the works area will be adequately protected using protective hoarding/fencing.

10.2.3 Low fertility soils will be used within soft estate where appropriate to encourage the development of species diversity and reduced aftercare costs. The use of topsoil will be avoided for areas of grassland, unless there is a need for normal agricultural levels of fertility.

10.2.4 Where rock encountered in cuttings is adequate, consideration will be given to retain rock exposures allowing natural weathering and regeneration to occur. Suitable locations will be identified during excavation works, then during soiling works.

Bats

10.2.5 The Environment Masterplan has been designed to take into account the existing key flight lines for bats (linear features used as corridors for movement) and seeks to replace any severed commuting corridors such as hedgerows through new planting in combination with the wildlife crossings (underpasses and culverts). The Environment Masterplan has also been designed so that the proposed planting guides bats towards the wildlife crossings.

10.2.6 Regarding roosting bats, a European Protected Species (EPS) mitigation licence from NRW will be obtained to cover any disturbance of bat roosts as a result of the scheme. This will be drawn up by the Contractor in consultation with NRW. The details in the method statements of the licences must be adhered to.

10.2.7 Pre-construction tree surveys for bats will be required to determine if there is any change to potential roost features or any new tree roosts before tree clearance activities. Where potential presence of roosting bats in any building or tree cannot be ruled out after the full suite of field surveys and pre-construction surveys (undertaken in accordance with best practice guidance), these must be precautionary measures must be carried out including the soft-felling of trees and the soft-stripping of buildings or other built structures.

10.2.8 As a general precaution, tree felling would only be undertaken in autumn, between late August and October/early November. This is because bats do not have dependent young at this time and are not hibernating and should therefore be active enough to escape harm if proper precautions are taken.

10.2.9 A Toolbox Talk regarding bats and foraging and commuting routes should be given by the ECoW prior to any works commencing.

10.2.10 Night working should be avoided where possible. If it cannot be avoided, it should be restricted in the vicinity of known bat commuting routes and valuable areas of foraging habitat (i.e. commuting routes should not be illuminated nor have generators placed next to them).

10.2.11 Production of a construction stage lighting strategy to limit the use of construction lighting and ensure all essential lighting is specified and designed to reduce light spill. This is to include locations of lighting

and lighting levels details. The following measures should be considered within the construction stage lighting strategy:

a) No bat roosts, or important foraging and commuting habitat should be directly illuminated;
b) Lighting levels should be as low as current standards and guidelines allow;
c) Lighting should only be provided only in essential areas;
d) Lighting should be directed to where it is needed and light spill avoided;
e) LED lighting produces no ultraviolet component and therefore is ideally suited as it greatly reduces the attraction of insects;
f) The height of lighting columns in general should be as low as possible. However, there are cases where taller columns will enable light to be directed downwards at a more acute angle and therefore reduce horizontal spill light.

Dead Hedgings

10.2.12 Dead hedges can be used to allow bats to continue using a favoured flight line during construction after tree lines/hedgerows/other structures are removed to accommodate the scheme.

10.2.13 Dead hedges may comprise a line of herras fencing panels or similar with hessian or netlon fencing stretched across them to provide a solid feature along which bats can commute during the construction phase. Such structures are only really suitable to maintain connectivity for bats across short distances and are only required during the bat activity season. If they need to be moved during the day due to construction activities, they must be put back before dusk so that the mitigation is effective between dusk and dawn every night.

Dormice

10.2.14 Dormice were confirmed to be present throughout the scheme during the 2019 presence absence surveys. The details of the mitigation for dormice will be set out in an NRW EPS mitigation licence for dormice and will most likely involve the carefully timed clearance of dormouse habitat (woodland, scrub, hedgerows) as well as the provision of replacement habitat.

10.2.15 With respect to mitigation measures (to be confirmed through the licensing process), the aim should be to achieve one of the following

outcomes, in decreasing order of preference. Each of these scenarios should be designed to satisfy Regulation 44(3)(b)[11]:

a) **Most preferable**. Avoidance of impact; no negative impact on dormouse populations.

b) **Minimisation of impact with on-site mitigation;** compensation by the improvement of existing nesting and feeding sites or the provision of new opportunities (such as nest boxes) within the site. Maintenance or reinstatement of hedges and tree lines linking wooded areas.

c) **Minimisation of impact with off-site compensation;** where on-site mitigation is not possible, new habitats should be created nearby.

d) **Least preferable.** In some situations, translocation of dormice may be needed.

Otters

10.2.16 Otters were found to use all the watercourses within the scheme as commuting habitat with lay-up sites (resting places) as well as spraints and other evidence found in several locations. The loss of lay-up sites and other disturbances caused during the construction phase will need to be licenced under a NRW otter mitigation licence.

10.2.17 Works in the vicinity of any of the watercourses by the Contractor would be done under a precautionary method of working as directed by a suitably qualified ecologist/ Ecological Clerk of Works. Details to be confirmed in the licence.

10.2.18 Protected Species fencing (otter and badger) is to be installed along the full length of the A40 scheme. The fence will not include a cranked top. A barrier to species crossing the road will be provided with guidance to suitable crossings under the road.

10.2.19 Any temporary excavations that need to be left overnight must either be covered or have a wildlife ladder installed to allow any otters which may enter a means of escape.

10.2.20 Night working should be avoided where possible. If it cannot be avoided, it should be restricted in the vicinity of known commuting routes and valuable areas of foraging habitat.

[11] The Conservation of Habitats and Species Regulations 2017 Part 3, Protection of Animals, Regulation 44

10.2.21 The following measures should be considered within the construction stage lighting design:

a) No known otter commuting routes or foraging areas (the watercourses or adjacent bankside habitat) should be directly illuminated;

b) Lighting levels should be as low as current standards and guidelines allow;

c) Lighting should only be provided only in essential areas;

d) Lighting should be directed to where it is needed and light spill avoided;

e) The height of lighting columns in general should be as low as possible. However, there are cases where taller columns will enable light to be directed downwards at a more acute angle and therefore reduce horizontal spill light.

Breeding Birds

10.2.22 Procedures for vegetation clearance to minimise the impact on birds are described below.

10.2.23 All vegetation clearance must take place outside of the bird breeding season (March to August inclusive). If this is not possible, nesting bird surveys will be undertaken within 48hrs prior to any clearance activities by a suitably qualified ecologist. If an active nest is identified, a suitable buffer shall be implemented around the nest with no works occurring within this buffer until the young are fully fledged. This mitigation will be managed by the ECoW.

10.2.24 Retained woodland, scrub, hedgerows providing suitable nesting habitat for the breeding bird assemblage identified through the surveys will be protected by best practice standard fencing during construction to prevent unnecessary habitat damage or degradation (**see Section 11 – Outline Arboricultural Method Statement and Tree Protection Plan for details of standard fencing xx used**).

10.2.25 During construction, mitigation for the temporary loss of habitat will include the provision of new nesting habitat including bird boxes in trees and buildings to be retained.

Barn Owls

10.2.26 Preconstruction surveys of potential nest sites (PNS) must be carried out in advance of the works.

10.2.27 During construction, night working would be avoided where possible. If it cannot be avoided, it should be restricted in the vicinity of known commuting routes and valuable areas of foraging habitat (i.e. commuting hedgerows should not be illuminated nor have generators placed next to them.

Reptiles

10.2.28 Common lizard was found to be present during the 2019 reptile presence absence surveys. Grass snake and slow worm are also assumed to be present. To mitigate against killing and injury of reptile species, phased vegetation clearance, including sequential strimming over a number of occasions will be carried out. If any reptiles are found during the works all works must stop in the area and advice obtained from the ECoW.

Badgers

10.2.29 A scheme-wide mitigation licence from NRW will be required for the temporary and permanent exclusion of badger setts, disturbance to badgers and the construction of a new artificial sett (as a replacement for the main sett A1 which will require permanent exclusion). All badger setts within 30m of the construction activities will be excluded, although where possible the exclusion will only be temporary. Monitoring post-construction will be required as part of the licence.

10.2.30 Licensable activities include:

a) Artificial setts will be provided to replace any main setts which will be lost to the scheme or which will need to be temporarily closed to accommodate the scheme.

b) Any sett closures can only be carried out during the licensable period - July to December, with 21 clear days from badger activity before construction can commence.

10.2.31 Any holes/excavations created during construction period which badgers or other mammals could fall into must be covered and a ramp provided as a means of escape.

Fish

Section 7 Species

10.2.32 Method statements will be drawn up at the detailed design stage comprising a series of mitigation measures including timing of works

and a phased vegetation clearance to prevent adverse impacts on any Section 41 species assumed present throughout the scheme (including hedgehog, brown hare, polecat, and common amphibians).

10.3 Pre-construction surveys

10.3.1 Prior to the construction phase of the scheme pre-construction surveys will be undertaken in accordance with best practice guidelines. These surveys will include:

a) Bat surveys of buildings and trees up to 50m from any construction activities to determine if roosts are present.
b) Otter surveys on waterbodies and associated habitat within the construction area and up to 250m either side of the scheme to determine if there are any new breeding or resting sites.
c) Barn owl surveys up to 50m from any construction activities.
d) Badger surveys up to 50m from any construction activities.

10.3.2 The results of the pre-construction surveys will be reviewed to determine if any protected species licences (or changes to the Draft licences as provided for the application) are required and shared with the NRW.

10.4 Procedures for Vegetation Clearance

General Site Clearance

10.4.1 Any site clearance activities must be in accordance with any mitigation licences from NRW including EPS mitigation licences (scheme-wide EPS licences for disturbance of bats, dormice and otter), and the scheme-wide badger mitigation licence.

Birds

10.4.2 Where possible vegetation clearance will be undertaken outside of the breeding bird season (March to August inclusive). If this is not possible, an Ecological Clerk of Works (ECoW) should be appointed to carry out a nesting bird check on any vegetation to be cleared, or vegetation directly adjacent to major works, no more than 48 hours prior to works commencing. If an active nest is identified, an appropriate exclusion zone will be decided by the ECoW based on the construction activity taking place. This exclusion zone will be marked out and protected from

any clearance activity until the young are fully fledged and have left the nest.

Bats

Soft felling of trees

10.4.3 If during the pre-construction surveys, any new confirmed tree roosts are identified within or in close proximity to the construction footprint, not already covered by the draft EPS licences, these must also be subject to mitigation licensing.

10.4.4 For any tree roosts where the potential presence of bats remains as low, moderate or high following all levels of presence /likely absence survey, i.e. where the possibility of roosting bats cannot be ruled out, these will require soft felling.

10.4.5 Soft felling must be undertaken in suitable weather conditions (above 10 degrees Celsius) and during the bat activity season (April to October inclusive). It involves removing the top branches first and working down the tree removing it in sections. Cutting through cavities/other potential roost features is avoided. Any sections of the tree identified as having bat roost potential will be lowered carefully using ropes to ground level. These sections will be laid on the ground with holes and cracks facing upward for as long as possible (at least 24 hours under suitable weather conditions is advisable). This gives bats/any other wildlife a chance to vacate the feature.

Reptiles, Amphibians and Section 7 mammals

10.4.6 Amphibians, reptiles or any Section 7 mammal (if encountered) will be carefully moved out of the construction areas to suitable receptor areas outside of the construction footprint.

10.4.7 Within grassland and heathland areas the following methods will be considered:

a) The height of the vegetation sward will be reduced in stages (Phased habitat manipulation) within works footprint to encourage reptiles to move out of these areas - strimming to 300mm above ground level. The use of this method may vary depending on the time of year and ambient temperatures.

b) installation of exclusion fencing and placement of artificial refugia (roofing felt, corrugated tin) installed at a density of at least 100 per hectare.

c) Capture and translocation of reptiles to receptor area.

d) Any drift fencing can be removed prior to construction but exclusion fencing to remain in place throughout construction.

e) Inspection of reptile fencing, if required, throughout construction period and maintenance where necessary.

10.4.8 Habitat manipulation methods should be used first, but if reptile translocation programme is required due to numbers, at least 60 visits, with 5 clear days at the end will be required. Reptile enhancement features such as stone and/or log pile hibernacula's will be provided in the habitat adjacent to that being removed. If required one-way exclusion fencing will be used to prohibit amphibians and reptiles returning to the construction area.

Procedure for instream works (if required)

10.4.9 Where instream works are required in waterbodies where fish were identified, they will be drained down under the supervision of an Ecological Clerk of Works. As water levels decrease the speed of dewatering will be slowed to allow any fish or amphibians to be removed to suitable receptor locations. Where possible aquatic vegetation from drained waterbodies will be placed on the banks of retained waterbodies for a minimum of 24 hours to allow invertebrates to move out of the vegetation.

10.4.10 Care will be taken during the draining of waterbodies to adhere to the requirements of the invasive species management plan as outlined in Annex D in relation to invasive aquatic plant species.

11 Outline Arboricultural Method Statement and Tree Protection Plan

11.1 Introduction

Purpose

11.1.1 The Arboricultural Method Statement must ensure the safe and healthy retention of all trees and hedges to be retained on this scheme.

11.1.2 The arboricultural method statement will describe how trees and hedges will be protected and managed during construction. It will need to be updated throughout the process. The purpose of the arboricultural method statement will be to explain:

a) how and when the protection measures should be installed; and

b) how they will be maintained for the duration of construction.

11.1.3 Integral to achieving this goal is the implementation of the special construction details and protection methods detailed within this report.

Scope of the Outline Arboricultural Method Statement and Tree Protection Plan

11.1.4 This section comprises an Outline Arboricultural Method Statement and is based on the information available at the preliminary design stage. As the detailed design progresses, the plan would be reviewed and updated accordingly.

11.1.5 The plan would be implemented through the construction of the scheme and all construction staff would be required to follow its provisions.

11.1.6 The arboricultural method statement must be read in conjunction with the tree protection plan.

Responsibilities

11.1.7 It is the Contractor's responsibility to ensure that the details of this arboricultural method statement and any agreed amendments are known and understood by all site personnel. Copies of the agreed documents will be available on site and the site manager will brief all personnel

who could have an impact on trees on the specific tree protection requirements. This will be a part of the site induction procedures and written into appropriate site management documents.

11.1.8 The Arboricultural Method Statement will ensure the safe and healthy retention of all trees to be retained on this scheme. Integral to achieving this goal is the implementation of the special construction details and protection methods to be detailed within the Arboricultural Method Statement (AMS) and Tree Protection Plan.

11.1.9 The key responsibilities for tree related issues on this site will be provided and set out in the detailed CEMP by the contractor in the format below.

Table 11 Responsibilities details

Name	Position/Responsibilities	Contact Details
	Welsh Government Project Manager	
	Site Manager	
	Principal Contractor Environmental Manager	
	Environmental Clerk of Works	
	Ecological Consultant	
	Arboricultural Consultant	
	Landscape Architect	

11.1.10 The Method Statement must be made available to all contractors and operatives on the site during the construction process so that they fully understand the importance of the measures set out for tree protection.

11.2 Landscape/Visual Mitigation Measures

11.2.1 The scheme passes through two areas of semi-natural broadleaved woodland which follow the valleys of small watercourses. These areas include wet woodland with alder and willow and are bordered by areas of marshy grassland, particularly to the south of the alignment. The scheme also crosses some mature hedgerows, some of which may be classed as important, and some improved grassland fields used for cattle grazing.

11.2.2 The contractor will be responsible for the landscape and visual mitigation measures to be identified in an Environmental Register of Actions and Commitments (REAC) to achieve the required mitigation as set out in the ES.

11.3 Outline Arboricultural Method Statement

11.3.1 The detailed Arboricultural Method Statement will provide an instruction manual and work schedule for the site manager to inform tree and hedge root protection measures prior to and during construction. The method statement will include information regarding the following:

a) A schedule of remedial tree surgery and tree removal works to be completed prior to the commencement of all other operations on site;

b) The final location, specifications and installation details of the construction exclusion zones to include both tree protection fencing and ground protection measures;

c) The final details and specifications for the special engineering measures where works are proposed to take place within the root protection area (RPA) of trees to be retained;

d) An application to the local authority must be made for any tree works, or construction works within a trees RPA that are subject to Tree Preservation Orders (TPO);

e) The location of site compounds, site offices and facilities, including parking arrangements, and areas for the storage of materials. Access routes for heavy plant and machinery, delivery vehicles and issues related to lifting plans for proposed crane use or access to site where aerial tree crown parts may affect intended operations;

f) Positions of responsibility on site, communication channels and details of intended contractors to be employed to undertake all arboricultural-related operations;

g) A programme setting out the sequence and timing for all works related to the trees on the site;

h) The system to be employed for monitoring the completion of each stage of the works and the protection measures specified; and

i) The appointment of an Arboricultural Clerk of Works. This will be an appropriately qualified and experienced person charged with the supervision and monitoring of the works related to trees and the reporting of satisfactory completion of operations to the client and the Local Planning Authority.

12 Outline Archaeological Mitigation Plan

12.1 Introduction

12.1.1 The section provides a high-level outline of what a future Written Scheme of Investigation (WSI) should include.

Purpose

12.1.2 This Outline Archaeological Mitigation Plan provides the framework through which archaeological mitigation would be managed and monitored.

12.1.3 Appropriate measures will be adopted to protect or record heritage assets affected by the scheme, as identified within the ES.

Scope of the Outline Archaeological Mitigation Plan

12.1.4 This document is based on the information available at the preliminary design stage. As the detailed design progresses, the plan would be reviewed and updated accordingly.

12.1.5 The detailed WSI will set out the methods and procedures for the identification and treatment of any significant archaeological remains that may be discovered during construction. Including any mitigation of effects on archaeological remains through archaeological excavation.

12.1.6 The WSI would be implemented potentially through advanced works and the construction of the scheme and all construction staff would be required to follow its provisions. The WSI must be read in conjunction with the detailed CEMP.

12.1.7 The contractor will manage the impact of construction works on cultural heritage assets. Non-designated buried archaeological remains will be considered and protected through the implementation of the detailed CEMP.

Responsibilities

12.1.8 A full detailed CEMP will be produced during the detailed design stage of the scheme and agreed with NRW and the Senior Development

Officer (Historic Environment) at PCC prior to construction.

12.1.9 It is the Contractor's responsibility to ensure that the details of this WSI and any agreed amendments are known and understood by all site personnel. Copies of the agreed documents will be available on site and the site manager will brief all personnel who could have an impact on cultural heritage assets and unknown buried archaeology. This will be a part of the site induction procedures and written into appropriate site management documents.

Contacts

12.1.10 The key position responsibilities for archaeological mitigation on this scheme are provided below. Details will be provided by the Contractor at detailed design.

Table 12 Responsibilities details

Name	Position/Responsibilities	Contact Details
	Welsh Government Project Manager	
	Site Manager	
	Environmental Manager	
	Archaeological Curator (Dyfed Archaeological Trust)	
	Coroner	
	Local Authority Archaeologist Contractor	
	Archaeologist Consultant	

12.2 Cultural heritage general provisions

Pre-construction surveys

12.2.1 All archaeological works shall be governed by a WSI. This will be produced and agreed with the Dyfed Archaeological Trust (Curator) to manage the pre-construction archaeological investigations required as mitigation for the direct impacts of the scheme. This will include:

A generic Written Scheme of Investigation which will describe common standards and approaches to the recording of archaeological deposits that will be applied on the project.

Site-specific WSIs for areas of detailed archaeological excavation and 'Strip-Map- Sample', which will include detailed research objectives for the works; and

Clear commitments for post excavation analysis, archiving, reporting, and where appropriate, publication.

Further geophysical surveys of additional and temporary land take

12.2.2 It is likely that the contractor will take land for temporary uses such as soil storage areas, lay down areas, site compounds and haul roads. Where these extend outside the limits of previously completed geophysical investigations, the Archaeological consultant will consult DAT to agree whether or not further geophysical surveys are required, the appropriate method. A geophysical surveyor with experience of archaeological investigation and data interpretation shall complete the additional survey.

Archaeological Watching Brief

12.2.3 During construction, an archaeological watching brief will be undertaken within areas identified in the detailed WSI that should be monitored. A watching brief is proposed in all areas where there is a potential for as-yet undiscovered significant archaeological remains to be identified.

12.2.4 Geophysical surveys have identified locations that potentially contain buried archaeological evidence. These will need to be examined by detailed examination during the watching brief. The assessment of impact and value of any historical asset may change with additional information collected by further work.

12.2.5 The scale and intensity of the watching brief will be agreed in conjunction with the regional curator. This will be decided on completion of the preliminary studies.

12.2.6 Any archaeological remains not previously identified which are revealed during construction must be retained in situ and reported to the Dyfed Archaeological Trust (Curator) as soon as reasonably practicable, and subject to appropriate mitigation.

Archaeological Watching Brief on additional areas

12.2.7 An archaeological watching brief shall be undertaken on any areas of land taken for temporary uses such as soil storage areas, lay down areas, site compounds and haul roads. This will be agreed with the regional curator and implemented by the appointed construction contractor. This may lead to a requirement for further archaeological investigation of any buried archaeological remains that are identified during the watching brief.

Monitoring, Review and Reporting

12.2.8 A programme of archaeological reporting, post excavation and publication will be required. All of the features identified in the ES will be recorded in the stated manner and to the correct level of detail as set out in accordance with the standards set out Chartered Institute for Archaeologists' Standard and Guidance documents. Records will be archived and deposited with the Sites and Monuments Record (SMR).

12.2.9 The Archaeologist consultant would be responsible for all liaisons with the Dyfed Archaeological Trust (Curator). They shall notify when field work is due to commence and prepare monitoring reports.

12.2.10 Features that will be recorded and monitored during construction shall include:

a) All buildings and all field boundaries to be demolished.

b) Parts of the field system, including field boundaries, which would be directly affected by the Scheme.

c) **126** Circular features, geophysical survey. These lie outside the limits of the Scheme, but associated features may extend into the affected area. It is recommended that a strip and record type programme of work is undertaken in this field that includes the location of site **64** of the Llanddewi Velfrey to Penblewin Scheme, this may alter the understanding of the impact on these features and as a consequence the degree of mitigation recording that may be required.

d) **127** Undulating earthworks. Although these features are believed to be the result of previous construction work on the road, it is possible that they were caused by other activities. A watching brief will be required in this area.

e) **128** Peat deposit. A watching brief will be required on this deposit. It is possible that further features may be found within the peat. It is also likely that environmental samples of this deposit may

provide useful information for the study of early environment in this area.

f) **39** Turnpike road. Any opening of the existing road should be monitored as part of the project watching brief. If features are observed, they should be recorded.

g) **63** Field system. It is recommended that prior to construction the affected portions of the field system, namely the hedge banks and vegetation are recorded. This should also record the nature and construction of the earth banks during the site clearance phase of the construction works.

h) **131** Lane on tithe map. These features should be recorded as part of the recording of field boundaries (63).

i) **137** Possible pond shown on first edition OS. This feature should be recorded as part of the recording of field boundaries (63) and monitored during construction to record any evidence if seen.

j) **138** Circular cropmark, 27m diameter, satellite image. This feature was identified at a late stage of the assessment of the project. Geophysical survey and a trial trench failed to provide confirmatory evidence for its archaeological origin. Despite this, the area has a high potential for prehistoric evidence, due to the topographic location and the proximity to other significant features. It is recommended that this field is subjected to a ‘strip, map and record’ operation during the initial topsoil stripping for construction.

k) Any further sites that are identified during investigation of additional areas taken on a temporary or permanent basis (such as for the site compound or haul roads) shall be investigated in accordance with a WSI to be prepared for those sites.

Appendix A

Site Waste Management Plan Checklist

A1 Site Waste Management Plan Checklist

Questions to consider	Tick if 'Yes'	Comment: If 'yes', what action have you taken/do you propose to take? If 'no', why not?
Questions 1-21 to be completed before work on site begins		
1. Have you read and understood the company Policies?		
2. Have relevant sub-contractors producing significant waste streams been identified and their competence verified?		
3. Has a careful evaluation of materials been made so that over-ordering and site wastage is reduced?		
4. Have areas suitable for all components and materials been identified to prevent damage during storage?		
5. Has full consideration been given to the use of secondary and recycled materials?		
6. Is unwanted packaging to be returned to the supplier for recycling or re-use?		
7. Can unused materials be returned to purchaser or used on another job?		
8. Has a 'Waste Champion' with responsibility for waste management planning and compliance with environmental legislation been assigned?		
9. Has a contract programme been developed to include likely waste arisings?		
10. Has an area of the site been designated for waste management, including segregation of waste?		
11. Have targets been set for the different types of waste likely to arise from the contract?		
12. Have measures been put in place to deal with expected (and unexpected) hazardous waste? *(Site registered as a hazardous waste producer?).*		
13. Has disposal of liquid wastes such as wash-down water and sewage been considered?		
14. Have opportunities been considered for re-use of materials on-site?		
15. Have opportunities been considered for re-use of materials off-site?		
16. Have opportunities been considered for on-site processing and re-use of materials?		
17. Have opportunities been considered for reprocessing materials off-site?		

Questions to consider	Tick if 'Yes'	Comment: If 'yes', what action have you taken/do you propose to take? If 'no', why not?
18. Have you identified the most appropriate sites for disposal of residual waste (non-hazardous and hazardous) from the contract?		
19. Do any of the planned waste activities require an environmental permit or an exemption to be registered?		
20. Have copies of all relevant duty of care documentation and other waste related legal documents been obtained and referenced on the Waste Summary Table		
21. Have toolbox talks been planned for all site personnel about waste management on-site?		
Questions 22-29 to be completed during the delivery of the contract on site		
22. Are selected waste materials segregated to allow best value to be obtained from good waste management practices?		
23. Are containers/skips clearly labelled to avoid confusion?		
24. Is the waste being stored securely to prevent any losses, in particular of hazardous substances?		
25. Are Duty of Care procedures complied with, including provision of transfer/consignment notes and checking authorisation of registered carriers, registered exempt sites and licensed waste management facilities?		
26. Are any checks made that waste is received at the intended site?		
27. Is implementation of agreed waste management procedures monitored?		
28. Are reports regularly produced regarding waste quantities and treatment/disposal routes, and on costs incurred?		
29. During site operations, are barriers to good waste management practice considered and noted for incorporation into the post-completion review?		
Questions 30-32 to be completed once operational activity on site is complete		
30. Has a final report of the use of recycled and secondary materials, waste reduction, segregation, recovery and disposal, with costs and savings identified, been completed?		
31. Have key waste management issues been considered for action at future contracts?		
32. What lessons have been learnt and communicated within the company?		

The above Checklist should be completed by the person responsible for producing the Site Waste Management Plan. If waste is being managed to sufficient standards, the contract should be able to answer ‘yes’ to all questions.

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Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 2.3 Register of Environmental Actions and Commitments (REAC)

A40PRC-RML-EAC-SWI-RP-LE-0014

P03| S4

29/05/2020

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Ref/Number		Subject	Secondary subjects	Description of Environmental Action or Commitment	Objective (desired outcome)	Main source of action or commitment	Recorded where? ES text,table or Masterplan Sheet				Responsibility for completion	When?	Commitment to mitigate or enhance?	How is outcome to be achieved?	Action completed /Commitment fulfilled?	Notes on completion	Evidence of completion
Pulldown	Pulldown	Pulldown	Add as necesssary	Description	Description	Pulldown	Table in Chapter	Sheet or chainage	Secondary source	Ref	Pulldown	Pulldown		Description	Pulldown	Description	location to be added
A	1	Agriculture		Water supplies and underfield drainage adversely effected by the scheme will be replaced or repaired where possible and new connections provided in accordacne with commitments made in responses to objections	To maintain the current condition of farmland	Env Statement				chapter 14	Contractor's team	Construction	Mitigation	Installation of replacement or repair			
A	2	Agriculture	Nature Conservation	A farm underpass is to be provided	To maintain connectivity for the farm	Env Statement			Masterplan	chapter 15	Contractor's team	Construction	Mitigation	A farm underpass is to be provided at chainage 1+150 (approximately) to connect land holdings along the line of an existing track to allow the passage of farmstock. The underpass will also serve bats and other protected species.			
A	3	Agriculture	Nature Conservation	A farm underpass is to be provided	To maintain connectivity for the farm	Env Statement			Masterplan	chapter 15	Contractor's team	Construction	Mitigation	A farm underpass is to be provided at chainage 1+375 (approximately) to connect land holdings and to provide access for maintenance vehicles to Attenuation Pond B. The underpass will also serve bats and other protected species.			
A	4	Agriculture		Measures to provide access including Private Means of Access to farms and field gates are set out in the ES and provision of replacement field drainage and water supplies as agreed with landowners.	To mitigate for the effects of the Scheme on farm businesses	Env Statement	T.7				Contractor's team	Construction	Mitigation	Development of a plan of mitigation during detailed design that demonstrates realistic mitigation for agreement with landowners and tenants.			
AQ	1	Air Quality		Develop and implement a stakeholder communications plan that includes community engagement before work commences on site	Early communication relating to dust issues that may arise during the construction phase.	Env Statement			CEMP		Contractor's team	Pre-construction	Avoidance	Prepare stakeholder comunication plan to be managed by the PLO and Community Liaision Manager			
AQ	2	Air Quality		Display the name and contact details of persons accountable for air quality and dust issues	To allow members of public to get in touch with the appropirate person if dust issues arise	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Inform stakeholder inemails, leaflets and other public information, alongside the contact details for other potential environmental nuisances.			
AQ	3	Air Quality		Display the head and regional office contact information	To allow open engagement with the community	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Inform stakeholder inemails, leaflets and other public information, alongside the contact details for other potential environmental nuisances.			
AQ	4	Air Quality		Develop and implement a dust management plan, which will include measures to control other emissions, approved by the local authority	A dust control document, outlining safeguards to be implemented on site to control dust generation and spread, which can be approved by the local authority who will be responsible for any dust nuisance should this arise	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Prepare method statements and implement through the contractor's PMP.			
AQ	5	Air Quality		Record all dust and air quality complaints, identify causes, take appropriate measures to reduce emissions in a timely manner and record the measures taken	To ensure all complaints are investigated thoroughly and to reduce the risk of future issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Maintain a complaints register to be maintained on site by the contractor's representatives.			
AQ	6	Air Quality		Make the complaints log available to the local authority when asked	To provide open and transparent engagement with the local authority and to allow the local authority to cross-reference any complaints they may receive direct from the local community	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Make complaints register available for public scrutiny			
AQ	7	Air Quality		Record any exceptional incidents that cause dust and/or air emissions, either on-site or off-site and the action taken to resolve the situation in the log book.	Good record keeping is beneficial should any complaints arise	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Maintain a complaints register to be maintained on site by the contractor's representatives.			
AQ	8	Air Quality		Carry out regular site inspections to monitor compliance with the Dust Management Plan, record inspection results and make the inpsection log avaialble to the local authority when asked.	This demonstrates to the local authority that the dust management plan is being complied with and appropriate control measures implemented. This also allows the contractor to understand where dust control measures are not being effective.	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Prepare method statements and implement through the contractor's PMP with regular site inspections.			
AQ	9	Air Quality		Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry and windy conditions.	To ensure changes in met conditions do not result in dust nuisance.	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Prepare method statements and implement through Cthe contractor's PMP with regular site inspections.			
AQ	10	Air Quality		Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as possible.	Site planning to prevent the potential of dust issues	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Develop site layouts, compounds, stores and haul routeswqhile being cognisant of surrounding sensitive receptors during construction planning.			
AQ	11	Air Quality		Keep site fencing, barriers and scaffolding clean using wet methods.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Prepare method statements for dust control and implement through the contractor's PMP with regular site inspections. When developing methodologies for using wet methods consider surface run-off impacts.			
AQ	12	Air Quality		Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Planning of mass haulage of excavated and imported fill to minimise stockpiling which could be wind-whipped.			
AQ	13	Air Quality		Cover, seed or fence stockpiles to prevent wind whipping.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Temporary storage of excavated materials to include meausres to control dust as necessary. Taking into account weather, season and proximity of receptors.			
AQ	14	Air Quality		All vehicles must switch off engines when stationary - no idling.	Good practice measure to help minimise the impact on local air quality	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Prepare method statements and implement through the contractor's PMP with drivers briefed to turn off engines when required.			
AQ	15	Air Quality		Impose and signpost a maximum speed limit of 15mph on surfaced and 10mph on un-surfaced haul roads and work areas.	Good practice measure to help minimise the impact on local air quality and dust generation on unsealed roads	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Prepare method statements and implement through the contractor's PMP with drivers briefed as necessary.			

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AQ	16	Air Quality		Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Prepare method statements and implement through the contractor's PMP with drivers briefed as necessary.			
AQ	17	Air Quality		Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques, such as water sprays or local extraction.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Prepare method statements and implement through the contractor's PMP with operatives briefed as necessary.			
AQ	18	Air Quality		Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement required to acknowledge the links between for dust suppression techniques and pollution spillage (surface run-off) on site and how this will be mitigated.			
AQ	19	Air Quality		Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement required for dust suppression and pollution spillage on site			
AQ	20	Air Quality		Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Placed materials to include measures to control dust as necessary. Tasking into account weather, season and proximity of receptors. Seeding to revegetate dusty materials to be completed as soon as feasible			
AQ	21	Air Quality		Only remove the cover in small areas during work and not all at once.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Soil stripping to be planned to avoid dust and silt generation where necessary to protect receptors			
AQ	22	Air Quality		Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement required for dust suppression and pollution spillage on site			
AQ	23	Air Quality		Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in soils with suitable emission control systems to prevent escape of material and overfilling during delivery.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Avoidance	Method statement required for cement delivery, to avoid dust and spillage on site			
AQ	24	Air Quality		Use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material transferred out of the site.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement required for dust suppression and pollution spillage on site			
AQ	25	Air Quality		Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement required for dust suppression techniques to be applied to on-site haul roads which are likely to be unsealed.			
AQ	26	Air Quality		Record all inspections of haul routes and any subsequent action in a site log book.	Record keeping is beneficial should any issues arise	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Maintain records of site inspections and any action taken to resolve any issues.			
AQ	27	Air Quality		Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	Good practice measure which will help reduce potential dust issues	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement required for dust suppression techniques to be applied to on-site haul roads.			
AQ	28	Air Quality		Implement a wheel washing system, with rumble grid at the exit of the site.	To prevent the transfer of material onto the local road network which has the potential to affect local air quality	Env Statement			CEMP		Contractor's team	Construction	Mitigation	Method statement for use of the wheel wash system, operatives to be briefed.			
CA	1	Archaeology & Cultural heritage		Site Watching brief	Recording chance finds in construction	Env Statement				Chapter 10 and appendices	Contractor's team	Construction	Mitigation	Archaeological monitoring management plan requiring a watching breif on all areas of the site			
CA	2	Archaeology & Cultural heritage		Protection of the nationally important archaeological remains on the north side of the existing A40, particularly in the area immediately west of Penblewin roundabout.	Minimising or avoiding damage to the site	Env Statement				Chapter 10 and appendices	Contractor's team	Pre-construction	Mitigation	To be considered in design of the roundabout, new roads,drainage and environmental mitigation to minise damage. Measures to be included in the Archaeological Monitoring Management Plan			
CA	14	Archaeology & Cultural heritage		Carry out a Geophysical Survey of the extent of land taken for the scheme	Identification and characterisation of unknown archaeological features	Cadw				Chapter 10 and appendices	Contractor's team	Pre-construction	Mitigation	Specialist subcontractor commissioned during Key Stage 3. Any additonal areas required by the contratcor, that extend beyond the existing geophysical survey area will need to be surveyed in accordacne with the agreed method set out in the geophysical survey report.	Yes	Completed in Key Stage 3 and the results included in the ES Chapter 10 and in the associated appendices. Note the need for contratcor to extend survey into any new areas needed on a temporary basis not previously surveyed.	Refer to ES Appendices
CA	15	Archaeology & Cultural heritage		Archaeological evaluation may be required as indicated by results of the geophysical survey	Identification and characterisation of unknown archaeological features	Env Statement				Chapter 10 and appendices	Contractor's team	Pre-construction	Mitigation	Archaeological monitoring management plan			
CC	14	Climate Change		Adopt the PAS 2080 framework	To guide the approach to reducing GHG emissions	Env Statement					Design team	Detailed Design	Mitigation	PAS 2080 to be followed by design and construction teams			

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Nature Conservation	Nature Conservation	Nature Conservation	Nature Conservation	Minimise the extents of lighting	To reduce operational carbon emissions as well as O&M costs and ecological impacts	Env Statement					Design team	Detailed Design	Mitigation	Only two roundabouts at either end of the scheme proposed to be lit. Lighting on approach to roundabouts have been reviewed and minimised.			
CC	14	Climate Change	Landscape Visual	Highway alignment to provide earthworks balance	To reduce construction carbon emissions by using excavated material for embankments, landscaping and road build-up.	Env Statement					Design team	Detailed Design	Mitigation	Excavated material exported to landfill minimised as majority used onsite			
CC	14	Climate Change		Minimise pavement thickness	To reduce need for carbon intensive pavement materials	Env Statement					Design team	Detailed Design	Mitigation	Pavement design has considered traffic forecast data			
CC	14	Climate Change		Consider alternative junction arrangement	Alternative junction arrangements made to reduce the carbon impact of stop-start conditions	Env Statement					Design team	Detailed Design	Mitigation	Alternative junction arrangements considered however, not adopted in current design.			
CC	14	Climate Change	Population and Health	Use local suppliers for materials and local workers where possible	Minimises journey distances to site and associated transport emissions	Env Statement					Design team and contractor's team	Detailed design and constriction	Mitigation	Local suppliers of resource and material used where practicable			
CC	14	Climate Change	Population and Health	Explore strategies to reduce emissions within the local community	This type of initiative would offset the carbon impact of the project by reducing carbon emissions elsewhere in the community	Env Statement					Design team and Welsh Government	Detailed Design	Mitigation	Strategies for community carbon reduction to be explored			
CC	14	Climate Change	Road drainage and Water Env	Monitor and manage climate risks into the future	Due to the uncertainties involved in adapting to climate change, a pathways approach should be adopted which includes monitoring to determine if any thresholds for further action are reached	Env Statement					Maintaining Agent	Detailed Design	Mitigation	Continue to monitor climate change risks			
GC	7	Geology and Soils	Road drainage and Water Env	Any discharge to the watercourse shall only be carried out with an appropriate environmental permit or consent from NRW or Local Flood Authority, where required, following monitoring, and if needed, treatment to ensure it is of acceptable quality.	Protect surface water quality	Env Statement					Contractor's team	Construction	Enhancement	Appropriate permits are obtained. Water monitoring during construction confirms compliance. Evidence provided via monitoring reports.			
GC	7	Geology and Soils		The reuse of site won or import of materials to the Scheme shall be managed by a verification system applied via the Specification for Highway Earthworks Series 600, and only materials found suitable for use will be acceptable for construction works.	Protect human health and controlled waters	Env Statement					Contractor's team	Construction	Enhancement	Verification system implemented. Evidence provided in the Geotechnical Feedback Report.	In progress		
GC	7	Geology and Soils		The environmental management of the construction activities shall be undertaken in line with best practice as outlined in the Construction Environmental Management Plan and as such would not have an impact on identified receptors. Construction mitigation measures outlined in Section 6.13 of the ES shall apply.	Protect human health and controlled waters	Env Statement	T.3		Other	Chapter appendices including PreCEMP	Contractor's team	Construction	Enhancement	Approperiate method statements are produced.	In progress		
GC	7	Geology and Soils		The available soil and groundwater chemical testing results shall be used to inform health and safety risk assessments for the construction and maintenance works.	Protect human health	Env Statement	T.7		Other	Chapter appendices including PreCEMP	Contractor's team	All	Enhancement	Health and Safety file for the scheme contains soil/GW quality data. RAMS consider available information.	In progress		

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LV	1	Landscape & visual	Nature Conservation	Translocation of existing hedges or Pembrokeshire hedgebanks, or formation of new hedgebanks on boundaries	Landscape integration and provision of habitat connectivity	Masterplan		All Sheets	Env Statement		Contractor's team	Construction	Mitigation	Pre planning of hedge bank removal to allow translocation to permanent receptor site so that the hedge shrubs, flora and fauna of the bank can re-establish and provide fast regrowth			
LV	2	Landscape Visual		Avoiding increased visual impacts on Penblewin Farm house	Minimal change from current situation	Masterplan		Sheet 2	Env Statement	Chapter 9	Contractor's team	Pre-construction	Avoidance	Protection of existing verges and trees			
LV	3	Landscape Visual		Screen planting for Blackmoor Hill dwellings	Completion of planting as set out in the EMP	Masterplan		Sheet 2	Env Statement	Chapter 9	Contractor's team	Construction	Mitigation	Protection of existing hedges, trees and shrubs bwetween the existing and proposed A40 and implentation of planting proposals.			
LV	4	Landscape Visual		Measures to provide visual screening and noise mitiation for dwellings in Redstone Cross to the north of the proposed A40	Effective mitigation	Masterplan		Sheet 1	Env Statement	Chapter 9	Contractor's team	Construction	Mitigation	Provision of false cuttings, Pembrokeshire hedge banks, planting and noise barriers as set out and in particular along the north side of the proposed A40 and along the west side of the realigned Redstone Road to the north of the proposed A40. Also to include planting to the west of Redstone Cottages to screen westerly views of the road.			
LV	5	Landscape Visual	Nature Conservation	Use of subsoil for wildflower rich grassland	Low-fertility soils that will discourage competitive grass growth and allow species-diversity to develop from seed.	Env Statement			Masterplan		Contractor's team	Construction	Combination	All areas of permanent wildflower grassland are to be prepared using subsoil only, or topsoil stripped from a species rich source.			
LV	6	Landscape Visual		Use of topsoil in planting areas	Fertile soil conditions to encourage fast establishment and good growth of trees and shrubs	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	All areas of wildflower grassland that are to be mass-planted with trees and shrubs may be prepared using topoil stripped from the scheme. Topsoil shall be spread to a depth of between 200mm and 300mm.			
LV	7	Landscape Visual	Nature Conservation	All subsoil and soiled cutting and embankment slopes to be permanent grassland or to be planted, will be seeded with appropriate grasses, with local provenence wildflowers from an indigenous seed source.	To provide visual interest and nature conservation/biodiversity benefits	Masterplan		All Sheets	Env Statement		Contractor's team	Construction	Combination	Seed to be collected by agreement, or purchased from a reputable supplier, with certified sources to ensure that wildflowers and any indigenous grass species (ie non cultivars) are from indingenous sources. Seed is to be spread on subsoil, or selected low-fertility topsoil. Subsequent management will require specific mowing regime.			
LV	8	Landscape Visual		Regraded embankment slope at Redstone Cottages with a footpath link to Redstone Road	To provide improved visual amenity	Masterplan		Sheet 1	Env Statement		Contractor's team	Construction	Combination	The former field, and surplus areas of carriageway is to be filled to form a gentle slope which can be seeded and managed as an amenity for the local community. A footpath is to be constructed across this area from the old Redstone Road to the proposed bridge for the benefit of pedestrians walking south along the B4313 to Narberth.			
LV	9	Landscape Visual	Noise and Vibration	Measures to screen dwellings to the south of the proposed A40 on Redstone Road	Provide noise and visual screening	Masterplan			Env Statement		Contractor's team	Construction	Mitigation	Construction of false cuttings, noise barriers and planting of trees and shrubs to provide the necessary noise attenuation and visual screen to Blaenmarlais Care Home and properties south along Redstone Road to Narberth.			
LV	10	Landscape Visual		Existing trees on the proposed enlarged roundabout at Penblewin are to be retained where these do not conflict with engineering requirements and a new planting scheme to be implemented.	To provide landscape integration and visual amenity	Masterplan		Ch. 0	Env Statement		Contractor's team	Construction	Combination	A design to be prepared during detailed design to take account of sightlines, utilities and maintenance requirements.			
LV	11	Landscape Visual	Road drainage and Water Env	The proposed balancing ponds are to be planted in the manner indicated on the Environmental Masterplan	To provide landscape integration and nature conservation	Masterplan		All Sheets	Env Statement		Contractor's team	Construction	Combination	A design to be prepared during detailed design to take account of nature conservation, visual screening and landfscape integration requirements. Species selected for these areas will not include willow or alder, which are highly invasive species in damp ground. spreading by seed.			
LV	12	Landscape Visual	Nature Conservation	Existing trees and hedges along the existing A40 are to be retained wherever possible unless removal is required for post construction access, achieving sightlines and accomodating other environmental measures.	To provide landscape integration, visual screening, nature conservation benefits, including habitat connectivity and for protection of the settings of cultural heritage sites.	Masterplan		All Sheets	Env Statement	Chapters 8, 9, 10	Contractor's team	Construction	Combination	The Existing Vegetation Design is to be prepared during Detailed Design to identify vegetaion that is to be removed, retained or translocated to relfect the requirements of the ES and the Environmental Management Plan			
LV	13	Landscape Visual	Nature Conservation	The protection of existing trees within the Scheme construction boundary.	The locations of existing trees within the Scheme boundary are to be surveyed with sufficient accuracy to allow the designers at detailed design stage to determine which trees can be retained, which are to be felled and which trees would require special physical protection from construction activity to ensure that the aerial parts and the RPAs are not damaged nor the soils compacted.	Masterplan		All Sheets			Contractor's team	Construction	Avoidance	The Existing Vegetation Design is to be prepared during Detailed Design to identify vegetaion that is to be removed, retained or translocated to relfect the requirements of the ES and the Environmental Management Plan			

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LV	14	Landscape Visual	Agriculture	Treatment of redundant A40 carriageway west of Redstone Road	Landscape integration, reducing impacts on agricultural land and provision of habitat	Masterplan		Sheet 1			Contractor's team	Construction	Mitigation	Treatment of the 70m long road and verges will achieve the following : 1. Removal of the carriageway and replacement with soils to be seeded for planting or agricultural use. 2. Woodland/woodland edge to provide adequate dormouse habitat 3. Removal of hedges, grading put of embankment and cuttings slopes and return of the land to agriculture so that the fields to north and south are rejoined. These may be alternative treatments if the requirement for habitat increases, or landowner does not want the land returned.			
LV	15	Landscape Visual	All Travellers	Creation or maintenance of views from the road	Visual amenity for travellers	Masterplan		All Sheets			Contractor's team	Construction	Mitigation	Use opportunities to maintain or open up views for travellers on the trunk road. This is particularly valaubble between chainage 0+850 to 1+380 where the scheme is on embankment. Here views south to the fields and balancing pond can be created without increasing visual impact on residential properties.			
LV	16	Landscape Visual	Agriculture	Cutting slope returned to agriculture	Landscape integration in an area of open hedged fields and to reduce impact on agriculture.	Masterplan		Sheet 2	Env Statement	Chapter 9	Contractor's team	Construction	Mitigation	The cutting slope on the north side of the Scheme from chainage 1+470 to 1+760 is to be graded out to 1:6 or less, topsoiled with the original topsoil and returned to agrciultural use. Hedge banks are to be replaced along the original line.			
LV	17	Landscape Visual	Agriculture	Restoring redundant carriageway immediately west of Penblewin roundabout	Landscape integration and reducing impact on agriculture	Masterplan		Sheet 2	Env Statement	Chapter 10	Contractor's team	Construction	Mitigation	Break out the existing carriageway and replace with agricultural topsoil to fill and soften low cutting and embankment slopes. Remove existing roadside hedges, but retain mature hedgerow trees. Return land to agriculture. Note that the road could overly previously unidentified archaeological remains connected with the nationally importnat areas to the north.			
LV	18	Landscape Visual	Archaeology & Cultural heritage	Design of new connector road from Penblewin roundabout to the detrunked A40	Avoidance of impact on buried archaeology and landscape integration in the hedged landscape	Masterplan		Sheet 1	Env Statement	Chapter 9 and 10	Contractor's team	Construction	Combination	Whilst the design should seek to minimise excavation and a full archaeological investigation should be carried out if required by Cadw, the landscape is to be kept open as much as possible. Hedges for landscape integration are proposed on the connector road, but these hedges and roadside planting can be taken out of the scheme and replaced by a suitable post and wire fence if hedges and trees are considered by Cadw to be damaging to the buried archaeology. Hedges around the perimeter of the roundabout are to be retained as a mitigation committment for the Llanddewi Velrey to Penblewin scheme.			
LV	19	Landscape Visual	Nature Conservation	Design of appropriate vegetation associated with underpasses and overhead crossings (hop-overs) for bats	To ensure bats can fly at sufficient height to avoid collision with passing vehicles.	Env Statement		All Sheets			Contractor's team	Construction	Combination	Design of appropriate vegetation associated with underpasses and overhead crossings (hop-overs) for bats using appropriate species, and plant sizes and forms. This will include the planting of groups of advanced nursery stock trees with a minimum height of 4 metres when planted at bat hop-overs. These occur along the existing A40 where the roadside boundaries intersect with field hedges.			
Mat	1	Materials		A Site Waste Management Plan (SWMP) and Materials Management Plan (MMP) will be produced	To minimise and manage waste created by the sceme	Env Statement				Paragraphs 16.5.16-15.5.18	Contractor's team	Pre-construction	Mitigation	Preparation and implementation of SWMP which will be managed by the Contractor.			
Mat	2	Materials		Aim to reuse site won materials in earthworks. Limit disposal and movements by design to maximise the earthworks balance.	To minimise use of primary aggregates and minimise import of general fill.	Env Statement				Paragraph 16.7.2	Contractor's team	Pre-construction	Mitigation	Maximise earthwork balance through design.			
Mat	3	Materials		Where removal from site is necessary, materials to be sorted, and where practical disposed of to recycling facilities rather than landfill.	To minimise material disposal to landfill and maximise reuse.	Env Statement				Paragraph 16.7.5	Contractor's team	Construction	Combination	This will be managed through the SWMP.			
Mat	4	Materials		All materials shall be stored in a manner that minimises environmental pollution and wastage.	To minimise environmental pollution and wastage.	Env Statement					Contractor's team	Construction	Combination	This will be managed through the Materials Management Plan (MMP).			
N	1	Nature Conservation	Landscape Visual	Low fertility soils to be used within soft estate where appoprriate	To encourage the development of Species diversity and reduced aftercare costs	Env Statement		All Sheets	Masterplan	All sheets	Contractor's team	Construction	Enhancement	Avoidanc eof the use of topsoil for areas of grassland, unless there is a need for normal agricultural levets of fertility			
N	2	Nature Conservation	Landscape Visual	Where rock encountered in cuttings is adequate, consider retaining rock exposures allowing natural weathering and regeneration to occur	Provision of habitat and supporting species diversity	Masterplan		All sheets	Env Statement		Contractor's team	Construction	Enhancement	Identification of suitable locations during excavation works. Then during soiling works.			

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N	3	Nature Conservation	Nature Conservation	The species rich soil from grassland and hedgebanks that will be cleared is to be translocated to areas to be identified during detailed design and managed appropriately	To provide visual interest and nature conservation/biodiversity benefits	Other		All Sheets			Contractor's team	Construction	Combination	Early identification of donor and receptor sites and careful soil handling with limited periods of soil storage.			
N	4	Nature Conservation	Landscape Visual	Protected Species fencing (otter and badger) is to be installed along the full length of the A40 scheme. The fence will not include a cranked top.	To provide a barrier to species crossing the road and to guide them to suitable crossings under the road.	Env Statement		All Sheets	Masterplan		Contractor's team	Construction	Mitigation	Protected species fence (badger and otter) is to be installed along the			
N	5	Nature Conservation	Nature Conservation	Provision of bat boxes	to provide replacement roosting opportunities for bats using Trenfangor Cottage	Env Statement					Contractor's team	Construction	Combination	bat boxes to be erected on suitable trees prior to demolition of Trefangor Cottage			
N	6	Nature Conservation	Road drainage and Water Env	Standard best practice pollution prevention and control measures must be adhered to at all times during construction including CIRIA C532: Control of Water Pollution from Construction Sites, CIRIA Environmental Good Practice on Site.	To ensure no pollution effects during construction on statutory (SAC, SSSI)	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP			
N	7	Nature Conservation	Road drainage and Water Env	Surface water monitoring to be undertaken to demonstrate no adverse effects on water quality during construction works	To ensure no pollution effects from construction activities	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP			
N	8	Nature Conservation	Road drainage and Water Env	Any pollution or spills to be reported immediately to the Contractor's Site Environmental Manager	To ensure no pollution effects from construction activities	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP			
N	9	Nature Conservation	Landscape Visual	Existing trees, woodlands and hedgerows to be retained, must be protected during construction with protective fencing where necessary in accordance with BS5837:2012.	To ensure protection of retained areas	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP			
N	10	Nature Conservation	Landscape Visual	Pre-construction survey of all areas within construction footprint to identify the location of any invasive species	To prevent the spread of invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)	Env Statement					Contractor's team	Construction	Mitigation	Invasive species management plan to be produced as part of CEMP			
N	11	Nature Conservation	Landscape Visual	A Method Statement for preventing the spread of any invasive species to be produced at Detailed Design stage and included within the CEMP.	To prevent the spread of invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)	Env Statement					Contractor's team	Construction	Mitigation	Invasive species management plan to be produced as part of CEMP			
N	12	Nature Conservation		Pre-construction surveys must be carried out to verify the location, status and characterisation of previously identified bat roosts and to identify any new bat roosts within the construction footprint and a 50metre radius	ensure compliance with protected species legislation	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP			
N	13	Nature Conservation		Obtain relevant Protected species licences (dormouse, badger and bat) from Natural Resources Wales	ensure compliance with protected species legislation	Env Statement					Contractor's team	Construction	Mitigation	Method statements included within the ES.			
N	14	Nature Conservation		Night working should be avoided where possible. If it cannot be avoided, it should be restricted in the vicinity of known bat commuting routes and valuable areas of foraging habitat.	To minimise construction stage impacts on bats, otter and dormice	Env Statement					Contractor's team	Construction	Mitigation	information to be provided in the CEMP			
N	15	Nature Conservation		No steep-sided, deep and/or water-filled excavations would be left uncovered overnight or without means of escape.	to minimise effects on terrestrial mammals	Env Statement					Contractor's team	Construction	Mitigation	through adherance to measures in the CEMP			
N	16	Nature Conservation		Site clearance activities should be timed to avoid the bird breeding season (March to August inclusive), where possible.	to minimise construction stage impacts breeding birds	Env Statement					Contractor's team	Construction	Avoidance	through adherance to measures in the CEMP			
N	17	Nature Conservation		Ecologist to carry out a nesting bird check on any vegetation to be cleared, or vegetation directly adjacent to major works, no more than 48 hours prior to works commencing.	to minimise construction stage impacts breeding birds	Env Statement					Contractor's team	Construction	Mitigation	through adherance to measures in the CEMP			
N	18	Nature Conservation	Landscape Visual	A detailed method statement for the potential translocation of the hedgerows will be drawn up at the detailed design stage.	to minimise the loss of hedgerow habitat	Env Statement					Contractor's team	Construction	Mitigation	through adherance to measures in the CEMP			

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N	19	Nature Conservation		The reptile mitigation will be determined at detailed design stage. Habitat manipulation and creation strategies will be prioritised over exclusion fencing and translocation strategies.	to minimise the impacts on reptile species	Env Statement					Contractor's team	Construction	Mitigation	through adherance to measures in the CEMP			
N	20	Nature Conservation		Method statements will be drawn up at the detailed design stage comprising a series of mitigation measures including timing of works, to prevent adverse impacts on Section 7 species.	to minimise the construction stage impacts on such species and biodiversity in general	Env Statement					Contractor's team	Construction	Mitigation	through adherance to measures in the CEMP			
N	21	Nature Conservation		Watercourse culverts to be oversized in accordance with the scheme design to provide wildlife underpasses.	to provide safe crossing points for bats	Env Statement			Masterplan		Contractor's team	Construction	Mitigation				
N	22	Nature Conservation	Landscape Visual	Provision of farm and maintenance underpasses area to be constructed to provide the appropriate height and width for farmstock, farm vehicles and balancing pond maintenance plant. These underpasses will also provide crossing for mammals	to provide safe crossing points for badgers and otters and to minimise visual intrusion of lighting at night	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	through detailed design			
N	24	Nature Conservation	Landscape Visual	use of species rich grassland seed mixtures on all areas to be seeded to grass	to increase the area of species rich grassland	Env Statement			Masterplan		Contractor's team	Construction	Enhancement	Through landscape specification. Note that this is particular requirement to contribute to the Welsh Government Green Corridors Initiative and to provide enhancements in accordance with the Environment (Wales) Act 2016 Part 1 Section 6 to maintain and enhance biodiversity.			
N	25	Nature Conservation	Landscape Visual	Develop and implementation mitigation strategies for dormouse and bat species	To set out and implement proposals for conservation of bats and dormouse	Env Statement			Other		Contractor's team	Construction	Mitigation	To reflect the requirements of NRW on adjacent Improvements schemes for the A40			
N	26	Nature Conservation	Landscape Visual	Design and implementation of fencing to facilitiate safe passage of otters under the road	To set out and implement proposals for Conservation of otter	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	In accordacne with published guidance and good practice			
N	27	Nature Conservation	Landscape Visual	Provision of a landscape and Ecology Management Plan (LEMP)	Long term management of habitats providing mitigation for impacts on protected species and monitoring proposals	Env Statement			Masterplan		Contractor's team	Construction	Combination	To set out how the completed landscape and ecological mitigation and enhancement is to be managed for a period of up to 25 years, stating long term management objectives as well as short and medium term management and maintenance tasks.			
N	28	Nature Conservation	Landscape Visual	Lighting	To agree the nature and construction of lighting to minimise adverse impacts on protected species	Env Statement					Contractor's team	Construction	Avoidance	To reflect the requirements of NRW on adjacent Improvements schemes for the A40			
N	29	Nature Conservation	Landscape Visual	Hop-over crossing are proposed for bats	To narrow down the width of road crossing by proviing advanced nursery stock trees of a size that has a canopy taller than high sided vehicles.	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	To reflect the requirements of NRW on adjacent Improvements schemes for the A40			
N	30	Nature Conservation	Landscape Visual	Provision of replacement habitat for dormouse	A minimum area of twice the area of woodland, hedge and scrub habitat lost to be planted by the Scheme within the CPO.	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	To provide early habitat and species connectivity, landscape integration and visual screening as required and in accordacne with the requirements set out in the ES. Where possible advanced tree planting will be carried out during the first available planting season using new nursery stock or translocated hedges or coppice stools. These advanced planting areas are to be identified and set out in drawings and their environmental functions will be as defined on the Environmental Masterplans.			
N	31	Nature Conservation	Landscape Visual	Low fertility soils to be used within soft estate where appropriate	To encourage the development of Species diversity and reduced aftercare costs	Env Statement			Masterplan	All sheets	Contractor's team	Construction	Enhancement	Avoidance of the use of topsoil for areas of grassland, unless there is a need for normal agricultural levels of fertility			
N	32	Nature Conservation	Landscape Visual	Treatment of rock exposures	Provision of habitat and supporting species diversity	Masterplan			Env Statement		Contractor's team	Construction	Enhancement	Where rock encountered in cuttings is adequate, consider retaining rock exposures allowing natural weathering and regeneration to occur. Identification of suitable locations during excavation works. Then during soiling works.			
N	33	Nature Conservation	Landscape Visual	Reuse of soils	To provide visual interest and nature conservation/biodiversity benefits	Other					Contractor's team	Construction	Combination	Soils from improved grassland will be spread on areas of new planting, for land to be restored to agriculture or as fill in false cuttings. All permanent grassland areas within the scheme are to have low fertility subsoil forming the surface soil to be seeded. No topsoil is to be used on these areas unless it is stripped from species-rich or unimproved grassland and			

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N	34	Nature Conservation	Landscape Visual	Installation of protected species fencing	To provide a barrier to species crossing the road and to guide them to suitable crossings under the road.	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	Protected Species fencing (otter and badger) is to be installed along the full length of the A40 scheme. The fence is to be 1.6 metres tall and will not include a cranked top. All other fencing on the scheme will be post and wire stockproof fencing.			
N	35	Nature Conservation	Nature Conservation	Provision of bat boxes	to provide replacement roosting opportunities for bats using Trenfangor Cottage	Env Statement					Contractor's team	Construction	Combination	bat boxes to be erected on suitable trees prior to demolition of Trefangor Cottage			
N	36	Nature Conservation	Road drainage and Water Env	Standard best practice pollution prevention and control measures to be followed.	To ensure no pollution effects during construction on statutory (SAC, SSSI)	Env Statement					Contractor's team	Construction	Mitigation	A detailed Ground and Surface Water Management Plan (GSWMP) will be put in place prior to and during construction. Standard best practice pollution prevention and control measures must be adhered to at all times during construction including CIRIA C532: Control of Water Pollution from Construction Sites, CIRIA Environmental Good Practice on Site			
N	37	Nature Conservation	Road drainage and Water Env	Surface water monitoring to be undertaken.	To ensure no pollution effects from construction activities	Env Statement					Contractor's team	Construction	Mitigation	A detailed Ground and Surface Water Management Plan (GSWMP) will be put in place prior to and during construction. Standard best practice pollution prevention and control measures must be adhered to at all times during construction including CIRIA C532: Control of Water Pollution from Construction Sites, CIRIA Environmental Good Practice on Site			
N	38	Nature Conservation	Road drainage and Water Env	Any pollution or spills to be reported immediately to the Contractor's Site Environmental Manager	To ensure no pollution effects from construction activities	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP			
N	39	Nature Conservation	Landscape Visual	Existing trees, woodlands and hedgerows to be retained, must be protected.	To ensure protection of retained areas	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP Existing trees, woodlands and hedgerows to be retained, must be protected during construction with protective fencing where necessary in accordance with BS5837:2012.			
N	40	Nature Conservation	Landscape Visual	Pre-construction survey of all areas to identify invasive species	To prevent the spread of invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)	Env Statement					Contractor's team	Construction	Mitigation	Invasive species management plan to be produced as part of CEMP Pre-construction survey of all areas within construction footprint to identify the location of any invasive species			
N	41	Nature Conservation	Landscape Visual	Existing trees, woodlands and hedgerows to be retained, must be protected.	To ensure protection of retained areas	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP Existing trees, woodlands and hedgerows to be retained, must be protected during construction with protective fencing where necessary in accordance with BS5837:2012.			
N	42	Nature Conservation	Landscape Visual	Pre-construction survey of all areas to identify invasive species	To prevent the spread of invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)	Env Statement					Contractor's team	Construction	Mitigation	Invasive species management plan to be produced as part of CEMP Pre-construction survey of all areas within construction footprint to identify the location of any invasive species			
N	43	Nature Conservation	Landscape Visual	A Method Statement for preventing the spread of any invasive species.	To prevent the spread of invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)	Env Statement					Contractor's team	Construction	Mitigation	Invasive species management plan to be produced as part of CEMP A Method Statement for preventing the spread of any invasive species to be produced at Detailed Design stage and included within the CEMP.			
N	44	Nature Conservation		Pre-construction surveys of previously identified bat roosts must be carried out.	ensure compliance with protected species legislation	Env Statement					Contractor's team	Construction	Mitigation	Detailed in the CEMP Pre-construction surveys must be carried out to verify the location, status and characterisation of previously identified bat roosts and to identify any new bat roosts within the construction footprint and a 50metre radius			
N	45	Nature Conservation		Obtain relevant Protected species licences (dormouse, badger and bat) from Natural Resources Wales	ensure compliance with protected species legislation	Env Statement					Contractor's team	Construction	Mitigation	Method statements included within the ES.			
N	46	Nature Conservation		Night working should be avoided where possible.	To minimise construction stage impacts on bats, otter and dormice	Env Statement					Contractor's team	Construction	Mitigation	Information to be provided in the CEMP If night work cannot be avoided, it should be restricted in the vicinity of known bat commuting routes and valuable areas of foraging habitat.			
N	47	Nature Conservation		No steep-sided, deep and/or water-filled excavations would be left uncovered overnight or without means of escape.	to minimise effects on terrestrial mammals	Env Statement					Contractor's team	Construction	Mitigation	through adherance to measures in the CEMP			

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N	48	Nature Conservation		Timing of site clearance activities to avoid the bird breeding season	to minimise construction stage impacts breeding birds	Env Statement					Contractor's team	Construction	Avoidance	Through adherance to measures in the CEMP Site clearance activities should be timed to avoid the bird breeding season (March to August inclusive), where possible.			
N	49	Nature Conservation		Nesting bird check on any vegetation to be cleared, or vegetation directly adjacent to major work.	to minimise construction stage impacts breeding birds	Env Statement					Contractor's team	Construction	Mitigation	Through adherance to measures in the CEMP Ecologist to carry out a nesting bird check on any vegetation to be cleared, or vegetation directly adjacent to major works, no more than 48 hours prior to works commencing.			
N	50	Nature Conservation	Landscape Visual	A detailed method statement for the potential translocation of the hedgerows and coppiced trees	to minimise the loss of hedgerow habitat	Env Statement					Contractor's team	Construction	Mitigation	Through adherance to measures in the CEMP A detailed method statement for the potential translocation of the hedgerows will be drawn up at the detailed design stage			
N	51	Nature Conservation		The reptile mitigation	to minimise the impacts on reptile species	Env Statement					Contractor's team	Construction	Mitigation	Through adherance to measures in the CEMP The reptile mitigation will be determined at detailed design stage. Habitat manipulation and creation strategies will be prioritised over exclusion fencing and translocation strategies.			
N	52	Nature Conservation		Method statements to prevent adverse impacts on Section 7 species.	to minimise the construction stage impacts on such species and biodiversity in general	Env Statement					Contractor's team	Construction	Mitigation	Through adherance to measures in the CEMP Method statements will be drawn up at the detailed design stage comprising a series of mitigation measures including timing of works, to prevent adverse impacts on Section 7 species.			
N	53	Nature Conservation	Road drainage and Water Env	Water course culverts to be oversized to 1.8m diameter or greater. Note that this has been superceded with a requirement for larger sizes of oversized culverts as set out in the Protected Species Conservation Plan.	to provide safe crossing points for bats	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	To meet the requirements of Natural Resources for Wales as set out in their letter dated 11th February 2020 to the A40 LPI Programming Officer in response to the Mitigation Strategy provided to NRW on the 28th January 2020.			
N	54	Nature Conservation	Landscape Visual	Provision of wildlife crossings to be provided at the locations shown in the EMP and to be designed to the parameters required for each species that is expected to use them.	to provide safe crossing points for badgers, bats otters, dormice and other species and to minimise visual intrusion of lighting at night	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	through detailed design			
N	55	Nature Conservation		Provision of dormouse underpasses	to provide safe crossing points for dormice	Env Statement			Masterplan		Contractor's team	Construction	Mitigation	through detailed design			
N	56	Nature Conservation	Landscape Visual	Use of species rich grassland seed mixtures on all areas to be seeded to grass	to increase the area of species rich grassland	Env Statement			Masterplan		Contractor's team	Construction	Enhancement	through landscape specification. Note that this is particular requirement to contribute to the Welsh Government Green Corridors Initiative and to provide enhancements in accordance with the Environment (Wales) Act 2016 Part 1 Section 6 to maintain and enhance biodiversity.			
N	57	Nature Conservation	Landscape Visual	Implementation of mitigation strategies for dormouse and bat species	To set out and implement proposals for Conservation of Bats and Dormouse	NRW					Contractor's team	Construction	Mitigation	To meet the requirements of individual species and to accord with any requirements of NRW			
N	58	Nature Conservation	Landscape Visual	Design and implementation of fencing to facilitiate safe passage of otters and badgers under the road.	To set out and implement proposals for Conservation of otter	NRW			Masterplan		Contractor's team	Construction	Mitigation	To meet the requirements of individual species and to accord with any requirements of NRW			
N	59	Nature Conservation	Landscape Visual	Provision of a landscape and Ecology Management Plan (LEMP)	long term management of habitats providing mitigation for impacts on protected species and monitoring proposals	Env Statement			NRW		Contractor's team	Construction	Combination	To meet the requirements of individual species and to accord with any requirements of NRW			
N	60	Nature Conservation		Lighting	The lighting on the new Penblewin roundabout and approaches will be designed in accordance with advice in the BCT and Institute of Lighting Professionals (ILP) guidance on Bats and artificial lighting in the UK	Env Statement			NRW		Contractor's team	Construction	Avoidance	It is only proposed to provide illumination on the Penblewin roundabout and its approaches, which is currently lit.			
N	61	Nature Conservation	Landscape Visual	A series of pollinator habitat strips will be created within the scheme	These habitats will include a diversity of native flowering plant species and will be created predominantly on south facing aspects in suitable locations within the Environment Masterplan, which provide more favourable conditions for invertebrates	Env Statement					Contractor's team	Construction	Avoidance	pollinator habitat strips			
N	62	Nature Conservation	Landscape Visual	Implementation of mitigation strategies for protection of retained woodlands, trees and hedgerows	Root protection measures of retained woodlands, trees and hedgerows prior to and during construction	Env Statement					Contractor's team	Construction	Avoidance	A detailed Arboricultural Method Statement and Tree Protection Plan			
NV	1	Noise and Vibration		Location of noisy equipment at furthest practicable distance from properties and provide temporary screening where possible.	Reduce construction noise impacts at properties.	Env Statement					Contractor's team	Construction	Mitigation	Contractor to identify optimum positions for noisy equipment and screening to minimize disruption. Commitment to be written into CEMP.			
NV	2	Noise and Vibration		Vibratory rollers not to be used within 90m of properties during operation (125m for start up/run down) unless further risk assessment and monitoring can demonstrate no likely adverse effect due to vibration.	Reduce construction vibration impacts at properties.	Env Statement					Contractor's team	Construction	Mitigation	Contractor to undertake further risk assessment prior to works and/or vibration monitoring at the start of works within the stipulated distances to confirm no adverse effects due to vibration. Commitment to be written into CEMP.			
NV	3	Noise and Vibration		Best practicable means to control noise and vibration	Reduce construction noise and vibration impacts	Env Statement					Contractor's team	Construction	Mitigation	Best practicable means measures to be written into the CEMP.			
NV	4	Noise and Vibration		Best Practicable Means as detailed in the Construction Environmental Management Plan (CEMP) will be implemented during all construction works	To minimise adverse effects on health and quality of life to residents due to construction noise & vibration	Env Statement			CEMP	'Outline Noise & Vibration Management Plan' in CEMP	Contractor's team	Construction	Mitigation	Requirement to be included in contractual terms of contracts signed between the Overseeing Organisation and the contractors.			

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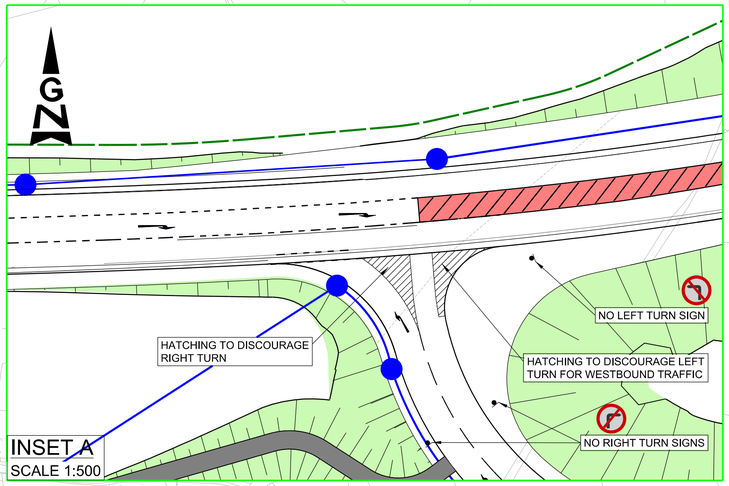
NV	5	Noise and Vibration		Low noise road surfacing	A road surface with performance of RSIH less than or equal to -5dB is laid in order to reduce operational noise from the new A40 by at least 3dB compared with a typical 1.5mm texture depth HRA surface	Env Statement				Operational noise assessment, noise & vibration chapter of ES	Contractor's team (construction), then relevant highways authority (maintenance)	Construction, then during maintenance	Mitigation	A HAPAS approved thin surface course system with a Road Surface Influence (RSI) ≤ -5dB is installed during construction and also re-laid each time surfacing needs maintaining/re-laying.			
NV	6	Noise and Vibration		Provision of wayside noise mitigation in the permanent scheme as landscape bunding	Bunding as shown in the Environmental Masterplan (EMP) will be included in the scheme – with bund heights of at least 2m above road level where specified on the masterplan	Masterplan			Env Statement: mitigation description in noise chapter	Env Statement	Contractor's team	Construction	Mitigation	By including the landscaping bunds shown in the Environmental Masterplan in the as-built design.			
Tr	1	All Travellers	Community and Private Assets	Removal of A40 through-traffic from Redstone Cross	To reduce community severance	Env Statement			Masterplan	All sheets	Contractor's team	Construction	Enhancement	To allow NMUs to move around safely without undue risk from traffic			
Tr	2	All Travellers	Community and Private Assets	Creation of routes for Non-Motorised Users based on footways, Public rights of Way and minor local roads	To encourage active travel by local residients	Env Statement			Masterplan	All sheets	Contractor's team	Pre-construction	Enhancement	To make safe public footpath and bridleway connections along the detrunked new A40			
W	29	Road drainage and Water Env		A surface water management system, using measures such as temporary silt fencing, cut-off ditches, settlement basins and bunds will be set up as early in the construction period as possible to capture all runoff within or traversing the construction corridor. The road drainage will be installed early in the construction period and used for site drainage	Protect surface water quality	Env Statement	T.13		Other	CEMP	Contractor's team	Construction	Mitigation	Method statement required for dust suppression and pollution spillage on site			
W	29	Road drainage and Water Env	Geology and Soils	Water with a higher risk of contamination, including groundwater pumped out of excavations during concrete pouring, will be contained and treated using appropriate measures such as coagulation of sediments, dewatering and pH neutralisation prior to discharge	Protect the environment from the results of water contamination	Env Statement				CEMP	Contractor's team	Construction	Mitigation	Method statement required for dust suppression and pollution spillage on site			
W	29	Road drainage and Water Env	Geology and Soils	Areas of exposed sediment deemed at risk of erosion during heavy rainfall or flood inundation should be protected using either temporary measures (e.g. sheeting) or semi-permanent measures (e.g. coir matting) until vegetation is able to establish on these surfaces	Prevent soil runoff, protect integrity of geomorphology	Env Statement				CEMP	Contractor's team	Construction	Mitigation	Method statement required for dust suppression and pollution spillage on site			



BETHESDA
SODSTON HOUSE
B4313
SODSTON LODGE
HAVERFORDWEST
EXISTING A40 TRUNK ROAD
PROPOSED 1.2m DIAMETER CULVERT TO EXISTING WATERCOURSE
JACOB'S PARK
EXISTING A40 TO BE STOPPED UP
ATTENUATION POND A
ACCESS TO ATTENUATION POND A
ATTENUATION POND C (LOCAL AUTHORITY)
B4313 TIE-IN TO A40
SBR 420 3x3m BOX CULVERTS FOR WATERCOURSE AND BAT CROSSING
NOISE BUNDING
EXISTING OVERHEAD POWER CABLES
REDSTONE CROSS JUNCTION TO B4313 CONNECTOR ROAD
REDSTONE FARM
REDSTONE CROSS JUNCTION
BWTHYNNOD MAENCOCH REDSTONE CROSS COTTAGES
REFER TO INSET A
TUMULI (BARROWS) SCHEDULED ANCIENT MONUMENT (SAM)
TREE-LINE ENHANCEMENT FOR BAT FLIGHT LINES
EXISTING A40 TRUNK ROAD (TO BE DETRUNKED)
ACCESS TO POND AND FIELD
LANDSCAPE AREAS
ACCESS TO ATTENUATION POND D
ATTENUATION POND D (LOCAL AUTHORITY)
PROPOSED 1.2m DIAMETER CULVERT
LANDSCAPE AREA
SBR 840 PROPOSED ENVIRONMENTAL MITIGATION CULVERT
MS4 SIGN RELOCATED
NOISE BUNDING
LANDSCAPE AREA
REDSTONE ROAD OVERBRIDGE SBR-0572
B4313 REDSTONE ROAD TO DETRUNKED A40
B4313 NARBERTH
WS2 +1 CARRIAGEWAY - WESTBOUND OVERTAKING (CH0+580 TO CH1+779)
FFERM BLACKMOOR HILL BLACKMOOR HILL FARM
DETRUNKED A40 TO PENBLEWIN ROUNDABOUT
LANDSCAPING AREA. TO BE RETURNED TO THE LAND OWNER.
LANDSCAPE AREA
LANDSCAPE AREA
LANDSCAPE AREA
ATTENUATION POND B
LANDSCAPE AREA
SBR 1150 2x3m BOX CULVERTS FOR BAT AND CATTLE CROSSING
PROPOSED 1.2m DIAMETER CULVERT TO EXISTING WATERCOURSE
BLACKMOOR HILL FARM UNDERPASS SBR-1380 FOR FARM ACCESS, WATER COURSE AND BAT CROSSING
CYLCHFAN PENBLEWIN PENBLEWIN ROUNDABOUT
ATTENUATION POND E
ACCESS TO ATTENUATION POND E
A40 LLANDDEWI VELFREY TO PENBLEWIN IMPROVEMENTS. FOR DETAILS REFER TO DRAWING A40LVP-ARP-HGN-SWI-DR-D-0001
SP27/1/1
SP27/2/1
A478
0+000.000
0+100.000
0+200.000
0+300.000
0+400.000
0+500.000
0+600.000
0+700.000
0+800.000
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1+500.000
1+600.000
1+700.000
1+779.145

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LEGEND:

- HIGHWAY BOUNDARY
- CPO BOUNDARY
- SITE EXTENTS (LICENCE OR EASEMENT)
- P.R.O.W - EXISTING
- EXISTING CULVERT
- PROPOSED CULVERT
- HIGHWAY DRAINAGE
- CUT OFF DITCH
- SIGN (INDICATIVE) REFER TO SIGN DRAWINGS
- WATER TREATMENT AREAS
- EXISTING OVERHEAD POWER LINES
- EARTHWORK EMBANKMENT
- EARTHWORK CUTTING
- TYPICAL CROSS SECTIONS (REFER TO DRAWING A40PRC-ARP-HML-SWI-DR-D-0025)

GENERAL NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. ONLY WRITTEN DIMENSIONS SHALL BE USED, DO NOT SCALE.
3. ALL EARTHWORKS (EMBANKMENTS AND CUTTINGS) 1:2 UNLESS OTHERWISE STATED.
4. REFER TO DRAWINGS A40PRC-RML-ELS-SWI-DR-LE-0001 AND 0002 FOR PROPOSED LANDSCAPING DETAILS

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction

*Existing overhead power cables (11KV) require diversion.
*Water main (HP) within Redstone Cross road verge requires temporary and permanent diversion.
*Refer to Statutory Utilities Report.

Maintenance / Cleaning

NONE

Use

NONE

Decommissioning / Demolition

NONE

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	17/09/19	FIRST ISSUE	DS	AJ	TE	GD
P02	25/10/19	UPDATED FOLLOWING WG COMMENTS	HJ	AJ	TE	GD
P03	10/12/19	UPDATED FOLLOWING COMMENTS	HJ	AJ	GD	GD
P04	12/02/20	FOR REVIEW AND COMMENT	DS	RC	RC	---
P05	26/02/20	FOR REVIEW AND COMMENT	DS	RC	RC	GD
P06	21/04/20	FOR REVIEW AND COMMENT	DS	GJ	RC	GD
P07	08/06/20	FOR REVIEW AND COMMENT	DS	GJ	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

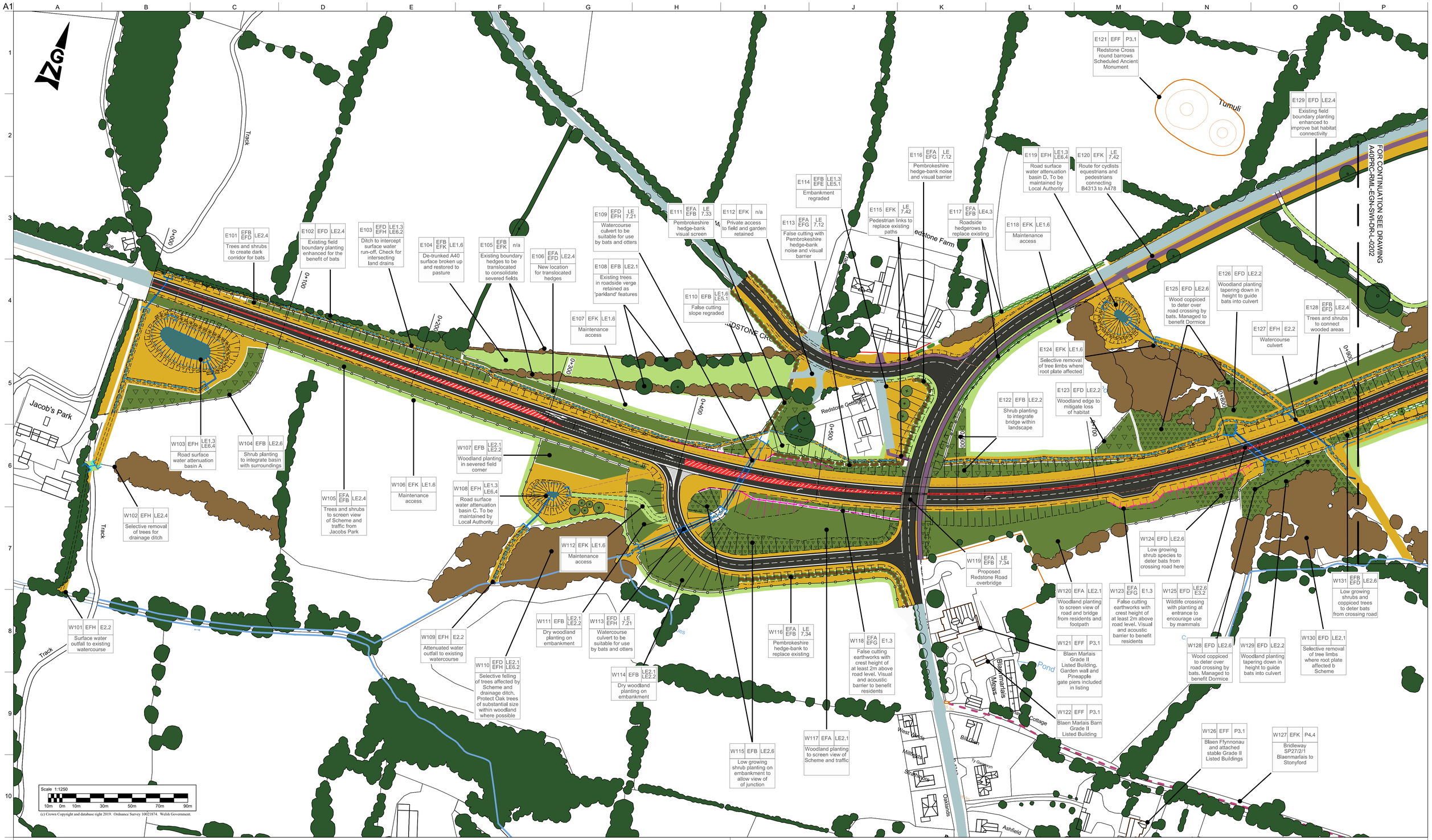
Drawing Title
GENERAL ARRANGEMENT

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P07	DS	GJ	TE	GD
	Date 08/06/20	Date 08/06/20	Date 08/06/20	Date 08/06/20

Name
A40PRC - ARP - HML - SWI - DR - D - 0002
Project | Originator | Volume | Location | Type | Role | Number



Sheet Layout (not to scale)

Original Features Retained
- Existing Roads
- Watercourse / Waterbody
- Woodland / Vegetation
- Notable trees
- Vegetation Management
- Trees management
- Masonry wall

Functions and Elements

Reference number
Environmental Function
Landscape Element (LE)
Environmental Element (E)
Planning and Policy feature (P)
Brief description or brief justification for inclusion.

Environmental Functions (EF)

Ref	Data Set
EFA	Visual screening
EFB	Landscape Integration
EFC	Enhancing the built environment
EFD	Nature conservation and biodiversity
EFE	Visual amenity
EFF	Heritage
EFG	Auditory amenity
EFH	Water quality
EFJ	Agricultural / Highway boundary
EFK	Access / Landscape management

Landscape Elements (LE)

LE1 Grassland
- LE1.3 Species rich grassland
- LE1.6 Open grassland

LE2 Native Planting
- LE2.1 Woodland
- LE2.2/2.6 Woodland edge/Shrubs
- LE2.4 Linear belts trees & shrubs
- LE2.7 Scattered trees and shrubs

LE4 Hedges
- LE4.2 Native species hedges
- LE4.3 Native species hedgerows
- LE4.4 Hedgerows with trees

LE5 Trees
- LE5.1 Individual trees

LE6 Wetlands
- LE6.2 Banks and ditches
- LE6.4 Marsh and wet grassland

LE7 Hard Landscape Features

LE7.1 Earthworks
- LE7.11 Shallow gradient Earthworks cutting
- Earthworks embankment

LE7.2 Structures
- LE7.21 Culvert headwall

LE7.3 Barriers and Fences
- LE7.31 Access gates
- LE7.32 Stock-proof fence
- LE7.33 Pembrokeshire hedge-bank

LE7.4 Pavement Surfaces
- LE7.41 New road
- LE7.42 Route for cyclists, equestrians and pedestrians
- LE7.43 Other hard surfaces

Environmental Elements (E)

E1 Noise
- E1.1 Noise barrier
- E1.2 Noise-reducing earthwork

E2 Water
- E2.11 Culverts

E3 Nature Conservation and Biodiversity
- E3.21 Wildlife barrier
- E3.22 Wildlife crossing

P4 Land use
- P4.4 Public Right of Way

Environmental Elements (E)

E1 Noise
- **E1.1** Noise-Reducing Surface
- **E1.2** Noise Barrier-Built Elements
- **E1.3** Noise-Reducing Earthworks

E2 Water
- **E2.1** Water Pollution Control Measures
- **E2.2** Surface-Water Outfalls
- **E2.3** Soakaways

E3 Nature Conservation and Biodiversity
- **E3.1** Protected Species
- **E3.2** Ecological Protection Measures

E4 Pests and Injurious Weeds
- **E4.1** Injurious Weeds
- **E4.1** Legislated Pests

Planning and Policy Features (P)

P1 Nature Conservation Designations
- **P1.1** Statutory Nature Conservation Designation
- **P1.2** Non-statutory Nature Conservation Designation

P2 Landscape Designations
- **P1.1** Statutory Landscape Designation
- **P3.1** Cultural Heritage Feature
- **P3.2** Conservation Area

P4 Land Use
- **P4.1** Agricultural Land
- **P4.2** Land Management
- **P4.3** Public Open Spaces
- **P4.4** Public Rights of Way

P5 Third Party
- **P5.1** Sensitive Location /Complaint/Third Party Claims

P6 Water Quality
- **P6.1** Watercourse Quality
- **P6.1** Areas of Groundwater Sensitivity

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	18/11/19	ISSUED FOR COMMENT	RE	AS	TE	---
P02	25/03/20	REV FINAL	RE	AS	RC	GD
P03	04/06/20	WILDLIFE CROSSING CHANGE	RE	AS	RC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

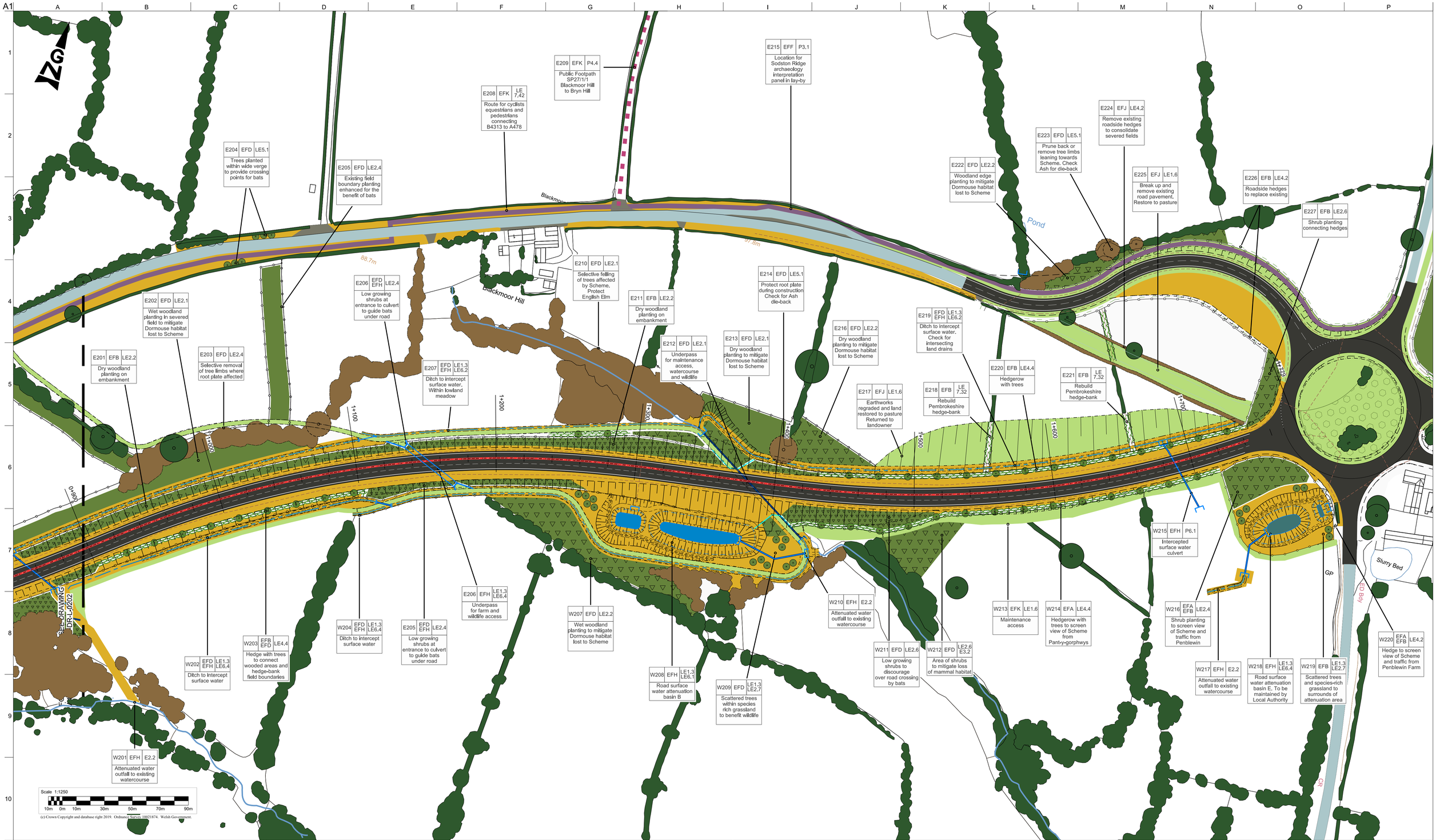
Drawing Title
ENVIRONMENTAL MASTERPLAN
SHEET 1 OF 2

Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A1 1:1250

Rev	By	Chkd	Appd	Auth
P03	RE	AS	RC	GD
	Date 03/06/20	Date 03/06/20	Date 03/06/20	Date 04/06/20

Name
A40PRC - RML - EGN - SWI - DR - L - 0201
Project | Originator | Volume | Location | Type | Role | Number



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Original Features Retained
- Existing Roads
- Watercourse / Waterbody
- Woodland / Vegetation
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- LE5.1 Individual trees

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- E2.11 Culverts

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- E3.21 Wildlife barrier
- E3.22 Wildlife crossing

P4 Land use
- P4.4 Public Right of Way

Environmental Elements (E)

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- **E1.2** Noise Barrier-Built Elements
- **E1.3** Noise-Reducing Earthworks

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- **E2.2** Surface-Water Outfalls
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- **E3.1** Protected Species
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- **E4.1** Legislated Pests

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- **P3.1** Cultural Heritage Feature
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- **P4.1** Agricultural Land
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- **P4.4** Public Rights of Way

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- **P5.1** Sensitive Location /Complaint/Third Party Claims

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- **P6.1** Watercourse Quality
- **P6.1** Areas of Groundwater Sensitivity

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	18/11/19	ISSUED FOR COMMENT	RE	AS	TE	—
P02	25/03/20	REV FINAL	RE	AS	RC	GD
P03	04/06/20	WILDLIFE CROSSING CHANGE	RE	AS	RC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

Drawing Title
ENVIRONMENTAL MASTERPLAN
SHEET 2 OF 2

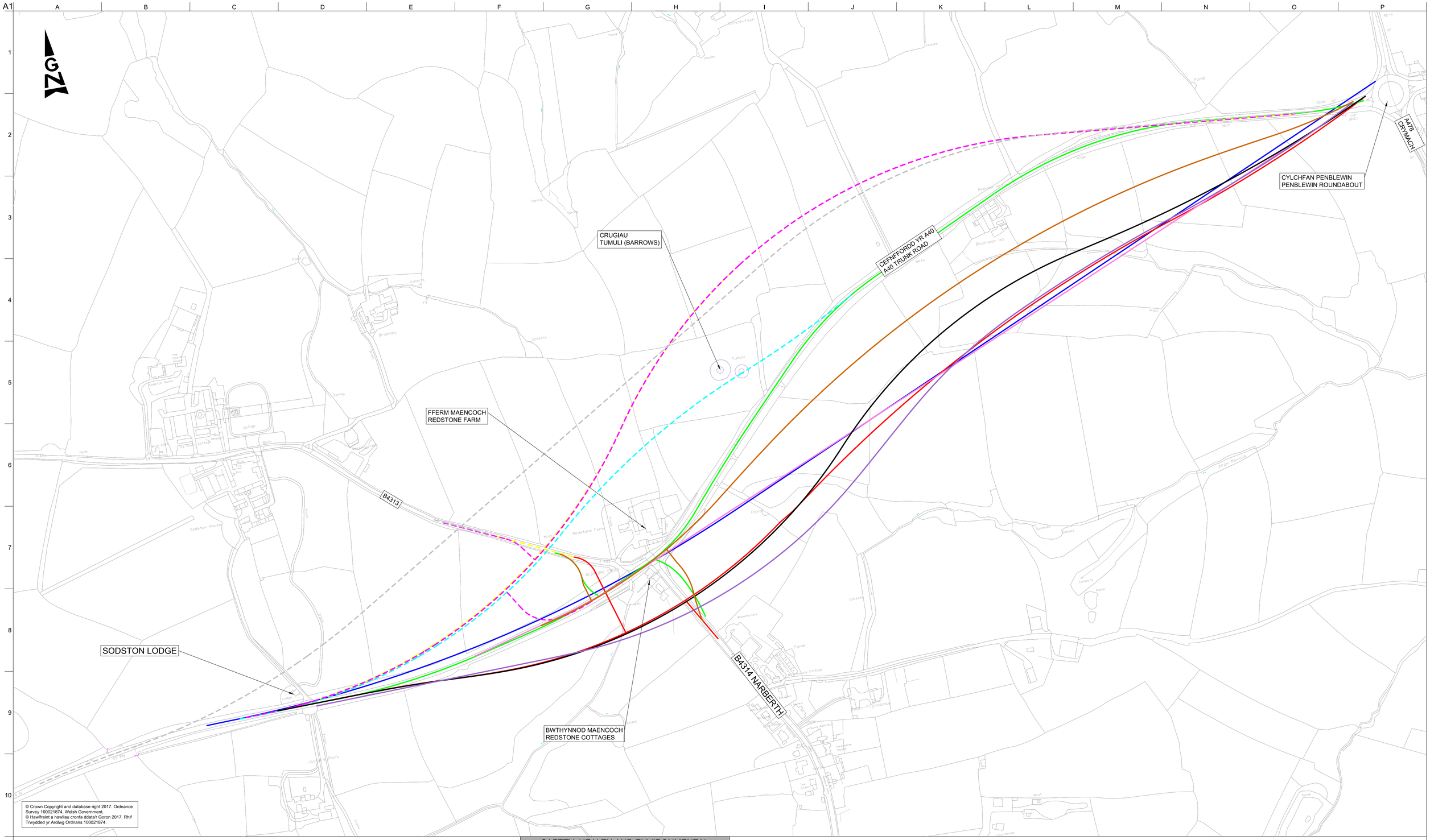
Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A1 1:1250

Rev	By	Chkd	Appd	Auth
P03	RE	AS	RC	GD
	Date	Date	Date	Date
	03/06/20	03/06/20	03/06/20	04/06/20

Name
A40PRC - RML - EGN - SWI - DR - L - 0202

Project	Originator	Volume	Location	Type	Role	Number
A40PRC	RML	EGN	SWI	DR	L	0202



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LEGEND

SOUTHERN ALIGNMENTS

- OPTION 1a
- OPTION 1b
- OPTION 1c
- OPTION 1d
- OPTION 1e
- OPTION 1f
- OPTION 1g

NORTHERN ALIGNMENTS

- OPTION 2a
- OPTION 2b
- OPTION 2c
- OPTION 2d

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev	Date	Description	By	Chkd	Appd	Auth
P01	09/07/19	FIRST ISSUE	DS	AC	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP, MOTT MACDONALD, ARCADIS, RICHARDS

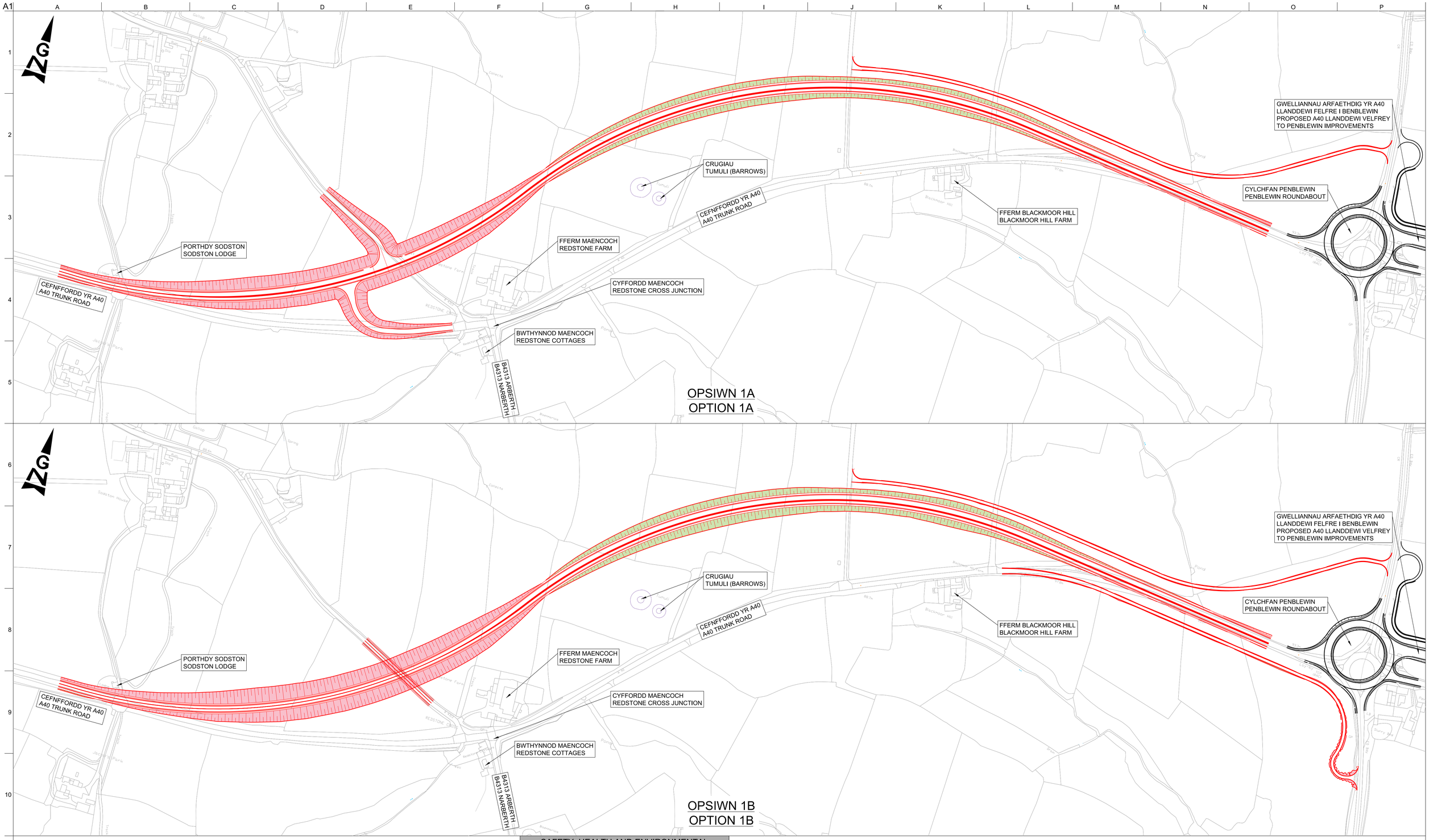
Drawing Title
FIGURE 3.1
CENTERLINES OF DESIGN OPTIONS

Suitability
S2 | SUITABLE FOR INFORMATION

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	DS	AC	TE	GD
	Date 09/07/19	Date 09/07/19	Date 09/07/19	Date 09/07/19

Name
A40PRC - ARP - HML - M02 - DR - D - 0013
Project | Originator | Volume | Location | Type | Role | Number



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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	10/02/20	---	AJ	GJ	TE	PB

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

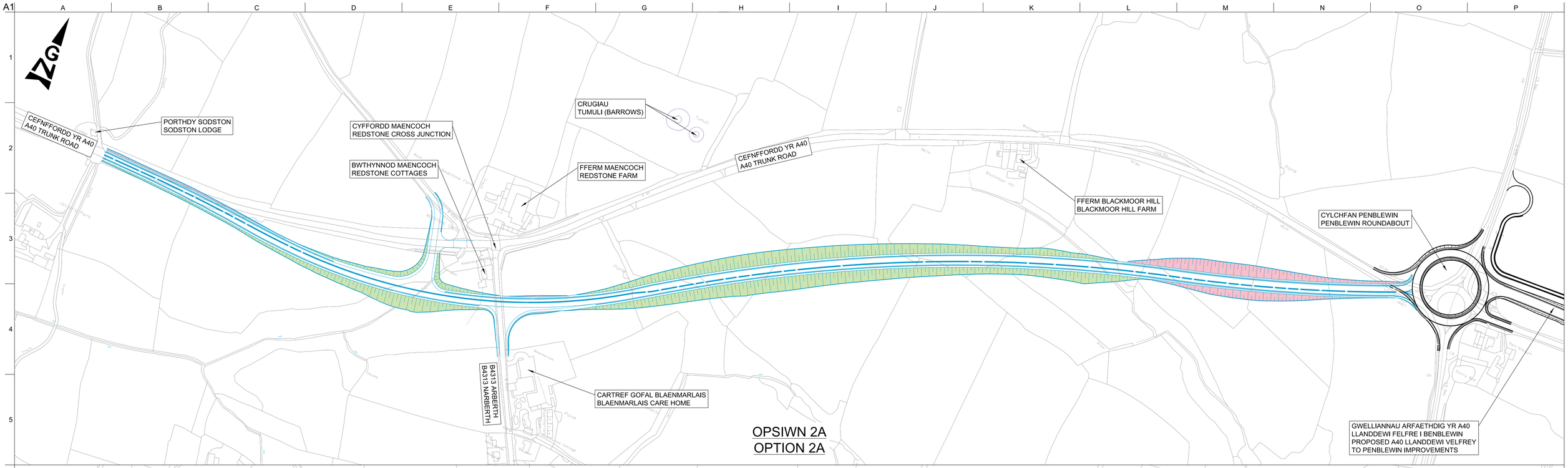
Drawing Title
FIGURE 3.2
NORTHERN ROUTE OPTIONS
1A & 1B

Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

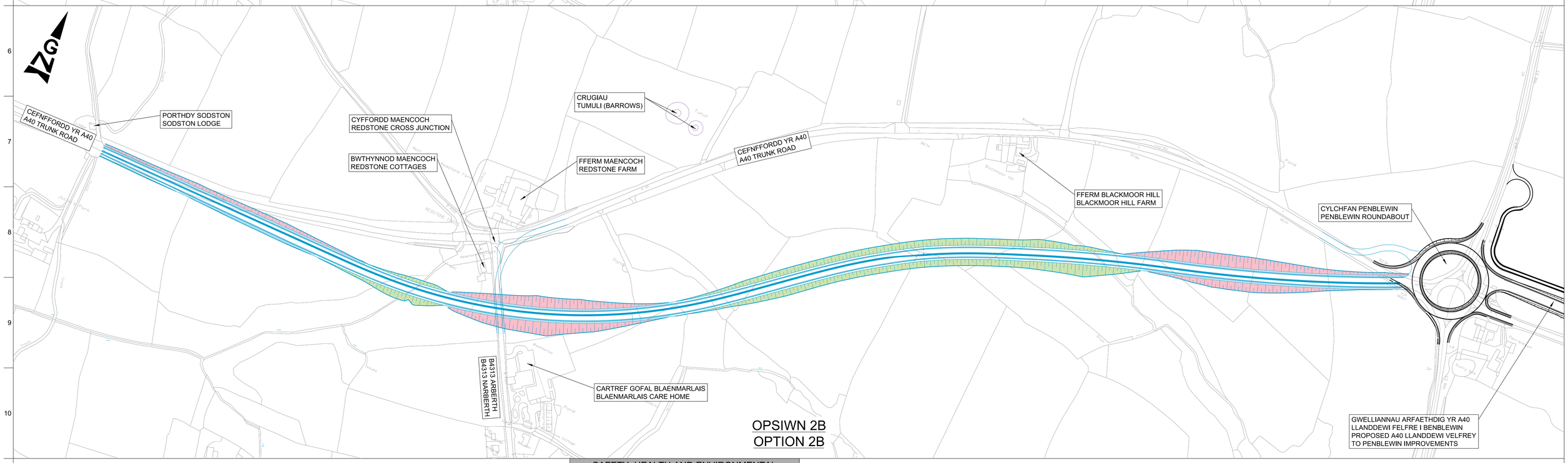
Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	AJ	GJ	TE	PB
	Date 24/05/19	Date 24/05/19	Date 24/05/19	Date 10/02/20

Name
A40PRC - ARP - HML - M02 - DR - D - 0012
Project | Originator | Volume | Location | Type | Role | Number



OPSIWN 2A
OPTION 2A



OPSIWN 2B
OPTION 2B

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	10/02/20	FIRST ISSUE	AJ	GJ	TE	PB

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS · MOTT MACDONALD · ARUP · RICHARDS PLANNING | LANDSCAPE | ENVIRONMENT

Drawing Title
FIGURE 3.3
SOUTHERN ROUTE OPTIONS
2A & 2B

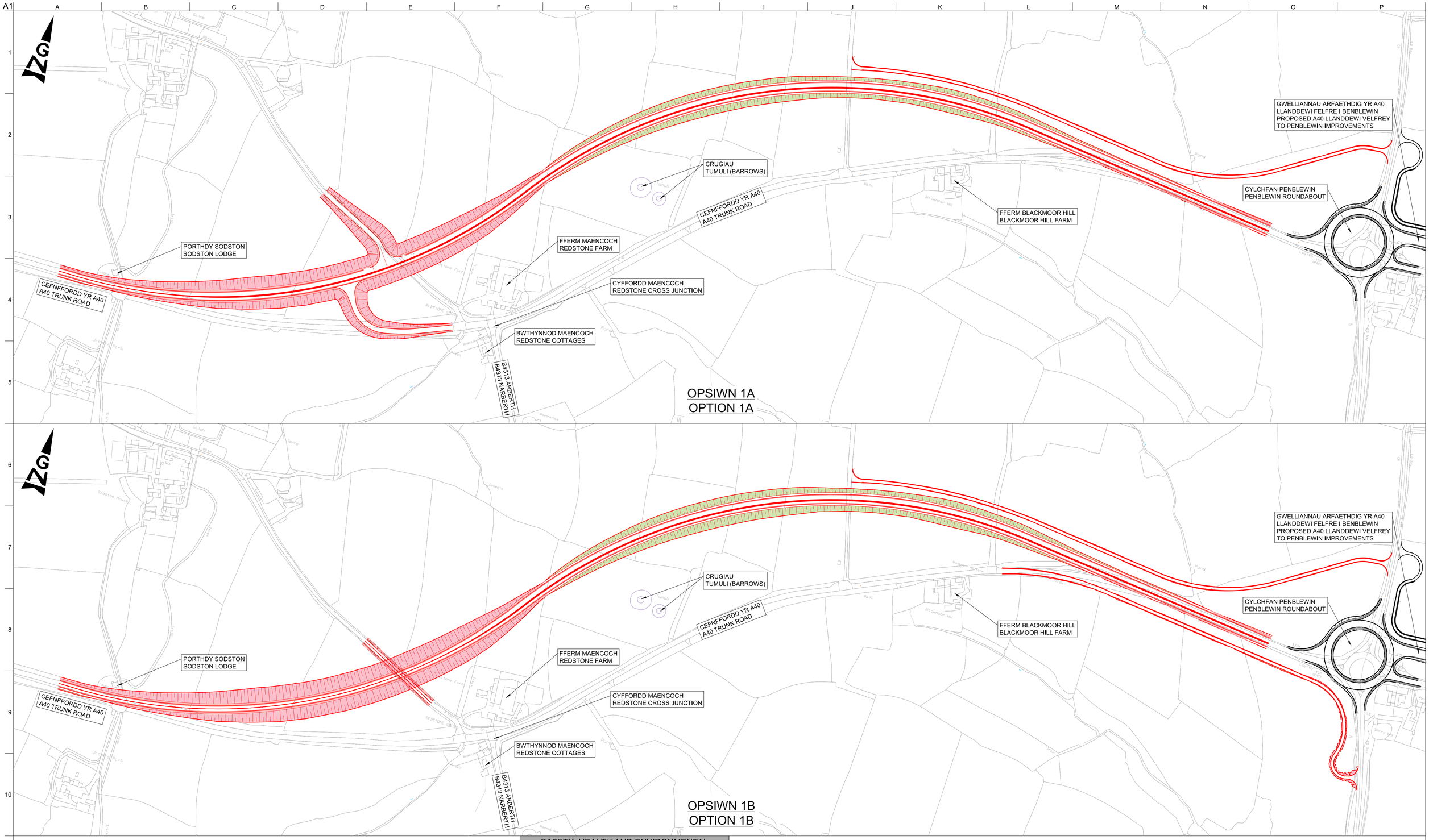
Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	AJ	GJ	TE	PB
	Date 24/05/19	Date 24/05/19	Date 24/05/19	Date 10/02/20

Name
A40PRC - ARP - HML - M02 - DR - D - 0011

Project	Originator	Volume	Location	Type	Role	Number



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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	10/02/20	---	AJ	GJ	TE	PB

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

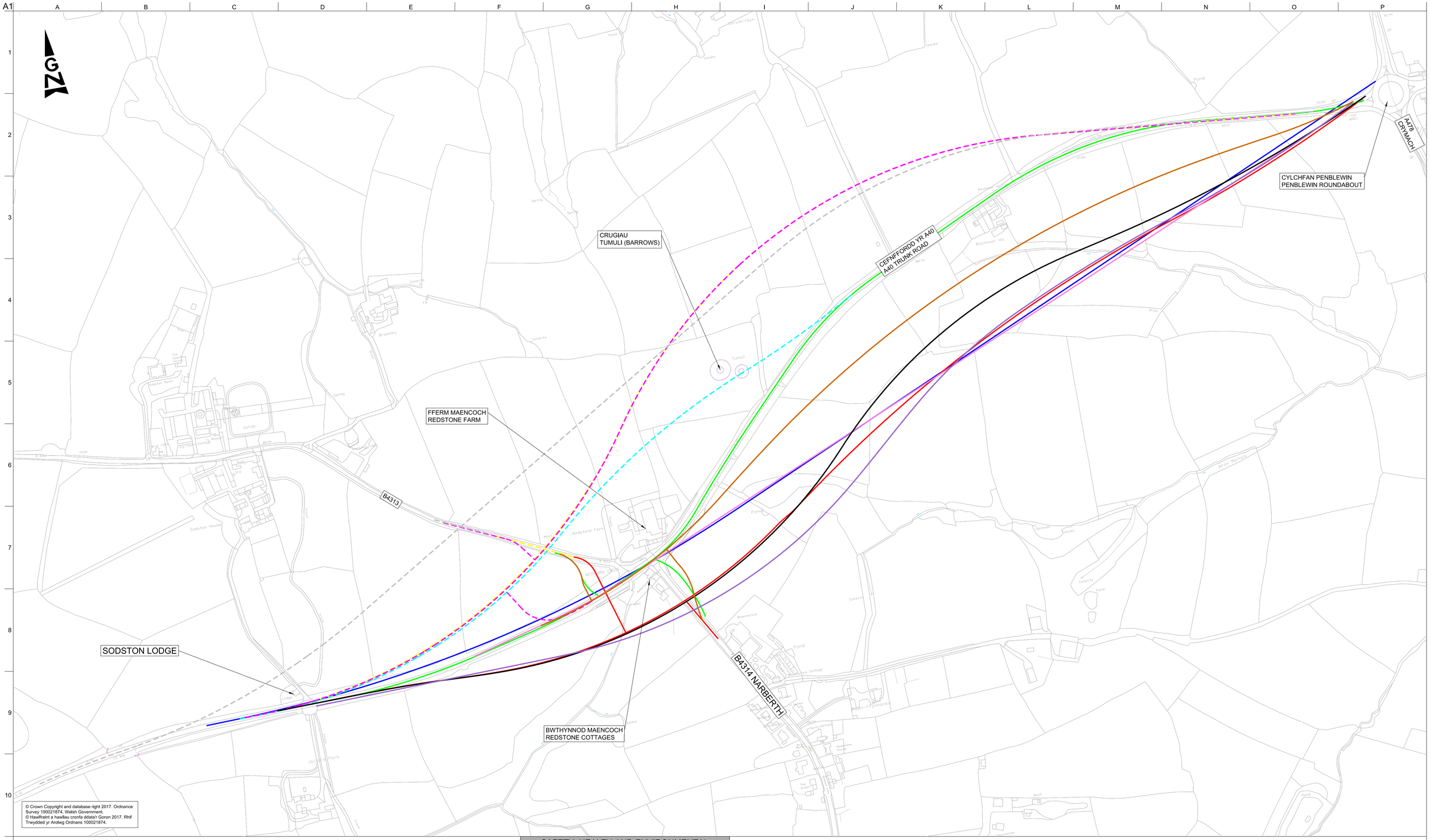
Drawing Title
FIGURE 3.2
NORTHERN ROUTE OPTIONS
1A & 1B

Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	AJ	GJ	TE	PB
	Date 24/05/19	Date 24/05/19	Date 24/05/19	Date 10/02/20

Name
A40PRC - ARP - HML - M02 - DR - D - 0012
Project | Originator | Volume | Location | Type | Role | Number



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LEGEND

SOUTHERN ALIGNMENTS

- OPTION 1a
- OPTION 1b
- OPTION 1c
- OPTION 1d
- OPTION 1e
- OPTION 1f
- OPTION 1g

NORTHERN ALIGNMENTS

- OPTION 2a
- OPTION 2b
- OPTION 2c
- OPTION 2d

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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Rev	Date	Description	By	Chkd	Appd	Auth
P01	09/07/19	FIRST ISSUE	DS	AC	TE	GD

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A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP, MOTT MACDONALD, ARCADIS, RICHARDS

Drawing Title
FIGURE 3.1
CENTERLINES OF DESIGN OPTIONS

Suitability
S2 | SUITABLE FOR INFORMATION

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	DS	AC	TE	GD
	Date 09/07/19	Date 09/07/19	Date 09/07/19	Date 09/07/19

Name
A40PRC - ARP - HML - M02 - DR - D - 0013
Project | Originator | Volume | Location | Type | Role | Number

Welsh Government

A40 Penblewin to Redstone Cross Improvements

WelTAG Stage 1 and 2 Impact Assessment Report

A40PRC-ARP-GEN-M02-RP-J-0001

P03 | S4

25/10/19

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Contents

			Page
1	**Introduction**		**5**
	1.1	Report structure	5
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	1.3	WelTAG	10
	1.4	Engagement	13
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1 Introduction

1.1 Report structure

1.1.1 This Impact Assessment Report comprise the following sections in support of the study into improvements for the A40 between Penblewin and Redstone Cross:

Section 1: Introduction – provides a summary of the project history, Welsh Transport Appraisal Guidance (WelTAG) and the study's proposed approach. It also outlines the problems and objectives.

Section 2: Legislation, Policy and Guidance – sets out the national, regional and local policy context for the study.

Section 3: Scheme Context – provides an overview of the existing context

Section 4: Options – considers the possible solutions to the identified transport-related problems. This includes consideration of a long list of options followed by an assessment of the short-listed options in relation to their ability to address the problems, achieve the objectives and their performance against the economic, environmental, social and cultural appraisal criteria.

Section 5: Recommendations are provided to select a preferred way forward and outline the next steps in the WelTAG appraisal process.

1.2 Project history

1.2.1 In November 2001, the National Assembly for Wales published The Transport Framework for Wales. This outlined that the east-west transport corridor in west Wales had been the subject of a multi-modal study, which concluded that the A40 west of St Clears was in need of improvements.

1.2.2 In December 2004 the Minister announced the publication of his Addendum to the 2002 Trunk Road Forward Programme (TRFP) and this included two major single carriageway improvement Schemes for the A40 west of St Clears. The improvements would use the 2+1 configuration allowing overtaking on the two-lane direction, with

overtaking prohibited in the one lane direction and would be delivered in the following phases:

a) A40 Penblewin - Slebech Park; and

b) A40 Llanddewi Velfrey - Penblewin.

1.2.3 A multi-modal study was undertaken[1] but it was concluded that the costs associated with enhanced passenger services were likely to exceed revenue, thus requiring an operating subsidy, whilst it was concluded that improvements to public transport would not reduce the amount of traffic on the A40 trunk road. Early work therefore steered a Route Options Report (ROR)[2] to explore single and dual carriageway options. In relation to the section of road between Redstone Cross and Penblewin, three single carriageway options and two dual carriageway options were considered as outlined below.

Option	Recommendation	Comments
Single Carriageway Option 1 – passes south of properties at Blackmoor Hill, provides junction for these properties at far eastern end of the Scheme. 600m overtaking in each direction.	Take forward	• High cost • Demolition of 2 properties • Adverse cultural heritage impact • Very good overtaking opportunities • Beneficial noise impact on 4 properties
Single Carriageway Option 2 – move the road away from the residential properties at Blackmoor Hill, followed by a northern bypass of Redstone Cross, no overtaking opportunities.	Discard	• Highest cost option and low economic return • Highest archaeological impact • Adverse impact on Redstone Farm • Adverse cultural heritage impact
Single Carriageway Option 3 – minor re-alignment and improvement of existing A40 including single lane dualling at the Redstone Cross junction and widening the approaches	Take forward	• Low cost • Slight increase in overtaking opportunity • Demolition of 2 properties • Adverse cultural heritage impact
Dual Carriageway Option 1 – passing south of Blackmoor Hill with overbridge at Redstone Cross (properties on southern side of existing A40 would need to be acquired)	Take forward	• High cost • Good overtaking opportunities • Demolition of 2 properties
Dual Carriageway Option 2 – runs to the north of properties at Blackmoor Hill, crossing the existing road midway between Blackmoor Hill and Redstone Cross	Discard	• Highest cost with low economic return • Highest potential archaeological impact

[1] Reported within The National Assembly for Wales – The Transport Framework for Wales, 2001
[2] Parsons Brinckerhoff – A40 West of St Clears Route Options Report, 2004

1.2.4 A roundabout junction was not considered appropriate from a traffic flow / turning movement consideration or in view of the likely demolition to property required and the delay to traffic flow introduced.

1.2.5 The routes that performed better in addressing the problems balanced with their likely economic, social and environmental impacts, were taken forward for further consideration in a Technical Appraisal Report (TAR) 2004[3], which was subsequently undertaken.

1.2.6 The Welsh Government then commissioned a further study in 2015, which updated work completed previously. The 2015 study further considered the need for the A40 improvements and appraised a number of options using WelTAG 2008 guidance. This included options at Redstone Cross[4]. A written statement on the A40 Improvement Study the Minister noted "*It is my intention to progress delivery of the A40 Llanddewi Velfrey to Penblewin Scheme as soon as possible…*"

1.2.7 The 2015 study reconfirmed that the main problems with this section of the A40 include:

1. Limited overtaking opportunities (particularly eastbound), which leads to poor journey time reliability and driver frustration risky manoeuvres and collision incidents;
2. Inconsistency in the level of overtaking provision between the eastbound and westbound directions with currently a total of 5.5km in the westbound direction and 3.2km in the eastbound;
3. Where overtaking provision does exist, it is currently not spread along the length of the A40 such that there are long lengths in each direction with no opportunity for overtaking;
4. Convoys of heavy goods vehicles from the ferry ports and slow moving agricultural vehicles both of which contribute to periods of platooning and journey time unreliability when combined with limited overtaking opportunity;
5. Slow moving traffic during the summer tourist seasons causing platooning and journey time unreliability when combined with limited overtaking opportunity;
6. Sub-standard sections of existing road;
7. A mix of traffic types including local motorists, HGVs, agricultural vehicles, strategic travellers and tourists on the same road;

3 Parsons Brinckerhoff – A40 West of St Clears Study Technical Appraisal Report, 2004
4 https://gov.wales/sites/default/files/publications/2017-09/a40-st-clears-to-haverfordwest-study-design-options-report-volume-1.pdf

8. Numerous side road junctions and the high number of direct accesses to property and fields; and
9. There are seasonal spikes in traffic volumes on the A40 and indeed the A477 during the summer months.

1.2.8 The 2015 study also involved an Economic Activity and Location Impacts (EALI) Report. That report explained whilst the A40 may be seen as an important local issue, it is unlikely that a conventional Transport Economic Efficiency (TEE) analysis would generate a positive Net Present Value (NPV) and Benefit-Cost Ratio (BCR) for a Scheme of this nature given the relatively low traffic volumes. The report clarified that EALI Guidance states that:

> *"It is important to recognise that perceptions of problems with the transport system by users, operators, the public at large and politicians can be equally as important as problems that can be quantified through analysis of data".*

1.2.9 Reflecting the data presented for the economy in this report, the 2015 study found:

a) The South West Wales region has lagged behind the other areas in Wales in terms of productivity.
b) The County was disproportionally impacted by the recession and is lagging behind the rest of Wales in terms of its recovery;
c) Unemployment is highest in the main industrial areas of Milford Haven and Pembroke Dock;
d) The south-east and south-west of the County, particularly industrial Pembroke Dock and Milford Haven have the lowest levels of attainment reflecting the wider socio-economic profiles of these areas;
e) The absence of higher education establishments in Pembrokeshire means that prospective students have to leave the County to study; and
f) Pembrokeshire is perhaps not receiving an equitable share of foreign direct investment projects and this may, in part be due to perceptions of, or the reality of, its peripheral location which are exacerbated by the current standard of the A40.

1.2.10 The 2015 study also explained how:

a) A common theme to emerge during a consultation process was that Pembrokeshire is perceived to be 'far away' and that this is deterring inward investment, the development of the travel-to-work market within the Swansea Bay City Region, tourism and population retention;

b) The evidence collected through the baselining, consultation and business survey in 2015 suggests that the main impact of improving the Pembrokeshire road network would be to tackle the perception of remoteness;

c) Road improvements could support Pembrokeshire in attracting additional inward investment to the area and would assist Pembrokeshire in tackling perception-related issues facing the area.

1.2.11 In February 2017, Arup (supported by RML) assisted the Welsh Government to commence work to develop a solution to address the transport related problems along the A40 between Llanddewi Velfrey and Penblewin.

1.2.12 Further study from 2017 resulted in the completion of a WelTAG Stage 3 report in accordance with WelTAG 2017 guidance, focusing on the A40 Llanddewi Velfrey to Penblewin Improvements. The Publication of Draft Orders and the supporting Environmental Statement is planned for the end of July 2019; to then proceed through the statutory process which may include a Public Local Inquiry[5], with a start date anticipated in summer 2021.

1.2.13 As part of the A40 Llanddewi Velfrey to Penblewin Improvements study, a public information exhibition held in 2018 alongside a stakeholder engagement exercise, which asked attendees their thoughts on the need or potential to extend the proposed improvements planned for Llanddewi Velfrey to Penblewin to further include the section to Redstone Cross. 51 responses submitted via completed comment forms supported such a need whilst only 4 comments expressed some reservations / concerns about the proposal to be included as part of the Scheme.

1.2.14 In August 2018 the Cabinet Secretary for Economy and Transport, Ken Skates AM, confirmed in writing to the H M Senior Coroner is response to the inquest into the death of a driver joining the A40 at Redstone Cross[6], that:

> *"there is a risk of future deaths at this location unless appropriate action is taken… Preliminary investigations have begun to develop further overtaking opportunities & safety improvements along the length of the A40. This includes improvements at*

[5] https://gov.wales/a40-llanddewi-velfrey-penblewin-overview
[6] https://www.judiciary.uk/wp-content/uploads/2018/09/2018-0242-Response-by-Welsh-Government.pdf

Redstone Cross. These additional A40 improvements are included in the update of the National Transport Finance Plan (NTFP)[7]".

1.2.15 Further to this, Arup (supported by RML) were instructed by the Welsh Government in January 2019 to develop a solution to address the transport related problems along the A40 between Penblewin Roundabout and Redstone Cross. Supporting the Penblewin Roundabout and Redstone Cross Scheme is this Welsh Transport Planning and Appraisal Guidance (WelTAG) study.

1.2.16 The problems and objectives are compatible with those from the A40 Llanddewi Velfrey to Penblewin Improvements. The concern for safety between Penblewin and Redstone Cross is particularly of significance for this Scheme, with particular concern for safety at Redstone Cross junction. The Welsh Government are considering the opportunity to deliver both the A40 Llanddewi Velfrey to Penblewin and A40 Penblewin to Redstone Cross Improvements as one Scheme.

1.2.17 The intention is currently for the two Schemes to be delivered independently with opportunities for the Schemes to be delivered together through the Construction Phase of the project.

1.3 WelTAG

1.3.1 WelTAG was published in 2008 and provides guidance for use in the development, appraisal, and evaluation of transport related projects requiring Welsh Government funding. The Welsh Government published revised guidance on 13 December 2017.

1.3.2 WelTAG 2017 aims to reflect current best practice and to provide a consistent approach with the Five Cases Business Model (the 'Five Cases'). It also embeds the principles of the Well-being of Future Generations (Wales) Act 2015. It applies five stages of appraisal; the first three stages lead up to the selection of the proposed intervention. The final two stages cover the period during and after implementation, recording what actually happens and is achieved.

1.3.3 The output produced at the end of each WelTAG 2017 stage is a short document, known as a WelTAG Stage Report. The Stage Report should

[7] https://beta.gov.wales/sites/default/files/publications/2017-12/national-transport-finance-plan-2017-update.pdf

clearly present the information to assess each of the options presented, make the necessary decisions and take the actions needed at the end of that WelTAG stage. Running alongside the production of the WelTAG Stage Reports is the WelTAG Impacts Assessment Report (IAR). This report contains the more detailed analysis that lies behind the material presented in the Stage Reports.

1.3.4 The WelTAG IAR is a live document which will be maintained and updated throughout the five WelTAG stages. Ultimately, the IAR will become a record of the appraisal work undertaken in reaching a preferred transport intervention and contain the evidence and detail behind the summary information within the Stage Report(s).

1.3.5 This document has been prepared in support of the combined Stage One (Strategic Outline Case) & Two (Outline Business Case) WelTAG Report and in accordance with the WelTAG 2017 guidance.

1.3.6 The approach taken to appraising potential transport interventions for the Penblewin to Redstone Cross improvements ('the Scheme') follows the WelTAG 2017 Guidance.

1.3.7 The appraisal of options will therefore evolve applying the Five Cases, within the framework of the five WelTAG Stages, with a process of sifting and increased certainty to assist Welsh Government decision making as more information becomes available throughout the WelTAG Stages.

1.3.8 The WelTAG 2017 document[8] sets out how the revised guidance should be applied.

1.3.9 It clarifies that at Stage One, a Strategic Outline Case should be presented, to understand the problem(s) and develop a long list of possible solutions, leading to the selection of a short list of options for further appraisal. It confirms that the Stage One report should follow the principle of proportionate appraisal; it need not be a lengthy exercise, but it is vital that the problem at hand is reviewed and the understanding gained is shared amongst stakeholders and decision makers.

1.3.10 WelTAG 2017 clarifies that the contents of the Stage One Strategic

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

Outline Case should include:

a) A clear evidence-based description of the issue that needs addressing and the problems both now and likely in the future;
b) An analysis of the factors that are contributing to the problems;
c) The objectives for any proposed solution, against which the proposed solutions will be judged;
d) A long list of options that could address the problems identified; and
e) Recommendations on the option(s) that should be taken forward to WelTAG Stage Two appraisal.

1.3.11 WelTAG 2017 explains that:

1.3.12 'During Stage One the strategic case will be almost fully developed as this sets out the need for change. The transport case will provide an initial assessment of the expected impacts of each of a long list of options for tackling the issue under consideration. At this Stage the assessment will be based predominately on currently available evidence. The delivery, commercial, and financial cases will be of a preliminary nature but must consider all the key issues which would affect the selection of options taken forward for further investigation.'

1.3.13 The WelTAG 2017 document clarifies that at Stage Two (the current stage) an Outline Business Case should be presented, to further investigate the shortlisted options and then select a preferred option.

1.3.14 WelTAG 2017 clarifies that the contents of the Stage Two Outline Business Case should include:

a) A re-statement of the problem(s) that needs to be addressed;
b) A review of any relevant changes that may have occurred in the transport system and its wider context since the completion of Stage One;
c) A description of each of the shortlisted options and how each would meet the objectives set out in Stage One;
d) A Five Cases assessment for each of the shortlisted options, with a separate presentation of the transport, delivery, financial and commercial case for each option; and
e) Recommendations on the preferred option to be taken forward to WelTAG Stage 3 appraisal.

1.3.15 As aforementioned, the appraisal should be focused on the Five Cases,

which include:

1. The *strategic* case: the case for change, fit with other policies and objectives.
2. The *transport* case: the social and cultural, environment and economic impacts of the change including a value for money assessment.
3. The *delivery* case: can the Scheme be delivered?
4. The *financial* case: is the proposed spend affordable?
5. The *commercial* case: how can the Scheme be procured, is it attractive to the private sector, is it commercially viable?

1.3.16 The methodology adopted in appraising the significance and scale of identified impacts uses the following seven-point scale.

Table 1 WelTAG Seven Point Assessment Scale

Large Beneficial	+++
Moderate Beneficial	++
Slight Beneficial	+
Neutral	0
Slight Adverse	-
Moderate Adverse	--
Large Adverse	---

1.4 Engagement

1.4.1 WelTAG recommends stakeholder engagement to help shape its outcomes. As part of the study into A40 improvements between Penblewin and Redstone Cross, two Public Information Exhibitions have been held. The first exhibition was held at Llanddewi Velfrey Village Hall, on the 10th April 2019 between 2pm and 8pm and 11th April between 10am and 8pm. The second exhibition was held at Bloomfield House Community Centre, Narberth on the 30th May 2019 between 12pm and 8pm.

1.4.2 The exhibitions were held to:

a) Attract as many people as possible to each exhibition, from a range of backgrounds and interests;

b) Share our key messages about the project, openly and honestly, and provide a fair and balanced representation of the project;

c) Reduce potential opposition to the project by explaining the need for the proposals, addressing any concerns, queries or misconceptions, and putting people at ease;

d) Give the opportunity and encourage any feedback to be submitted to the Welsh Government; and

e) Educate people about the process required to progress the project.

1.4.3 Measures that were undertaken to publicise the Public Information Exhibitions included:

a) Personal Invitation Letters hand delivered throughout the local community;

b) Personal Invitation Letters via email communication or post to key identified stakeholders (e.g. the local authority); and

c) Posters displayed at prominent locations;

d) Local politicians communicated to their constituents; and

e) Articles were published in the local news.

1.4.4 95 people signed the attendance register at the first Public Information Exhibition and 170 people attended the second. Questionnaires and Verbal Record Sheets helped record feedback.

1.4.5 Details have been recorded within Public Information Exhibition Reports, held by the Welsh Government to support its evidence base for decision making.

1.4.6 Information about how the feedback has helped inform decision making is presented within the relevant sections of this report.

1.4.7 A Public Consultation will be undertaken during WelTAG Stage 3 to provide the public with a further opportunity to engage with and respond to proposals.

1.5 Review Group

1.5.1 As part of WelTAG 2017, involvement is recommended to help shape the identification and appraisal of problems, objectives and possible solutions. WelTAG 2017 specifically requires a Review Group to help steer the appraisal process.

1.5.2 A Review Group for the Scheme was established at the outset of the Stage One appraisal in order to help ensure that key stakeholders were

identified and meet on a regular basis to be involved in any decision making.

1.5.3 The Review Group comprises the Welsh Government's Project Director, in addition to the Employer's Agent, the Designer (Arup supported by RML), and Pembrokeshire County Council as the relevant local authority.

1.5.4 The Review Group has and will meet at key milestones in each of the WelTAG Stages in order to consider the content of the WelTAG reports and actions to be taken forward to the next stage of the process.

1.5.5 The Review Group play a key role in advising on the methods to be adopted in assessing impacts of the option(s) to be taken forward for subsequent Stages and should make recommendations in relation to any specific additional evidence and/or modelling requirements.

1.5.6 A Review Group for the study was held on 7th February 2019 to which all members of the review group were invited. The workshop discussed and agreed how to proceed with the Stage One and Two appraisal for the Scheme. As outlined in the first section of this report, WelTAG 2017 Stage One requires the identification of the problem(s), objectives and possible solutions for appraisal whilst Stage Two involves an appraisal of the shortlisted solutions and recommending a preferred route to be taken forward to Stage Three.

1.5.7 In order to inform discussions, a draft list of problems and objectives were presented. These were based on the outcomes of previous development work and the review of relevant legislation, policy and guidance. This included developing objectives in line with the Wellbeing of Future Generations Act 2015's Well-being goals.

1.5.8 The workshop attendees discussed and agreed an initial list of problems that the Scheme should aim to address, with consensus that the problems whilst taking into account previous development work still remained valid problems today, including alterations. These are presented in section 1.6 of this report.

1.5.9 Following agreement on the problems and objectives, the workshop presented an indicative long list of options for the improvements which built on previous development work and included a combination of online and offline options in addition to a number of non-road building

options. Agreement was reached that the Stage One appraisal should consider a variety of options. These are presented in section 4 of this report.

1.6 The problems

1.6.1 The following problems have been identified in collaboration with the A40 Llanddewi Velfrey to Penblewin Improvements study, the Review Group and informed by stakeholder engagement:

a) The A40 Redstone Cross Junction is below modern design standards. Poor visibility and substandard junction layout can lead to severe road accidents.

b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.

c) Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to period of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.

d) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.

e) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributed to operational problems along the road.

f) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.

g) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

1.6.2 Problems c) and d) are categorised as temporary problems owing to the temporal nature of them; with problem c) occurring when convoys of heavy goods vehicles or slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, and d) occurring largely within the summer months. It is considered that the other problems are more permanent in nature.

1.7 Scheme objectives

1.7.1 A number of strategic transport planning objectives have been developed iteratively taking into account the A40 Llanddewi Velfrey to

Penblewin study, agreed with the Review Group and informed by stakeholder engagement. For this A40 Penblewin to Redstone Cross study, these objectives consider both the strategic and local transport issues. The Scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (including perceived safety) and reduce the number and severity of collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

1.7.2 The objectives have taken account of particular drivers, issues and opportunities identified through the baseline review of relevant legislation, policy, guidance and the social / cultural, environmental and economic position within the study area and wider region (see Section 2 of this report).

1.7.3 The objectives therefore respond to the identified problems, aiming to help address them, as well as respond to the strategic issues identified in national and local policy and programmes e.g. the need to improve connectivity to the Enterprise Zone and City Region.

1.7.4 In developing the objectives, a review was undertaken against the well-being goals as presented within the 2015 Well Being of Future Generations Act.

1.7.5 This helps ensure that the Scheme objectives align to the wider sustainable development principle of the Welsh Government, and take into account the needs of Wales' future generations.

1.7.6 Each objective aims to address one or more of the identified problems.

1.7.7 Therefore, if a transport intervention is appraised to perform positively in addressing the objectives it is given that it would overcome the problems identified.

1.7.8 In addition, an option that performs well against the objectives would be expected to align to the Well Being of Future Generations Act well-being goals.

1.7.9 The Well-being Goals (WFGA 1-7) are listed within Table 2 and the problems (1-8) are set out within paragraph 1.6. These are considered to align to the objectives for the Scheme and problems identified, as shown in Table 2. Given the interlinkages between the problems and objectives in the way that the objectives aim to address the problems, whilst contributing to the Well-being goals, Table 2 provides a detailed summary of the alignment of the Scheme objectives and identified problems with the Well-being Goals.

Table 2 Alignment of Scheme Objectives and corresponding Problems with the Well-being Goals

Objective and corresponding problems	Well-being Goals
Objective 1: To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations. **Problems: 1, 2, 3, 4, 5, 6, 7**	1: A prosperous Wales The objective seeks to improve connectivity along the east-west transport corridor. In achieving this objective, this would provide benefits to the economy by improving access to key employment, community and tourism sites. By improving accessibility, West Wales would become more attractive as a place to invest in, including providing potential additional employment opportunities, and attract people to live and work in the area.
	2: A resilient Wales The objective does not relate directly to the well-being goal however the aim of the Scheme is to give due consideration to the impact of transport on the environment and therefore aims to contribute to a resilient Wales.
	3: A healthier Wales The Scheme aims to improve safety of which relates to having good accessibility. The Scheme would improve the safety of

Objective and corresponding problems	Well-being Goals
	movement by improving the standard of the highway network and providing opportunities for overtaking, thus reducing the likelihood of a collision occurring. Moreover, the Scheme would improve connections to essential services such as to a hospital, GP surgery of dentist.
	4: A more equal Wales Through improving connectivity within West Wales and improving the perception of the area in terms of its accessibility, the Scheme would contribute to improving the economy of a relatively deprived area in comparison to other areas across Wales.
	5: A Wales of cohesive communities Improving accessibility along the east-west corridor would enable communities to become more connected. The Scheme would also improve safety for communities by improving the safety of the highway network and also by providing improvements to active travel connectivity.
	6: A Wales of vibrant culture and thriving Welsh Language The Scheme would contribute positively to this objective by providing enhanced connectivity to cultural facilities, this includes improving accessibility to the region for tourists; therefore, helping to maintain a thriving culture in West Wales. The Scheme would also improve connections to Welsh Language institutions such as to Welsh Language schools.
	7: A globally responsible Wales The aim of the Scheme is to give due consideration to the impact of transport on the environment and therefore aims to contribute to a globally responsible Wales. The A40 forms part of the TEN-T network of which provides an important link for international connectivity via the ports. The Scheme objective does not specifically relate to this Well-being goal.
Objective 2: To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock. **Problems: 1, 2, 3, 4, 5, 6, 7**	1: A prosperous Wales The Scheme would contribute to improving prosperity and providing better accessibility to key areas by enhancing connectivity and resilience to key employment and tourism destinations. Improved overtaking opportunities and thus more reliable journey times would contribute to helping improve the perception of Pembrokeshire for both businesses and tourists.
	2: A resilient Wales A resilient Wales is about maintaining and enhancing a biodiverse natural environment with healthy functioning ecosystems of which support economic resilience in conjunction with social and economic resilience. The Scheme aims to improve prosperity and also to give due consideration

Objective and corresponding problems	Well-being Goals
	to the impact of transport on the environment, therefore the Scheme aims to contribute to a resilient Wales.
	3: A healthier Wales A key driver of the Scheme relates to safety and accessibility. The Scheme aims to provide better access to key locations; a key consideration of accessibility is being able to safely travel. By addressing the existing safety concerns at Redstone Cross junction and by improving overtaking opportunities and therefore reducing the likelihood of risky manoeuvres being made, the Scheme would positively contribute to a healthier Wales. The Scheme also provides the opportunity for benefits to be experienced for walking, cycling and horse riding.
	4: A more equal Wales Through improving connectivity within West Wales and improving the perception of the area in terms of its accessibility, the Scheme would contribute to improving the economy of a relatively deprived area in comparison to other areas across Wales.
	5: A Wales of cohesive communities Providing better access to key locations would enable communities to become more connected. The Scheme would also improve safety for communities by improving the safety of the highway network and also by providing improvements to active travel connectivity.
	6: A Wales of vibrant culture and thriving Welsh language The Scheme would contribute positively to this objective by providing enhanced connectivity to cultural facilities, this includes improving accessibility to the region for tourists; therefore, helping to maintain a thriving culture in West Wales. The Scheme would also improve connections to Welsh Language institutions such as to Welsh Language schools.
	7: A globally responsible Wales The aim of the Scheme is to give due consideration to the impact of transport on the environment and therefore aims to contribute to a globally responsible Wales. The A40 forms part of the TEN-T network of which provides an important link for international connectivity via the ports. The Scheme objective does not specifically relate to this Well-being goal.
Objective 3: To reduce community severance and provide health and amenity benefits **Problems: 1, 2, 3, 4, 6**	1: A prosperous Wales Improvements to the safety of the highway network would lead to the provision of health benefits with a reduced likelihood of collisions occurring and less driver frustration experienced. The Scheme's contribution to affecting safety and journey time reliability will improve access to key

Objective and corresponding problems	Well-being Goals
	economic sites such as strategic employment sites and tourism destinations, thus contributing to a prosperous Wales.
	2: A resilient Wales This objective demonstrates the Scheme's commitment to providing health and amenity benefits. Active travel enhancements to the local area will provide the opportunity for more active travel journeys to be made locally; walking, cycling or horse riding would have a better impact on the environment compared to travelling by car for example. The Scheme will nonetheless largely provide benefits to those travelling by car.
	3: A healthier Wales This objective strongly relates to the Well-being goal as a key element of the Scheme is addressing a need to improve safety. By improving the standard of the highway network and addressing safety issues at Redstone Cross junction, the Scheme contributes to building a healthier Wales. Improvements to connectivity via walking, cycling and horse riding will also contribute positively to a healthier Wales.
	4: A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5: A Wales of cohesive communities By improving safe connectivity to the A40 and thus reducing the severance issues currently experienced at Redstone Cross, the Scheme would enable improved connectivity for communities and provide improvements to active travel connectivity.
	6: A Wales of vibrant culture and thriving Welsh language There is no direct link between the Scheme objective and this Well-being goal.
	7: A globally responsible Wales There is no direct link between the Scheme objective and this Well-being goal.
Objective 4: To improve the Redstone Cross Junction safety (including perceived safety) and reduce the number and severity of collisions.	1 A prosperous Wales By improving safety and reducing the number and severity of collisions, there will be beneficial impacts on productivity, on the emergency services and on journey time reliability, all benefits would contribute towards a prosperous Wales.
	2 A resilient Wales There is no direct link between the Scheme objective and this Well-being goal.

Objective and corresponding problems	Well-being Goals
Problems: 1, 2, 3, 4, 5, 6	3 A healthier Wales This Scheme objective strongly links with this Well-being goal as by improving safety and reducing the number and severity of collisions would have a positive impact on people's physical health. The improvements to safety would also provide benefits for the perception of safety, benefitting people's mental health due to reduced driver stress.
	4 A more equal Wales The severity of collisions at this location is proportionately worse than other, similar roads by comparison. Those using Redstone Cross are therefore putting their selves at risk more so in comparison to similar roads, thus by improving safety, the Scheme is contributing towards a more equal Wales.
	5 A Wales of cohesive communities By improving safety, the Scheme would enable improved connectivity for communities and provide improvements to active travel connectivity, contributing towards a Wales of cohesive communities.
	6 A Wales of vibrant culture and thriving Welsh language Through improvements to safety, accessibility is improved for journeys to cultural and Welsh language education facilities.
	7 A globally responsible Wales By improving safety along the A40 of which forms a part of the TEN-T network, accessibility will improve for all users including those travelling via the ports, thus enhancing international connectivity.
Objective 5: To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles. **No specific problems identified however the Scheme aims to improve active travel connectivity to provide enhancements to walking, cycling, horse riding in the local community.**	1 A prosperous Wales By improving active travel connectivity for residents and visitors to the area, enhanced and / or additional routes have the potential to increase active travel journeys, contributing to improvements to health and productivity, with a positive impact on health and care services in the long term.
	2 A resilient Wales Active travel improvements would provide enhanced opportunities for active travel journeys to be made. Journeys that were previously made by car and are now made by active travel would have a positive impact on the environment, contributing to a resilient Wales. The Scheme nonetheless has the potential to encourage more journeys by car on a strategic scale, thus negatively impacting on a resilient Wales. It is anticipated that in the long term, as vehicle technology improves, the environmental impact from cars will reduce.
	3 A healthier Wales

Objective and corresponding problems	Well-being Goals
	This Scheme objective and Well-being goal strongly align with each other. The Scheme aims to provide enhancements to active travel connectivity of which will provide more opportunity for healthy lifestyles, thus contributing to a healthier Wales.
	4 A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5 A Wales of cohesive communities Improvements to active travel through the Scheme would provide the opportunity for communities to feel more connected, and also provide improvements to safety for the local community.
	6 A Wales of vibrant culture and thriving Welsh language This Well-being goal aims at promoting and protecting culture such as encouraging people to participate in sports and recreation. By improving active travel connectivity, the Scheme contributes to this Well-being goal.
	7 A globally responsible Wales Active travel improvements would provide enhanced opportunities for active travel journeys to be made. Journeys that were previously made by car and are now made by active travel would have a positive impact on the environment, contributing to a globally responsible Wales. The Scheme nonetheless has the potential to encourage more journeys by car on a strategic scale, thus negatively impacting on a resilient Wales. It is anticipated that in the long term, as vehicle technology improves, the environmental impact from cars will reduce.
Objective 6: To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs. **Problems: 1, 2, 3, 4, 5, 6, 7**	1 A prosperous Wales Although the Scheme itself is unlikely to encourage modal shift, it would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability along the A40 corridor. Improved connectivity would provide benefits for commuting along the corridor, benefitting social inclusion and contributing towards a prosperous Wales.
	2 A resilient Wales There is no direct link between the Scheme objective and this Well-being goal.
	3 A healthier Wales The Scheme aims to enhance opportunities for active travel and therefore promote social inclusion and integration with the local transport network, therefore contributing towards a healthier Wales.

Objective and corresponding problems	Well-being Goals
	4 A more equal Wales The World Bank Group defines social inclusion as 'the process of improving the terms for individuals and groups to take part in society, and the process of improving the ability, opportunity, and dignity of those disadvantaged on the basis of their identity to take part in society'[9]. The Scheme has aimed to encourage engagement with the local community and stakeholders throughout the study's development. The exhibitions and consultations have been held to include out-of-office hours for example, to maximise attendance and engagement. The Scheme's Public Liaison Officer is also available on a weekly basis to respond to queries in the local community. Moreover, the Scheme aims to improve active travel connections meaning that walkers, cyclists and horseriders would experience benefits of the Scheme, promoting social inclusion. The Scheme's aim to improve safety would also contribute to a more equal Wales as the community is currently disadvantaged by the safety issues present at Redstone Cross.
	5 A Wales of cohesive communities The engagement undertaken, as outlined above, has enabled the public and stakeholders to put forward their opinions and ideas and thus has provided the community opportunities to consider how and if improvements to transport should be considered between Redstone Cross and Penblewin Roundabout. By addressing safety concerns and providing active travel improvements would also contribute positively to a Wales of 'attractive, viable, safe and well-connected communities'.
	6 A Wales of vibrant culture and thriving Welsh language By promoting social inclusion and accessibility, the Scheme contributed to improving access to cultural and Welsh language facilities. As noted previously, although the Scheme itself is unlikely to encourage modal shift, it would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability along the A40 corridor
	7 A globally responsible Wales By improving active travel improvements, the Scheme aims to enable more journeys to be made on foot, by bicycle or by horse riding. It is nonetheless noted that the Scheme would promote social inclusion on a strategic scale by improvements to journey time reliability for motor vehicles.

[9] The World Bank Group – Social Inclusion - https://www.worldbank.org/en/topic/social-inclusion

Objective and corresponding problems	Well-being Goals
Objective 7: Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon. **No specific problems however the objective relates to the aim of the Scheme to deliver a sustainable improvement. The Scheme will take steps to reduce or offset waste and carbon where possible.**	1 A prosperous Wales By delivering a project that is sustainable, the Scheme would contribute to a prosperous Wales by ensuring that the environment's natural resources are protected or enhanced where practicable, contributing towards a prosperous Wales.
	2 A resilient Wales This Scheme objective and this well-being goal strongly interconnect as delivering a project that is sustainable and takes steps to reduce or offset waste and carbon that will contribute positively to a resilient Wales; a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems.
	3 A healthier Wales By aiming for a sustainable project in which reduces or offsets waste and carbon, the Scheme aims to reduce any potential adverse health impacts of the Scheme and providing enhancements for health where possible. Mitigation measures for the waste and carbon impact of the Scheme will be set out for the construction and operation phases.
	4 A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5 A Wales of cohesive communities There is no direct link between the Scheme objective and this Well-being goal.
	6 A Wales of vibrant culture and thriving Welsh language There is no direct link between the Scheme objective and this Well-being goal.
	7 A globally responsible Wales This Well-being goal is embedded within this Scheme objective. In line with the Future Generations (Wales) Act 2015, the Scheme aims to take account of whether the improvements that could be provided to the economic, social, environmental and cultural well-being of Wales, would also make a positive contribution to global well-being.
8: Give due consideration to the impact of transport on the environment and provide enhancement when practicable.	1 A prosperous Wales This Scheme objective links with this well-being goal due to the importance of the environment for a strong economy. The environment provides resources to the economy, and so by reducing the environmental quality of a place, economic growth can be adversely affected by lowering the quantity and quality of resources, or due to health impacts[10].

[10] The Organisation for Economic Co-operation and Development (OECD) – Global Forum on Environment and Economic Growth - https://www.oecd.org/economy/greeneco/global-forum-on-environment-2016.htm

Objective and corresponding problems	Well-being Goals
No specific problems however the objective relates to the aim of the Scheme to give due consideration to the impact of transport on the environment throughout option development.	2 A resilient Wales This Scheme objective and this well-being goal strongly interconnect as mitigating environmental impacts and enhancing when practicable will contribute positively to a resilient Wales; a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems.
	3 A healthier Wales The aim of the Scheme is to also improve the active travel network locally. The northern options would sever a Public Right of Way (PRoW) however it is considered that the associated impacts would be mitigated through diversions and reinstatements. Moreover, all proposed options would allow the existing A40, of which would no longer exist as a trunk road, to perform as a local access route and provide safer opportunities for active travel movements. Mitigation and enhancement measures for the impact on the environment e.g. biodiversity and the water environment would also be in place.
	4 A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5 A Wales of cohesive communities There is no direct link between the Scheme objective and this Well-being goal.
	6 A Wales of vibrant culture and thriving Welsh language There is no direct link between the Scheme objective and this Well-being goal.
	7 A globally responsible Wales The Scheme would inevitably have environmental impacts including on the landscape, biodiversity and soils. The aim of the Scheme nonetheless is to minimise environmental impact of the Scheme and provide enhancement where practicable.

1.7.10 This demonstrates the positive interrelationship between them.

2 Legislation, Policy and Guidance

2.1 Overview

2.1.1 This section explores the relevant legislation, policy and guidance, which provides the context for identifying the problems, developing the objectives and identifying, appraising, sifting and selecting appropriate transport interventions.

2.2 National Level

Taking Wales Forward 2016-2021

2.2.1 Taking Wales Forward is the latest Programme for Government and sets out how the Welsh Government will deliver more and better jobs through a stronger, fairer economy, improve and reform its public services, and build a united, connected and sustainable Wales.

2.2.2 It emphasises that the UK withdrawal from the European Union creates some uncertainty and challenges, but the Welsh Government's mandate is clear: The Welsh Government's relentless focus will be on driving improvement in the economy and public services.

2.2.3 The policy document includes a transport commitment to deliver improvements to the A40 in West Wales.

Prosperity for All: The National Strategy 2017-2021

2.2.4 Taking Wales Forward is the latest Programme for Government and this strategy takes those key commitments, places them in a long-term context, and sets out how they fit with the work of the wider Welsh public service to lay the foundations for achieving prosperity for all.

2.2.5 The National Strategy explains how although Wales as a whole has grown strongly out of recession, there are areas of the country which have not seen the full benefits of growth. This has left some communities struggling to prosper and feeling isolated from other parts of Wales. Government has a key role in stimulating economic growth in areas of greatest need.

2.2.6 As part of the National Strategy is a commitment to deliver modern and

connected infrastructure, including enhancements to the A40 in West Wales.

Prosperity for All: A Low Carbon Wales 2019

2.2.7 Prosperity for All: A Low Carbon Wales sets the foundations for Wales to transition to a low carbon nation and works within the context of the Environment (Wales) Act 2016 of which requires Welsh Government to reduce emissions of greenhouse gases in Wales by at least 80% for the year 2050. It also sets a target that in 2017, Welsh seek to achieve a carbon neutral public sector by 2030. This Plan identifies measures for how Welsh Government plans to meet the first carbon budget (2016-20). The Plan notes how in 2017, Welsh Government set the ambition of achieving a carbon neutral public sector by 2030.

Climate Emergency 2019

2.2.8 On 29 April 2019, the Welsh Government declared a climate emergency in Wales to draw attention to the magnitude and significance of the latest evidence from the Intergovernmental Panel on Climate Change and highlighting the recent climate protests across the UK.

2.2.9 Welsh Government have expressed their hope that the declaration could help to trigger a wave of action at all levels, and stated that tackling climate change requires collective action and the government has a central role to making collective action possible.

2.2.10 It refers to Prosperity for All: A Low Carbon Wales, published the previous month, and states that this Plan sets the policies and proposals intended to meet the 2020 carbon emission targets. The statement refers to the Welsh Government's previously set targets in 2017, reaffirming the commitment to achieving a carbon neutral public sector by 2030. The Welsh Government states that the next plan, of which will set measures to meet emissions reduction targets by 2021-26, is currently being prepared and must go further and faster.

Well-being of Future Generation (Wales) Act, 2015

2.2.11 This 2015 Act[11] is about improving the social, economic, environmental and cultural well-being of Wales with an overarching aim of creating a Wales we all want to live in, now and in the future. The Act puts in place seven well-being goals as shown in Figure 1 Well-being Goals

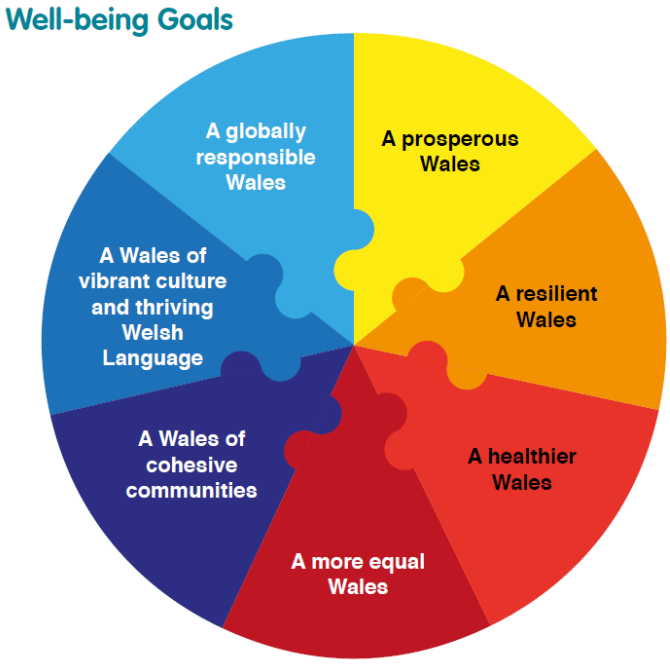


Figure 1 Well-being Goals

2.2.12 The 2015 Act 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. To help do this they must set and publish well-being objectives and think more about the long term, work better with people and communities and each other, look to prevent problems and take a more joined-up approach12.

2.2.13 The WelTAG 2017 guidance requires the consideration of the well-being goals and ways of working throughout appraisal.

[11] http://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en
[12] http://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en

Wales Transport Strategy, 2008

2.2.14 Published in 2008, by the then Welsh Assembly Government, the overarching aim of the Wales Transport Strategy13 is to promote sustainable transport networks that safeguard the environment while strengthening the country's economic and social performance. The strategy has been prepared in the context of the One Wales programme, a progressive agenda for Wales. The strategy sets out a number of policy outcomes, delivered through strategic priorities. These include;

a) Reducing environment impacts from transport;
b) Integrating local transport;
c) Improving access between key settlements and sites;
d) Enhancing international connectivity; and
e) Increasing safety and security.

Reducing environment impacts from transport

2.2.15 Road Schemes can contribute positively to reducing environmental impacts. For example, removing congestion by increasing road capacity and making journeys more reliable by providing better overtaking opportunities can reduce CO2 emissions. In addition, bypassing settlements can remove traffic and improve air quality for existing communities.

Integrating local transport

2.2.16 Tackling congestion and ensuring journey reliability requires an integrated package of solutions that take account of a variety of local factors. This might include improvements to the public transport network, creation of more opportunities for walking and cycling, park and ride facilities and any future potential for road pricing.

2.2.17 Improving safety along transport corridors, by removing heavy traffic flows, can enhance opportunities for sustainable forms of travel, including walking and cycling. This is enshrined in Welsh Governments 'Safe Routes in Communities Scheme'.

13 http://gov.wales/docs/det/publications/140909-transport-strategy-en.pdf

Improving access between key settlements and sites

2.2.18 The most effective way of improving access to essential services will be to improve links within key settlements and links between key settlements and employment sites and their hinterland.

2.2.19 It is the aim of Welsh Government to improve links between north, west and south Wales. Specifically, by improving the reliability of the road system especially between key settlements and employment areas. Bypassing existing settlements can also help address severance and cohesiveness within existing communities.

Enhancing international connectivity

2.2.20 Wales has a series of ports, railways and roads that form part of the strategic Trans-European Networks (TEN-T). This was developed to reinforce economic and social cohesion across Europe.

2.2.21 The A40 is part of the wider TEN-T network and its performance is integral to connecting Wales, and West Wales in particular, to the wider European community.

Increasing safety and security

2.2.22 Reducing the number of road casualties is a priority – with the ultimate aspiration being no casualties. This will be facilitated through the 'Safe Routes in Communities Scheme' and is linked to integrating local transport.

National Transport Finance Plan, 2018

2.2.23 The National Transport Finance Plan was originally published in July 2015, setting out the Schemes the Welsh Government propose to deliver. The framework document has since been updated in 2017 and 2018 to comment on its progress since publication and to revise the programme for the next two years and beyond.

2.2.24 Schemes of key relevance to the study are detailed below:

a) NEW 2 - Improvements to the A40 (2 plus 1 Schemes); 10.8km of improved (2+1 configuration) highway between St Clears and Haverfordwest in the medium term.

a) R15 - Improvements to the A40 - Llanddewi Velfrey to Penblewin in the short term.

2.2.25 The R15 Scheme is described as;

a) 2 km of new highway to the north of the village of Llanddewi Velfrey;

b) 2.5km of improved highway west of Ffynnon Wood; and

c) Improved facilities for non-motorised travel via new cycle tracks and new bridleway, with a means of crossing the new highway either over or beneath.

Trunk Road Forward Programme, 2002, 2004 and 2008

2.2.26 The aim of the Welsh Government's 2002 Trunk Road Forward Programme[14] was to improve the economic and social conditions in Wales, through increasing efficiency and accessibility in all areas.

2.2.27 The Forward Programme indicated the Welsh Government's intentions for road Schemes that were expected to cost £1 million or more.

2.2.28 The A40 St Clears to Haverfordwest was identified in the Forward Programme within the 'East – West (south) strategic corridor'.

Planning Policy Wales, 2018

2.2.29 Published in December 2018, the tenth edition of Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. Within the latest edition, a new emphasis is given to the concept of placemaking, in conjunction with a closer alignment with the Well-being of Future Generations (Wales) Act 2015.

2.2.30 Within PPW, sustainable development is defined as "the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the well-being goals."

2.2.31 Placemaking is emphasised as a key component within planning and urges incorporation at the earliest possible stage.

2.2.32 It is defined as "draw[ing] upon an area's potential to create high quality development and public spaces that promote people's prosperity, health, happiness and well-being in the widest sense". The understanding is that placemaking involves consideration beyond the

[14] http://gov.wales/topics/transport/roads/Schemes/?lang=en

context of the development site and into the wider surroundings.

2.2.33 It is stated that access to jobs and services through shorter, more efficient and sustainable journeys should be enabled through the planning system. Targeted new infrastructure is shown as an example of how we can achieve more efficient movement of people.

2.2.34 It is recognised that rural areas may require different approaches to sustainable transport, however, this is not to be established in contrast to the transport hierarchy, with emphasis on reducing reliance on the private car continuing to play a key factor.

Environment (Wales) Act, 2016

2.2.35 Enacted in 2016 by the National Assembly for Wales, the Environment (Wales) Act 201615 provides an iterative framework that ensures managing natural resources sustainably will be a core consideration in decision-making. Natural Resources Wales are the principal organisational body to help deliver the aims of the Act and are required to prepare a number of documents, which include:

a) State of Natural Resources Report;
b) National Natural Resources Policy; and
c) Area Statements.

2.2.36 These documents will help inform the design of road Schemes so that they can be delivered in a way that manages natural resources sustainably. The Act also includes provisions to tackle climate change, through statutory emission reduction targets and carbon budgeting to support their delivery.

Active Travel (Wales) Act, 2013

2.2.37 Enacted in 2013 by the National Assembly for Wales, the Active Travel (Wales) Act 201316 requires legal requirement for local authorities in Wales to map and plan for suitable routes for active travel, and to build and improve their infrastructure for walking and cycling every year. It creates new duties for highways authorities to consider the needs of walkers and cyclists and make better provision for them. It also requires both the Welsh Government and local authorities to promote walking

15 http://www.senedd.assembly.wales/mgIssueHistoryHome.aspx?IId=12572
16 http://www.senedd.assembly.wales/mgIssueHistoryHome.aspx?IId=5750

and cycling as a mode of transport so that local communities rely less on cars when making short journeys.

2.2.38 In the context of road Schemes, there is significant opportunity to reconfigure existing infrastructure so that it better meets the needs of existing and new settlements and facilitates active travel.

Labour Leadership Manifesto, 2018

2.2.39 The Manifesto sets out "a detailed plan with fresh initiatives in every major policy area." It maintains a commitment to tackle congestion, particularly in areas such as the A40 in Mid and West Wales.

2.3 Regional Level

Joint Transport Plan for South West Wales, 2015

2.3.1 Published in 2015, the Joint Transport Plan for South West Wales17 is the culmination of collaborative working between Carmarthenshire County Council, Neath Port Talbot County Borough Council, Pembrokeshire County Council and the City and County of Swansea. This collaborative working is closely linked with wider initiatives under the Swansea Bay City Region concept. The plan will provide the framework for improving connectivity to, from and within the region for the period 2015 – 2020.

2.3.2 The plan is targeted at addressing;

a) Economic growth: Supporting and Safeguarding jobs in the City Region;

b) Access to employment: Reducing economic inactivity by delivering safe access to major employment sites in the City Region;

c) Tackling poverty: Maximising the contribution that transport services can make to targeting improvements to tackling poverty and target improvements at the most disadvantaged communities;

d) Sustainable travel and safety: Encouraging safer, healthier and more sustainable travel; and

e) Access to services: Connecting communities and enabling access to key services.

17 https://www.swansea.gov.uk/media/7872/Joint-Transport-Plan-for-South-West-Wales-2015-2020/pdf/Joint_Transport_Plan_for_South_West_Wales_-_ENG.pdf

2.3.3 The plan acknowledges the strategic road network, including the Trans-European Transport Network which links Europe to the Republic of Ireland, as vital gateways to the region for freight and passenger movements and as the most commonly used entry/exit routes to south-west Wales.

2.3.4 This is an important driver for the regional economy and supports growth at Haven Waterway Enterprise Zone in Pembrokeshire and other strategic growth zones such as that of Cross Hands in Carmarthenshire.

2.3.5 Key policies within the plan, in the context of this Scheme, include;

a) Policy KS1 - work collaboratively to develop improved public transport services, to link key settlements and their hinterlands with strategic corridors and employment sites.

b) Policy KS2 - seek to improve the journey time reliability between key settlements and strategic and local employment sites.

c) Policy KS3 - improve walking and cycling links within and between key settlements.

d) Policy IC1 - work with the WG through the NTP programme to improve the TENs and the Trunk Road network to facilitate journey time reliability and support the economic regeneration of the region.

e) Policy IC3 - work collaboratively to facilitate more reliable, effective and sustainable movement of people and freight to, from and through our ports. Also to improve access to our ports.

f) Policy IC4 - work with the WG and other parties, to support the development of good access to regional and national airports in the UK, especially by public transport.

g) Policy IT3 – work with agencies and organisations to reduce barriers to more sustainable travel behaviour and develop sustainable travel information which meets the ATA requirements on promotion.

h) Policy IT4 – work with agencies and organisations that provide transport to ensure it is accessible to all users and that innovative solutions are developed for those areas with little or no public transport;

i) Policy E2 – facilitate and promote improved rail and bus services, walking, cycling and car sharing to encourage modal shift and improve air quality;

j) Policy E4 – encourage more sustainable freight distribution through better access to and use of rail, intermodal facilities and ports;

k) Policy SS1 - seek to reduce the number of road casualties and collisions through improvements to highways and traffic management; and

l) Policy SS2 – work collaboratively to promote the safety of and safe behaviour by all road and rail users.

2.3.6 The plan specifically addresses trunk road priorities setting out that;

'They are the life blood of the region and essential to connect, sustain and grow local and regional economies. Trunk roads also provide national and international connectivity and support road based public transport connections to and from communities, settlements and employment, training, health care and leisure facilities.'

2.4 Local Level

Pembrokeshire County Council Local Development Plan, 2013

2.4.1 Adopted in 2013, the Pembrokeshire County Council Local Development Plan18 establishes the local policy framework to guide development in the area.

2.4.2 Llanddewi Velfrey to Penblewin improvement Scheme is identified under Policy GN.39 'Transport Routes and Improvements'. The proposals map has identified sufficient land in order to safeguard a possible route for the Scheme to avoid potential land use conflicts over the plan period.

2.4.3 The plan identifies three key trunk roads whose routes run into Pembrokeshire, namely the A40 (T), A477 (T) and A487 (T). They link to the 2 ferry terminals, at Pembroke Dock (A477 (T)) and Fishguard Harbour (A40 (T) and A487 (T)). The A4076 (T) is a further important Trunk Road, linking Haverfordwest with Milford Haven. Pembrokeshire County Council has identified a need for significant investment in transport infrastructure, for example dualling the A40 and improving the A477.

2.4.4 The plan identifies a number of strategic economic priorities citing the

18 http://www.pembrokeshire.gov.uk/content.asp?nav=1626,109,2045

tourist industry as the County's largest industry and employer alongside industrial and energy development at the port of Milford Haven. Improving access to both tourist destinations and employment growth hubs will be important for the future prosperity of the area.

2.4.5 In terms of future growth, the plan identifies a number of allocations within proximity of the study area, of which are set out in detail within paragraph 3.5.28. In summary, the plan identifies a number of housing and employment allocations within and around Narberth, Clarbeston Road and Haverfordwest. The main strategic areas for growth are located within the settlements of Haverfordwest, Milford Haven, Pembroke and Fishguard. When these sites come forward and development is realised they will contribute to flows along the A40 corridor.

Pembrokeshire Coast National Park Local Development Plan, 2010

2.4.6 The Plan19 was adopted in 2010 and provides the framework for town and country planning decisions to be made up until 2021 on how land is used and developed in the National Park. In general, although not promoting large scale growth in the same way as the Pembrokeshire County LDP, the Plan is supportive of wider growth outside of the National Park and in turn recognises the importance of the A40 as a key east-west link.

Pembrokeshire Destination Management Plan 2013-2018

2.4.7 Published in 2013 by the Destination Pembrokeshire Partnership, the Pembrokeshire Destination Management Plan20 is designed to act as a development guide for all Pembrokeshire based organisations, businesses and employees in tourism related roles. The plan aims to improve the tourist offer in the region in order to stave off competition from elsewhere in the UK.

2.4.8 A key objective of the plan is to develop and sustain the tourism infrastructure, environment and cultural resources. A component of this is the improvement of countryside access and access to remote locations as well as transport options. The plan specifically identifies a geography

19 http://www.pembrokeshirecoast.org.uk/default.asp?PID=178
20 https://businesswales.gov.wales/dmwales/sites/dmwales/files/documents/pembrokeshire-dm-plan.pdf

and connectivity related barrier;

> *"Pembrokeshire's relative isolation and distance from visitor markets is a significant limiting factor, especially for encouraging short breaks outside peak summer months. Improved road and rail networks linking other destinations, especially those in south west England, will have a displacement effect on visits to Pembrokeshire."*

3 Scheme Context

3.1 Overview

3.1.1 This section of the IAR presents the context within which the Scheme should be considered and within which possible solutions should be appraised. This explores the current situation in relation to the existing study area and also considers the broader social, environmental and economic context for any potential intervention.

3.2 Transport Network

A40 West of St Clears

3.2.1 The A40 trunk road, together with the M4 Motorway, the A48 trunk road and the A477 trunk road forms part of the Trans-European Transport Network (TEN-T) in south-west Wales and is a strategically important link between the national Motorway network and the port of Fishguard. However, the Trunk Road Forward Programme 2002 identified the A40 West of St Clears as forming the lowest standard section of the TEN-T in the UK.

3.2.2 The A40 west of St Clears provides a key road link between south-east Wales and Haverfordwest, which is a gateway town to the ports of Milford Haven, Fishguard and Pembroke Dock, as well as the tourist economy of central and north Pembrokeshire.

3.2.3 The St Clears to Haverfordwest section of the A40 (see Figure 2) has developed to connect small villages and as such many sections of the A40 pass through these communities, leading to issues around severance, air and noise concerns and safety problems.

3.2.4 The A40 accommodates a mix of traffic types, with seasonal variations. In the winter months, the road carries local residents (typically car-based traffic); commercial vehicles, particularly around ferry arrival and departure times; and agricultural vehicles. In the summer months, the mix is supplemented by a higher volume of tourist traffic (increasing in some areas by over 40%) including cars and caravans.

A40/B4313 Redstone Cross

3.2.5 Redstone Cross forms a staggered junction with the B4313 and the A40. The junction is not to modern highway standards. The A40 forms a strategic connection between Carmarthen and Haverfordwest. It forms part of the wider A40 strategic trunk road network, linking Fishguard onto Carmarthen, then joining the M4 to London.

3.2.6 There is limited pedestrian infrastructure at Redstone Cross. There is a footway stretching along the northern section of the A40 providing provision for pedestrians crossing from one side of the B4313 to the other. There is no dropped kerb on the footway on the southern side of the B4313. Formal pedestrian infrastructure is not provided along the B4313 with the exception of informal footway/parking for access to residential properties on the southern side. There is footway provision along the eastern side of Redstone Road between Redstone Cross and Narberth.

3.2.7 At Redstone Cross, there are a few residential and field accesses off the A40 and the B4313. A residential and farming property is located off the north side of the A40 with an area of hardstanding located adjacent to the highway. This hardstanding connects with the footway and is likely used more often as a crossing point for pedestrians than a parking space. The residential farming property also has a vehicular access off the B4313 as a more appropriate and convenient space for parking.

3.2.8 Residential properties also front the B4313 and A40 on the south of the A40. The properties are slightly separated from the highway via an area of hardstanding for parking/informal pedestrian space.

3.2.9 The section through the village is illuminated, and the national speed limit of 60mph applies.

3.2.10 Approximately 55m south of Redstone Cross, the speed limit reduces to 40mph along Redstone Road, as the route enters a more built up area. The speed limit reduces again to 30mph approximately 2m south of the Rushacre Lane priority junction.

3.2.11 The national speed limit applies to the B4313 to the north of Redstone Cross.

Public Transport

3.2.12 The A40 provides an important linkage for the communities located along it to the main transport hubs within Pembrokeshire offering access to wider transport modes and more strategic / regional public transport connectivity.

3.2.13 Local public transport services from Redstone Cross are provided by Taf Valley Coaches 322 Service. The service currently provides four daily trips in each direction operating between 8:00 and 17:05.

3.2.14 Wider connections to other destinations from Haverfordwest are provided by First Cymru and Richard Brothers as shown in Table 3.

Table 3 Bus Services from Redstone Cross

Destination	Service	Duration
Haverfordwest (via Narberth)	322	27 min
Carmarthen	322	35 min
Milford Haven	322/302	1 h 30 min
Pembroke	322/348/349	1 h 29 min
Fishguard	322/T5	1 h 08 min

Source: Traveline Cymru / Google Maps Journey Planner

3.2.15 Table 3 shows that in order to reach other destinations within Pembrokeshire from Redstone Cross users must change at Haverfordwest and join another service. In general, service frequency on the majority of routes is low and the journey times are not competitive with car-based transport on the longer routes. This corresponds with the high level of car ownership in the County and reliance on the car for journeys.

3.2.16 Regional rail and coach services can be accessed from the major towns with services available from Haverfordwest and Carmarthen.

3.2.17 Journey times for coach travel from Haverfordwest and Carmarthen are shown in Table 4. These National Express services operate infrequently throughout the day. Other coach operators do offer similar services although journey times are not competitive with car journeys.

Table 4 Journey time by Coach from Haverfordwest and Carmarthen

	Swansea	Cardiff	London (Victoria)
Haverfordwest	~ 2 h 25 min	~ 4 h 15 min	~ 7 h 35 min
Car equivalent	*~ 1 h 17 min*	*~ 1 h 53 min*	*~ 4 h 24 min*
Carmarthen	~ 45 min	~ 2 h 15 min	~ 5 h 55 min
Car equivalent	*~ 42 min*	*~ 57 min*	*~ 3 h 29 min*

Source: National Express

3.2.18 Services from Haverfordwest and Carmarthen are not competitive when compared to equivalent car journeys. The only service that provides a similar journey time by coach and by car is between Carmarthen and Swansea. However, consideration must be given to the need for users to get to Carmarthen in order to connect with the National Express Service, and the very low frequency of coach services.

3.2.19 Narberth railway station is located to the south of Penblewin roundabout, providing services to Pembroke Dock, Swansea and Tenby. The services run approximately every 2 hours. In 2017/18, station patronage was 18,966, which is a 4.81% decline in patronage since 2016/17.

3.2.20 Rail services are also accessible from Haverfordwest and operated Transport for Wales Rail Services. Station patronage was approximately 133,164 in 2017/18, which is a 0.25% decline in patronage since 2016/17. Journey times to key destinations are shown in Table 5.

Table 5 Journey times by rail from Haverfordwest

Station	Services per Day	Journey Time	Road Equivalent
Swansea	10	~ 1 h 27 min	~ 1 h 14 min
Cardiff (Central)	9	~ 2 h 28 min	~ 1 h 53 min
London (Paddington)	7[21]	~ 4 h 43 min	~ 4 h 19 min
Fishguard Harbour	6[22]	~ 1 h 20 min	~ 26 min

Source: Traveline Cymru / Arriva Trains Wales

3.2.21 Although some journey times are fairly similar when compared to car journey equivalents, consideration must be given to any journeys needed prior to the rail section to join the services on offer. From Redstone Cross, journeys by bus would take an additional 37 minutes

[21] Requires change at Cardiff Central
[22] Requires change at Clarbeston Road

to reach Haverfordwest Railway Station, not including wait/transfer time, making the overall journey un-competitive when compared to car alternatives.

Port (Passenger Ferry and Freight)

3.2.22 The A40 provides an important connection to 2 ferry routes between Pembrokeshire and Ireland:

a) Fishguard to Rosslare – operated by Stena Line; and

b) Pembroke Dock to Rosslare – operated by Irish Ferries.

3.2.23 The routes both offer twice daily sailings in either direction as summarised in Table 6.

Table 6 Ferry Routes from Pembrokeshire to Ireland

	Fishguard to Rosslare	Pembroke Dock to Rosslare
Pembrokeshire to Rosslare	13:10 – 16:25 23:45 – 04:00	02:45 – 06:46 14:45 – 18:46
Crossing time	~ 3 h 15 min / 4 h 15 min	~ 4 h 1 min
Rosslare to Pembrokeshire	08:00 – 11:15 18:10 – 21:25	08:45 – 12.46 20:45 – 00:46
Crossing time	~ 3 h 15 min	~ 4 h 1 min

3.2.24 The two crossings are similar in terms of timings and journey time with a timetable built around hauliers accessing key logistic hubs in both countries in the early hours. As a result, ferry traffic is generally generated at off peak times.

3.2.25 Statistics on freight passing through UK ports are published by the DfT[23]. Volumes for Pembrokeshire ports are shown in Table 7.

Table 7 Total Freight Tonnage at Pembrokeshire Ports

Port	2017 Freight (thousand tonnes)
Fishguard	381
Milford Haven / Pembroke Dock	31,990

3.2.26 In terms of trends over time, Figure 2 identifies tonnage passing through both ports between 2008 and 2017. This shows a general decline at Milford Haven from 2011, and relatively constant throughput at

23 Source: DfT Port Freight Statistics (Table PORT0205): UK major ports, main freight units by port, annually: 1992 - 2015

Fishguard.

3.2.27 Despite an overall decline in freight throughput at Milford Haven, it remains a priority of Pembrokeshire County Council and the Welsh Government to help ensure that the infrastructure is in place in order to make the ports and associated Haven Waterway Enterprise Zone (focused on industry and energy development) as attractive as possible to future investment.

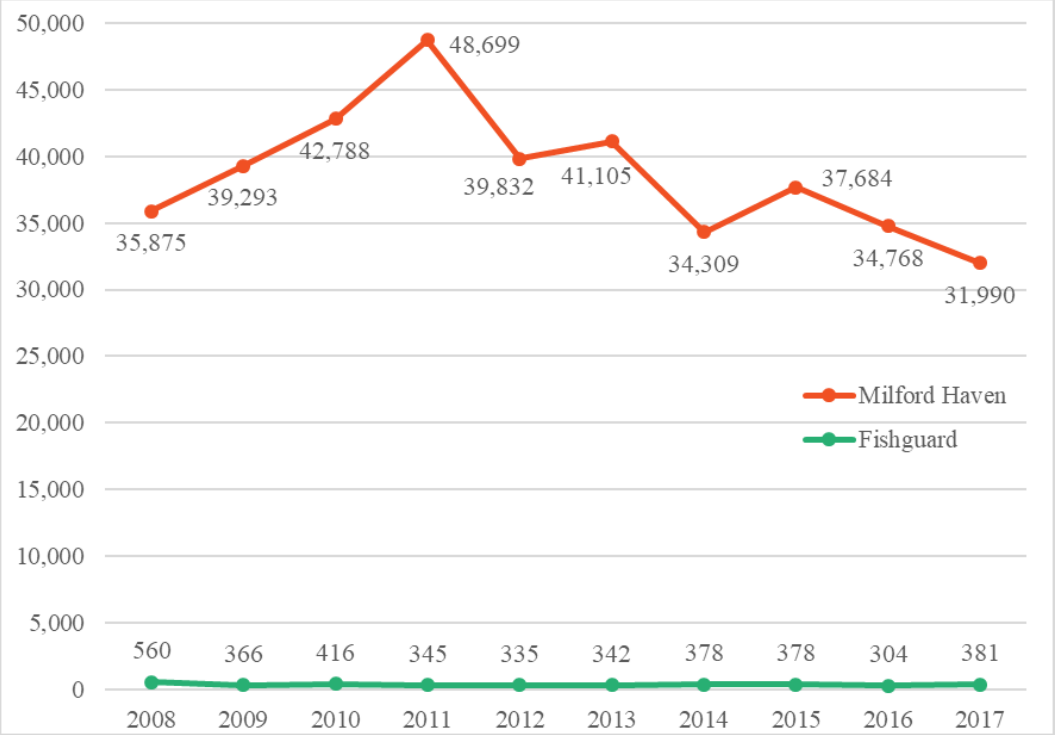


Figure 2 Trends in freight tonnage

Active Travel Network

3.2.28 There is consistent provision of footways throughout Narberth, with a continuous footway provided between Redstone Cross and Narberth. The A40 comprises a trunk road subject to the national speed limit, with limited footway provision provided within the study area.

3.2.29 There are limited Public Rights of Way (PRoW) in the local area, comprising footpaths and bridleways. The Public Rights of Way located closest to Redstone Cross include a bridleway located approximately 250m to the south-east (ref SP27 2/1) and a footpath located approximately 750m to the north-east (ref SP27 1/1). The former provides a connection between Redstone Road and a farm located to the

south of the A40. The latter connects from the A40/unnamed road accessing Nant-y-Ffin Hotel and Motel to a farming property off the A478.

3.2.30 There is no formal cycle network infrastructure within the local area with the nearest National Cycle Network approximately 12km to the south at Saundersfoot (National Cycle Network Route 4) and 16km to the north at Mynachlogddu (National Cycle Network Route 47).

3.2.31 National Cycle Network Route 4 comprises a long-distance route between London and Fishguard via Reading, Bath, Bristol, Newport, Swansea, Carmarthen, Tenby, Haverfordwest and St Davids. The route stretches across 432 miles. Between Swansea and Fishguard, the cycle route includes two large traffic-free sections; the Millennium Coastal Park near Llanelli and the Brunel Trail along a disused railway between Pembroke and Haverfordwest.

3.2.32 National Cycle Network Route 47 also comprises a long-distance route between Newport and Fishguard, passing through Neath and Carmarthen. The total length of the route is 128 miles and is mainly made up of minor and quiet roads.

Journey Times / Reliability

Road

3.2.33 Table 8 summarises car-based journey times from Redstone Cross to key destinations, all of which would utilise the A40 (in part or in full). This shows generally good car-based accessibility to the main towns of Haverfordwest and Carmarthen with journeys taking on average less than 30 minutes.

Table 8 Car-based Journey Time from Redstone Cross to key Destinations

	Redstone Cross	Haverfordwest	Milford Haven	Fishguard	Carmarthen	Cardiff	Bristol	London
Redstone Cross	N/A	0:15	0:30	0:37	0:26	1:39	2:15	4:22
Haverfordwest	0:15	N/A	0:18	0:26	0:41	1:54	2:31	4:38
Milford Haven	0:30	0:19	N/A	0:42	0:55	2:08	2:47	4:54
Fishguard	0:37	0:27	0:43	N/A	1:03	2:17	2:57	5:01
Pembroke Dock	0:27	0:22	0:17	0:45	0:44	1:57	2:35	4:42

Source: Google Maps Journey Planner

3.2.34 Journey time reliability has been identified as one of the key problems associated with the A40 between St Clears and Haverfordwest. The long stretches of single carriageway and alignment of the road limits safe overtaking opportunities and causes platooning behind slow moving vehicles (e.g. HGVs, agricultural vehicles and caravans).

3.2.35 Platooning is the traffic condition, similar to a convoy, where a queue of traffic builds up behind the front vehicle. If the front vehicle is moving at a slower speed than the rest it creates queues of traffic if there is no opportunity for overtaking. In the context of the A40 platooning is particularly experienced:

a) When there has been a ferry arrival at either Milford Haven or Fishguard and there are a number of HGVs heading east along the trunk road at the same time;

b) When agricultural vehicles are travelling along the A40; and/or

c) When slow moving vehicles such as caravans are travelling along the trunk roads – particularly prevalent during the summer months.

3.2.36 A significant variation in journey times between the peak hours and other hours of the day is a good indicator for the presence of traffic congestion during certain times of day.

3.2.37 Trafficmaster data is a GPS sourced dataset providing detailed information about vehicle movements and their speeds throughout Great Britain. The data was used to extract average journey times along the A40 for typical weekday conditions (Mondays to Thursdays)

between September 2015 and August 2016. The location of data analysed was between the access for Flimston Farm west of Redstone Cross and the rest area approximately 350 meters east of Penblewin roundabout. The following time periods were defined for this analysis:

a) Morning Peak (08:00-09:00);
b) Evening Peak (17:00-18:00);
c) Inter-peak (10:00-16:00); and
d) Off-peak (22:00-06:00).

3.2.38 The analysis of journey times during the peaks was deliberately limited to single peak hours in order to establish the 'worst case'. The timeframe selected for the off-peak period was based on hours in which the traffic flow was less than 100 vehicles per hour in each direction in order to capture the 'best case' for journey times. Journey times for the inter-peak were also extracted to provide a comparative measure for typical daytime conditions outside of peak hours.

3.2.39 Table 9 shows that the travel times through the study area along the A40 are similar during the morning peak, evening peak and inter-peak in the eastbound and westbound direction respectively. This indicates that the additional traffic that travels in the morning and evening peaks compared to the inter-peak does not appear to have a notably adverse impact on journey times during these hours.

Table 9 Journey times along the A40 (in minutes and seconds)

Month	Morning Peak	Evening Peak	Inter-peak	Off-Peak	Congestion Factor
Eastbound	02:01	02:04	02:02	01:45	1.18
Westbound	02:07	02:05	02:04	01:42	1.25

3.2.40 During the off-peak it is evident that journey times are faster than for the rest of the day. This is likely to be linked to the much lower traffic volumes during these hours, which allows traffic to travel freely with a much lower likelihood of getting held up by slower moving vehicles and without experiencing any junction delay at Penblewin roundabout. A 'congestion factor' has been calculated on the basis of comparing the 'worst case' travel time to the 'best case'. This indicates that congested travel times are on average between 18% and 25% higher than in the off-peak.

3.2.41 The monthly variation of travel times is shown in Figure 3 and Figure

4 for the eastbound and westbound direction respectively. This indicates that the fluctuation in traffic volumes by month has no significant impact on journey times. Typically, the trend that is observed over the average year is reflected in each month with only small fluctuations. Even in August, when traffic volumes are highest, the trend between journey times in the peaks and off-peak is broadly similar to January when flows are lowest. This is a further sign that there is only very limited congestion in the area. The higher journey times during the morning, evening and inter-peak compared to the off-peak are therefore likely to be the result of lack of overtaking opportunities rather than traffic congestion resulting from road sections or junctions exceeding their theoretical capacity.

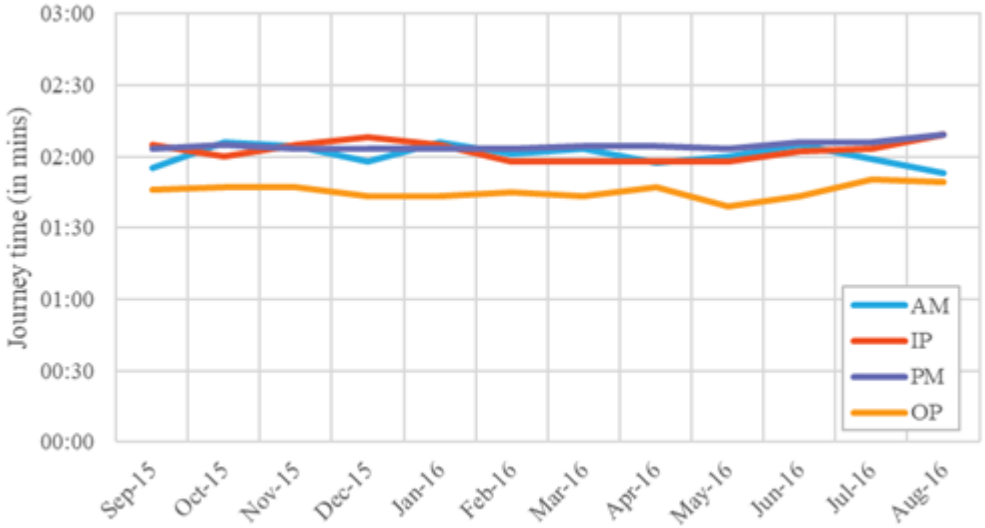


Figure 3 Eastbound journey times along the A40 by month

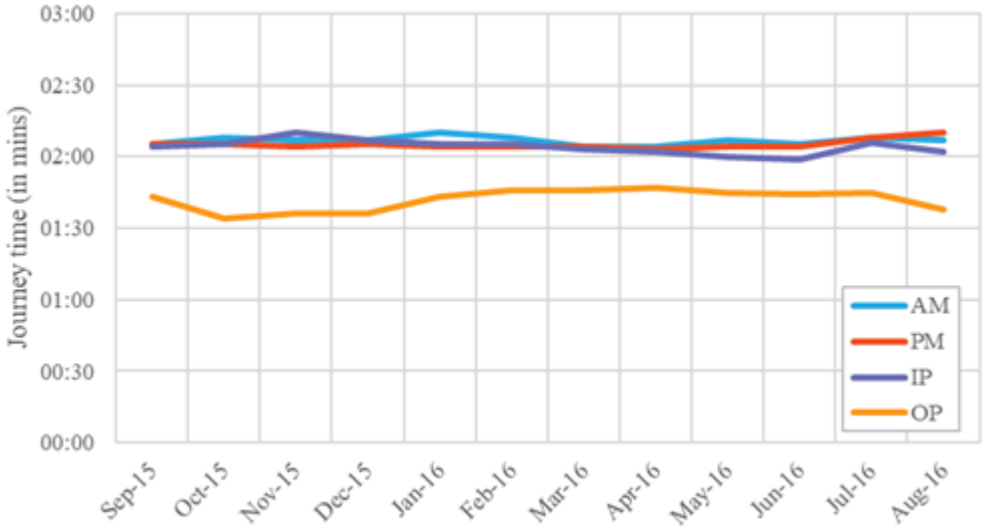


Figure 4 Westbound journey times along the A40 by month

3.2.42 Completed improvements between Penblewin and Slebech Park have helped to relieve this problem to an extent, however there continues to be long stretches to the west of Penblewin where overtaking opportunities are limited, including around the study area. For instance, there is no opportunity for vehicles travelling east to overtake for at least 19km from Robeston Wathen towards St Clears roundabout. Similarly, for vehicles travelling west there is no opportunity for vehicles to overtake for 10km from the west of Whitland to the east of Llanddewi Velfrey. There is also no opportunity for vehicles to overtake for at least 9.5km from Canaston Bridge to Haverfordwest roundabout.

Traffic Flows

3.2.43 This section of the report summarises information within the 'Initial Traffic and Accident Data Report'[24] (May 2019), which details traffic trends in the past and as existing.

Historic growth

3.2.44 The closest location to the proposed Llanddewi Velfrey to Penblewin improvements at which continuous traffic count data is available over a prolonged period is along the Whitland Bypass section of the A40. The Whitland Bypass section is situated slightly east of the Llandewi Velfrey to Penblewin section but is considered to be representative.

24 Ref. A40PRC-ARP-VTR-M02-RP-TR-0001

3.2.45 Figure 5 illustrates the annual average daily traffic (AADT) flows and associated growth rates flows on the A40, adjacent to the A40/B4314 Count Point between 1999 and 2018. This shows that traffic volumes have increased in the area by 18% over the 19-year period.

3.2.46 Between 2006 and 2008 annual traffic growth plateaued and then turned negative between 2009 and 2012, which is likely to be linked to the global recession. Following the period of negative growth, the traffic growth rates accelerated to 4% per annum for the subsequent two years. Since 2015 annual traffic growth has fluctuated in the range of 0 to 3%.

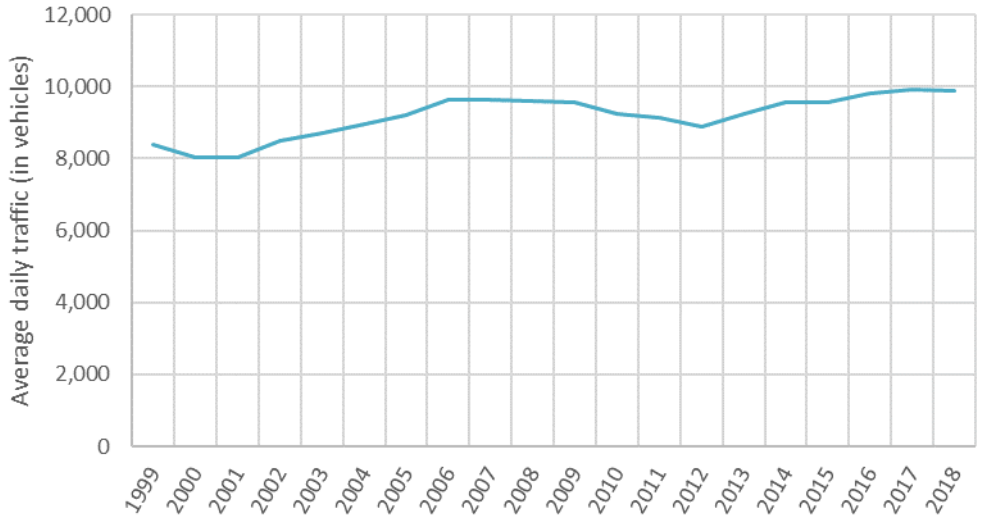


Figure 5 AADT flows 1999-2018

3.2.47 The two-way AADT for the A40 Whitland Bypass was 9,895 in 2018. A comparison of monthly flows based on the Whitland Bypass count location in 2018 is shown in Figure 6.

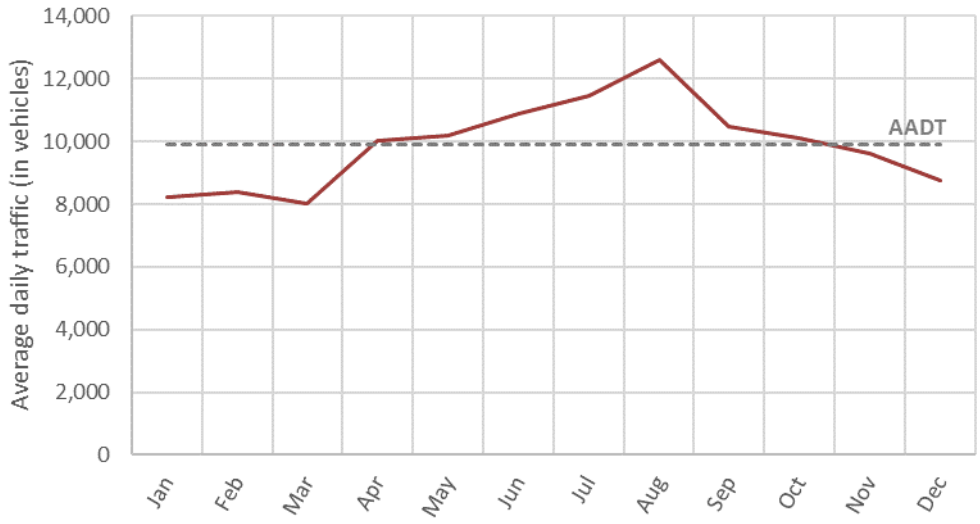


Figure 6 Monthly variation in traffic flows

3.2.48 Figure 6 demonstrates the significant seasonal variation in traffic volumes, with a clear trend towards higher traffic volumes during the summer and lower traffic volumes during the winter. The highest traffic flows were observed during the peak holiday season in August and the lowest in January. Traffic volumes in August were 27% higher than the annual average, whereas volumes in January to March were between 15% and 19% lower in 2018. This means that traffic volumes in the busiest month of August were over 50% higher than those observed in the quietest months.

3.2.49 The level of seasonality in traffic flows reflects the prominence of Pembrokeshire as a tourism destination as well as the attractiveness of the National Park which attracts approximately 4.2 million visitors per annum or 13 million visitor days[25].

3.2.50 A comparison of traffic volumes by day of week has been undertaken based on automatic traffic count (ATC) data collected in June 2017 along the A40 west of Llanddewi Velfrey. The reason for using this count, which is located to the east of Penblewin Roundabout and not on the section between Redstone Cross and Penblewin, is because this is the closest available traffic count that captured traffic volumes over a period of several weeks. This data was collected as part of a series of surveys conducted as input to the traffic modelling for this project. The results of the analysis are shown in Figure 7.

[25] http://www.nationalparks.gov.uk/students/whatisanationalpark/factsandfigures

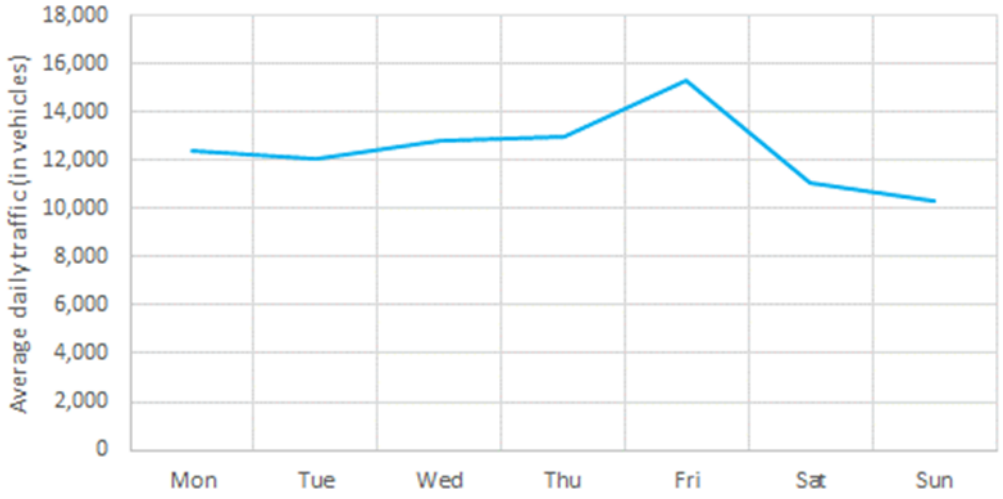


Figure 7 Daily variation of traffic flows on A40 west of Llanddewi Velfrey

3.2.51 Figure 7 shows that there is little fluctuation of daily traffic volumes between Mondays and Thursdays. However, traffic volumes on Fridays are shown to be 17% higher than the Monday to Friday average. The increased traffic volume on Fridays is likely to be linked to tourism traffic and residents of Pembrokeshire who work in other parts of Wales or the rest of the UK during the week and then return home for the weekend. Traffic volumes on Saturdays and Sundays are 11% and 17% lower than the Monday to Sunday average traffic volume respectively.

3.2.52 The ATC data has also been analysed to determine the typical hourly profile of traffic flows throughout a day. The hourly traffic flow profile is very similar between Mondays and Thursdays. However, it varies significantly from the typical weekday pattern on Fridays, Saturdays and Sundays, as shown in Figure 8.

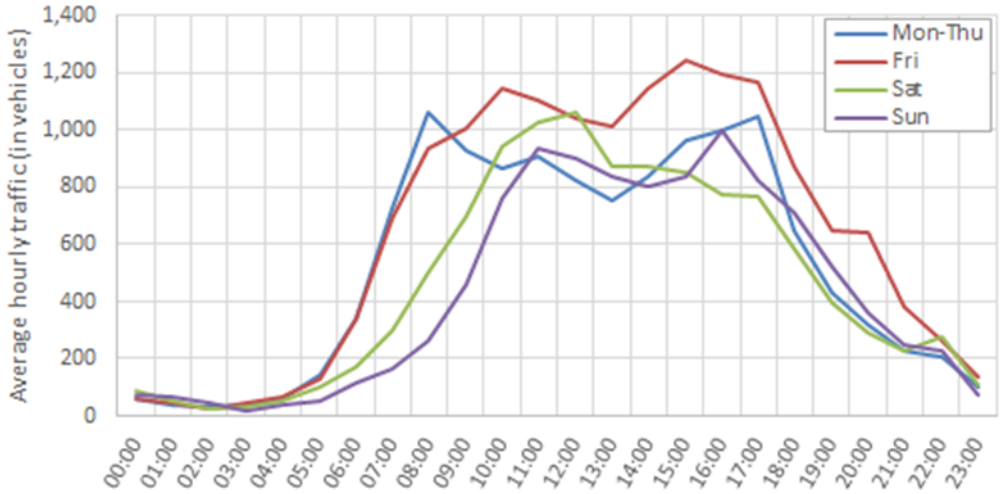


Figure 8 Hourly variation of traffic flows west of Llanddewi Velfrey

3.2.53 Figure 9 shows the tidality of traffic flows between Penblewin and Redstone Cross based on the manual classified count (MCC) collected at Redstone Cross on 30 March 2017. This illustrates that the westbound traffic is higher in the morning peak than the evening peak, whilst the reverse is the case for the eastbound direction. It is also evident that the evening peak is less pronounced than the morning peak.

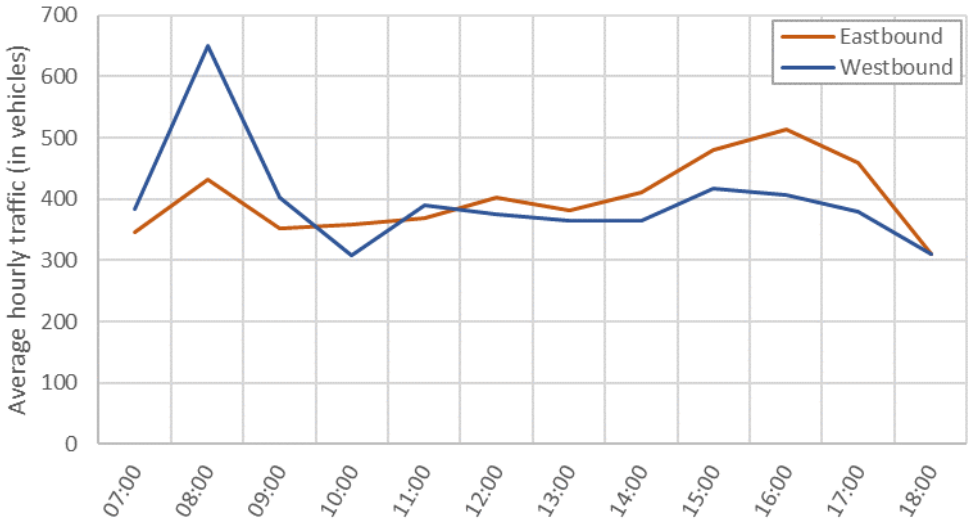


Figure 9 Tidality of traffic flows on A40 east of Redstone Cross

3.2.54 An analysis of the proportion of vehicle types by time of day has been undertaken between Penblewin and Redstone Cross based on the manual classified count (MCC) collected at Redstone Cross on 30 March 2017. The results of the analysis are shown in Figure 10.

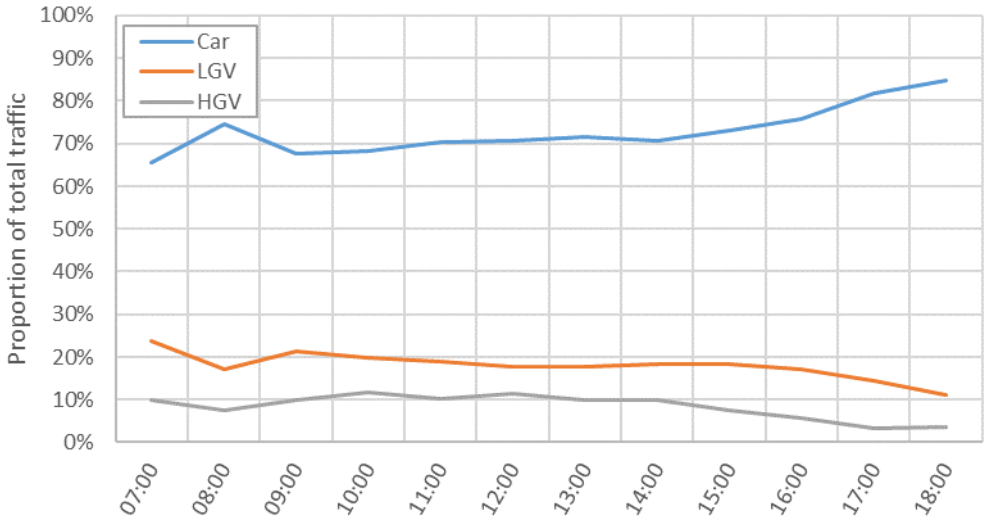


Figure 10 Proportion of vehicle types on A40 east of Redstone Cross

3.2.55 The proportion of light goods vehicles (LGV) and heavy goods vehicles (HGV) is highest in the inter-peak closely followed by the morning peak. The proportion of HGVs drops off significantly towards the evening peak. The average vehicle split throughout the surveyed period is 73% cars, 18% LGV and 8% HGV. Around 1% of total vehicles are made up of a mix of all other vehicles types, including motorcycles, coaches and public service buses.

Traffic Forecasts

3.2.56 Transport modelling is underway which will provide AADT data for forecast years in the 'do-minimum' and 'do-something' scenarios. This will be presented for WelTAG Stage 3 appraisals and will help identify any future capacity issues on the highway network. For the purposes of this Stage Two appraisal, it is assumed that traffic growth would continue to plateau as a central scenario, which would be consistent with past trends as identified in Figure 5.

3.2.57 However, it would reasonable to consider a high growth scenario in light of the national and local economic development policies and initiatives, including the Haven Waterway Enterprise Zone, the Swansea Bay City Region and associated movements of goods and people along the east-west corridor and from west Wales Ports.

Road Safety

3.2.58 As outlined above, this section of the A40 is considered to be substandard and has a perceived problem with regard to overtaking opportunities and associated risks of accidents.

3.2.59 The 2015 Design Options Report updated previous development work. It explains that historically there have been safety concerns along the A40 St Clears to Milford Haven, confirming that between 2009 and 2013 there were 99 collisions, of which 3 were fatal and 10 were serious. On average there were 20 collisions per year, with years 2009, 2012 and 2013 exceeding the annual average each year[26].

3.2.60 Section 3 of the Initial Traffic and Accident Data Report presents the updated details of historic traffic and accident data relevant to the Penblewin to Redstone Cross study area, with all personal injury accidents reported to the police for the ten-year period between October 2008 and September 2018, the most recent timeframe for which complete datasets are available.

3.2.61 A total of 8 PIAs recorded within the study area for the ten-year period as summarised in Table 10. The summary includes the number of vehicles involved and casualties as well as the location and circumstances under which each accident occurred.

Table 10 Details of individual accidents

Date & Time	Vehicles	Casualties	Details
30/06/2009 16:35	4	1	Occurred at Penblewin roundabout. Details of circumstances not recorded.
26/04/2010 11:55	2	1	Occurred at Redstone Cross. Details of circumstances not recorded.
08/03/2011 19:55	4	3	Occurred approximately 400m west of Penblewin roundabout. Details of circumstances not recorded.
27/01/2013 22:35	2	1	Occurred at Redstone Cross, where V1 was travelling eastbound on A40 approaching Redstone Cross when V1 has failed to take the left-hand bend & drifted across the carriageway coming into contact with V2 travelling in opposing direction.
27/06/2013 17:00	2	3	Occurred at Redstone Cross, where V1 pulled out from Redstone Road junction onto the A40 directly into path of V2 which was travelling westbound.
03/07/2013	2	2	Occurred at Redstone Cross, where V2 travelled along A40 & been indicating left (misleading). V1

[26] A40 St Clears to Haverfordwest Design Options Report Volume 1, Welsh Government 2015

Date & Time	Vehicles	Casualties	Details
08:30			been waiting at junction of A40 with B4313 & has seen misleading signal on V2 & pulled out in front of V2 believing it to be turning left into junction.
22/05/2017 08:22	3	2	Occurred approximately 500m east of Redstone Cross, where V1 commenced to overtake unknown V3. As V1 moved to his offside he collided with V2 which was travelling in the opposing direction.
06/03/2018 13:30	2	1	Occurred at Redstone Cross, where V2 travelled towards Haverfordwest on A40. Upon approaching Redstone Cross junction, V1 exited junction from Narberth into nearside of V2 HGV & into its path. V2 swerved across carriageway pushing V1 down the road.

3.2.62 Table 11 below demonstrates how the accidents within the study area were distributed over the last ten years. Given that the section of A40 analysed is relatively short and traffic flows are relatively low there are several years in which no PIAs were recorded at all. However, this should not be interpreted as meaning that this section of A40 currently has a good safety record as explained further in the following analysis.

Table 11 Road traffic accidents by year and severity

Year	Fatal	Serious	Slight	Total
2009	0	0	1	1
2010	0	0	1	1
2011	1	0	0	1
2012	0	0	0	0
2013	0	1	2	3
2014	0	0	0	0
2015	0	0	0	0
2016	0	0	0	0
2017	0	1	0	1
2018	1	0	0	1
Total	**2**	**2**	**4**	**8**

3.2.63 Combined link and junction accident rates have been calculated according to the methodology provided within WebTAG. A comparison of the observed accident rates with the WebTAG default accident rates of the corresponding road type is shown in Table 12.

Table 12 Link and junction accident rates (average of years 2009 to 2018)

Location	Observed	WebTAG default
Redstone Cross to Penblewin Roundabout	0.160	0.196

3.2.64 The results show that this section of the A40 generally has a slightly lower than average accident rate for this type of road. However, Table 13 shows that a high proportion of accidents result in fatal and serious injuries on this stretch of A40. A comparison against the default severity split given in the COBA-LT software demonstrates that the severity of accidents on this section of the A40 is particularly skewed towards fatalities, with likelihood of a fatality ten times higher than observations on roads of similar standard.

Table 13 Road traffic accident severity split (observed versus COBA-LT default)

Severity Split	Fatal	Serious	Slight
Observed	25.0%	25.0%	50.0%
COBA-LT default, Older S2 A roads, >40mph	2.8%	15.3%	81.9%

3.2.65 Observed accident rates along the A40 are lower than the average default accident rate for this type of road, but accident severities are significantly higher meaning that the rate at which fatalities and serious injuries occur on this section of road is much higher than would statistically be expected from a road of this standard.

Speed Profile

3.2.66 Initial average speed analysis has been undertaken based on Traffic Master data for two sections of the A40 either side of Llanddewi Velfrey, to provide a high-level indication of potential journey time reliability issues. The data for average traffic speeds in October 2015 for normal school days (Monday to Thursday) do not show significant variations in average speeds during the day (07:00 – 19:00) although speeds do vary significantly when compared to the off-peak hours. Whilst the limitations of this data is acknowledged, it does show some potential journey time unreliability for drivers.

3.2.67 Further interrogation and more reliable data about journey times will be available to inform further appraisal during WelTAG Stage 3.

3.3 Social and Cultural

Study Area

3.3.1 The study area extends some 3km from the centre point of the route to capture the relevant communities, facilities and services within the wards of Narberth, Narberth Rural Martletwy, Maenclochog and Lampeter Velfrey.

Settlement Patterns / density

3.3.2 Pembrokeshire is one of the most rural counties in Wales with an estimated population of 124,71127 and a population density of 76 people per square kilometre compared to Welsh average of 149. 2 of the county's largest towns are connected to the wider region by the A40, including Haverfordwest with a population of approximately 12,000 and Milford Haven with a population of approximately 13,90028.

3.3.3 The study area comprises the wards of Narberth, Narberth Rural Martletwy, Maenclochog and Lampeter Velfrey, and has a total population of 10,104. The main settlement in the area is the town of Narberth, with a population of 1,923. Population density across the study area is 4.6 persons per hectare, compared with 0.8 for Pembrokeshire and 1.5 across Wales. Outside of Narberth, the study area density is 0.4 persons per hectare.

Community facilities/amenities

3.3.4 A review has been undertaken of the facilities and amenities within an approximate 3km radius of the existing A40. Rushacre Enterprise Park is located within approximately 700m south of Redstone Cross junction with Redstone Road. The enterprise park was established in 2007.

3.3.5 Business and services within the local area include a car dealership; farming products and services; building supplies; bike hire; pet supplies; solar farm operations and maintenance; a community centre; a farm shop; an embroidery and print company; a garage; cleaning services; a gallery and gift shop; an art and framing shop; a baker; a fairy farm; a homeware shop; a weaving company; a caravan park; a

[27] ONS Population estimates, 2017 (accessed February 2019)
[28] 2011 Census of Population, Table KS101EW – Usual resident population (accessed March 2017)

care home; a glassworks and a veterinary centre.

3.3.6 Facilities and amenities are concentrated within Narberth with limited facilities provided elsewhere in the study area.

Population profile

3.3.7 Figure 11 illustrates the age profile of the study area, in comparison with Pembrokeshire and Wales. This shows that the study area has a slightly higher than average proportion of residents falling into older age groups, and a slightly lower than average proportion of residents who are children under the age of 16. 23.0% of residents of the study area are aged 65 and over, 60.2% are aged between 16 and 64, and 16.8% of residents are aged 15 and under.

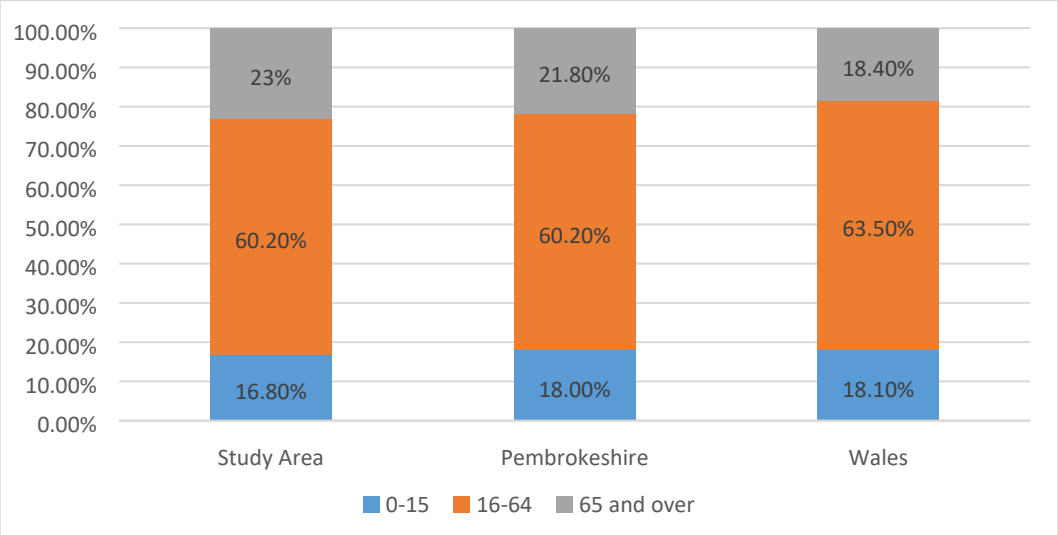


Figure 11 Age profile (Source: ONS, Census 2011)

3.3.8 Data on household composition shows that the study area also has higher than national average proportions of households where all members are aged 65 and over. This is in line with averages for Pembrokeshire overall. 14.8% of all households are single-person households aged 65 and over, and 11.1% are single-family households where all are aged 65 and over. The corresponding figures for Wales are 13.7% and 8.9% respectively.

Table 14 Household composition (Source: ONS, Census 2011)

		Study area	Pembroke-shire	Wales
One person household	Total	20.8%	30.9%	30.8%
	Aged 65 and over	14.8%	15.0%	13.7%
	Other	13.1%	15.8%	17.1%
One family only	Total	66.0%	63.7%	62.8%
	All aged 65 and over	11.1%	10.9%	8.9%
	Married, same-sex civil partnership or cohabiting couple	45.2%	41.8%	42.5%
	Lone parent	9.7%	11.0%	11.4%
Other		6.1%	5.4%	6.5%

Economic Activity

3.3.9 The older than average age profile of the study area is reflected in data for economic activity, which shows that 18.3% of residents are retired. This is slightly below the figure for Pembrokeshire (18.7%), but above the national average (16.1%). The study area has a higher than average rate of economic activity, with low levels of unemployment and a lower than average proportion of residents who are long-term sick or disabled. The proportion of working-age residents who are employed full-time is, however, lower than the national average, and it is notable that there is a high rate of self-employment: 19.5% of working-age residents of the study area are self-employed, compared with 13.5% in Pembrokeshire and 8.6% nationally.

Table 15 Economic activity (Source: ONS, Census 2011)

		Study area	Pembroke-shire	Wales
Economically active	Total	68.7%	66.0%	65.8%
	Employed full-time	14.1%	30.9%	35.6%
	Employed part-time	31.0%	15.3%	13.9%
	Self-employed	19.5%	13.5%	8.6%
	Unemployed	2.1%	4.0%	4.3%
	Full-time student	2.0%	2.2%	3.3%
Economically inactive	Total	31.3%	34.0%	34.2%
	Retired	18.3%	18.7%	16.1%
	Student	4.4%	3.8%	6.0%
	Looking after home or family	3.3%	4.3%	3.8%

		Study area	Pembroke-shire	Wales
	Long-term sick or disabled	3.9%	5.3%	6.3%
	Other	1.4%	1.9%	2.0%

Travel to work

3.3.10 Table 16 presents data on the method of travel to work used by residents of the study area, in comparison with Pembrokeshire and Wales. The proportion of residents who travel to work using a car, taxi or motorbike is lower than the average for Pembrokeshire and Wales. The proportion of residents using buses or trains is also below average, reflecting the rural nature of the area and the relative lack of public transport provision. It is notable that the proportion of residents who work mainly at or from home is significantly higher than the national and local average.

Table 16 Method of travel to work (Source: ONS, Census 2011)

	Study area	Pembrokeshire	Wales
Car, taxi or motorbike	72.5%	73.2%	75.2%
Train, metro, light rail or tram	1.0%	0.5%	2.1%
Bus, minibus or coach	1.0%	3.0%	4.6%
Bicycle	0.6%	0.9%	1.4%
On foot	9.1%	11.9%	10.6%
Other method	0.8%	0.9%	0.6%
Work mainly at or from home	14.9%	9.7%	5.4%

3.3.11 Figure 12 below shows the distance travelled to work by residents of the study area, in comparison with Pembrokeshire and Wales. This suggests that, in general, residents of the study area are more likely to travel longer distances to work, with 39.5% travelling more than 10km compared with 29.8% in Pembrokeshire and 31.3% nationally. This trend reflects the traffic patterns of higher traffic levels on a Friday PM peak, with workers returning home from working outside of the region. The proportion who state that they work mainly at or from home is again higher than average, at 24.8% compared with 17.3% for Pembrokeshire and 10.4% nationally.29 It is likely that this reflects both the rural nature of the area and the relatively high proportion of self-employment among residents of working age.

[29] These figures for home-working are considerably higher than those presented in Table 10. This is because of differences in the way method of travel to work and distance travelled to work are calculated.

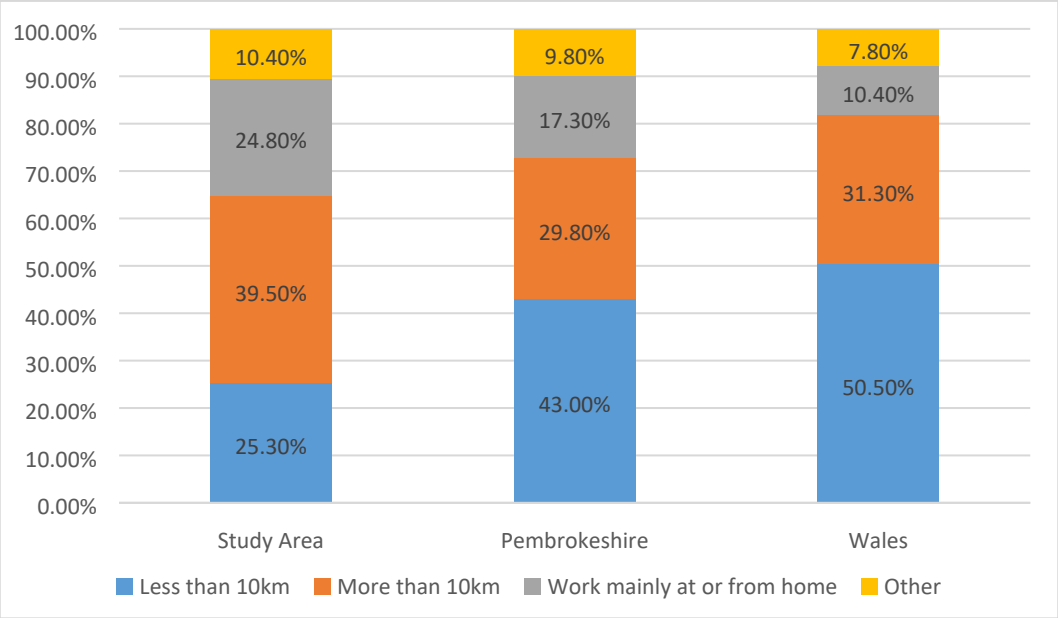


Figure 12 Distance travelled to work (Source: ONS, Census 2011)

Access to transport

3.3.12 Car ownership in the study area and across Pembrokeshire is relatively high. Figure 13 shows the proportion of households that do not have access to a car or van. In the study area, only 10.4% of households fall into this category, compared with 17.9% across Pembrokeshire and 22.9% nationally.

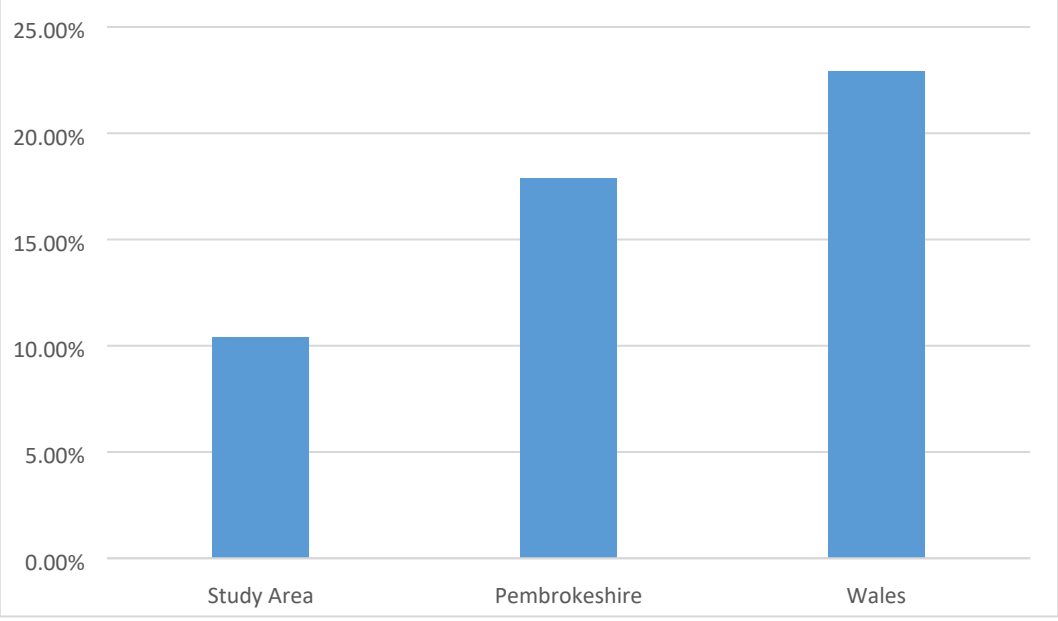


Figure 13 Proportion of households without access to a car or van

3.3.13 This is in line with national trends, which show that car ownership is

generally higher in rural areas than in urban areas. This also reflects the population profile of older people living in the study area.

3.3.14 Data from the National Survey for Wales 2013-14 shows that 86% of people in rural areas have access to a car, compared with 77% in urban areas[30]. Car ownership in rural areas also tends to be less sensitive to motoring costs than in urban areas[31], reflecting the lack of alternative modes of transport and the importance of car ownership in accessing services and employment.

3.3.15 Analysis by Sustrans Cymru suggests that between 40 and 50% of people in Pembrokeshire could find the costs of running a car challenging[32].

3.3.16 The Welsh Index of Multiple Deprivation shows that Martletwy, Lampeter Velfrey, Maenclochog (2) and Narberth Rural experience relatively high rates of deprivation in terms of access to services, underlining the importance of access to cars and other forms of private transport. Martletwy in particular is the 58th most deprived Lower Super Output Area (LSOA) of 1,909 in Wales.

3.4 Environmental

3.4.1 This section of the report presents the baseline situation in relation to key environmental considerations. The level of detail is reflective of the fact that work to date has mainly involved desk-based reviews and limited survey information. At the time of writing, environmental surveys are underway and further information will be available for further appraisal at WelTAG Stage 3.

Air Quality

3.4.2 Air quality monitoring is undertaken in both Pembrokeshire and Carmarthenshire using diffusion tubes. No monitoring has been undertaken by local authorities in the vicinity of the route with the nearest monitoring location being an automatic monitor in Princes Gate, 4km south of this section of A40. Scheme specific NO2 monitoring was carried out in 2017 for the A40 LVP Scheme. Details of the monitoring

[30] National Survey for Wales, 2013-2147014 – Transport.
[31] Dargay, J. (2002) Determinants of car ownership in rural and urban areas: a pseudo-panel analysis. Transportation Research E, 38 (5), pp.351-366. Accessed online: http://eprints.whiterose.ac.uk/2486/1/ITS2106-determinants_of10_car_ownership_uploadable.pdf
[32] Sustrans Cymru (2012) Access Denied: Transport poverty in Wales.

sites are shown in Table 17 and monitoring results are shown in Table 18.

3.4.3 Scheme specific monitoring and background pollutant mapping from Defra have been used to determine the baseline air quality conditions.

Table 17 A40 Llanddewi Velfrey Scheme Specific NO_2 Monitoring details (2017)

DT ID	Site ID	Type	X	Y	Distance to Scheme (km)
1	AURN – Princes Gate	Background	214376	212776	4.8
2	Blackmore Hill	Roadside	211430	216592	0.3
3	Penblewin Roundabout	Roadside	212055	216635	0.1
4	Maes-y-Rhos (Public footpath)	Roadside	214356	217009	2.4
5	Llanfallteg junction	Roadside	214741	216897	2.7
6	Penllan	Roadside	215562	216855	3.4
7	Willow Tree School for Dogs	Background	215100	217030	3.2

Table 18 A40 Llanddewi Velfrey Scheme Specific NO_2 Monitoring details (2017)

DT ID	Site ID	Annualised and bias adjusted NO_2 concentrations (µg/m^3)
1	AURN – Princes Gate	2.7
2	Blackmore Hill	19.9
3	Penblewin Roundabout	20.1
4	Maes-y-Rhos (Public footpath)	7.4
5	Llanfallteg Junction	18.2
6	Penllan	18.5
7	Willow Tree School for Dogs	4.0

3.4.4 The A40 LVP NO2 monitoring at all sites is well below the relevant air quality objective (40 µg/m3). The highest recorded concentration was 20.1 µg/m3 at Penblewin roundabout.

3.4.5 Background pollutant concentrations of NO_2, PM_{10}, and $PM_{2.5}$ are well below the relevant air quality objectives (40 µg/m^3). This reflects the rural nature of the area. The predicted background pollutant concentrations for the baseline year (2017), opening year (2023), and

future year (2038) for NO_2, PM_{10}, and $PM_{2.5}$ are shown in Tables 11, 12 and 13 respectively. The background pollutant mapping is produced for each year up until 2030, therefore, the future year (2038) concentrations are based on 2030 concentrations.

Table 19 NO_2 Background Pollutant Concentrations

Grid reference	Background NO_2 (µg/m^3)		
	2017	2023	2038 (based on 2030)
210500_215500	3.9	3.0	2.6
210500_216500	4.3	3.3	2.8
211500_216500	4.3	2.2	2.8

Table 20 Background PM_{10} Concentrations

Grid reference	Background PM_{10} (µg/m^3)		
	2017	2023	2038 (based on 2030)
210500_215500	10.4	9.8	9.6
210500_216500	9.9	9.3	9.1
211500_216500	9.8	9.2	9.0

Table 21 Background $PM_{2.5}$ Concentrations

Grid reference	Background $PM_{2.5}$ (µg/m^3)		
	2017	2023	2038 (based on 2030)
210500_215500	6.2	5.6	5.5
210500_216500	6.1	5.7	5.4
211500_216500	6.1	5.6	5.4

Noise

3.4.6 The area surrounding the existing A40 is predominantly rural and sparsely populated, however there are a few isolated properties within proximity to the A40 and the immediate surrounding area.

3.4.7 The study area is within a Noise Action Plan Priority Area, which comprises Redstone Cross and extends for approximately 600m east.

Landscape and Townscape

3.4.8 The Scheme is located between Carmarthen in Carmarthenshire and Haverfordwest in Pembrokeshire, with the Preseli Hills 12km to the north and Carmarthen Bay 10km to the south. One kilometre to the west are the upper reaches of the Afon Cleddau, while to the west lies the

Afon Taff. Within the 5km study area, there is one Registered Historic Park and Garden, Blackaldern, to the south of the Scheme near Narberth. There are no Historic Landscape Areas. Two of the three areas of the Pembrokeshire Coast National Park (PCNP) lie close to the Scheme. Eastern Cleddau Valley and surrounding landscape approach to within 3.8 km to the west, and Carmarthen Bay and surroundings, approach to within 8km to the south east.

3.4.9 The setting of the Scheme is entirely rural, lowland agricultural landscape with the existing road passing through hedged pastureland and woodland. The population is dispersed with scattered houses and small villages. The landform is undulating with convex-sloped ridges and small valleys formed by winding flashy watercourses and narrow, damp floodplains. The land consists of improved or semi-improved grassland used for grazing, silage/haylage with fields divided by hedges and hedge banks with small linear belts of woodland mainly alongside the watercourses or on steeper slopes. The existing A40 west of Penblewin roundabout follows the spring line along the south side of the Sodston Ridge. The springs flow south and east in small, narrow and wet valleys. At Redstone Cross there is a scattered group of farms and other residential properties, with ribbon development associated with Narberth along the B4313 to south. Narberth is the largest town in the area. To the west of Redstone Cross the topography gradually becomes more pronounced with long steep-sided ridges and wider valleys.

Biodiversity

3.4.10 A review of both statutory and non-statutory designated sites for nature conservation has been undertaken within the appropriate zone of influence of the proposed Scheme options.

3.4.11 There are four Special Areas of Conservation (SAC) within 10km of the Scheme, the closest being the Cleddau Rivers SAC which lies 1.3km to the west. Pembrokeshire Bat Sites and Bosherton Lakes SAC lies 7km to the west of the site and there are a further two SACs designated for bats within 30km.

3.4.12 The Eastern Cleddau River Site of Special Scientific Interest (SSSI) which forms part of the Cleddau Rivers SAC also lies 1.3km to the west. There are four further SSSIs within 5km of the site: Bryn Bank Quarry SSSI, Llanfallteg Track Section SSSI, Milford Haven Waterway SSSI

and Robeston Wathen Quarries SSSI. There are no non-statutory locally designated sites for nature conservation within the 2km.

3.4.13 The habitats either side of the A40 predominantly include fields comprising improved grassland and semi- improved grassland. These fields are bordered by mature hedgerows of varying diversity, often with mature trees. To the south of the existing A40, in line with the two southern options, lies two areas of semi-natural broadleaved woodland largely associated with the locations of the freshwater streams in this area. Much of this woodland comprises wet woodland; a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and is bordered by woodland scrub and areas of marshy grassland.

3.4.14 Of the European Protected Species (EPS), the habitats either side of the A40 are suitable to support several bat species including greater and lesser horseshoe bats which are the qualifying features of the nearby bat SAC, otter, dormouse, great crested newt and barn owl. The habitats present support a diverse assemblage of breeding birds, as well as a population of badgers. Other protected or notable species potentially present include water voles and reptiles.

Cultural Heritage

3.4.15 The archaeological and cultural heritage assets contained within the area covered by the route option is varied. Most sites are from the last two hundred years, with a range of sites in the area stretching back through the medieval to the Prehistoric period.

Neolithic (4000 BC to 2200 BC)

3.4.16 Although Mesolithic and probably earlier, people had used this area, it is not until the Neolithic that evidence of man is known. This is limited to a couple of isolated findspots and the Llan burial chamber in Lampeter Velfrey. In the study area, there must be further Neolithic sites, but they have yet to be identified.

Bronze Age (2500 BC to 700 BC)

3.4.17 Evidence of Bronze Age use of the area is shown by large numbers of round barrows in the Redstone area. These represent a belief in the afterlife shown by the burials within them. Bronze Age society was relatively mobile; burial sites being a fixed point the landscape, located

on relatively high points. Five groups of such sites have been designated as Scheduled Ancient Monuments, including one to the north east of Redstone Cross.

3.4.18 Evidence of domestic use of the area is shown by the frequent discovery of burnt mounds. These are collections of burnt fire shattered stone in a matrix of charcoal rich soil. They are typically found in close association with springs or small watercourses. Radiocarbon dating normally shows them to be of Bronze Age date, although some are earlier and they can be as late as the Post-Roman era. On excavation, these features are usually associated with a small water-filled trough. This technique can be used for cooking or possibly, some form of sauna. These sites are very common in Wales, Ireland and Scotland. It is likely that many more of these insignificant sites await discovery in the area, as shown by over 50 such sites found on the route of a pipeline across South Wales.

Iron Age (800 BC to AD 43)

3.4.19 This period is characterised by a more settled economy featuring defended enclosures often containing houses enclosed by defensive bank and ditch. Some were formed by cutting off ridges with an earth bank to create a promontory fort. There are several of these in the western study area using the ridges along the meanders of the East Cleddau River Valley. The economy of these people is thought to be based on herds of cattle and sheep which required protection. There are many other similar enclosures known only from cropmarks in the area. Although these sites originate in the Iron Age, many continue to be used through the Roman period and it is likely that some continued even into the post Roman period.

Roman (AD 43 to AD 410)

3.4.20 The most obvious evidence of Roman activity in the study area is the line of the road running west from Whitland along the north of the study area. This was well constructed with evidence of 2 periods of construction. It can be traced towards the Roman fort at Wiston, just outside study area. Though the road is likely to have had its origins in the military period, it indicates strong interest in West Wales. No other sites of Roman date have been identified, although activity has been recorded in some of the Iron Age sites adjacent to the study area. This is typical and is probably repeated in similar sites in the study area.

Early Medieval (AD 410 to AD 1066)

3.4.21 The adoption of Christianity during the Roman period can be seen in the discovery of inscribed crosses in several locations dating to the early medieval. Domestic settlement probably continued or re-established itself in the defended enclosures, although new centres of settlement probably began, possibly in the locations used by later farms and, consequently, are difficult to identify.

Medieval (1066 to 1540)

3.4.22 Llanddewi Velfrey, Lampeter Velfrey and Crinow were part of the commote of Efelffre, a pre-Norman territorial unit, which was the origin of the suffix Velfrey.

3.4.23 The medieval period is characterised by castles and churches with associated settlement that signified a settled landscape with a developed farming system. To the east was the Whitland Abbey, which is most associated with being the place where Hywel Dda drew up his laws around 940. It functioned as a Cistercian monastery between the 12th and 16th centuries.

3.4.24 The period saw the early development of market towns such as Narberth, and some of the larger villages began to develop such as Lampeter Velfrey, Clunderwen and Llandissilio. The villages were set in a landscape of long rectangular fields, parts of which can be seen in the present-day landscape.

Post-medieval (1540-1901)

3.4.25 The strong social and cultural division of West Wales, the Landsker line, probably was at its strongest in this period. Though it originates from the settlement of Flemings in South Pembrokeshire in the 12th century, the clearest evidence for the linguistic provision comes from names, records and civil transactions of the later period. The study area lies north of the Landsker division and firmly in the Welsh speaking area.

3.4.26 Communications were prominent in this period. The line of the A40 in the area was adopted as a turnpike operated by the Whitland Trust. A later development was the railway line from Carmarthen to Haverfordwest erected in 1854 along the north of the study area.

Whitland was the junction for lines to Pembroke Dock, Tenby, Fishguard and Cardigan. The station became a marshalling yard and was a focal point in the transport of agricultural products to industrial areas. The construction of a milk processing factory gave a huge impetus to the development of the town. This was in contrast the town of Narberth, isolated from both the A40 and the railway leading to a slower growth.

3.4.27 Settlement appears to have moved more toward the line of the present day A40 as shown by historic maps in the 19th century. This resulted in the development of scattered linear settlement along the A40, such as that at Redstone Cross, while scattered settlement accessible by tracks leading north from the A40 are likely to be considerably older.

Designated and undesignated sites

3.4.28 Sites that are located within 500m of the route options include 12 Listed Buildings (LB) within 500m of the existing A40, which would also be within 500m of the northern and southern routes. There include 3 Grade II Listed Buildings at Cilrath Fach to the north of Redstone Cross, 1 at Sodstone Manor and 2 at Sodston House to the north east, with 2 more at Blaen Marlais and two at Blaen-ffynnonau beside the Narberth Road to the south of Redstone. There are no direct physical impacts on any of these sites, although it is possible that noise and visual perception may be impacted in certain circumstances.

3.4.29 The historic core of Narberth, which includes the site of Narberth Castle, lies 1.4 km to the south of Redstone Cross is designated as a Conservation Area.

3.4.30 There is a Scheduled Ancient Monument (SAM), to the north of the existing A40 north east of Redstone Cross which covers a group of barrow mounds in a field within 30 metres of the A40. There are a further 11 SAMs within 5km, for example:

a) Caerau Gaer a prehistoric defensive enclosure located 1.9km to the east-southeast of Penblewin
b) Llanddewi Gaer Promontory Fort located 2.4km to the east southeast of Penblewin
c) Narberth Castle located 1.7km south of Redstone Cross
d) Caneston Wood Iron Age domestic enclosure 1.9km southwest of Redstone Cross

e) Bush Inn Camp Prehistoric Promontory Fort located 3.3 km west of Redstone Cross

f) Vaynor Gaer Prehistoric Defensive Ringwork located 1.7km north east of Redstone Cross.

3.4.31 There are a range of non-designated archaeological sites recorded in the Historic Environment Record (HER) within the setting of the route options. A standing stone is located close to the barrows within the SAM and it is believed that 'cattle scratching post' could have originated as a Standing Stone in the area and could possibly have been relocated to its current position. On the north side of the A40 the Medieval field pattern is partially preserved as hedges.

Recent archaeological investigations

3.4.32 A full non-invasive geophysical survey and an archaeological walkover survey of the land to the north and south of the existing A40 have identified the likely remains of a significant number of previously unrecorded barrows and associated bronze age features along the ridge to the north of the existing A40 from Penblewin to Redstone Cross. There are no similar features identified to the south. Those features to the north would be affected by northern route options and those closest to Penblewin would be affected by aspects of the southern route.

Agriculture

3.4.33 According to the Predictive Agricultural Land Classification Map, the study area predominantly comprises of sub-grade 3b moderate quality agricultural land with some small areas of sub-grade 4 poor quality agricultural land as well as non-agricultural land. To the south of Redstone Cross, Narberth is classified as urban.

Water Environment

3.4.34 The existing A40 west of Penblewin roundabout follows the spring line along the south side of the Sodston Ridge. The springs flow south in small, narrow and wet valleys. The B4313 south to Narberth from Redstone Cross follows higher ground which divides the catchments of the Taf and Cleddau. There are five watercourses directly under the Scheme corridors or within the immediate setting, these are described from west to east and all seem to arise from springs close to the existing A40 road:

a) A small un-named watercourse which appears to arise near to Redstone Cross and then flows south west to meet the Eastern Cleddau at Caneston Bridge. The Eastern Cleddau is part of a marine Special Areas of Conservation (SAC).

b) The Afon Marlais which appears to arise from springs and pools just to the east of Redstone Cross to flow eastwards to Pant-y-gorphwys on the Narberth Road. From here it flows east to converge with the Afon Taf near Whitland. The estuary of the Afon Taf is part of a marine Special Areas of Conservation (SAC).

c) A very minor un-named watercourse arising from springs and pools just to the west of Blackmoor Farm. This forms the southern edge of seasonally wet fields and flow east as a tributary of (d) below;

d) A minor un-named watercourse arising from springs and pools just to the south of Blackmoor Farm. This forms the northern edge of the seasonally wet fields and flows east as a tributary of the Afon Marlais which it meets just to the west of Pant-y-gorphwys on the Narberth Road.

e) A minor unnamed and probably seasonal watercourse arising to the north west of Penblewin roundabout and crossing under the A40 around 400 metres west of the roundabout. This merges with watercourse a) above just to the west of Pant-y-gorphwys on the Narberth Road;

3.5 Economic

Economic performance and industrial structure

3.5.1 Data on Gross Value Added (GVA) per head of population can be used to give an indication of economic performance. This data is available for local authorities of the UK, but not at lower level geographies.

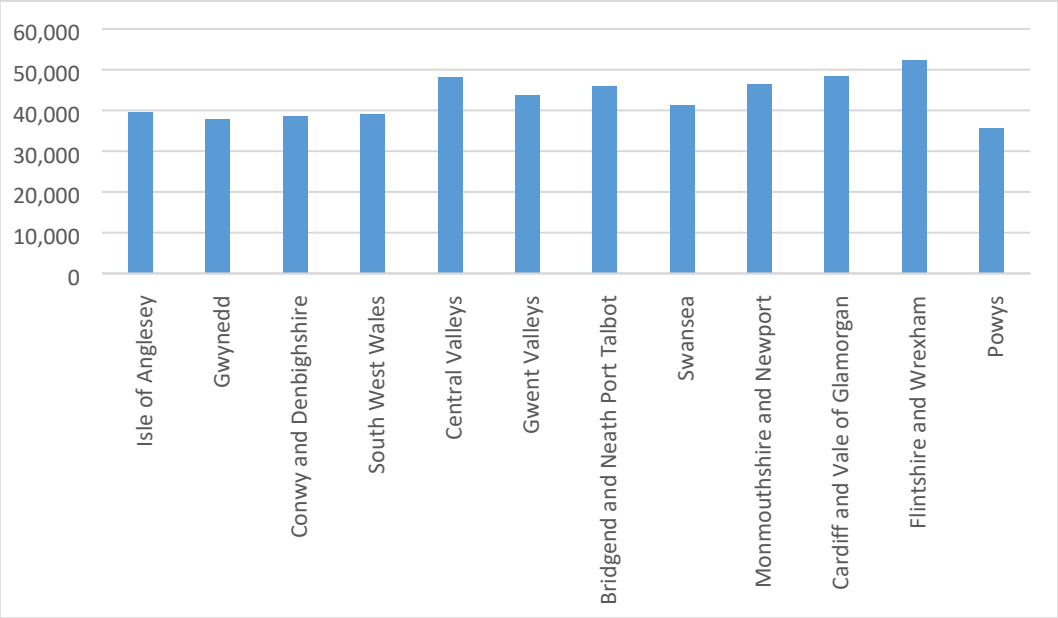
3.5.2 Table 19 presents data on GVA per filled job, which can be used as a measure of productivity. This shows a similar pattern, with South-West Wales recording the fourth lowest level, out of twelve subregions, of GVA per filled job in Wales in 2017. GVA per filled job was £38,987 in South-West Wales, compared with £44,407 across the country.

Table 22 Gross Value Added (GVA) Income Approach by Local Authority

Local Authority	GVA per head (2015) (£million)	Percentage change (2010-2015)
Caerphilly	13,415	+17.60%
Powys	16,971	+17.60%
Bridgend	19,560	+17.00%
Gwynedd	18,855	+16.60%
Conwy	15,568	+16.30%
Wrexham	18,683	+15.70%
Flintshire	23,648	+15.70%
Carmarthenshire	15,159	+15.40%
Torfaen	16,250	+14.30%
Rhondda Cynon Taf	15,431	+14.20%
Merthyr Tydfil	15,420	+14.10%
Vale of Glamorgan	15,894	+14.00%
Denbighshire	16,482	+12.80%
Swansea	18,577	+12.70%
Neath Port Talbot	15,191	+12.60%
Ceredigion	16,849	+12.20%
Isle of Anglesey	13,411	+11.70%
Monmouthshire	20,418	+11.30%
Blaenau Gwent	10,980	+9.00%
Cardiff	25,243	+8.50%
Pembrokeshire	15,905	+7.60%
Newport	20,851	+5.00%

(Source: ONS, Regional GVA, 2015)

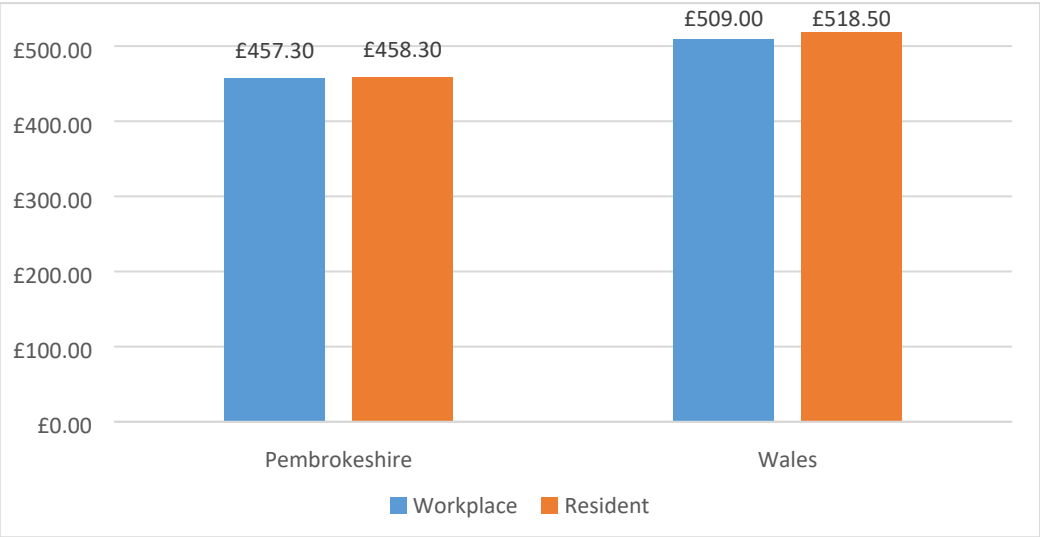
3.5.3 Figure 14 GVA per filled job, NUTS3 areas in Wales shows that Pembrokeshire recorded the 13th out of 22 local authorities for GVA per head in Wales in 2015. Pembrokeshire also came 21st in terms of percentage increase over the 2010 to 2015 period.



(Source: ONS, Subregional productivity, 2017)

Figure 14 GVA per filled job, NUTS3 areas in Wales

3.5.4 Data on average wages is available at local authority level. This shows that Pembrokeshire is also a relatively low-wage economy, recording median gross weekly earnings that are significantly below the national average on both a resident and workplace basis. The underlying data shows that Pembrokeshire has some of the lowest average wages in Wales, with only Conwy and the Isle of Anglesey recording lower workplace-based wages, and only Merthyr Tydfil recording lower residence-based wages.



(Source: ONS, Annual Survey of Hours and Earnings, 2018)

Figure 15 Median gross weekly pay, workplace and resident-based

3.5.5 It is likely that this data reflects the importance to the local economy of

employment in several relatively low-wage and low-productivity sectors such as agriculture, forestry and fishing, and accommodation and food services[33] and the relative under-representation of higher-productivity sectors such as manufacturing and business services, as well as the higher than average rate of self-employment recorded across the county (see Table 15).

3.5.6 Table 23 sets out data on industry of employment, and shows that both Pembrokeshire and the study area record higher than average proportions of working-age residents in agriculture, forestry and fishing, and in professional, scientific and technical activities. Pembrokeshire also has a higher than average proportion of residents working in accommodation and food, reflecting the importance of tourism and the visitor economy.

Table 23 Industry of Employment – proportion of residents aged 16-74

Industry	Wales	Pembrokeshire	Study Area
G Wholesale and retail trade; repair of motor vehicles and motor vehicles	15.6%	15.7%	14.7%
Q Human health and social work activities	14.5%	13.4%	13.8%
P Education	10.1%	9.3%	9.9%
F Construction	8.2%	10.7%	9.7%
A Agriculture, forestry and fishing	1.7%	4.7%	8.1%
I Accommodation and food service activities	6.2%	8.7%	7.1%
C Manufacturing	10.5%	7.6%	6.9%
O Public administration and defence; compulsory social security	7.9%	7.4%	6.3%
M Professional, scientific and technical activities	4.3%	4.1%	5.4%
R, S Arts, entertainment and recreation; other service activities	4.5%	5.1%	5.3%
H Transport and storage	3.9%	4.0%	3.5%
N Administrative and support service activities	4.0%	3.6%	3.4%
K Financial and insurance activities	3.1%	1.3%	1.5%
J Information and communication	2.3%	1.2%	1.5%
L Real estate activities	1.2%	1.2%	1.2%
E Water supply, sewerage, waste management and remediation activities	0.9%	0.7%	0.7%
B Mining and quarrying	0.2%	0.5%	0.5%
D Electricity, gas, steam and air conditioning supply	0.8%	0.7%	0.5%

[33] A recent report by the Institute of Public Policy Research into Britain's low-wage sectors identified the following sectors that are both low-wage and low-productivity: agriculture, forestry and fishing; wholesale and retail trade and repair of motor vehicles; accommodation and food services; administrative and support service activities; and arts, entertainment and recreation. IPPR (2016) Boosting Britain's Low-wage Sectors: A strategy for productivity, innovation and growth.

Industry	Wales	Pembrokeshire	Study Area
T Activities of households as employers; undifferentiated goods - and services - producing activities of households for own use	0.0%	0.0%	0.1%
U Activities of extraterritorial organisations and bodies	0.0%	0.0%	0.0%

3.5.7 Despite recording lower than average levels of productivity across South-West Wales and lower than average wage rates in Pembrokeshire, both the study area and Pembrokeshire have a relatively highly-qualified workforce. Within the study area, 31.2% of residents aged 16 and over have a degree-level qualification, compared with 24.8% in Pembrokeshire and 24.5% across Wales. The proportion of the population with no formal qualifications is also below average in both the study area and Pembrokeshire.

Economic development and opportunities for growth

3.5.8 The data above supports the strategic developments and economic regeneration initiatives within the Pembrokeshire economy, which aim to stimulate economic development, create high-skilled jobs and reduce the claimant count (and could affect traffic levels using the A40 in the future):

a) The formation of the Swansea Bay City Region;
b) The further growth of the Haven Waterway Enterprise Zone;
c) The growth plans for Pembroke Port and the Port of Milford Haven; and
d) Pembrokeshire County Council Local Development Plan proposals.

Swansea Bay City Region

3.5.9 The Swansea Bay City Region covers the local authority areas of Swansea City, Neath Port Talbot, Carmarthenshire and Pembrokeshire, extending over an area of 4,805 square kilometres and with a combined population of over 698,733 (2017 Population Estimates).

3.5.10 The city region is seen to offer a new approach to economic regeneration, offering:

a) Larger and more efficient labour markets and therefore better prospects for job creation;

b) Scope for better planning of housing, transport, support for business and other services beyond existing administrative boundaries; and

c) Better prospects for attracting inward investment and value added economic activity.

3.5.11 The Region board have recently outlined a £1.3bn City Deal which would fund projects covering the four local authorities over a 15-year period.

3.5.12 Investment aims to deliver up to 9,465 new jobs in the region, contributing to uplift in gross value added (GVA) of £1.8bn.

3.5.13 Of the 11 projects that were defined at the bid stage, the Haven Waterway area featured with £76.3m identified for the Pembroke Dock Marine project which would focus on the development of a marine energy test area utilising the deep port of Milford Haven, an energy engineering centre of excellence and a wave energy demonstration zone.

3.5.14 A fund of £650,000 has been allocated to kick start dockyard improvements as part of the Pembroke Dock Marine project34.

3.5.15 It is considered that the A40 connection to the Enterprise Zone will contribute to the success of the project identified within the City Deal, to provide fit-for -purpose strategic highway infrastructure to this strategic employment area.

Haven Waterway Enterprise Zone

3.5.16 In 2012, the Haven Waterway was declared an Enterprise Zone by the Welsh Government, due to its importance for the energy sector. The Zone is considered to be an attractive location for energy companies with its excellent access to energy infrastructure, established supply chain and distribution infrastructure, skilled workforce and network of universities with expertise in a range of energy-related fields.

3.5.17 The zone is also recognised for gaining a marine energy focus and for its diversity and innovation with a range of local businesses. Alongside new and established energy, food and tourism businesses and their extensive supply chains, life sciences, ICT and manufacturing firms are

[34] https://www.mhpa.co.uk/news/2017/12/19/port-gives-green-light-for-cash-to-kick-start-76m-marine-renewable-energy-project/

flourishing in Haven Waterway Enterprise Zone.

3.5.18 Figure 16 below shows the range and geographic extent of sites within the Haven Waterway.

Figure 16 Haven Waterway

3.5.19 The sites contain a mix of opportunities ranging from existing industrial areas with existing units and potential for expansion (e.g. Goodwick and Withybush Industrial Park) to strategic employment opportunities (e.g. Priory Park and the Science and Technology Park) and existing key facilities (e.g. ports of Milford Haven and Fishguard).

3.5.20 Transport links are a key selling feature of the enterprise zones in Wales and whilst the Haven Waterway is recognised as a gateway to Ireland through Milford Haven port there is a need to ensure that the key road connections are of a standard to serve the zone and attract inward investment opportunities.

3.5.21 However, the Trunk Road Forward Programme has identified the A40 West of St Clears as forming the lowest standard section of the TEN-T in the UK.

Pembroke Port and Port of Milford Haven

3.5.22 Pembroke Port and Port of Milford Haven are key employment areas in the region, and rely on road access including the A40 for the movement of goods and people.

3.5.23 Pembroke Port is a secure deep-water cargo port, specialising in the transportation of loose, baled, palletised and heavy lift cargoes - from animal feed and aggregates to refinery components and renewables devices35. The Port facilitates a diverse range of businesses and projects including ship building, marine renewables and transportation.

3.5.24 The Port of Milford Haven is the UK's largest energy port and the biggest port in Wales. The Port is the country’s largest handler of oil and gas, and is capable of delivering 30% of the UK gas demand. Activities such as cargo handling, ferry operations, fish landing, marina services and cruise calls are undertaken.

3.5.25 In 2011, the Port of Milford Haven commissioned a new economic report by Cardiff University on the employment and economic impact of the Port and the industries that are linked to it. The key findings are:

a) The Waterway supports over 5,000 jobs in Wales as a whole, 4,000 of which are in Pembrokeshire;

[35] https://www.mhpa.co.uk/pembroke-port/

b) 30% of jobs in the local economy are in oil refining, gas processing and power generation;

c) 10% of jobs are in sea transport services;

d) £324m of gross value added (GVA) is injected into the Pembrokeshire economy by activities dependent on the Waterway; and

e) £88.5m of GVA is put into the Welsh economy.

3.5.26 The Port is committed to continually investing in port infrastructure and services that delivers sustainable economic growth in Pembrokeshire. Current port projects that demonstrate future growth opportunities for the region include:

a) Milford Waterfront: a flagship development that comprises approximately 420,000 sqft of development space for retail, leisure, hotels, restaurants and residential.

b) Pembroke Dock Marine: as a key operating hub for the traditional energy sector, it is now also proving of value to the emerging renewables sector - particularly marine renewables. The location offers proximity to natural energy resources, a highly-skilled supply chain, and extensive supporting infrastructure. Work is underway by the Port operators to increase the opportunities presented by this sector; and

c) piSCES: an Interreg funded project (supported by the European Regional Development Fund), it aims to use smart grid technologies to reduce the costs and carbon footprint of Energy Networks in the fish processing industry. This will be done through modelling the usage profile of their energy networks and optimising that against the wholesale energy market and any available onsite generation.

3.5.27 The A40 and A477 directly connect the region to Milford Haven and Pembroke. Any improvements would help to enable and support access to the above future development opportunities.

Local Development Plan Proposals

3.5.28 The Pembrokeshire County Council Local Development Plan (LDP) was adopted in February 2013 and sets the policy framework for the County (excluding the National Park area).

3.5.29 There are various allocations within the community of Narberth to the south of Redstone Cross. The following are considered to be of key relevance to the study:

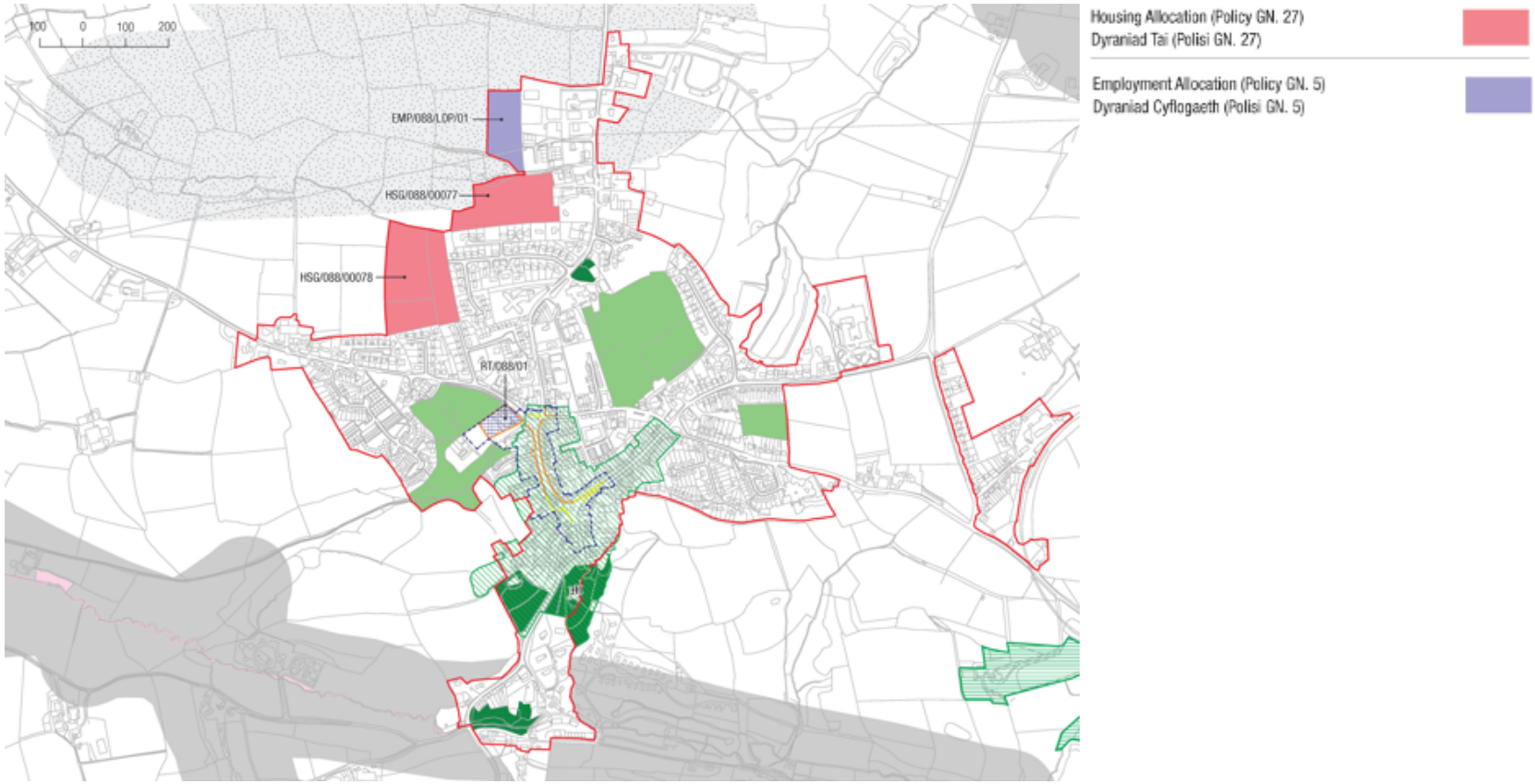
a) Employment allocation for 1.32 ha at Rushacre Enterprise Park Extension – EMP/088/LDP/01;
b) Housing allocation for 58 units at Narberth – West of Rushacre – HSG/088/00077;
c) Housing allocation for 89 units at Narberth – West of Bloomfield Gardens - HSG/088/00078; and
d) A housing allocation for 65 units is also located within Bethesda (HSG/003/00024).

3.5.30 There is another housing allocation within Robeston Wathen, to the south-west of Redstone Cross for 14 units (HSG/113/LDP/01) and also within Llanddewi Velfrey for 12 units (HSG/057/LDP/01), to the east.

3.5.31 The LDP identifies the Llanddewi Velfrey to Penblewin improvement Scheme specifically under Policy GN.39 'Transport Routes and Improvements' and the proposals map identifies a safeguarded route for the improvements. A WelTAG Stage 3 Study has been undertaken on the A40 Llanddewi Velfrey to Penblewin Improvements and the Publication of Draft Orders and supporting Environmental Statement is planned for the end of July 2019 and will proceed through the statutory process, which may include a Public Local Inquiry.

3.5.32 Within the wider area, the LDP identifies a number of other housing and employment allocations within Clarbeston Road and Haverfordwest, all of which will potentially add traffic to the A40.

3.5.33 The main strategic growth in the area is located within the settlements of Haverfordwest, Milford Haven, Pembroke and Fishguard.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EMP/088/LDP/01
HSG/088/00077
HSG/088/00078
RT/088/01
Housing Allocation (Policy GN. 27)
Dyraniad Tai (Polisi GN. 27)
Employment Allocation (Policy GN. 5)
Dyraniad Cyflogaeth (Polisi GN. 5)

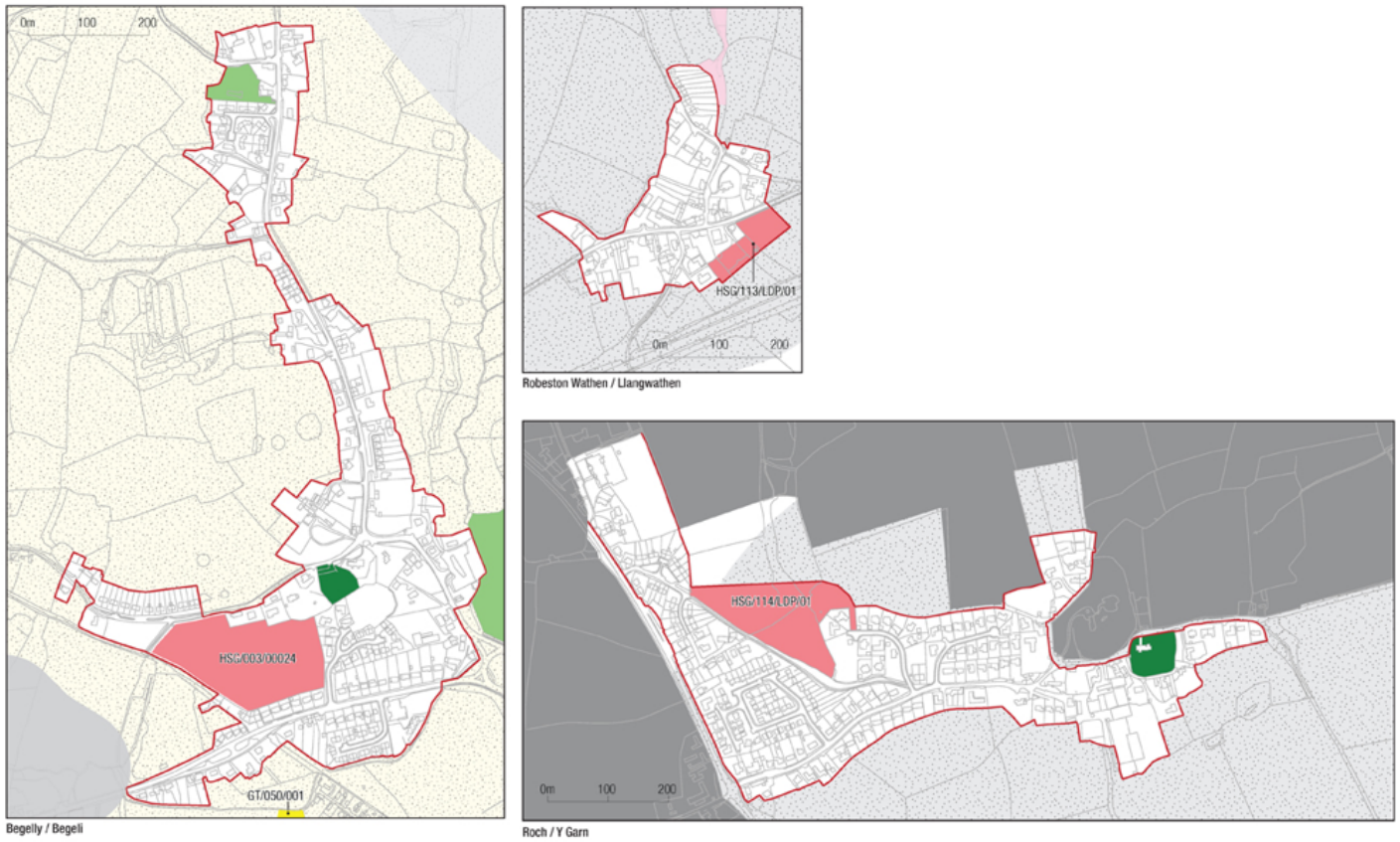


Figure 17 Extract from the Pembrokeshire LDP – Narberth (top), Bethesda (bottom left), Robeston Wathen (bottom right)

4 Options

4.1.1 Whilst Section 1 of this report provides a summary of the project history, this section considers the possible solutions to the identified transport related problems on the A40 between Penblewin and Redstone Cross.

4.2 Options – Long List

4.2.1 In order to consider all of the potential ways of addressing the problems identified, a multi-modal long list of options has been developed including active travel, public transport and highways options.

4.2.2 This formed a two-part process, first involving a technical review of previous work and latest thinking, then informed by stakeholder engagement as is explained below.

Phase 1: Technical Review

4.2.3 All options have been assessed in terms of their potential ability to address the problems (see section 1.6) and achieve the objectives (see section 1.7). The options have also been subject to appraisal within the Design Options Report, including an engineering appraisal of which included appraisal of geometry and length of 2+1 and other criteria including deliverability. The full list of appraisal criteria is as follows:

a) Engineering:
   i. Geometry;
   ii. Length of 2+1 carriageway that can be provided;
   iii. Mainline junctions;
   iv. Side road interface;
   v. Walking, cycling and horse-riding interface;
   vi. Structures;
   vii. Flooding and drainage;
   viii. Lighting;
   ix. Communications;
   x. Earthworks volume and balance;
   xi. Statutory Undertakers utility services;
   xii. Construction issues.

a) Other criteria:

i. Traffic;
ii. Deliverability;
iii. Construction safety;
iv. User safety;
v. Lands and Orders;
vi. Objection and Compensation.

4.2.4 Table 24 below summarises the long list of options identified and provides the explanation as to whether the option was selected for further appraisal as part of a shortlist or not, and why. Further information is contained in the appraisal table within the Design Options Report[36], with the relevant option reference number provided for convenience.

Table 24 Long list of options

Option reference	Description	Decision whether to take forward option to shortlist
Active travel		
AT	Active travel options aimed at improving local connectivity including walking, cycling and horseriding. Complementary active travel measures would be investigated and designed during WelTAG Stage Three, in conjunction with a WCH Assessment and Review Report.	**Recommended to be shortlisted**. Improving active travel connectivity would enable enhanced local connectivity and would align with the duties of the Active Travel (Wales) Act (2013). Active travel provision would help address objective O3, O4, O5 and O6 as it would provide local active travel connectivity to the community of Redstone Cross, linking into Narberth and could provide connectivity to the A40 Llanddewi Velfrey to Penblewin Improvements Scheme. It could also provide additional North/South connectivity over the A40 Corridor. However active travel measures are unlikely to change traffic conditions and alleviate the current traffic problems including highway safety concerns. This option should therefore be considered complementary to other options and should be considered further in the context of each of the short-listed options going forward.
Public transport		

[36] A40 Penblewin to Redstone Cross Improvements Design Options Report 2019

Option reference	Description	Decision whether to take forward option to shortlist
PT	Increase frequency of bus services.	**Not recommended to be shortlisted.** As part of the A40 Llanddewi Velfrey to Penblewin Improvements study, a multi-modal study considered public transport improvements including rail, bus, freight and integrated bus and rail. However, it was concluded that the costs associated with enhanced passenger services were likely to exceed revenue, thus requiring an operating subsidy. It was also acknowledged that improvements to public transport would not reduce the amount of traffic on the A40 trunk road. Whilst that or another public transport option could contribute to moving towards sustainable forms of transport (supporting the 'a globally responsible Wales' well-being goal); the contribution to addressing the study problems would not be sufficient. For example, the problem of highway safety concerns would not be addressed by public transport investment without significant levels of modal shift, which are deemed to be unrealistic even in the long term based on current reliance on the private car for travel in the area. There are wider initiatives being led by the local authority and the Welsh Government separately seeking to increase modal shift. As such, this option is not recommended for further appraisal as part of this study.
Highway options – southern route		
RSX1a	Offline straight alignment between Penblewin and Redstone Cross, with online ghost island junction improvement at Redstone Cross. Vertical tie-in west of Redstone Cross to improve geometry and visibility at the junction.	**Not recommended to be shortlisted.** This option has not been recommended to form part of the short list of options to be taken forward because it would not contribute to meeting most of the objectives for the following reasons: The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. Objective **O3** - There is significant impact upon property at the Redstone Cross Junction, including demolition of at least 2 residential properties. Objective **O5** and **O6 -** Active travel consideration would be limited by the

Option reference	Description	Decision whether to take forward option to shortlist
		proposed junction and WCH users would have to cross the mainline. Objective **O7** - There would be significant impact during the construction of the Scheme as the new junction would be constructed online and most of the material required to construct the Scheme would be imported.
RSX1b	Offline straight alignment between Penblewin and Redstone Cross, with online ghost island junction improvement at Redstone Cross. Vertical tie-in east of Redstone Cross. No improvement to mainline vertical geometry through the junction.	**Not recommended to be shortlisted.** This option has not been recommended to form part of the short list of options to be taken forward as this option would not contribute to meeting most of the objectives for the following reasons: The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. Objective **O3** - There is significant impact upon property at the Redstone Cross Junction, including demolition of at least 2 residential properties. Objective **O4** – The Improvements to the junction would improve the separation of the current staggered arrangement, but there is no change to the alignment through the junction, therefore not improving visibility (not compliant to standard). This would marginally improve safety but not satisy this objective. Objective **O5** and **O6 -** Active travel consideration would be limited by the proposed junction and WCH users would have to cross the mainline.
RSX1c	Offline alignment minimising separation between proposed and existing A40. Online ghost island junction improvement at Redstone Cross. Vertical tie-in east of Redstone Cross Junction. No improvement to mainline vertical geometry through the junction.	**Not recommended to be shortlisted.** This option has not been recommended as this option would not contribute to meeting most of the objectives for the following reasons: The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. Objective **O3** - There is significant impact upon property at the Redstone Cross Junction, including demolition of at least 2 residential properties.

Option reference	Description	Decision whether to take forward option to shortlist
		Objective **O4** – The Improvements to the junction would improve the separation of the current staggered arrangement, but there is no change to the alignment through the junction, therefore not improving visibility (not compliant to standard). This would marginally improve safety but not satisfy this objective. Objective **O5** and **O6 -** Active travel consideration would be limited by the proposed junction and WCH users would have to cross the mainline. Objective **O7** - There would be significant impact during the construction of the Scheme as the new junction would be constructed online and most of the material required to construct the Scheme would be imported.
RSX1d	Offline alignment between Penblewin and Redstone Cross south of existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Offline junction improvement south of existing Redstone Cross Junction.	**Recommended to be shortlisted.** This option has been recommended to form part of the short list of options to be taken forward to Stage Two as this option is considered to contribute to meeting many of the objectives. This would be subject to more detailed appraisal. A summary of the reasons why this option has been short listed are: The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. Properties at Redstone Cross would have marginally less severance (Objective **O3**) as the A40 would be moved to the south of the properties currently on the junction. Those living in Redstone Cross would still need to cross the junction to travel to Narberth. Local access to the A40 from the Redstone Cross area is provided via the improved Redstone Cross Junction. This doesn't limit access and therefore satisfied objective **O6**. The Redstone Cross junction would be improved to comply with modern standards (although requiring a departure from standard for the left-right arrangement). This would significantly improve junction safety (Objective **O4**), providing full standard visibility and geometry.

Option reference	Description	Decision whether to take forward option to shortlist
		Active Travel measures (Objective **O5**) could be incorporated within this option as the existing A40 corridor would provide an attractive route.
RSX1e	Redstone Cross Junction Improvement works only. No improvements to A40 mainline west of the junction.	**Not recommended to be shortlisted.** This option has not been recommended as this option would not contribute to meeting most of the objectives for the following reasons: The strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor would not be met. This option does not provide any improvements to the A40. The existing alignment is substandard, with tight horizontal and vertical (crest/sags) curves, which do not meet modern highway standards. There is no overtaking provision Objective **O3** - There is significant impact upon Redstone Cross Junction Farm in order to provide the required forward visibility at the junction. Objective **O4** – The Improvements to the junction would improve the separation of the stagger, but there is no change to the alignment through the junction, therefore limiting improvements to visibility (not compliant to standard). This would marginally improve safety but not satisfy this objective. Objective **O5** and **O6 –** There would be little to no active travel benefits for the Scheme and little to no improvements to social inclusion and connecting the community.
RSX1f	Offline alignment between Penblewin and Redstone Cross south of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). No Junction provided for Redstone Cross. Side road diversions and underpass provided for north-south connectivity between Narberth & Bethesda.	**Not recommended to be shortlisted.** This option has not been recommended for the following reasons: The option provides similar benefits to that of Option RSX1g (below), but with more extensive side road construction required and with a greater impact upon landowners and landtake. The side road access would create a more tenuous and unattractive route for those travelling from North to South. As Option RSX1g delivers the objectives more efficiently therefore this option has been ruled out.

Option reference	Description	Decision whether to take forward option to shortlist
RSX1g	Offline alignment between Penblewin and Redstone Cross south of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). No junction provided for Redstone Cross. Overbridge provided for north-south connectivity between Narberth & Bethesda.	**Recommended to be shortlisted.** This option has been recommended to form part of the short list of options to be taken forward as this option is considered to contribute to meeting many of the objectives. The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. This option would provide the maximum lengths of 2+1 achievable of all the options considered. Properties at Redstone Cross would be better connected, (Objective **O3** and **O4**) because Redstone Cross would pass over the A40 on an overbridge. This would mean that those living in Redstone and the communities to the north of the A40 would not need to negotiate an A40 junction in order to travel south towards Narberth. For those wanting to travel West along the A40 from the Redstone cross area, would experience an increase in journey time as they would need to join the A40 at Penblewin. The Redstone Cross junction safety (Objective **O4**) would be improved as the junction would be removed, therefore removing the conflict point. Active Travel measures (Objective **O5**) could be incorporated within this option as the existing A40 corridor would provide an attractive route. The Redstone Cross overbridge would provide a convenient and safe link over the A40, without the need to negotiate a junction. This option has improved benefit against Option **O7** compared to the majority of other options. This is because the option as there is less waste and less import required due to the earthworks.
RSX1h	Offline alignment between Penblewin Roundabout and Redstone Cross south of the existing alignment. Offline roundabout constructed to the south of the existing Redstone Cross Junction.	**Not recommended to be shortlisted.** This option has not been recommended for the following reasons: The option provides similar benefits to that of Option RSX1d (below), but with a significantly greater impact upon the strategic road network (the A40 Trunk Road) and therefore not satisfy objectives

Option reference	Description	Decision whether to take forward option to shortlist
		O1 and **O2**. By introducing a roundabout, all vehicles travelling along the A40 need to slow down to negotiate the junction. This has a detrimental impact upon the overall economic benefit that the Scheme would deliver. This roundabout would be in close proximity to the roundabouts on the A40 at Roberston Wathern and Penblewin. Therefore, would be 3 roundabouts within approximately 3 kilometres. There would be detrimental impact upon noise and air quality at Redstone Cross as all vehicles require to slow down and accelerate at the junction. As Option RSX1d delivers the objectives more efficiently therefore this option has been ruled out.
Highway options – northern route		
RSX2a	Single carriageway offline alignment to the north of existing Redstone Farm, with offline junction improvement north of Redstone Cross.	**Not recommended to be shortlisted.** This option has not been recommended because: The strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor would not be met. This option only provides local improvements in the area of Redstone Cross The Redstone Cross junction would be improved to comply with modern standards (although requiring a departure from standard for the left-right arrangement). This would significantly improve junction safety (Objective **O4**), providing full standard visibility and geometry. This option has a significant impact upon the Barrows, which are a Scheduled Ancient Monument (SAM), as the route passes over the top of them. It is unlikely that this impact could be mitigated and therefore this option is unlikely to acceptable.
RSX2b	Offline alignment between Penblewin Roundabout and Redstone Cross north of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Overbridge provided along Bethesda Road to maintain north –	**Recommended to be shortlisted.** This option has been recommended because: The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. This option would provide the maximum lengths of 2+1 achievable. Properties at Redstone Cross and communities to the north of the A40 would

Option reference	Description	Decision whether to take forward option to shortlist
	south connectivity between Narberth – Bethesda. New side road provision connecting the A478 south of Penblewin with the existing A40.	be better connected, (Objective **O3** and **O4**) because Redstone Cross would pass over the A40 on an overbridge. This would mean that those living in the communities to the north of the A40 would not need to negotiate an A40 junction in order to travel south towards Narberth. For those wanting to travel West along the A40 from the Redstone cross area, would experience an increase in journey time as they would need to join the A40 at Penblewin. The Redstone Cross junction safety (Objective **O4**) would be improved as the junction would be removed, therefore removing the conflict point. Active Travel measures (Objective **O5**) could be incorporated within this option as the existing A40 corridor would provide an attractive route. The Redstone Cross overbridge would provide a convenient and safe link over the A40, without the need to negotiate a junction. This option has improved benefit against Option **O7** compared to the majority of other options. This is because the option as there is less waste and less import required due to the earthworks.
RSX2c	Offline alignment between Penblewin Roundabout and Redstone Cross north of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Offline junction improvement north of existing Redstone Cross Junction.	**Recommended to be shortlisted.** This option has been recommended because: The Option satisfies the strategic objectives (**O1** and **O2**) of improving network resilience and improving accessibility on the east-west corridor. Properties at Redstone Cross would have marginally less severance (Objective **O3**) as the A40 would be moved to the north of the properties currently on the junction. Those living to the north of the A40 would still need to cross the junction to travel to Narberth. Local access to the A40 from the Redstone Cross area is provided via the improved Redstone Cross Junction. This doesn't limit access and therefore satisfied objective **O6**. The Redstone Cross junction would be improved to comply with modern standards (although requiring a departure from standard for the left-right arrangement). This would significantly improve junction safety

Option reference	Description	Decision whether to take forward option to shortlist
		(Objective **O4**), providing full standard visibility and geometry. Active Travel measures (Objective **O5**) could be incorporated within this option as the existing A40 corridor would provide an attractive route.
RSX2d	Offline alignment (long option) between Penblewin Roundabout and Redstone Cross north of the existing alignment Vertical tie-in west of Jacob's Park. Overbridge spanning across the new alignment providing north – south connectivity between Narberth – Bethesda.	**Not recommended to be shortlisted.** This option has not been recommended for the following reasons: The option provides similar benefits to that of Option RSX2c (below), but with a significantly greater impact upon the strategic road network (the A40 Trunk Road) and therefore not satisfy objectives **O1** and **O2**. By introducing a roundabout, all vehicles travelling along the A40 need to slow down to negotiate the junction. This has a detrimental impact upon the overall economic benefit that the Scheme would deliver. This roundabout would be in close proximity to the roundabouts on the A40 at Roberston Wathern and Penblewin. Therefore, would be 3 roundabouts within approximately 3 kilometres. There would be detrimental impact upon noise and air quality at Redstone Cross as all vehicles require to slow down and accelerate at the junction. As Option RSX2c delivers the objectives more efficiently therefore this option has been ruled out.
RSX2e	Offline alignment between Penblewin Roundabout and Redstone Cross to the north of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Offline roundabout to the north of existing Redstone Cross Junction.	**Not recommended to be shortlisted.** This option has not been recommended for the following reasons: The option provides similar benefits to that of Option RSX2b, but with additional length of improvements to the A40, which would impact upon Sodston Lodge and access to Sodston Manor. There is an area of ancient woodland that would be impacted upon with this option. As Option RSX2b delivers the objectives more efficiently therefore this option has been ruled out.

4.2.5 To summarise, three options were first recommended to be taken forward for further detailed appraisal. Active travel should form

complementary measures alongside any of the four shortlisted highway route options. The shortlisted options therefore are presented as follows:

a) Active travel, supporting:
b) Option 1A: Northern highway route (Ref RSX2b); or
c) Option 1B: Northern highway route (Ref RSX2c); or
d) Option 2A: Southern highway route (Ref RSX1d).

Phase 2: Stakeholder feedback

4.2.6 Section 1 of this report provides a summary of engagement as part of the study. Informing the optioneering process were two Public Information Exhibitions as part of a stakeholder engagement process.

4.2.7 The first Public Information Exhibition presented the identified problems, objectives and options in April 2019. A majority of those who provided feedback at both exhibitions were in support for the need for improvements between Penblewin Roundabout and Redstone Cross. A majority of respondents also agreed with the problems and objectives. At both exhibitions, the issue of safety at Redstone Cross junction is a particular and consistent concern. Comments were received in relation to witnessed collisions and near misses; the junction's poor visibility; the high-speed traffic within the local area and the limited space in the central reserve.

4.2.8 Three options were presented including Option 1A, 1B and 2A.

4.2.9 The first Public Information Exhibition showed no clear preferred option by respondents with 17 respondents preferring Option 2A (Southern Route), 15 respondents preferring Option 1B (Northern Route without Junction), 13 respondents preferring Option 1A (Northern Route with Junction) and 12 respondents chose the 'None of the options / other' option. 3 respondents either left the response blank or provided an alternative response.

4.2.10 With regards to alternative options, suggestions were made for a roundabout to replace Redstone Cross junction; traffic calming measures; alterations to the Southern Option (an underpass or bridge/no junction); and improvements to the existing junction layout.

4.2.11 Following feedback received and further route development from

highway engineering specialists, Option 2B was developed.

4.2.12 A second Public Information Exhibition was held to present the four highway options to the public in May 2019.

4.2.13 Feedback in opposition to all options presented was also received at both events including regarding concerns for impact on land and property, the environment and noise.

4.2.14 Additional questions were included in the questionnaire at the second Public Information Exhibition. The purpose of this was to decipher public opinion on a north or south option, and on a junction or no junction option.

4.2.15 Respondents were also provided with the opportunity to state that they did not want either option or that they did not have a preference. 52% of respondents preferred an option with no junction at Redstone Cross whilst 26% preferred an option with a junction and 22% left the response blank or provided an alternative response.

4.2.16 Results concerning whether respondents preferred a route to the north or the south showed that 45% of respondents preferred a southern route, 10% showed no preference between the options, 26% preferred a route to the north, 2% did not want either of the routes, 14% left the response blank and 4% stated an alternative response.

4.2.17 There was a clear preferred option demonstrated by respondents with 72 respondents stating their preference for Option 2B (Southern Route without Junction). The second most preferred route was Option 1B (Northern Route without junction) with 25 respondents stating their preference for the option. This demonstrates that the two most favoured options did not include a junction at Redstone Cross. 15 respondents preferred Option 1A (Northern Route with Junction) and 13 respondents preferred Option 2A. 5 respondents chose both Option 1B and 2B (favouring options without a Junction) and 3 respondents chose both Option 1A and 2A (favouring options with a Junction). 7 respondents chose No option or left the response blank.

4.2.18 60% of respondents felt all options have been considered. Feedback suggesting alternatives and additions to the proposal included a roundabout to replace Redstone Cross junction, traffic calming measures and the provision of a slip road.

4.3 Options – Shortlist

4.3.1 In light of the above technical and stakeholder inputs, the shortlist has been refined for WelTAG appraisal as follows:

a) Active travel, supporting:

b) Northern highway route (Ref RSX2b) – referenced as Option 1A; or

c) Northern highway route (Ref RSX2c) – referenced as Option 1B; or

d) Southern highway route (Ref RSX1d) – referenced as Option 2A; or

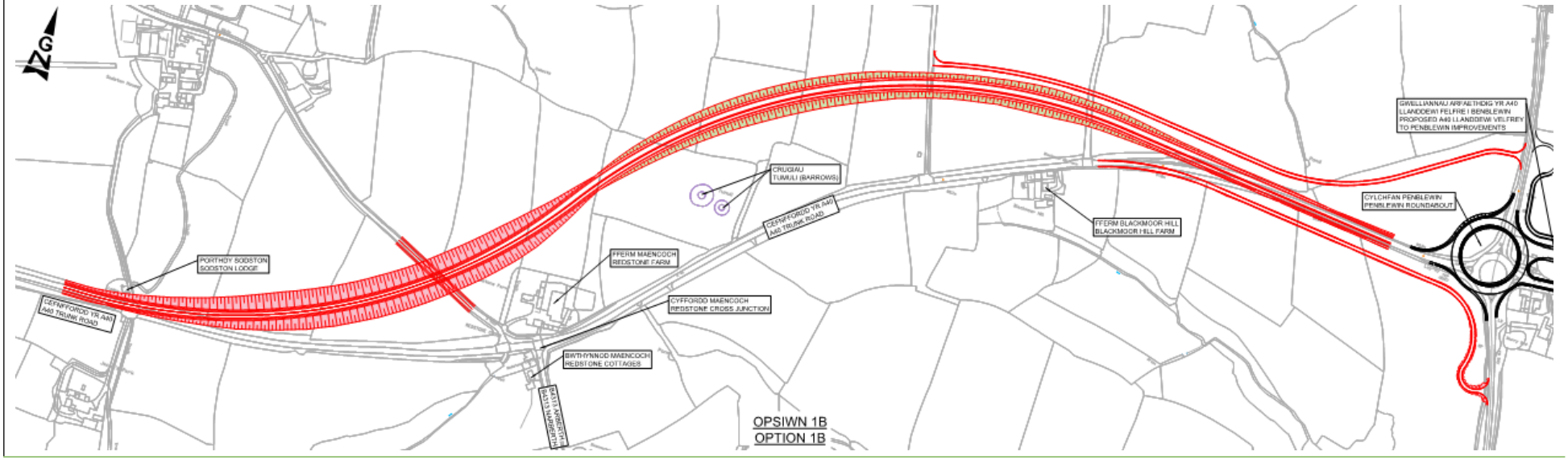
e) Southern highway route (Ref RSX1g) – referenced as Option 2B.

4.3.2 WelTAG involves further assessment of the shortlisted options to assist in determining whether any of the transport options can address the issues identified, contribute positively to the well-being goals and objectives, and can be delivered within technical and financial constraints. These have been put forward by the Review Group and are appraised in the Design Options Report to help progress towards a preferred option.

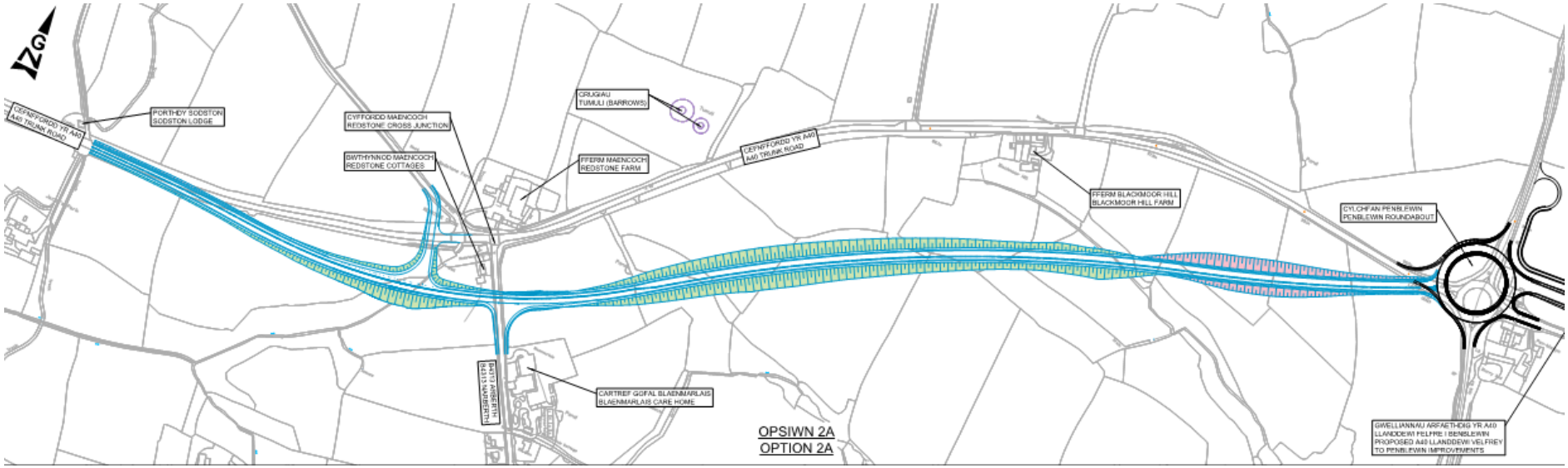
4.3.3 The four options are shown and described further on the following pages.

Option 1A - Northern Route with staggered T-junction at Redstone Cross

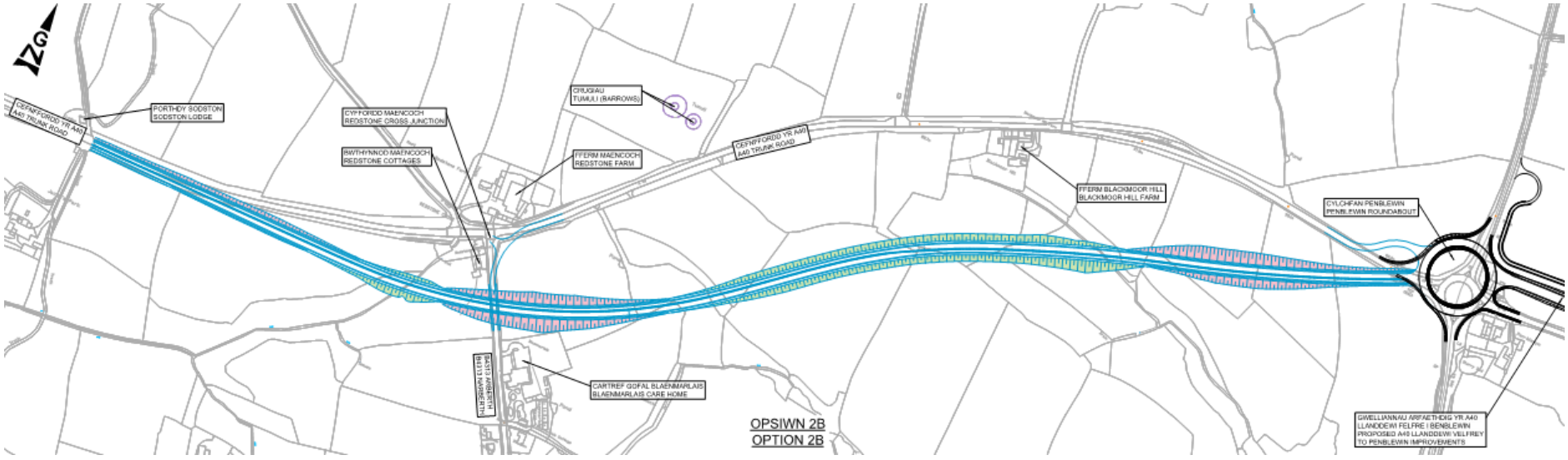
Option 1B - Northern Route (no Redstone Cross Junction)



Option 2A - Southern Route with staggered T-junction at Redstone Cross



Option 2B - Southern Route (no Redstone Cross Junction)



4.3.4 The four options are further described and assessed against the do minimum option in the sections below.

4.3.5 It should be noted that the development of these options is explained in the Design Options Report, which refers the sub-options 1A, 1B, 2A and 2B as 'RSX1d: Southern route with staggered junction', 'RSX1g: Southern route with no junction', 'RSX2b: Northern route with staggered junction' and 'RSX2c: Northern route with no junction' respectively.

4.3.6 The do minimum involves limited intervention reflecting the existing situation, plus the addition of any planned or committed measures as identified in the Pembrokeshire LDP.

4.3.7 Each of the options are subject to WelTAG Stage Two equivalent appraisal, taking into account WelATG 2017 guidance, with the following sections providing a more detailed consideration of each option, how it tackles the identified problems, how it meets the objectives, as well as key risks, adverse impacts, constraints and dependencies.

4.3.7.1 At WelTAG Stage 3, further and more quantitative information will become available, utilising environmental surveys that are underway, and an Environmental Statement and other technical work that will support the preparation of any draft Orders to help progress the preferred option, once agreed, through the statutory process.

Do Minimum

Description

4.3.8 The do minimum option represents the existing situation on the A40 Penblewin to Redstone Cross with the addition of any planned or committed measures as identified within the Pembrokeshire County Council LDP and Pembrokeshire Coast National Park LDP.

4.3.9 This option would therefore see limited change to the existing section of the A40 with the trunk road, for example, continuing to provide limited overtaking opportunities at Redstone Cross continuing to be of safety concern, with a single carriageway in both directions and numerous private and farm access points onto the trunk road.

How are the problems addressed?

4.3.10 Given the limited intervention as part of the do minimum option, none of the problems identified would be addressed and with planned growth as part of the LDP, some of the problems may be further exacerbated.

4.3.11 The following adverse impacts would continue to occur:

a) The substandard nature of the A40 mainline and Redstone Cross Junction would continue to cause problems including safety (including perceived safety) and poor visibility;

b) Overtaking opportunities would continue to be limited, leading to poor journey time reliability and driver frustration; and

c) The presence of side road junctions and direct accesses to properties and agricultural fields off the A40, which would contribute to further operational problems along the road.

4.3.12 It is considered that such adverse impacts would continue or worsen under the do minimum option with an element of population growth and therefore assumed traffic growth along the A40.

Objectives

4.3.13 Overall, the do minimum option would not achieve the identified objectives. With limited change to the current situation and predicted growth in terms of both population and traffic on the A40, the existing problems would continue.

4.3.14 Therefore, it is assumed that the do minimum would perform with a neutral scoring against all of the objectives. If traffic growth were to increase above central forecasts, it is likely that there would be a negative result.

Key Risks

4.3.15 In considering a do minimum option, the following risks have been identified and relate back to the baseline information and context provided in the preceding sections:

a) There is a risk that with minimal intervention the existing problems will continue or be exacerbated through planned growth;

b) There is a risk that the current problems on the A40 would cause a barrier to future growth within the region and in particular the success of the Haven Waterway Enterprise Zone and the Swansea Bay City Region. The route could also impact on the potential of the tourism industry and the success of the ports of Fishguard and Pembroke Dock; and

c) There is a risk that community safety and severance issues associated with the current route of the A40 between Redstone Cross and Penblewin would restrict the potential of this settlement in performing its role within the Pembrokeshire settlement hierarchy.

Constraints and Dependencies

4.3.16 Given the do minimum nature of this option there are not considered to be any constraints to delivery or dependencies upon which the option would be reliant.

Option 1A – Northern Route with staggered T-junction at Redstone Cross

Description

4.3.17 The conceptual design seeks to divert the mainline carriageway to the south of the existing A40 runs through an area of woodland, a watercourse and negatively impacts nearby properties at Redstone Cross.

4.3.18 The horizontal alignment runs north of the existing A40. This design option avoids going through the environmentally sensitive areas to the south of the existing highway alignment.

4.3.19 An alignment to the north of the existing A40 carriageway has a detrimental effect on land use as it impacts farms and land holdings. It also severs private means of access and public footpaths which is avoided in the conceptual design option.

4.3.20 The route also runs in close proximity to the setting of a Scheduled Ancient Monument, with the potential for more archaeological findings along the trace of the route.

4.3.21 With the north alignment there is a reduced volume of earthworks with a better cut and fill balance when compared to the conceptual design.

4.3.22 The mainline alignment in this vicinity is fully compliant with the DMRB with no departures from standard.

4.3.23 The option provides benefit to the buildability and risk in relation to deliverability and safe by design in the short term as it proposes to construct the Redstone Cross junctions offline in comparison to the online approach with the conceptual design.

Option 1B – Northern Route (no Redstone Cross Junction)

Description

4.3.24 The conceptual design seeks to divert the mainline carriageway to the south of the existing A40 runs through an area of woodland, a watercourse and negatively impacts nearby properties at Redstone Cross.

4.3.25 The horizontal alignment runs north of the existing A40. This design option avoids going through the environmentally sensitive areas to the south of the existing highway alignment.

4.3.26 An alignment to the north of the existing A40 carriageway has a detrimental effect on land use as it impacts farms and land holdings. It also severs private means of access and public footpaths which is avoided in the conceptual design option.

4.3.27 The route also runs in close proximity to the setting of a Scheduled Ancient Monument, with the potential for more archaeological findings along the trace of the route.

4.3.28 With the north alignment there is a reduced volume of earthworks with a better cut and fill balance.

4.3.29 The mainline alignment in this vicinity is fully compliant with the

DMRB with no departures from standard.

4.3.30 The option removes the constraint of the junction therefore allows for a greater length of 2+1. This has the benefit of reducing driver frustration and improving journey time reliability.

4.3.31 Removing the junction will eliminate risks associated with the junction turning manoeuvres from the Scheme. North–south connectivity between Narberth and Bethesda will be maintained by the provision of an overbridge along the current alignment of Bethesda Road.

4.3.32 It provides benefit to the buildability and risk in relation to deliverability and safe by design in the short term as it proposes to construct the Redstone Cross junctions offline in comparison to the online approach with the conceptual design.

Option 2A – Southern Route (with Redstone Cross Junction)

Description

4.3.33 The horizontal alignment runs south of the existing A40, leading in a generally south-westerly direction from Penblewin roundabout. The alignment runs to the south of the existing Redstone Cross junction (between Redstone Cottages and Blaenmarlais Care Home) and re-joins the existing A40 near the entrance to Jacob's Park.

4.3.34 A vertical constraint would be at Redstone Road due to the need to provide an at-grade junction at this location to provide access to Bethesda & Redstone Road. The junction would be a staggered ghost island junction.

4.3.35 In comparison with the norther routes, the option has a slightly better cut and fill material balance due to the slightly reduced earthwork embankment between Redstone Junction and Penblewin roundabout. This is achieved by running the mainline alignment south of the existing Redstone Cross junction, thereby removing the vertical tie-in constraint located immediately to the east of the existing Redstone Cross junction in the conceptual design. The embankment height would still be significant (approx. 10 metres).

4.3.36 The option goes through the environmentally sensitive woodland area.

4.3.37 It does avoid the demolition of property at Redstone Cross as the new junction is proposed at a new location to the south of the existing junction.

4.3.38 The mainline alignment in this vicinity is fully compliant with the DMRB with no departures from standard.

4.3.39 This option provides benefits to the deliverability and 'Safe by Design' safety benefits in the short term as a greater length of the mainline, as well as the proposed Redstone Cross junction, are constructed offline in comparison to the online construction of the junction improvement proposed within the conceptual design.

Option 2B – Southern Route (no Redstone Cross Junction)

Description

4.3.40 The horizontal alignment is very similar to Option 2A, however due to the omission of a junction at Redstone Cross, it does not tie-in vertically into Redstone Road. Instead, the road travels underneath Redstone Road and ties back in vertically near the access to Jacob's Park.

4.3.41 An overbridge is proposed along Redstone Road to maintain the north-south connectivity between Narberth and Bethesda. There would be no junction on the A40 mainline at Redstone Cross.

4.3.42 A new side road would be constructed from Penblewin to allow access onto the existing A40 leading to Redstone Road & Bethesda.

4.3.43 The design crosses environmentally sensitive land which includes mature trees and a watercourse which would be affected. The option goes through the environmentally sensitive area.

4.3.44 It avoids land take from nearby property at Redstone Cross as the new junction is proposed at a new location to the south of the existing junction.

4.3.45 It provides a significantly better earthworks balance than the northern routes due to the cutting required to take the road below Redstone Road. This also reduces the volume of material required to import for the embankment between Redstone Cross and Penblewin. The

embankment height between Redstone Cross and Penblewin roundabout is significantly lower than the conceptual design, therefore reducing the visual impact.

4.3.46 The mainline alignment of this option is fully compliant with the DMRB with no departures from standard. However, in order for the road to drop below Redstone Road, there are relaxations in the vertical alignment.

4.3.47 The removal of the junction from the A40 mainline allows for a greater length of 2+1 carriageway cross-section provision. This will allow for overtaking sections in both directions instead of eastbound only (as specified in the conceptual design). This will reduce driver frustration as a greater length of safe overtaking opportunities will be provided.

4.3.48 This option provides benefits to the deliverability and 'Safe by Design' safety benefits in the short term as a greater length of the mainline, as well as the proposed Redstone Cross junction, are constructed offline in comparison to the online construction of the junction improvement proposed within the conceptual design.

4.3.49 The benefits of this option compared to 2A include:

a) Reduced disruption during construction for the construction of the proposed A40 alignment;
b) Reduced hazards associated with Redstone Cross junction by removing the junction from the Scheme; and
c) Provide a greater length of 2+1 sections which improve journey time reliability and reduce driver frustration.

How are the Problems addressed?

4.3.50 Table 25 below outlines how the problems would be addressed by the shortlist:

Table 25 How the proposed options would address the problems

Problem	How the Problem is addressed
1. The A40 mainline and Redstone Cross junction is substandard.	All options are designed to the requirements within the Design Manual for Roads and Bridges (DMRB). In particular the standards "Highways Link Design-TD9/93", "Design of Wide Single 2+1 Roads-TD70/08" and "Geometric Design of Major/Minor Priority Junctions-TD42/95". Option 2A would require a departure from standard for the layout of the Staggered T- Junction arrangement. The allowable (to standard) arrangement contained within TD70, is for a right/left junction stagger. The proposed layout reverses this layout, which would be a right/left stagger, which requires a departure from standard. Option 2B has a marginally reduced standard, due to a reduction in vertical geometry (crest curve), which is an allowable relaxation within the standard. This is to allow the proposed realigned A40 to pass beneath Redstone Cross Road. Redstone Cross Road would pass over the top on an overbridge. The number and severity of collisions having been recorded at Redstone Cross junction highlights a safety concern. In addition to this, many respondents as part of the Public Information Exhibitions voiced their safety concerns including related to witnessing collisions and near-misses. Concerns also related to any proposed staggered junction at this location. Options 1B and 2B would therefore remove the junction onto the A40. It is nonetheless considered that Options 1A and 2A would provide significant improvements to the current situation.
2. Limited overtaking opportunities lead to poor journey time reliability and driver frustration.	Options 1B and 2B provide the longest extent of 2+1 carriageway and therefore maximise safe overtaking opportunities within this section of the trunk road which in turn will positively contribute to improved resilience and journey time reliability. These options would provide approximately 1.2km of 2+1 overtaking opportunity. There is potential for these options to provide opportunities for overtaking (two lanes) for both directions at different sections of the route.

Problem	How the Problem is addressed
	In addition, Options 1B and 2B do not include provision for a staggered junction at the location of Redstone Cross, which means transport users travelling east-west do not need to negotiate / slow down at this location. Options 1A and 2A would provide approximately 0.9km of 2+1 carriageway. The two lanes could be provided in either direction however it is not possible to provide overtaking opportunities (two lanes) for both directions owing to the length of the route. All options would provide significantly enhanced overtaking opportunities along the A40, improving east-west connectivity by improving journey times and journey time reliability, and reducing likelihood of driver frustration.
3. Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.	Through the provision of enhanced overtaking opportunities, the likelihood and/or length of platooning is reduced. All options present a significantly enhanced opportunity for vehicles to overtake slow-moving vehicles such as heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles. By improving overtaking opportunities, all options present benefits to journey time reliability. Moreover, many agricultural vehicles travelling between the existing Redstone Cross Junction and Penblewin Roundabout would utilise the detrunked route (the existing A40), thus removing a proportion of slow-moving traffic away from the new A40, reducing the likelihood of platooning to a greater extent. Options 1B and 2B remove direct access to and from Redstone Cross, by removing the junction. This increases the lengths of overtaking available, which benefits the strategic road network and improves journey time reliability. Local traffic would access Redstone Cross via Penblewin and utilise the existing A40 carriageway. This would increase journey times for local traffic travelling to/from the west.
4. Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.	Seasonal spikes in traffic volumes especially during the summer months are clearly evidence within the Impact Assessment Report. Providing enhanced overtaking opportunities would allow for improved journey time reliability and enhanced highway capacity; of which would reduce the likelihood and severity of traffic problems during the summer period.
5. There are many side road junctions and direct	All options would reduce the number of side road junctions and direct accesses onto the A40, with

Problem	How the Problem is addressed
accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road.	Option 1B and 2B removing all accesses between Redstone Cross junction and Penblewin Roundabout. By removing these junctions and accesses, there is a reduced likelihood of traffic slowing down as well as a reduced conflict between vehicles on the A40 and vehicles joining the A40. There is less overtaking opportunity provided within Options 1A and 2A owing to the proposed Redstone Cross junction.

How are the Objectives addressed?

4.3.51 Table 26 below outlines how the objectives would be achieved by the shortlist, with the methodology adopted in appraising the significance and scale of identified impacts using the seven-point scale set out in Section 1 of this report.

Table 26 How the objectives would be achieved by the shortlist

O 1	**To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.** As a key east-west route, the options will improve accessibility along the A40 to key towns such as Haverfordwest and Carmarthen. This will provide associated benefits for car-based journeys as well as accessibility for those using public transport. This would improve accessibility to key employment, community and tourism destinations. The potential benefits are maximised given the high dependency on the private car in light of the socio-demographic and geographical context of the region. Options 1B and 2B provide the longest extent of 2+1 carriageway and therefore maximises safer overtaking opportunities within the section of the trunk road which in turn will positively contribute to improved resilience and journey time reliability. These options would provide approximately 1.2km of 2+1 overtaking opportunity. There is potential for these options to provide opportunities for overtaking (two lanes) for both directions at different sections of the route. In addition, Options 1B and 2B do not include provision for a staggered junction at the location of Redstone Cross, which means transport users travelling east-west do not need to negotiate / slow down at this location. Options 1A and 2A would provide approximately 0.9km of 2+1 carriageway. The two lanes could be provided in either direction however it is not possible to provide overtaking opportunities (two lanes) for both directions owing to the length of the route. Both 1A and 2A include a staggered junction. This would require traffic to negotiate joining, crossing and leaving the junction of which would increase the likelihood of east-west traffic needing to slow down and thus slightly reducing strategic connectivity benefits in comparison to Options 1B and 2B of which do not include a	Option 1A ++ Option 1B +++ Option 2A ++ Option 2B +++

	Redstone Cross junction.	
O 2	**To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.** As a key east-west route, the options will improve accessibility along the A40 to key towns such as Haverfordwest and Carmarthen as well as key employment areas. Maximising the extent of 2+1 carriageway would provide the maximum benefit in terms of journey reliability and wider prosperity. Options 1B and 2B would provide 1.2km of overtaking opportunity compared to 0.9km for Options 1A and 2A. It is therefore considered that Options 1B and 2B would provide greater benefits for strategic connectivity when compared to Options 1A and 2A. Providing no junction onto the new A40 at Redstone Cross would enable maximised strategic benefits for connectivity as vehicles would not need to negotiate vehicles joining the carriageway from the north and south. It would also provide transport users with improved opportunities to overtake slow moving vehicles. Without a new Redstone Cross junction, some transport users would be adversely affected, for example, those living and working within proximity of the existing Redstone Cross junction and along Redstone Road. With Option 1B and Option 2B, transport users would need to take a longer journey to join the A40 in comparison to the current situation. An initial economic assessment has been undertaken for the four short-listed options. The BCR results indicate that Option 2A provides the best BCR. Option 2B provides similar strategic benefits but with a local disbenefit. Feedback received at the Public Information Exhibitions suggested that whilst some respondents stated a negative impact on accessibility to the A40, more comments were received in support for no Redstone Cross junction as part of proposals. 73 respondents stated their preference for no junction whilst 36 stated their preference for a junction. It is noted that 31 respondents did not provide a response or provided an alternative response. Many respondents cited their safety concerns for any staggered junction at Redstone Cross during both events; this included safety concerns for the existing situation and Options 1A and 2A. With all this considered, it is anticipated that Option 1B and 2B would provide greater outcomes for this objective because	**Option 1A** + Option 1B ++ Option 2A + Option 2B ++

	of the routes' connectivity benefits on a strategic scale. A large number of respondents also preferred the removal of the Redstone Cross junction.	
O 3	**To reduce community severance and provide health and amenity benefits** It is considered that all options would reduce community severance and provide health and amenity benefits largely due to the removal of a significant proportion of traffic off the existing A40. This would allow the existing A40, of which would be no longer be a trunk road, to perform as a local access route and also provide safer opportunities for active travel movements. Options 1B and 2B would remove direct access onto the new A40 at the location of the existing Redstone Cross junction. Although some respondents stated a desire for the maintained connection onto the A40 at this location, more respondents stated their preference for no junction. This demonstrates that no junction may not create significant concerns about severance for many of the local community. It is nonetheless noted that removing a direct connection would increase journey times e.g. for locals and for those accessing Redstone Cross industrial park. Options 1B and 2B would retain a north-south connection. Options 1A and 1B would sever direct access onto the A40 from unnamed roads to the north of the A40 however accesses would be created to run parallel to the new route, with a new access connecting to the A478 to the north of Penblewin roundabout. These new access routes would	Option 1A + Option 1B ++

	provide a longer route for accessing the A40 to the west, however the routes would no longer have a junction onto a trunk road. Options 1A and 2A provide access from both the north and the south onto the new A40 via a staggered junction designed to modern design standards. This would maintain direct access onto the A40 at this location however from feedback received from the community, a junction at this location was not favoured by most respondents, with many comments relating to concerns for any staggered junction. The option to use the new Redstone Cross junction would nonetheless be preferable to some of the community, and with the junction designed to modern design standards, this would provide an improvement upon its existing situation. All options would maintain north-south connectivity between Narberth and Bethedsda. Options 1B and 2B would facilitate this connection via an overbridge as opposed to a staggered junction. Although the staggered junction would be designed to modern design standards and would be an improvement on its existing situation, an overbridge would produce more benefits as transport users do not need to negotiate the crossing against the traffic. Overall, it is considered that all options would reduce community severance and provide health and amenity benefits. It is nonetheless noted that Option 1B and 2B would revise the junction arrangement, creating more benefits for north-south connectivity. Active travel movements would be enhanced within the local area most through Options 1B and 2B as walkers, cyclists and horse riders would not need to cross the A40 for north-south movements.	Option 2A + Option 2B ++
O 4	**To improve the Redstone Cross Junction safety (and perceived safety) and reduce the number and severity of A40 mainline collisions.** Maximising the lengths of 2+1 carriageway means that Options 1B and 2B provide greatest benefit in terms of removing direct accesses onto the trunk road and providing the maximum extent of safe, unambiguous overtaking opportunities, reducing the likelihood of collisions through risky manoeuvres. Potential conflict is removed to a slightly greater extent with Options 1B and 2B, given no intermediate junctions. Options 1B and 2B would therefore remove the junction onto the A40; an option supported by most respondents during stakeholder engagement. It is however the case that Options 1A and 2A would provide a significant improvement upon the existing situation.	Option 1A ++ Option 1B +++

	Given that a majority of collisions identified over the study period within the study area have been recorded at Redstone Cross, all of the options would provide significant improvements to safety. This would include improvements to perceived safety. It is anticipated that Options 1B and 2B would provide slightly greater benefits owing to the increased overtaking opportunities and there being no junction at this location for vehicles to negotiate.	Option 2A ++ Option 2B +++
O 5	**To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles** Options 1A and 1B would sever one PRoW however it is considered that associated impacts will be mitigated through diversions and reinstatements. The parallel access road along the western section of the new road would help maintain local accesses. The options also provide the opportunity to improve / enhance walking, cycling and horse-riding links within the local community through diversions of existing routes and provision of new routes. The measures would be established as part of WelTAG Stage 3 with a WCH Assessment and Review likely to then be available. All options would reduce the traffic flow along the existing A40, and thus provide opportunities for safer and more pleasant active travel journeys. Options 1B and 2B would provide greater benefits for active travel connectivity between Narberth and Bethesda, as walkers, cyclists and horse riders are able to cross the new A40 via an overbridge, and therefore do not need to negotiate the traffic along the A40.	Option 1A 0 Option 1B + Option 2A 0 Option 2B +
O 6	**To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs** Although the options are unlikely to encourage modal shift they would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability. Access to local communities would also be benefited by improved highway and WCH conditions.	Option 1A + Option 1B +

		Option 2A +
		Option 2B +
O 7	**To deliver a project which is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon** Although the options would not encourage modal shift to more sustainable transport options, it would, through maximising overtaking opportunities, provide sustainability benefits in terms of the overall efficiency of journeys as well as improving access to key employment areas, supporting economic growth and social inclusion. However, the highway options would all involve construction carbon impacts. Option 2B would have less adverse impact given its improved conditions for operational traffic, reducing the impact of vehicle emissions. In the context of a climate change emergency, a full Environmental Impact Assessment will be undertaken at WelTAG Stage 3 where consideration of the likely impact of the scheme on the Welsh Government's ability to meet its climate change targets.	Option 1A --
		Option 1B --
		Option 2A --
		Option 2B -
O 8	**Give due consideration to the impact of transport on the environment and provide enhancement when practicable** There would be land take required for all route options with associated environmental impacts on the landscape, biodiversity, soils etc. which requires further survey and assessment. However, this needs to be balanced against the opportunities for mitigation and enhancement and wider Scheme benefits. Options 2A and 2B travel through more environmentally-sensitive land, however Options 1A and 1B travel through more cultural heritage-sensitive land.	Option 1A --
		Option 1B --
		Option 2A --
		Option 2B --

4.3.52 The assessment of effects on the WebTAG criteria are included in the section below. A completed WebTAG worksheet will be prepared for the preferred option, once agreed, at WelTAG Stage 3.

Social and Cultural Considerations

4.3.53 The various social and cultural considerations outlined within the WelTAG guidance have been considered and an appraisal of the four options is presented below.

4.3.54 For reference to further information in relation to the evidence presented within the Impact Assessment Report, please refer to:

a) Transport network conditions in section 3.2;

b) Road safety issues in section 3.2.58-3.2.65;

c) Social and Cultural conditions including those related to active travel (e.g. travel to work and access to transport) and community services and facilities in section 3.3; and

d) Economic conditions including employment areas in section 3.5.

Do Minimum

Do Minimum		
Impacts	**Description**	**Scale**
Physical Activity	Negligible / neutral impact on physical activity. Limited change or investment is likely to lead to or encourage little change in the amount of walking, cycling and other physical exercise undertaken by people within the study area.	0
Journey Quality	Slight adverse impact on journey quality with limited intervention. At peaks times and times of platooning, journey quality would be adversely affected with increased traffic levels, with above average driver stress as a result of operational problems	-
Accidents	A slight adverse impact on accidents is anticipated given existing traffic growth patterns and employment and housing allocations proposed to the south of Redstone Cross and within the wider study area.	-
Security	Limited intervention will lead to a slight adverse impact on safety with transport users including drivers and cyclists continuing to experience safety concerns, particularly at Redstone Cross junction. Linked to sub-standard nature of Redstone Cross junction and visibility problems	-

Do Minimum		
Impacts	**Description**	**Scale**
Commuting and Other users	A slight adverse impact on commuting and travel for other users is anticipated given existing traffic growth patterns and employment and housing allocations proposed to the south of Redstone Cross and within the wider study area.	-
Reliability impact on Commuting and Other users	A slight adverse impact is anticipated with the forecasted traffic flow increases with the do-minimum scenario.	-
Access to Services	A slight adverse impact on access to employment is anticipated given existing traffic growth patterns and employment and housing allocations proposed to the south of Redstone Cross and within the wider study area.	-
Affordability	Limited intervention would lead to little or no change to the cost of travel paid by users. Users will continue to experience time delays which could be attributed as a cost.	0
Severance	The A40 will continue to create severance including for north-south connectivity and for access onto the A40 from the north and the south at Redstone Cross. The substandard nature of the junction and its associated visibility problems would continue to be of safety concern to various members of the public.	-
Option and non-use values	Limited intervention would not provide alternatives for current journeys nor would it change the resilience of the transport system. Continued growth within the region could lead to the system having less resilience moving forward under a do minimum option.	-

Do Something

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Physical Activity	• Options 1A and 1B would sever one PRoW but it is considered that associated impacts will be mitigated through diversions and reinstatements. • All routes provide the opportunity to improve / enhance walking, cycling and horseriding journeys, details of which would be provided at Stage 3 with an WCH study informing the option(s) presented. • The removal of traffic off the existing A40 would provide benefits in itself for walkers, cyclists and horseriders; by removing a proportion of traffic, there would be reduced conflict between vehicles	Option 1A +

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	and WCHs. This would produce benefits in terms of reducing community severance. In addition to this, the reduction in traffic would produce amenity benefits and has the opportunity to encourage more active travel journeys, largely owing to the perceived safety benefits from a detrunked route. • Given there being no intermediate junction for Options 1A and 2A, potential conflict between vehicles and WCHs is reduced. North-south connections at the location of Redstone Cross would be provided via an overbridge, providing benefits for WCHs given there is no requirement to negotiate east-west traffic whilst crossing the A40. • It is noted that cyclists and potential other WCHs using the new A40 would require a longer journey to join for Options 1B and 2B given no intermediate junction. It is anticipated that a limited number of cyclists would journey along this route however this would be investigated during Stage 3. • With a roundabout to the east (part of the Llanddewi Velfrey Scheme), WCHs would need to cross multiple sections of road of the roundabout arrangement. • In summary, all options could lead to an increase in physical activity within the study area. It is considered that Options 1B and 2B would provide slightly more benefits for physical activity because of the improved north-south connectivity, especially for leisure trips accessing the countryside. Whilst it is acknowledged that these options may require a longer route to be taken to join the A40, it is anticipated that a majority of walking, cycling and horseriding would comprise local journeys as opposed to longer journeys using the trunk road. Types of journeys would be further considered as part of Stage 3's WCH study.	Option 1B ++ Option 2A + Option 2B ++
Journey Quality	• All options provide enhanced overtaking opportunities which would contribute to improved journey quality and reduce driver stress. Options 1B and 2B would provide for approximately 1.2km of 2+1 overtaking opportunity compared to 0.9km for Options 1A and 2A. • The improved standard of the new road would also	Option 1A +

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	contribute to increasing journey quality within the study area. • The increased capacity of the road would also improve highway resilience in times of heavy traffic during the summer months and during occurrences of platooning. • Options 1A and 2A would require an increased journey length to connect to the A40 from both the north and the south of Redstone Cross, however, many respondents at the Public Information Exhibitions expressed their concerns for a staggered junction with or without the improvements proposed, with Option 2B being received as the most preferred. • Overall, it is considered that through the improved overtaking opportunities and the modern standard of the road, all options would provide benefits to journey quality. It is considered that Options 1B and 2B would provide significant benefits for strategic connectivity and would reduce the amount of traffic using the existing A40 to Narberth in particular. It is considered that Option 2B would offer slightly more benefits to journey quality for than 1B owing to the reduced adverse impact for journey quality for properties to the north. Still, it is considered that both routes should be appraised the same as Option 1B would provide a longer journey for residents, visitors and workers of just two properties of which is considered of minor significance on both a local and strategic scale.	Option 1B ++ Option 2A + Option 2B ++
Accidents	• Maximising the extent of the 2+1 carriageway provides the maximum length of safe, unambiguous overtaking opportunities. This will reduce the number of risky manoeuvres on the road and generally contribute to reducing the potential of accidents. Options 1B and 2B would provide 1.2km of overtaking opportunity in comparison to Options 1A and 2A of which would provide for approximately 0.9km. • The routes would take traffic away from the existing	Option 1A ++

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	A40 which would in turn provide a local access route for communities. This would also reduce interface between traffic and WCHs on the existing A40, thereby creating a safer environment and reducing the potential of accidents. Potential conflict is removed to a slightly greater extent with Options 1B and 2B, given no intermediate junctions. • Options 1A and 2A would be to modern design standards and provide improved visibility, however Options 1B and 2B would remove the need to negotiate the A40 and the staggered junction. Moreover, perceptions of staggered junctions from the local community suggest that even with improvements, many respondents from the local community would prefer the removal of the junction in its entirety. • A majority of collisions over the study period have been recorded at Redstone Cross junction. In addition to this, respondents from the Public Information Exhibitions voiced their safety concerns for the junction; many of whom stated their knowledge and/or experience of near-misses at the junction. • Given that a majority of collisions identified over the study period within the study area have been recorded at Redstone Cross, all of the options would provide significant improvements to safety. This would include improvements to perceived safety. It is anticipated that Options 1B and 2B would provide slightly greater benefits owing there being no junction at this location for vehicles to negotiate.	Option 1B +++ Option 2A ++ Option 2B +++
Security	• All options would divert traffic away from the local access routes, with the detrunked (existing A40) road become a local access route. This will increase the feeling of safety within the settlement for the local community and WCH's. Potential conflict is removed to a slightly greater extent with Option 1B and 2B, given no Redstone Cross junction. • Maximising the extent of the 2+1 carriageway provides the maximum length of safe, unambiguous overtaking opportunities. This will reduce the number of risky manoeuvres on the road and generally contribute to reducing the potential of accidents. • Options 1B and 2B would provide 1.2km of overtaking opportunity in comparison to Options 1A and 2A of which would provide for approximately	Option 1A + Option 1B ++ Option 2A +

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	0.9km. This would lead to road users feeling safer when overtaking on this stretch of the A40 with reduced risk of dangerous driving.	Option 2B ++
Commuting and Other users	• As a key east-west route, the route will improve accessibility along the A40 including to employment sites including the Haven Waterway Enterprise Zone, services and key tourist destinations. Maximising the extent of 2+1 carriageway will provide the maximum benefit in terms of journey reliability and wider prosperity. Options 1A and 2A would provide approximately 0.9km of overtaking opportunity whilst Options 1B and 2B would provide for approximately 1.2km. • Providing no junction onto the new A40 at Redstone Cross would enable maximised strategic benefits for connectivity as vehicles would not need to negotiate vehicles joining the carriageway from the north and south. It would also provide transport users with improved opportunities to overtake slow moving vehicles. • Without a new Redstone Cross junction, some transport users would be affected, for example, those living and working within proximity of the existing Redstone Cross junction and along Redstone Road. With Option 1B and Option 2B, transport users would need to take a longer journey to join the A40 in comparison to the current situation. • Feedback received at the Public Information Exhibitions suggested that whilst some respondents stated a negative impact on accessibility to the A40, more comments were received in support for no Redstone Cross junction as part of proposals. Many respondents cited their safety concerns for a staggered junction at this location, even if designed to modern design standards. • With all this considered, it is anticipated that Option 1B and 2B would provide greater outcomes for this objective because of the routes' connectivity benefits on a strategic scale.	Option 1A + Option 1B ++ Option 2A + Option 2B ++
Reliability impact on Commuting and Other users	• Enhanced overtaking opportunities would substantially reduce the risk of platooning and thus all options would provide beneficial impacts to journey time reliability. • It is considered that Options 1B and 2B would provide additional benefits to Options 1A and 2A given their enhanced overtaking opportunities with greater lengths of overtaking sections of road.	Option 1A ++

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
		Option 1B +++
		Option 2A ++
		Option 2B +++
Access to Services	• As a key east-west route, the route will improve accessibility along the A40 to key services. Maximising the extent of 2+1 carriageway will provide the maximum benefit in terms of journey reliability and wider prosperity. Options 1A and 2A would provide approximately 0.9km of overtaking opportunity whilst Options 1B and 2B would provide for approximately 1.2km. • Providing no junction onto the new A40 at Redstone Cross would enable maximised strategic benefits for connectivity as vehicles would not need to negotiate vehicles joining the carriageway from the north and south. It would also provide transport users with improved opportunities to overtake slow moving vehicles. • Without a new Redstone Cross junction, some transport users would be affected, for example, those	Option 1A +
		Option 1B ++

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	living and working within proximity of the existing Redstone Cross junction and along Redstone Road. With Option 1B and Option 2B, transport users would need to take a longer journey to join the A40 in comparison to the current situation. • Feedback received at the Public Information Exhibitions suggested that whilst some respondents stated a negative impact on accessibility to the A40, more comments were received in support for no Redstone Cross junction as part of proposals. Many respondents cited their safety concerns for a staggered junction at this location, even if designed to modern design standards. With all this considered, it is anticipated that Option 1B and 2B would provide greater outcomes for this objective because of the routes' connectivity benefits on a strategic scale	Option 2A + Option 2B ++
Affordability	• For those requiring access onto the new A40 route from the north and south of Redstone Cross, Options 1B and 2B would mean a longer journey is required for some users. Although Option 1A and 1B would also warrant a longer journey for the properties to the north of the A40 on the eastern side, the low number of potential users impacted would not cause a significant impact. • The route would bring limited change to costs paid by users of the A40. was clearly favoured as part of the second Public Information Exhibition.	Option 1A 0 Option 1B 0 Option 2A 0 Option 2B 0
Severance	• It is considered that all options would reduce severance largely due to the removal of a significant proportion of traffic off the existing A40. This would allow the existing A40, of which would be no longer be a trunk road, to perform as a local access route and also provide safer opportunities for active travel movements. • Options 1B and 2B would remove direct access onto the new A40 at the location of the existing Redstone Cross junction. Although some respondents stated a desire for the maintained connection onto the A40 at this location, more respondents stated their preference for no junction. This demonstrates that no junction may not create severance for many of the	Option 1A +

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	local community. Options 1B and 2B would retain a north-south connection. • Options 1A and 1B would severe direct access onto the A40 from unnamed roads to the north of the A40 however accesses would be created to run parallel to the new route, with a new access connecting to the A478 to the north of Penblewin roundabout. These new access routes would provide a longer route for accessing the A40 to the west, however the routes would no longer have a junction onto a trunk road. • Options 1A and 2A provide access from both the north and the south onto the new A40 via a staggered junction designed to modern design standards. This would maintain direct access onto the A40 at this location however from feedback received from the community, a junction at this location was not favoured by most respondents, with many comments relating to concerns for any staggered junction. The option to use the new Redstone Cross junction would nonetheless be preferable to some of the community, and with the junction designed to modern design standards, this would provide an improvement upon its existing situation. • All options would maintain north-south connectivity between Narberth and Bethedsda. Options 1B and 2B would facilitate this connection via an overbridge as opposed to a staggered junction. Although the staggered junction would be designed to modern design standards and would be an improvement on its existing situation, an overbridge would produce more benefits as transport users do not need to negotiate the crossing against the traffic. • Overall, it is considered that all options would reduce severance. It is nonetheless noted that Option 1B and 2B would remove the junction, therefore producing more benefits for north-south connectivity. Active travel movements would be enhanced within the local area most through Options 1B and 2B as walkers, cyclists and horseriders would not need to cross the A40 for north-south movements.	Option 1B ++ Option 2A + Option 2B ++
Option and non-use values	• The provision of the 2+1 carriageway configuration provides enhanced opportunities for overtaking between Penblewin roundabout and Redstone Cross, increasing the resilience of the network to cope with a variety of traffic, platooning and seasonal peaks.	Option 1A +

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	• It is considered that the resilience benefits would be slightly greater with Options 1B and 2B given the additional length of overtaking provision. • Although there is no intermediate junction onto the A40 at the location of Redstone Cross, it is considered that the strategic connectivity benefits would outweigh the increased journey length for some journeys from and to the local communities within proximity of Redstone Cross. Feedback from the Public Information Exhibitions demonstrated that 52% of respondents preferred no junction (compared to 26% of whom prefer an option with a junction and 22% of whom left the response blank or provided an alternative response) and that there are significant safety concerns for the existing Redstone Cross junction arrangement, concerns that may not be erased through the provision of a junction designed to modern standards. • It is noted that the options provide limited benefit to users of public transport, although the options would provide improved accessibility to train stations and bus stops.	Option 1B ++ Option 2A + Option 2B ++

Environmental Considerations

4.3.55 In advance of Environmental Impact Assessment at Stage 3, a higher level environmental appraisal has been undertaken for the options by relevant specialists. The results of this appraisal are provided below. For reference to further information in relation to the evidence presented, please refer to the following sections of the Impact Assessment Report:

a) Air quality conditions in section 3.4.2-3.4.5;

b) Noise conditions in section 3.4.6-3.4.7;

c) Landscape and townscape in section 3.4.8-3.4.9;

d) Biodiversity in section 3.4.10-3.4.14;

e) Cultural heritage in section 3.4.15-3.4.32;

f) Agriculture in section 3.4.33; and

g) Water environment in section 3.4.34.

Do Minimum

Do Minimum		
Impacts	**Description**	**Scale**
Noise	The do minimum option would lead to no change in the baseline situation. It is anticipated that the slight increases in traffic growth would affect people close to the A40 however it is possible that a gradual change to low emission vehicles such as electric vehicles is likely to reduce traffic noise in the long term.	0
Air Quality	With traffic growth the existing air quality situation could worsen, although it is possible that a gradual change to electric vehicles over the next 30 years is likely to reduce traffic related air pollution.	0
Greenhouse gases	The do minimum option would lead to no change in the baseline situation. It is anticipated that the slight increases in traffic growth would provide an adverse impact however it is possible that a gradual change to low emission vehicles such as electric vehicles is likely to reduce traffic noise in the long term. A neutral impact is therefore anticipated.	0
Landscape	With continuing traffic growth, the existing visual and landscape impact would have an increasingly adverse effect on views, character and amenity. Any online changes to improve the existing road, or junction, are likely to remove roadside hedges and could require demolition of properties in Redstone Cross.	-
Townscape	N/A	N/A
Historic Environment	Minor changes would have an insignificant effect on cultural heritage.	-

Do Minimum		
Impacts	**Description**	**Scale**
	With continuing traffic growth, the settings of designated sites would be adversely affected, and the existing road could require online improvements. These could remove roadside hedges, adversely changing the landscape settings of the designated sites. Improvements could also intrude into the area of archaeological importance around the SAM on the north side of the existing road.	
Biodiversity	The Do Minimum option is unlikely to result in any significant ecological effects. If the existing road required online improvements there may be some minor localised losses of semi-improved grassland verges and/or hedgerows which could easily be mitigated. If such online improvements were required, this may present an opportunity to include culverts underneath the road as multi-species crossings thereby creating a net gain for biodiversity. Some form of attenuation and pollution control could also be implemented with a beneficial impact on water quality of nearby watercourses. With the expected change to electric vehicles over the next 10-20 years there is unlikely to be any negative consequential ecological effects from air quality in the locality.	0
Water Environment	There would be no likely significant effects on the water environment, unless road drainage were improved to reduce impacts. With continuing traffic growth, the level of pollution from the road could increase. If the existing road required online improvements some form of attenuation and pollution control could be implemented with a beneficial impact on water quality in watercourses.	0

Do Something

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Noise	Option 1A and 1B would likely provide a reduction in traffic noise for properties at Redstone Cross as the route would be in cutting to the north. However, local traffic using the B4313 Redstone Road would continue to pass through the existing arrangement to use the new staggered junction for access onto the A40. Both Option 1A and 1B would be further from Blackmoor Hill Farm on the existing A40 however as the properties are situated on embankment, there would be no barrier to traffic noise reaching the property. Properties to the north could experience increased traffic noise because the A40 would be closer and raised on embankment. Penblewin Farm is unlikely to experience any change with Options 1A or 1B whilst properties to the west of Redstone could experience an increase in noise due to greater speed of traffic. Option 2A would move traffic noise slightly further from residential properties at Redstone Cross, but bring it closer to Blaenmorlais Care Home. Option 2B, in cutting where it would cross Redstone Road, and on embankment to the east and west, would move the source of traffic noise away from properties on the crossroads and the cutting would provide some containment of noise. Overall noise is likely to be reduced with Option 2B. Options 2A and 2B would be further away from properties to the north, therefore these properties would experience less traffic noise however properties to the south would be closer. Penblewin Farm, again, is unlikely to experience any change due to these options. Properties to the west of Redstone could experience an increase in noise due to greater speeds of traffic, similar to Options 1A and 1B. Enhanced overtaking opportunities would reduce the likelihood of platooning, therefore it is likely that all options would increase noise owing to the reduced likelihood of vehicles slowly travelling behind slow-moving vehicles.	Option 1A - Option 1B - Option 2A - Option 2B -

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Air Quality	Option 1A moves the A40 further away from the closest residential receptors than the existing alignment, creating more distance between receptors and traffic emissions. The new option is in some cases 150m further away from receptors than it is currently. The northern option is further away from residential receptors than the southern option therefore it can be expected that concentrations of air pollutants will be lower for the northern option than the southern option. The offset junction at Redstone Cross is similar to the existing offset junction but is further away from residential receptors. The junction provides an opportunity for vehicles to be accelerating and decelerating therefore creating greater emissions than if there was no interruption to the flow of traffic at this location.	Option 1A +
	Option 1B moves the A40 further away from the closest residential receptors than the existing alignment, creating more distance between receptors and traffic emissions. The new option is in some cases 150m further away from receptors than it is currently. The northern option is further away from residential receptors than the southern option therefore it can be expected that concentrations of air pollutants will be lower for the northern option than the southern option. There is no junction at Redstone Cross and therefore there is less opportunity for interruption to the flow of traffic at the location. It is expected that emissions would be less than if there was junction.	Option 1B +
	Option 2A moves the A40 away from some of the residential receptors along the existing alignment, creating more distance between the receptors on the existing A40 alignment. However the new distance is up to 130m away which is not as far as the northern options. Additionally the southern option is within 80m of a care home which will have residents who are considered as a sensitive receptor. The junction provides an opportunity for vehicles to be accelerating and decelerating therefore creating greater emissions than if there was no interruption to the flow of traffic at this location.	Option 2A +
	Option 2B moves the A40 away from some of the residential receptors along the existing alignment, creating more distance between the receptors on the existing A40 alignment. However the new distance is up to 130m away which is not as far as the northern options. Additionally the southern option is within 80m of a care home which will have residents who are considered as a	

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	sensitive receptor. There is no junction at Redstone Cross and therefore there is less opportunity for interruption to the flow of traffic at the location. It is expected that emissions would be less than if there was junction. Overall, at this stage, it is considered that there is little difference between each option in an air quality context. The existing situation also shows improvements for air quality along the existing route. It is likely that there would be an improvement for all receptors for the northern options, with an improvement for all receptors with an exception of the care home, for the southern options. It is likely there would be a limited difference between each of the options, however it is considered there would be a slight benefit for the options without a junction. A more detailed air quality assessment would be conducted as part of Stage 3, where the impact of traffic movements would be available for consideration.	Option 2B +
Greenhouse gases	Options 1A and 1B would be longer. This increased distance is likely to result in increased GHG. The new road infrastructure for all options will also produce embodied carbon in addition to the operational GHG emissions. In terms of carbon, Options 2A and 2B would provide slightly less adverse impacts than Options 1A and 1B by reducing the distance travelled by those travelling east-west. That would also increase emissions for both private and public transport vehicles using a longer diverted route. It is nonetheless noted that those travelling from local communities within proximity of Redstone Cross would require taking a longer route for some journeys with Options 1B and Option 2B for travelling west along the new A40.	Option 1A -- Option 1B - Option 2A -- Option 1B -

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Landscape	Options 1A and 1B would be very similar in their effect on views and landscape as the routes would pass along the top of the ridge through a landscape of large hedged fields. For the eastern length from Penblewin to north of Redstone Cross, the routes would be on embankment of up to 4 metres high on top of the Redstone / Sodstone Ridge making it visible from the north and the south. The route would provide good northern views for travellers to the Presili Hills. The elevated route and vehicles would be visible from Blackmoor Hill Farm and Penblewin Farm, and possibly also from properties to the north.	Option 1A --
	The western section of the routes would be in cutting over 4 metres deep and so the road and vehicles would be hidden from local residential viewpoints. Options 2A and 2B would follow a similar horizontal alignment through low-lying land comprising small irregular fields, irregular landform and small wooded watersources. The hedgerows are tall with mature trees whilst the landscape is intimate with views contained by landform and vegetation.	Option 1B --
	Option 2A would be mostly on embankment or at grade with a short length of cutting at Penblewin. The high embankment would be more visible from surrounding areas and the landtake for the Scheme would cause greater disruption to the landscape setting than Option 2B. While traffic would be removed from the existing A40, the route would be visible from Blackmoor Hill Farm. The at-grade section of the Scheme through Redstone Cross would be a major change to the landscape south of the existing cross roads with views opened up by the removal of roadside hedges and trees. The staggered junction would be visible in views from properties south of the existing A40. Option 2B would be mostly on embankment or in cutting. The embankment would be lower than 2A and so would be less visible from surrounding areas. The	Option 2A --

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	reduced landtake compared to Option 2A would cause less disruption to the landscape setting. While traffic would be removed from the existing A40, the route would be visible from Blackmoor Hill Farm, although to a lesser degree than Option 2A. The route, in cutting through Redstone Cross, would be a major change to the landscape south of the existing crossroads through the removal of roadside hedges and trees. However, the cutting is over 4m deep, so the road and traffic in the cutting would not be visible in views from properties to north and south. To the west of Redstone Cross, the route would be on a low embankment that would be visible from rear windows of properties south of Redstone Cross, but to a lesser degree than for Option 2A.	Option 2B -
Townscape	N/A	
Historic Environment	Options 1A and 1B would adversely affect the setting of a Scheduled Ancient Monument (SAM) containing tumuli, and would directly impact on non-designated sites identified in the setting of the SAM. The findings of archaeological geophysical surveys have confirmed that the high ground of the Redstone/Sodston Ridge is of national importance and that Options 1A and 1B would have an adverse effect on these remains. Further investigation could find remains not identified by geophysical surveys. There are several Listed Buildings in the area although none of these would be directly affected and are sufficiently distant for potential impacts on settings not to be significant. Both Options 2A and 2B would not directly impact on any designated sites but could affect the settings of the SAM to the north of the A40 and on the Listed buildings clustered along the Redstone Road south of the A40. The archaeological geophysical survey has found potential archaeological features at various locations along the route, but none of these are confirmed as being of the same importance as the features found to the north of the existing A40. Further investigation could find remains not identified by geophysical surveys. Both Option 2A and 2B will require a short length of road to link the old A40 to the Penblewin roundabout. This link could intrude into archaeological features on the north side of the existing A40.	Option 1A --- Option 1B --- Option 2A - Option 2B -

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Biodiversity	Options 1A and 1B would result in the loss and fragmentation of habitats including mature hedgerows and improved and semi-improved grassland fields . The hedgerows are likely to form part of a wider network of green corridors for the movement of bats across the landscape including those which are the qualifying features of the nearby internationally designated bat SACs (greater horseshoe bat, lesser horseshoe bat and barbastelle bat). Any mature trees along the hedgerows may potentially provide roosting habitat for bats and barn owl . The hedgerows are also suitable to support hazel dormouse and a diverse assemblage of breeding birds. Together with the grassland habitats they also provide suitable foraging habitat for badgers, reptiles, amphibians and other notable species. Options 2A and 2B would result in the loss and fragmentation of two areas of semi-natural broadleaved woodland. The majority of this habitat comprises wet woodland , since it is largely associated with the valleys of the small freshwater streams which run through this area. These options would also result in the loss and fragmentation of mature hedgerows with trees and areas of marshy grassland. The woodlands and hedgerows are likely to form part of a wider network of green corridors for the movement of bats across the landscape including those species which are the qualifying features of the nearby internationally designated bat SACs; greater horseshoe bat, lesser horseshoe bat and barbastelle bat. The woodlands and mature trees along hedgerows are also likely to provide roosting habitat for bats and barn owl. The freshwater streams in this area provide suitable habitats for otter and water vole and there is a main badger sett and a number of outliers within the woodland areas. The woodland and hedgerow habitats are also suitable to support dormice, and a diverse assemblage of breeding birds including barn owl. The hedgerows and areas of semi-improved grassland bordering these boundary habitats also provide suitable foraging habitat for badgers, reptiles, amphibians and other notable species. The marshy grassland present along the southern options may be important for invertebrates as well as foraging bats, reptiles, breeding birds and badgers. Due to the lower-lying topography of the two southern options this presents better opportunities for providing multi-species crossings under the road to provide safe passage for species including those which are the	Option 1A -- Option 1B -- Option 2A -- Option 2B --

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	qualifying species of the SACs. This would be more difficult to achieve with the northern options as it is mostly at grade.	
Water Environment	Options 1A and 1B would not directly affect any watercourses but could have an impact on groundwater. There would be an impact on groundwater flows where cuttings are excavated with possible adverse impact on springs within proximity. The new road would increase the impermeable surface which could result in increases in the rates of surface water runoff with potential flooding downstream, unless the surface water is managed appropriately with suitable attenuation of flows. Attenuation measures would also include pollution control devices. Option 2A and 2B would directly affect five minor watercourses that flow south from a spring line along the Redstone/ Sodston ridge. Four of these flow east into the Taf and the fifth into the Eastern Cleddau. Both of these form part of Marine Special Areas of Conservation. There would be an impact on groundwater flows where cuttings are excavated, or embankments are formed with possible adverse impact on watercourses within proximity. The new road would add impermeable surface which could result in increases in the rates of surface water runoff with potential flooding downstream, unless the surface water is managed appropriately with suitable attenuation of flows. Attenuation measures would also include pollution control devices.	Option 1A - Option 1B - Option 2A -- Option 2B --

Economic Considerations

4.3.56 The options have been considered in relation to economic factors, as outlined within the WelTAG 2017 guidance. A summary for each of the options is included below. For reference to further information in relation to the evidence presented within the Impact Assessment Report, please refer to:

a) Transport network conditions in section 3.2;

b) Journey time information in section 3.2.33-3.2.42;

c) Speed profile information in section 3.2.66-3.2.67;

d) Road safety conditions in section 3.2.58-3.2.65; and

e) Economic conditions including economic performance, industrial structure, economic development and opportunities for growth in section 3.5.

Do Minimum

Do Minimum		
Impacts	**Description**	**Scale**
Business users & transport providers	• The do-minimum would have a slight adverse impact on business users & transport providers with the forecasted traffic flow increases affecting journey time, journey time reliability and safety.	-
Reliability impact on Business users	• A slight adverse impact is anticipated with the forecasted traffic flow increases with the do-minimum scenario.	-
Regeneration	• It is anticipated there would be no impact on regeneration with the do-minimum scenario.	0
Wider Impacts	• Under the do-minimum scenario, a slight adverse impact is anticipated on wider impacts including journey time change, journey time reliability, safety, productivity and the local economy.	-

Do Something

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Business users & transport providers	• Enhanced overtaking opportunities would substantially reduce the risk of platooning and thus all options would provide beneficial impacts to business users & transport providers.	Option 1A +
	• It is considered that Options 1B and 2B would overall provide additional benefits to Options 1A and 2A given their enhanced overtaking opportunities with greater lengths of overtaking sections of road, albeit	Option 1B ++

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	access to businesses along Redstone Road would receive greater benefits with Options 1A and 2A and would experience longer journeys from and to the A40.	Option 2A +
		Option 2B ++
Reliability impact on Business users	• Enhanced overtaking opportunities would substantially reduce the risk of platooning and thus all options would provide beneficial impacts to journey time reliability on business users. • It is considered that Options 1B and 2B would overall provide additional benefits to Options 1A and 2A given their enhanced overtaking opportunities with greater lengths of overtaking sections of road, albeit access to businesses along Redstone Road would receive greater benefits with Options 1A and 2A and would experience longer journeys from and to the A40.	Option 1A ++
		Option 1B +++
		Option 2A ++
		Option 2B +++
Regeneration	• It is anticipated that there would be no impact on regeneration.	Option 1A 0
		Option 1B 0
		Option 2A 0
		Option 2B 0
Wider Impacts	• It is considered that there will be positive impacted including on journey time change, journey time reliability, safety, productivity and the local economy from all options. Options 1B and 2B would overall	Option 1A ++

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
	provide additional benefits to Options 1A and 2A given their enhanced overtaking opportunities.	Option 1B +++ Option 2A ++ Option 2B +++

4.4 Public Accounts considerations

Do Minimum		
Impacts	**Description**	**Scale**
Cost to Broad Transport Budget	• The do minimum would have no additional impact to the cost to broad transport budget.	0
Indirect Tax Revenues	• It is anticipated that the do minimum would have no or very limited impact on indirect tax revenues.	0

Do Something

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Cost to Broad Transport Budget	• A third of the cost of the Scheme would be met by Welsh Government.	+++ +++ +++ +++

Options 1A, 1B, 2A and 2B		
Impacts	**Description**	**Scale**
Indirect Tax Revenues	• It is anticipated that Options 1B and 2B would have a slightly more positive impact on indirect tax revenues compared to Options 1A and 2A owing to the longer route required for some journeys; from the south of Redstone Cross to reach the proposed A40 when travelling west. The likely slight increase in speeds as a result of enhanced overtaking opportunities could increase the fuel expenditure and therefore also have a positive impact on indirect tax revenues. • At Stage 3, the preferred option's impact on indirect tax revenue will be assessed in further detail.	+ ++ + ++

4.5 Comparative Performance

4.5.1 The following Appraisal Summary Table (Table 27) provides a comparative analysis of the options considered above.

Table 27 Appraisal Summary Table – Comparative Analysis

	Do Minimum	**Option 1A**	**Option 1B**	**Option 2A**	**Option 2B**
Social & Cultural					
Physical Activity	0	+	++	+	++
Journey Quality	-	+	++	+	++
Accidents	-	++	+++	++	+++
Security	-	+	++	+	++
Commuting and Other users	-	+	++	+	++
Reliability impact on Commuting and Other users	-	++	+++	++	+++
Access to Services	-	+	++	+	++

	Do Minimum	Option 1A	Option 1B	Option 2A	Option 2B
Affordability	0	0	0	0	0
Severance	-	+	++	+	++
Option and non-use values	-	+	++	+	++
Environment					
Noise	0	-	-	-	-
Air Quality	0	+	+	+	+
Greenhouse gases	0	--	-	--	-
Landscape	-	--	--	--	-
Townscape	N/A	N/A	N/A	N/A	N/A
Historic Environment	-	---	---	-	-
Biodiversity	0	--	--	--	--
Water Environment	0	-	-	--	--
Economic					
Business users & transport providers	-	+	++	+	++
Reliability impact on Business users	-	++	+++	++	+++
Regeneration	0	0	0	0	0
Wider Impacts	-	++	+++	++	+++
Public Accounts					
Cost to Broad Transport Budget	0	+++	+++	+++	+++
Indirect Tax Revenues	0	+	++	+	++

Objectives				
O 1	++	+++	++	+++
O 2	+	++	+	++

O 3	+	++	+	++
O 4	++	+++	++	+++
O 5	0	+	0	+
O 6	+	+	+	+
O 7	--	--	--	-
O 8	--	--	--	--

4.5.2 Appraisal makes it clear that Options 1B and 2B would best address the problems, best achieve the objectives and perform best against the majority of cultural, social and economic appraisal criteria, appreciating that there would be some adverse impacts in particular on the environment. Option 2B would have less adverse impact on the environment.

4.5.3 Stakeholder feedback has demonstrated clear preference for Option 2B, largely with its junction arrangement being perceived to be safer than the alternatives.

4.6 Sustainable Development Principle

4.6.1 In accordance with the 2017 WelTAG guidance, the objectives have taken into account the well-being goals as set out in the Well-being of Future Generations (Wales) Act 2015.

4.6.2 As set out at Figure 1, the well-being goals include:

a) A prosperous Wales;
b) A resilient Wales;
c) A healthier Wales;
d) A more equal Wales;
e) A Wales of cohesive communities;
f) A Wales of vibrant culture and thriving Welsh Language; and
g) A globally responsible Wales.

4.6.3 The Options would contribute to most of the well-being goals as follows:

a) A Prosperous Wales: Enhancing network resilience and improving accessibility to key employment, community and tourism destinations will support prosperity, for example increased

productivity would create a more attractive Pembrokeshire to work in and to invest in;

b) A resilient Wales: Whilst all options would have an adverse impact on biodiversity and the natural environment, throughout the project, mitigation and enhancement measures are integrated within Scheme development;

c) A healthier Wales: Improving accessibility to health services will contribute to a healthier Wales. Moreover, complementary active travel measures are integrated within Scheme development. Whilst it is anticipated that there will be adverse noise and air quality impacts for certain areas, it is anticipated there will also be benefits for other areas;

d) A Wales of cohesive communities: By improving accessibility, connectivity between communities will be enhanced. Moreover, removing a large proportion of traffic off the existing A40, benefits for both active travel and car movements would improve, enhancing community cohesion;

e) A Wales of vibrant culture and Welsh Language: Options would also improve accessibility to cultural facilities, whilst the WelTAG Scheme itself has been developed in line with Welsh Language guidance, providing exhibition materials in both English and Welsh for example; and

f) A globally responsible Wales: All options are developed to minimise the environmental impact of the Scheme, alongside addressing the problems and meeting the other objectives of the Scheme.

4.6.4 The Welsh Government and other public bodies are required to publish their own well-being objectives, seeking to achieve the above well-being goals. A detailed assessment of how the preferred option may align to the sustainable development principle, taking into account the well-being goals, objectives and ways of working, will be provide at WelTAG Stage 3, when sufficient detailed information is available to inform that assessment.

4.6.5 At this stage, the appraisal indicates that Option 2B is most likely to perform best compared to the other options in contributing towards the well-being goals and any well-being objectives, given it performs best against the majority of cultural, social and economic appraisal criteria, appreciating that there would be some adverse impacts on the environment.

5 Management Case

5.1.1 The Management Case considers delivery arrangements for the project to include management during the lifetime of the project moving forward. It demonstrates that the project is achievable and outlines the arrangements that have been put in place or will be considered further at the next stage (WelTAG Stage 4). It is considered that the proposed Scheme is deliverable based on the information available at this stage.

5.1.2 This case will need to be updated when a new Design and Build (D&B) Contractor is procured, following completion of Key Stage 4 of the project.

5.1.3 The project will likely be delivered using the NEC Engineering and Construction Contract. These types of contract have been successfully used on a number of Schemes including the A40 Penblewin to Slebech Park, A477 St Clears to Red Roses and A465 Heads of the Valley Dualling, Sections 2 and 3.

5.1.4 The Scheme is split into three key stages which cover design, statutory process, construction and aftercare in accordance with the Welsh Government's Transport Division's Key Stage Approval Process. The KSA process provides a staged financial approval system to manage the process of projects from inception, through to construction and initial maintenance and complies with the principles of PRINCE2 project management (Figure 18)

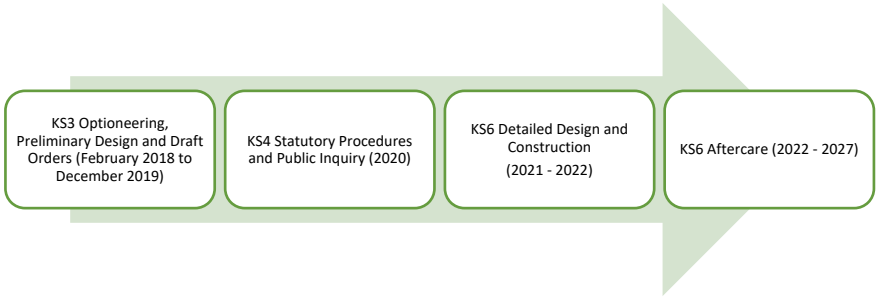


Figure 18 Project Timeline

Key Stage 3

5.1.5 Key Stage 3 (KS3) includes Optioneering, Preliminary Design and setting of land required for the Scheme and associated Statutory Orders required to obtain land via Compulsory Purchase Order (CPO) and any need to designate new sections of road as trunk road. This will be delivered by Arup / RML.

5.1.6 KS3 is planned to run from January 2019 until January 2020 and involves the development of the outline design and Outline Business Case, preparation of a Scheme Cost Estimate, publication of draft Orders documentation and associated environmental documentation such as the Environmental Statement.

5.1.7 The table below (Table 28) identifies the illustrative dates associated with Key Stage 3 programme.

Table 28 Outline Key Stage 3 Programme

Event	Time in weeks after contract award
1. Commencement of Key Stage 3 Services	21 January 2019
2. Issue WelTAG Stage 1 & 2 Report to WG	05 July 2019
3. Completion of WelTAG Stage 3	24 October 2019
4. Submission of Final Draft Orders to Employer	31 October 2019
5. Employer's Approval of Preliminary Design	20 December 2019
6. Publish Draft Line and Side Road orders (End of KS3)	22 January 2019

5.1.8 An Environment Statement and other technical assessments are submitted alongside the draft Orders for the Scheme. Statutory Orders are prepared by Welsh Ministers and published in draft. The draft Orders for the Scheme include the following:

a) A draft Line Order to provide for the new section of trunk road and the reclassification of the existing A40 (de-trunking);

b) A draft Side Roads Order to deal with local highway issues (including roads, footpaths, bridleways, byways and cycleways) and private access issues. Side Roads Orders can relate to closure, diversion, improvement or new provision; and

c) A draft Compulsory Purchase Order, which provides for the acquisition of the land and rights required.

Key Stage 4

5.1.9 Key Stage 4 (KS4) is from publication of Draft Orders through a statutory process to Notice to Proceed to Construction. A Public Local Inquiry may be held if deemed necessary by the Welsh Government. This will be delivered by Arup / RML. KS4 is planned to run from January 2020 to January 2021 and involves completion of statutory processes, including publication of the draft Orders, Orders Exhibitions, dealing with objections, and representations, preparation for and conduct of the Public Inquiry (if required), finalising the Orders and preparing Contract Documentation ready for the procurement of the Design and Build (D&B) Contractor. Table 29 below identifies the

illustrative key dates associated with Key Stage 4 programme requirements.

Table 29 Outline Key Stage 4 Programme

Event	Time in weeks following start of KS4
Start of Key Stage 4	0
Publication of draft CPO	3
Public Orders Exhibition	3
End of Objection/Comment Periods	6
State of Public Inquiry	22
Inspector's report received	32
Review of SASICOM Annex IV (if required)	-
Minister's Decision Letter (approx. 3-4 months after receipt of Inspector's Report depending on complexity of issues)	42
Confirmation of Orders (approximately 3-4 weeks after Minister's decision)	44
High Court Challenge Period begins	44
End of High Couth Challenge Period	50
Notice to Treat	52

Key Stage 5

5.1.10 Key Stage 5 (KS5) will proceed subject to the satisfactory completion of the statutory procedures, the availability of finance and the Minister's decision as to whether the Orders should be made.

5.1.11 During KS5 a Design and Build (D&B) Contract will be procured in compliance with European Union Procurement Directives[37] and the corresponding UK Public Contract Regulations 2015. Further detail of this is provided within Section 7 of this Report.

Key Stage 6

5.1.12 KS6 involves detailed design and construction of the Scheme including an environmental and landscape aftercare period. The suppliers for this stage of the project are unknown and will be chosen following the procurement process carried out in KS5.

5.1.13 KS6 is planned to run from 2021 and involves the detailed design / construction period for all works, plus environmental, landscape and ecological aftercare and management (up to 2027). KS6 also includes Gateway Review No. 3, preparation of the KSA7 and Completion Report. Table 30 below contains the illustrative programme requirements for Key Stage 6, including the main submission events

[37] Directive 2004/18/EC

and anticipated timing.

Table 30 Outline Key Stage 6 Programme

Event	Timing
Commence detailed design	On WG's instruction
Submission of Key Stage 6 programme	2 weeks after commencement of KS6
Submission of Statutory Authorities' diversion works	In accordance with Contractor's programme
Submission of Construction Quality Plan	4 weeks prior to start on site
Submission of Health and Safety Plan	4 weeks prior to start on site
CEMP (update of Pre-CEMP)	4 weeks prior to start on site
Contractor's KS6 Design submission including updated SU Works Report	3 weeks prior to start on site
Submission of Stage 2 Road Safety Audit	In accordance with the Contractor's programme following completion of detailed design
Licences and Consent applications	In accordance with Contractor's programme
Construction start on site	To be determined by Contractor
Submission of Stage 3 Road Safety Audit	3 weeks (min) prior to road opening
Road opening	To be arranged
Completion of KS6 construction works	69 weeks after Key Stage 6 starting date
Health and Safety File (including all 'as built' and manuals etc.)	At time of certification of Completion by the Project Manager

5.2 Construction Programme

5.2.1 The construction programme has not yet been defined. This case will be updated during Stage 3 and will include further information on the proposed Construction Programme.

5.2.2 This section outlines an indicative construction sequence and the likely key construction activities. The details of the construction programme would be updated by the appointed D&B Contractor shortly after

award.

5.2.3 A description of the outline construction programme will be included within the Environmental Statement Chapter 2.

Overall Duration

5.2.4 Detailed design and construction works are currently planned to commence in 2021 and continue for around 16 months.

5.2.5 Maintenance and aftercare of the environmental aspects of the Scheme remain the responsibility of the Contractor for five years after the completion of the Works (likely to be up to 2027).

Sequence of Operations

5.2.6 Following the issue of the Notice To Proceed To Construction, there would be a period when the detailed design will be developed. Prior to work starting on site, property precondition surveys and vegetation surveys would be carried out. Early construction activities would be undertaken.

5.2.7 The site would be made secure as early as possible by the erection of permanent fencing. Where this is not possible, temporary fencing would be erected. Site clearance work would commence with vegetation clearance. Main site accesses would be established at either end of the Scheme at the junction locations;

5.2.8 Bulk earthworks would mainly be carried out in the summer season but would take advantage of any periods of dry weather in the other seasons. Pre-earthworks drainage would follow the earthworks sequence. Mainline pavement would commence in 2022 and intermittently continue through to completion.

5.2.9 Structures would be progressed throughout the construction period. Subject to agreement with a Contractor, the construction sequence would help ensure that the Scheme would be built with minimum disruption to the local environment, local population and the travelling public.

5.2.10 The latter stages of construction would include: Mainline, side road and tie-in pavement works, installation of street furniture, such as traffic signs and street lighting and landscaping and planting of soft estate.

5.3 Contract Management Plan

5.3.1 The appointed D&B Contractor would likely operate an Integrated Management System (IMS) which will form the foundation for the management of the Scheme. The system would be accredited to appropriate British and international standards.

In accordance with the IMS, a Contract Management Plan (CMP) would be developed for the Scheme. The objective of the CMP would be to provide a coordinated approach to the management of the Works and to clearly define policy, standards, processes, procedures, organisation, roles and responsibility and key performance indicators.

5.3.2 Under the overall control of the CMP would be:

a) Health and Safety Management; (see Section 2.12 of the Environmental Statement);

b) Construction Environmental Management Plan (CEMP) (see Section 2.13 of the Environmental Statement);

c) Quality management (see Section 1.14 of the Environmental Statement); and

d) Public Relations (See Section 2.15 of the Environmental Statement).

5.3.3 The Register of Environmental Actions and Commitments (REAC) would be an appendix to the CEMP. The REAC will be developed throughout Key Stage 3 and will continue to be developed through Key Stage 4 taking into account any changes. This will become a requirement of the D&B Contractor during Key Stage 6.

5.4 Governance, organisational structure and roles

5.4.1 The core parties involved in the delivery of the project are:

a) Welsh Government (the Employer) – representing the Welsh Ministers. The project is being led by the Transport group which sit within the Economy and Transport Division, with the Project Director and Project Engineer as the main points of contact.

b) Arcadis (Employer's Agent) – acting as the Welsh Government's representative, providing financial, project management, contract and technical advice (support from Mott MacDonald) throughout the project.

c) Arup / RML– employed by the Welsh Government to carry out the preliminary environmental and engineering design for the

preferred route, as well as undertake all activities necessary for the publication of orders. They will also support the Welsh Government through the Statutory process. Their involvement in the project will cease at the end of Key Stage 4.

d) Project Manager and Supervisor: under the NEC ECC Contract. During Key Stage 6 of the contract the role will be undertaken by Arcadis and Mott MacDonald as delegated by Welsh Government.

5.4.2 D&B Contractor: During Key Stage 5 of the project a D&B Contractor will be procured by the Welsh Government (refer to Section 7.3). The D& B Contractor will be responsible for the delivery of the detailed design and construction (Key Stage 6) and aftercare (Key Stage 7) of the Scheme. Figure 19 below sets out a typical organisational structure for the delivery of Key Stage 6 – Detailed Design and Construction.

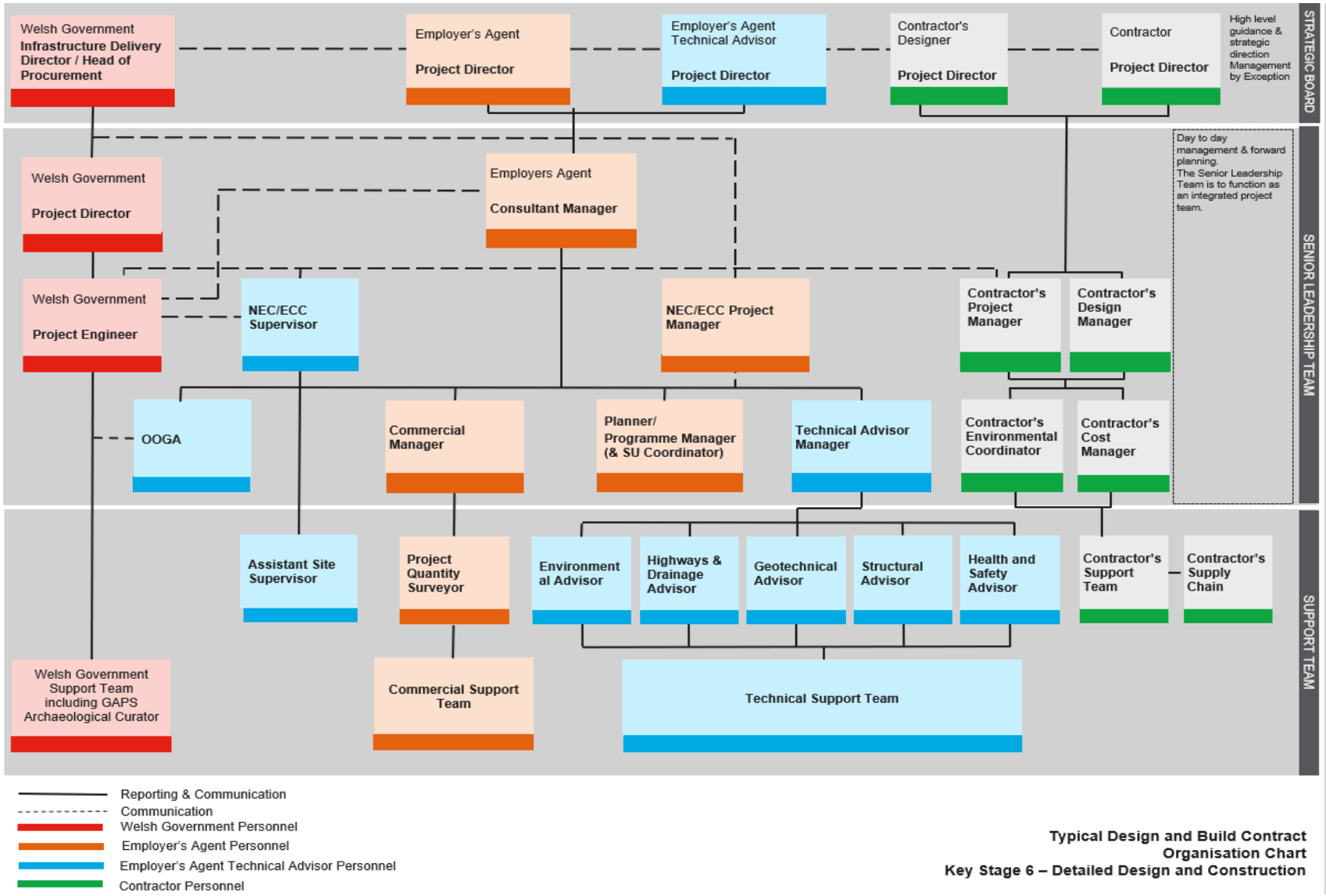


Figure 19 Organisational Structure

5.4.3 Key Stage 6 of the project is overseen by the Senior Leadership team, who are responsible for the day to day management of the project. The Senior Leadership Team comprises members of the Client (Welsh Government), Employers Agent (Arcadis), the Employers Agent's Technical Advisor's Team and the D&B Contractor.

5.4.4 The Strategic Board comprises Project Directors from the various parties involved along with the Welsh Government's Deputy Director of Infrastructure Delivery. Table 31, outlines the participating parties to the Strategic Board for each Key Stage.

5.4.5 The Strategic Board will meet by exception with no planned regular meetings. The function of the Strategic Board is to: make decisions and resolve matters that the Senior Leadership Team cannot resolve, secure working relationships; provide strategic direction; and align values and goals.

Table 31 Strategic Board Members

Key Stage	Attendees
Key Stage 3	WG Deputy Director of Infrastructure Delivery/ Arcadis Project Director/ Arup Design Director
Key Stage 4	
Key Stage 5	WG Deputy Director of Infrastructure Delivery/ Arcadis Project Director
Key Stage 6	WG Deputy Director of Infrastructure Delivery/ Employers Agent Project Director (Arcadis) / Employer's Agent's Technical Advisor Project Director / D&B Contractors Project Director (TBC)/ D&B Designer Project Director (TBC)

5.4.6 WelTAG 2017 specifically requires a Review Group to help steer the appraisal process. A Review Group for the Scheme was established at the outset of the Stage 1 appraisal in order to help ensure that key stakeholders were identified and meet on a regular basis to be involved in any decision making.

5.4.7 It is considered that the project risk is low to medium, in light that despite there being some sensitives in terms of environmental impacts and the need for land acquisition. the project benefits from the previous involvement of an experienced and that the project involves a well-tested approach to procurement and delivery. As such, the Review Group comprises the Welsh Government's Project Director, in addition to the Employer's Agent, the Designer (Arup) and Pembrokeshire County Council as the relevant local authority. The Review Group is as outlined in Figure 20.

Figure 20 Review Group

5.4.8 The Review Group will meet at key milestones in each of the WelTAG Stages in order to consider the content of the WelTAG reports and actions to be taken forward to the next stage of the process.

5.4.9 The Review Group will also play a key role in advising on the methods to be adopted in assessing impacts of the option(s) to be taken forward for subsequent Stages and should make recommendations in relation to any specific additional evidence and/or modelling requirements.

5.4.10 The Review Group will evolve through the project Key Stages. During Key Stage 6 representatives from the D&B Contractor will likely form part of the review group replacing Arup.

5.5 Project management and reporting

5.5.1 The project is being managed following the principles of the PRINCE2 project management process combined with a compatible web-based project management system. The three Key Stages (KS3, KS4, and KS6) of the project will form the Stage Boundaries within PRINCE2 and will require Project Board approval.

5.5.2 The project will be led by Transport within the Economy and Transport Division of the Welsh Government as the Employer. The Employer will also include other individuals, Division and Ministerial portfolios within Welsh Government identified by the Project Engineer and Project Director for the delivery of the project.

5.5.3 All interaction with Welsh Government, unless otherwise agreed, will be made through the Project Director or the Project Engineer.

5.5.4 Progress meetings will be held at monthly intervals unless otherwise advised. The detailed arrangements for these progress meetings are outlined in the KS3 and 4 contract, Section 2.1 of the Professional Services Contract Volume -2 Scope of Services. Similar requirements will be included within the D&B Contractors Contract. The Project Manager will also hold Quarterly Financial Review meetings.

5.5.5 The Project Manager will call a Design Effectiveness Review meeting approximately twelve months after the opening of the Scheme to road traffic. The D&B Contractor and a representative of the design team will attend the meeting and be responsible, as directed by the Project Manager, for drafting a brief report on the findings of the review, identifying areas where the project has been found capable of improvement in detail design and particularly identifying elements with a high maintenance liability.

5.6 Public Relations

5.6.1 Construction works on this scale will likely result in some inconvenience and disruption to residents. It is therefore very important that there are effective channels of communication in place to keep all interested parties informed of activities and to quickly address any complaints or queries.

5.6.2 Arup have appointed a dedicated Public Liaison Officer (PLO) for Key

Stages 3 and 4 to keep the public, community, affected landowners and stakeholders informed of progress and advise on forthcoming activities.

5.6.3 During the construction phase the PLO may be adopted by or change to a member of the D&B Contractor's team and would be based in a site office.

5.6.4 The PLO would be the first point of contact for any concerns or queries and provides the opportunity for feedback to be provided and taken into account on an ongoing basis.

5.6.5 The PLO would be contactable through a project e-mail address, telephone number, by post or in person at the site office.

5.6.6 The D&B Contractor when procured would distribute information about the Scheme, including information letters delivered from time to time addressing specific issues to specific residents.

5.6.7 The D&B Contractor when appointed would work together with all stakeholders to ensure concerns are addressed through a process of providing information, listening, reviewing, taking action and feedback.

Public acceptability

5.6.8 The project team records any relevant feedback on the consultee aspirations and commitments in an Environmental Management Plan and Register of Commitments, to enable it to be integrated into the design and construction process as environmental design objectives and mitigation measures.

5.6.9 Workshops and Public Information Exhibitions were undertaken through early 2019, where feedback was invited and received. This has helped inform project design and development, in order to maximise the level of public acceptability to the proposals.

5.6.10 A summary is provided below.

Review Group Stage 1 Workshop

5.6.11 A WelTAG Stage 1, 2 and 3 has been undertaken for the A40 Llanddewi Velfrey to Penblewin Improvments.

5.6.12 As part of WelTAG Stage 1 of this study, a workshop was held on 6

March 2017 to which all members of the review group were invited. The workshop discussed the revised WelTAG process and agreed how to proceed with the Stage 1 appraisal for the Scheme. As outlined in the first section of this report, WelTAG 2017 Stage 1 requires the identification of the problem(s), objectives and possible solutions for appraisal.

5.6.13 In order to inform discussions, a draft list of problems and objectives were presented. These were based on the outcomes of previous development work and the review of relevant legislation, policy and guidance.

5.6.14 The workshop attendees discussed and agreed a list of problems that the Scheme should aim to address, with consensus that the problems whilst taking into account previous development work still remained valid problems today, including additions.

5.6.15 The workshop attendees discussed and reviewed the initial list of objectives against the 2015 Act Wellbeing goals, and a revised list of objectives were agreed.

5.6.16 Following agreement on the problems and objectives, the workshop presented an indicative long list of options for the improvements which built on previous development work and included a combination of on-line and off-line options in addition to a number of non-road building options. Agreement was reached that the Stage 1 appraisal should consider a variety of options and not focus only on road building options.

5.6.17 The problems and objectives identified in this combined WelTAG Stage 1 and 2 share the same strategic principles as that of the A40 Llanddewi Velfrey to Penblewin Improvements. The local problems and objectives have been reviewed and refined to align with the Penblewin to Redstone Cross Improvements.

Public Information Exhibition – April 2019

5.6.18 Exhibitions were held at Llanddewi Velfrey Village Hall, Llanddewi Velfrey, Narberth, SA67 7PA on 10 April 2019 between 2pm and 8pm and 11 April 2019 between 10am and 8pm. The exhibition location was identified as being located close to the Scheme and accessible to those most affected by the proposed Scheme to maximise attendance. Measures that were undertaken to publicise the Public Information Exhibitions included:

a) Personal Invitation Letters hand delivered throughout the local community;

b) Invite posters displayed at prominent locations in the local area;

c) Stakeholder Invitation Letters via email communication or post (including Non-Motorised User (NMU) groups, non-statutory environmental bodies and other road user groups who may be affected by the proposals); and

5.6.19 Further details about the events are reported in a Public Information Exhibition Report (April 2019)38.

5.6.20 The purpose of the exhibitions was to:

a) Explain how the Scheme was developed since the exhibitions held in 2017 for the separate Llanddewi Velfrey to Penblewin Improvements;

b) Seek stakeholder feedback on the problems, objectives and possible solutions for the A40 between Penblewin Roundabout and Redstone Cross; and

c) Advise stakeholders as to how they can stay involved and help them understand the likely next steps.

5.6.21 95 people signed the attendance register over the two days. Questionnaires and Verbal Record Sheets helped record feedback.

5.6.22 An overwhelming majority of those who provided feedback considered that the A40 between Penblewin Roundabout and Redstone Cross needs improving (75%). The majority also agreed with the problems and objectives presented (68%).

5.6.23 53% of respondents considered the project team to have explored all options compared to 37% who did not feel all options had been considered. Of those that provided feedback, the top comments on alternatives/additions that should be considered were:

a) A roundabout to replace Redstone Junction (including one suggestion to be further west);

b) Traffic calming measures e.g. speed limit reductions, speed cameras;

c) Only improve junction / improve layout for safety reasons; and

d) Alterations to Southern Option – underpass or bridge/no junction.

[38] Welsh Government, A40 Penblewin to Redstone Cross Improvements, Public Information Exhibition Report April 2019 (A40PRC-ARP-HGN-M02-RP-D-0001)

5.6.24 Of the three options presented at the Exhibition, there was no clear preferred options. The following outlines the findings:

a) 17 respondents preferred Option 2 (Southern Route);
b) 15 respondents preferred Option 1b (Northern Route no junction);
c) 13 preferred Option 1a (Northern Route with junction);
d) 12 chose the 'None of the options / Other' option; and
e) Three respondents either left the question black or entered an alternative response outside of the options listed.

5.6.25 Feedback in opposition was also received, including four respondents stating that they are against funds being spent on a Scheme. Three respondents also stated that they did not feel a Scheme is necessary.

5.6.26 The feedback has helped the design team to consider key issues and help address concerns in the option selection phase. In particular, a focus is on:

a) Further consideration of a roundabout option.
b) An additional option for a Southern route with no junction.
c) Further consideration of traffic impacts upon Narberth, in particular, to the traffic movements to the commercial premises at the north of Narberth accessed currently via Redstone Cross road.

5.6.27 Following the Exhibition further feedback was received, via the Public Liaison Office, consisting of a letter and a Statement of Concern. Further feedback was received from the office of Angela Burns AM, recommending that a further exhibition be held in Narberth.

Public Information Exhibition – May 2019

5.6.28 Following feedback from the Public Information Exhibition in April 2019, a further Exhibition was held at the Exhibition was held at Bloomfield House Community Centre, Redstone Road, Narberth, SA67 7ES on 30 May 2019 between 12pm and 8pm. The exhibition location was identified following feedback from the office of Angela Burns AM that the exhibition should be held in Narberth. Measures that were undertaken to publicise the Public Information Exhibitions were similar to the April Exhibition, but also included:

a) Extended Letter drop extents (further into Narberth)
b) Advised in the Narberth and Whitland Observer on 22 May 2019 and 24 May 2019. This was organised by a local councillor.

c) The Office of Simon Hart extended the invite to members of his constituent who had expressed an interest in the Scheme.

5.6.29 Further details about the events are reported in a Public Information Exhibition Report (May 2019)[39].

5.6.30 The purpose of the exhibitions was similar to the April Exhibition, but with the addition of displaying and inviting comment of a fourth option (2B), developed following the April Exhibition.

5.6.31 170 people signed the attendance register over the one day exhibition. Questionnaires and Verbal Record Sheets helped record feedback.

5.6.32 The key points expressed or indicated by attendees of the May 2019 PIE were, in no particular order:

a) The need for improvements between Penblewin Roundabout and Redstone Cross is strongly supported (89% of respondents);

b) A majority of respondents (79%) agree with the problems and objectives outlined;

c) The issue of safety at Redstone Cross junction is a particular and consistent concern. Comments included: witnessed collisions and near misses; the junction's poor visibility: the high-speed traffic within the local area and limited space in the central reserve;

d) 45% of respondents stated a preference for the route to go to the south of the existing A40 and 26% of respondents preferred a Northern corridor and

e) The majority of respondents (52%) stated a preference for no junction at Redstone Cross with just over a quarter (26%) preferring a junction to be provided

[39] Welsh Government, A40 Penblewin to Redstone Cross Improvements, Public Information Exhibition Report April 2019 (A40PRC-ARP-HGN-M02-RP-D-0002)

5.6.33 There was a clear preferred option by number of questionnaire responses:

a) 72 respondents preferred Option 2b (Southern Route without Junction).
b) 25 respondents preferred Option 1b (Northern Route without Junction).
c) 15 respondents preferred Option 1a (Northern Route with Junction).
d) 13 respondents preferred Option 2a (Southern Route with Junction).
e) 3 respondents chose both Option 1a or 2a (Favouring Options with a Junction).
f) 5 respondents chose both Option 1b or 2b (Favouring Options without a Junction).
g) 7 respondents chose No option or left it blank.

5.6.34 Concerns partially related to the potential direct impacts upon the respondent in relation to the proposed options e.g. impacts on their own property and accessibility as well as the concern that traffic will be rediverted through Narberth in option with no junction. Despite pointing out that it will be more difficult to access the new A40 in options without a junction, respondents still preferred to improve safety.

5.6.35 A majority of 60% of respondents felt that all options have been considered by the project team. Feedback suggesting alternatives and additions to the proposal included:

a) Alternative Junction forms including a roundabout and slip roads;
b) Mainline Speed Limit and Traffic calming measures;
c) Improvement to the current junction;
d) Improvement to the existing A40 road layout; and
e) Consideration of public transport.

5.6.36 The key points raised by respondents at the May 2019 PIE regarding the exhibition itself were, in no particular order;

a) The exhibition was considered to be well attended by the local community with 170 in attendance; and
b) The public were given sufficient notice to attend and that the exhibition was held in a suitable venue. The respondents appreciated that the exhibition was held in Narberth in a place

where the local community gathers. The identification of areas under consideration generated a discussion point and raised valuable feedback.

Public meeting

5.6.37 A public meeting was held on 20 June 2019, organised by some local residence to discuss the options presented at the Public Information Exhibitions. The meeting was held at the Bloomfield Community Centre and was attended by 35 members of the public, including several councillors. The following views were expressed and recorded by representatives of the project team:

a) Narberth will see increased traffic which will cause it to be grid-locked;
b) Improving the road will bring increased environmental impact;
c) Redstone Road will become isolated;
d) Increased use of A478 as a route into Narberth;
e) There will be a detrimental impact on Blaenmarlais Care home;
f) A poorly designed Scheme will have a big negative impact on Narberth, whereas a well designed Scheme will keep it as it is;
g) Noise during night of the convoy of 20 + ferry lorries;
h) If the route is ever dualled this then the impacts are only going to get worse; and
i) Any proposal will prevent the 'Secret Owl Garden' from being relocated to Noble Court.

Strategic Board Stage 2 Presentation / Workshop

5.6.38 A WelTAG Stage 2 workshop was held on 29 June 2019. The workshop discussed the outcomes of the WelTAG Stage 1 & 2 Study and agreed how to proceed based upon the preferred recommendation contained within this report.

5.6.39 To inform discussions, the long list and short list of options was presented. These were based on the information contained within the Design Options Report[40] and the development work associated with this, the public information exhibition results and the review of relevant legislation, policy and guidance.

5.6.40 Wider discussion on likely impacts against economic, social and environmental criteria was had, which helped finalise the WelTAG

[40] A40-PRC-ARP-HGN-MO2-RP-C-0002 Design Options Report

Stage 2 Reporting.

The Strategic Board decided that further consideration should be given to junction strategy during Stage 3, in relation to access from the west at Redstone Cross.

5.7 Risk Management

5.7.1 A risk workshop was conducted early in the Key Stage 3 process with the project team to prepare the Project Risk Register.

5.7.2 This Risk Register is reviewed and would continue to be updated as a minimum, every 3 months during Key Stages 3 and 4, and every 1 month during Key Stage 6. Risks are allocated within the register to the relevant party who is best placed to manage the Risk. This will need to be reviewed and form part of the procurement process, with risks reallocated to the D&B Contractor as appropriate.

5.7.3 The Project Risk Register will be updated in later stages to provide an estimate of the financial impact (quantified) if each risk is encountered. This will be analysed, and the outcome used to inform the risk budget for the project, which will be included within the Scheme Cost Estimate.

5.7.4 The Risk Register is discussed at each Progress Meeting and would continue to include the following once the D&B Contractor has been appointed:

a) A description of key risks to the project delivery / cost;
b) The likely effect / cost of each risk;
c) The organisation best placed to remove / manage each risk;
d) Target dates for action; and
e) Hazards with implications under the CDM Regulations.

5.7.5 Table 32 provides a summary of some of the top unmitigated risks that are included within the Project Risk Register and outlines the mitigation measures that are proposed.

5.7.6 The D&B Contractor would manage risk on the project in accordance with the procedures set out in the latest version of the Value for Money Manual – risk Analysis and Management.

5.7.7 At intervals, not exceeding 6 months, the Technical Advisor will carry out a risk identification and assessment exercise and report the results to Welsh Government.

5.7.8 The D&B Contractor would be responsible for arranging and taking part in a Risk Workshop, including other advisors where appropriate, to identify risks and take these into account in the preparation of cost estimates in a manner to be agreed with Welsh Government.

Table 32 Summary of Project Risk Register: Top Unmitigated Risks

Risk register I.D.	Description of Risk	Consequence of Risk	Risk Classification	Mitigation
0001	Insufficient ground investigation available	Incorrect design assumptions	Very High	Undertake Ground Investigation of preferred option to better understand the ground conditions.
0002	Lack of topographical survey data.	Inaccurate design affecting alignment at tie in locations and earthwork quantities, resulting an increase to the Scheme cost	Very High	Key areas of the Scheme to be surveyed and verified against the ground model that has been used to develop the Scheme layout.
0003	Habitat surveys undertaken in parallel to the design process	Inefficiencies in design, redesign as more information is obtained	Very High	Review information as it becomes available and feed into the design
0004	Contractor / Sub Contractor becoming insolvent.	Increase in overall Scheme cost	High	
0005	Unanticipated increase in land costs. Potential for some properties to be "blighted" and compensation / purchase costs associated with this	Increase in overall Scheme cost	High	Undertake an updated Land cost estimate.
0006	Archaeological remains discovered during construction which were not identified in KS3 and KS4 investigations	Construction programme delays, increased cost	High	Review interpretation of Geophysical Survey and incorporate into the preliminary design.

5.8 Details of legal requirements

5.8.1 The Scheme will conform to all EU and UK Environmental Legislation. The Scheme will be delivered under the Highways Act 1980, a Line Order will give the powers to the Welsh Government to create a new trunk road. A Side Roads Order gives the Welsh Government the powers to stop up, improve and create, Side Roads, Private Means of Access and Public Rights of Way. Land required for the Scheme will be acquired via the Acquisition of Land Act 1981 via a Compulsory Purchase Order.

5.8.2 The design and construction of the Scheme will be undertaken with due consideration of the Construction (Design and Management) Regulations 2015, the Equality Act 2010, the Active Travel (Wales) Act 2013, The Well-being and Future Generations (Wales) Act 2015, Wales Act 2017 and Welsh Language Standards Regulations 2015.

5.9 Communications & stakeholder engagement plan

5.9.1 A Communications Plan has been prepared for the project and identifies how all communications between project team members and external parties will be consistently managed to ensure that the needs of the Welsh Government are met at a national, regional and local level to deliver the Scheme.

a) The Communications Plan sets out;
b) Key communication roles and responsibilities;
c) Communication management strategy;
d) Public liaison;
e) External communications;
f) Complaints and enquiries; and
g) Communication with the media.

Benefits realisation plan

5.9.2 Requirements will be placed upon the D&B Contractor through their contract to undertake monitoring during the 5-year aftercare period of the Scheme. The requirements of this are likely to be in line with the requirements included in the ECI Contract as detailed in Section 7 of Volume 2 – Works Information.

5.9.3 This details the requirement to compile a post-opening report to satisfy that the objectives, indicators and conditions set out in the European Regional Development Fund (ERDF)[41] funding offer letter and Business Case have been achieved[42]. The relevant extract of the Works Information is:

> *"7.4* ***Post Opening Evaluation & Reporting to WEFO***
>
> *"7.4.1 The Contractor will compile a post-opening evaluation report to satisfy the funder, WEFO, that the funding objectives, indicators and conditions set out in the offer letter and in the Business Case have been achieved. The report will provide evidence to key audit scrutiny via the direct reference to objectives, project deliverables and themes set out at the time of such agreement."*

5.10 Monitoring and Evaluation Plan

5.10.1 Environmental aftercare and management will be carried out for a period of five years following the completion of the works. It will be undertaken in accordance with the agreed Construction Environmental Management Plan Aftercare (CEMPA).

5.10.2 Annual Environmental Performance and Monitoring Report (AEPMR) will be prepared to monitor performance, followed by a Final Environmental Performance and Monitoring Report (FEPMR) at the end of the aftercare period.

5.10.3 The D&B Contractor will be required to undertake these activities. The previous ECI Contract contains the requirements and it is assumed any D&B Contract requirements will be similar. Section 7.3 of Volume 2 – Works Information sets out the requirements for monitoring the performance of Environmental Designs. Clause 7.2 of Volume 2 sets out the requirement for an Annual Environmental Performance and Monitoring Report (AEPMR) and Final Environmental Performance and Monitoring Report (FEPMR). The relevant extract of the Works Information is:

[41] Managed by the Wales European Funding Office (WEFO)
[42] See section 6.5 of this report

7.2 Environmental Aftercare and Management

7.2.1 The *Contractor* shall carry out environmental aftercare and management for a period of five years following the completion of the *works*. It shall be undertaken in accordance with the agreed Construction Environmental Management Plan Aftercare (CEMPA) (written in accordance with the requirements of DMRB and associated Procedural Advice and Guidance Notes (PAGs) and IANs.) which will have been submitted to the *Employer* 6 months prior to the end of the construction period.

7.2.2 Annual Environmental Performance and Monitoring Report (AEPMR) will be prepared to monitor performance, followed by a Final Environmental Performance and Monitoring Report (FEPMR) at the end of the aftercare period.

5.10.4 Six months before the end of the aftercare period, the CEMPA will be updated into a suitable Handover Environmental Management Plan (HEMP) written in accordance with the requirements of DMRB and associated Procedural Advice and Guidance Notes (PAGs) and IANs. The HEMP will cover the management of all environmental features (both hard and soft environmental measures).

5.10.5 The HEMP will set out the environmental maintenance and management required for the completed project for the next 10 year maintenance period and will be developed in consultation with Welsh Government and their Environmental Representatives of the Managing Agent responsible for the Trunk Road Network.

5.10.6 Safety audits are required at the following stages of Key Stage 6:

5.10.7 Stage 2 audit: on completion of the detailed design in Key Stage 6 as part of the Key Stage 6 Design Submission;

5.10.8 Stage 3 audit: immediately prior to occupation or use of any parts of the permanent works, any remedial works so identified shall be completed before opening of the road to public use except where otherwise agreed with Welsh Government; and

5.10.9 Stage 4 (monitoring) audits: at times in Key Stage 6 aftercare period to be agreed, but normally Stage 4A at one year after opening and Stage 4B at three years after opening to monitor the road's performance in road safety terms.

5.10.10 The Road Safety Audits will also cover an area 500m in radius beyond the termination of the works.

5.10.11 Traffic and accident data will continue to be collected by Traffic Wales and all personal injury accidents on public roads are reported to the police and recorded using the STATS19 accident reporting form.

5.10.12 Stakeholder feedback will continue to be facilitated and taken into account, with the continued role of the PLO.

5.10.13 Evidence is required on the actual inputs used when implementing the Scheme and during its on-going operation, what was actually delivered, the impacts experienced, to what extent the intervention met its objectives and how they were achieved. It is considered that sufficient levels of data will have been collected at Stage 3 to provide the 'before' data, thus avoiding any requirement for the collection of any further evidence to be carried out in advance of the project's implementation. The data will be provided in the following Stage 3 documents:

a) Traffic and Accident Data Report;
b) Traffic Data Collection Report;
c) Historic Accident Data Analysis;
d) Local Model Validation Report;
e) Traffic Forecasting Report;
f) Walking, Cycling and Horse-riding Assessment; and
g) Environmental Statement.

5.10.14 In line with the revised WelTAG 2017 guidance, there may be additional requirements for the Contractor to undertake evaluation of the Scheme against the objectives set in WelTAG once they are appointed (being responsible for Stages 4 and 5 of WelTAG 2017).

5.10.15 The WelTAG Stage 4 Report will record an immediate post opening evaluation recording the actual outputs delivered and the initial impacts. This should cover the first six months of operation and be completed within 12 months' post opening or completing of the intervention.

5.10.16 Then at Stage 5 the Welsh Government should produce a record of what was delivered, an evaluation of the process of delivering the option, a record of the actual impacts compared to the anticipated impacts and an assessment into the extent to which it met the original objectives.

5.10.17 The budget required to cover the cost of conducting the highway maintenance and environmental monitoring and evaluation work is

included in the design costs of the Scheme, outlined at Section 7 of the project Works Information.

5.10.18 Accident and traffic data would be available without cost, with traffic count data obtained from Traffic Wales, annual average daily traffic (AADT) data published by the Department for Transport, and personal injury accidents are available using the STATS19 reporting forms.

Five Ways of Working

5.10.19 The Well-being of Future Generations (Wales) Act 2015 sets out five key ways of working that the Welsh Government is obliged to take account of:

5.10.20 The Welsh Government is committed to working in accordance with the sustainable development principle. For example, in its Works Information it sets out several requirements for its Contractor that are considered to be generally aligned to the five ways of working as defined in the 2015 Act:

a. The Welsh Government asks the Designer (and any future D&B Contractor) to record the consideration given to sustainability through all stages of works. Throughout the duration of Key Stage 6 the Contractor maintains a register of consideration of sustainability in optioneering, design, construction and operation methods;

b. The Welsh Government asks the Designer (and any future Contractor) to register the Scheme with CEEQUAL. They shall undertake all work necessary to support a CEEQUAL submission including liaison, consultation, meetings and submission of preparation etc. and shall submit for a Whole Project Award (to promote, record and recognise improvements in sustainability and environmental performance). CEEQUAL is an award Scheme

designed to promote, record and recognise improvements in sustainability and environmental performance;

c. The Welsh Government adopts informal partnering with the Designer (and would continue to do so with any future Contractor), including Technical Working Groups and partnering workshops. The objective of partnering workshops is to develop an integrated team. This involves interactive planning sessions focussing on Scheme specific issues rather than generic team building sessions;

d. The Welsh Government requires the use of a web-based project management system for the sharing and management of information within the project. This provides improved communications between the organisations in the team; and

e. The Designer and any future Contractor must comply with the Welsh Language Scheme and official guidance. All non-technical material made available to the public shall be in Welsh and English, preferably within the same document. This shall include, but is not limited to, material and plans displayed at public exhibitions, questionnaires, newsletters, draft orders and plans, as well as published Scheme documents.

5.10.21 A commentary of how the project would embed the five ways of working is provided below.

Table 33 The five well-being ways of working

Well-being Way of Working	How the project embeds the ways of working
1. Looking to the long term so that we do not compromise the ability of future generations to meet their own needs	Table 25 sets out how there are transport and economic problems along the A40 now that need to be addressed, whilst section4.3 explains how the proposed options would provide the long term and sustainable solution to the identified problems and would help achieve the objectives to benefit current and future generations.
2. Taking an integrated approach so that public bodies look at all the well-being goals in deciding on their well-being objectives	Section 4.6 of this report explains how the well-being goals were taken into account during the development of the Scheme objectives, as well as how the proposed solution would contribute to the well-being goals and the Welsh Government's latest well-being objectives. In summary, the project would largely contribute positively and therefore is considered to align well with the sustainable development principle.
3. Involving a diversity of the population in the decisions that affect them	The project has been developed through engagement with a wide range of stakeholders. Involvement of key stakeholders continues as the Scheme is progressed subject to the statutory process. The project team undertakes liaison with the Statutory Environmental Bodies (Natural Resources Wales, CADW and Pembrokeshire County Council) through the Environmental Liaison Group (ELG) and other interested bodies, also consulting with appropriate interest groups and organisations as appropriate. Feedback from the above stakeholders has informed the decision making process to identify a preferred option by helping identify risks and suggest measures of mitigation to help shape the development. Through the next stages of development, the project team will engage with the Design Commission for Wales (DCfW). DCfW promote the importance of good design for the built environment across all sectors, including infrastructure. Public Information Exhibitions were undertaken over two occasions, over two days in April 2019 in the community hall in Llanddewi Velfrey and one day in May 2019, based and in the Bloomfield Community Centre in Narberth. Feedback was invited and received.
4. Working with others in a collaborative way to find shared sustainable solutions	The advantages of the Welsh Government utilising the same team to develop the Key Stage 3 of the A40 Penblewin Redstone Cross Improvments as the Llanddewi Velfrey to Penblewin Improvments are the following: a) The Designer has a good understanding of the potential environmental impacts which may occur during construction. This assists in the decision of a

Well-being Way of Working	How the project embeds the ways of working
	preferred route. As a result, there will be a better understanding of the implementation of the mitigation measures during the preparation of the Environmental Statement. b) There is a better understanding of construction issues through all stages of the design. c) More accurate assessments of costs, programme and risk. d) A risk management strategy has been developed to ensure that all key risks are identified and minimised early within the Scheme development process. e) The temporary working space required outside the permanent land take will be identified and incorporated within the draft Compulsory Purchase Order. This land will be included so that the Scheme can be built efficiently and safely, whilst minimising the environmental impacts. The second Public Information Exhibition was held after a fourth option was developed following feedback from the public and further assessment work by the project team. The exhibition was held to seek the views of the public on all four options under consideration. A number of attendees made positive verbal feedback to the project team that they were happy to see that their feedback had been taken on board. The events were advertised in a variety of ways to maximise attendance including through letter drops, posters and communication via local politicians. Events were held throughout the day and the evening in order to maximise attendance from a diversity of people. Suggestions from the first Public Information Exhibition stated a preference towards Bloomfield House Community Centre in Narberth as a location for an exhibition; efforts were therefore made to ensure the second Public Information Exhibition was held here. In addition to this, members of the local community were advised that they could also speak with the project's Public Liaison Officer after the event, with some questionnaire responses being submitted via this means.
5. Understanding the root causes of issues to prevent them from occurring	A robust approach to problem identification is outlined in Section 1.6, taking into account a wide range of traffic, accident and environmental data. The involvement of the Review Group and other stakeholders has also informed problem identification. The identification of Scheme objectives (see section 1.7) and the development and design of options (see section 4) has responded to the identified problems, helping ensure a long term and sustainable solution.

6 Financial Case

6.1.1 The Financial Case considers the affordability and long-term financial viability of the option(s). Consideration is given to both capital and annual revenue requirements.

6.1.2 This case will need to be updated when a new Design and Build (D&B) Contractor is procured, following completion of Key Stage 4 of the project.

6.1.3 An initial Scheme Cost Estimate has been undertaken and is likely to represent a worst case in advance of the appointment of a new D&B Contractor, largely given all of the risk currently sits with the Employer. The base year prices have also been updated to 2018 prices.

6.1.4 The initial cost Estimate for the Scheme is likely to be between £14,700,000 and £17,800,000, as follows:

Table 34 Scheme initial cost summary

Component	Estimate
Preparation	£300,000 to £500,000
Supervision	£700,000 to £1,000,000
Construction	£12,500,000 to £14,500,000
Land	£1,200,000 to £1,800,000
Total (excluding VAT and inflation to completion)	**£14,700,000 to £17,800,000**

6.1.5 Optimism Bias has been included within the indicative costs outlined above. These initial cost estimates will be updated once further information is available and the Scheme has been developed in more detail during Stage 3. There will also be an updated Risk and Optimism Bias at Stage 3.

6.1.6 These costs are assumed on the basis that this Scheme would be delivered separately to the A40 Llanddewi Velfrey to Penblewin Improvements Scheme. The intention is currently for the two Schemes to be delivered independently with opportunities for the Schemes to be delivered together through the Construction Phase of the project. The main advantages/opportunities of delivering construction as one scheme are: optimised project delivery programme, reduced Construction Preliminary Costs and Overhead Costs, optimised design/construction for certain elements for such things as earthworks

movements and balancing, consistency in one Contractor delivering all works (no interface).

6.1.7 It should be acknowledged that the cost estimate is likely to change with the appointment of a D&B Contractor. At that stage the cost could reduce, should risk be shared, and a result of greater cost certainty and with local market conditions being taken into account.

6.1.8 The procurement of the D&B Contractor will include requirements for them to implement Welsh Government Policy as outlined in the following guidance: "Community Benefits: Delivering Maximum Value for the Welsh Pound" and "the Welsh Procurement Policy Statement (WPPS)". This would maximise opportunities in: Training and Employment; Supply Chain and SMEs; work with local schools and colleges; and contributing to community regeneration. This would be part of the requirements for the D&B Contractor and they will be required to make commitments through the procurement process. Through implementation of this policy it is anticipated that much of the cost could be spent in Wales, of which about half could be spent in the local area.

6.1.9 The new trunk road would also have revenue implications in terms of maintenance costs, which would be the responsibility of the Welsh Governments Network Management team. Some of the revenue cost would be covered by a transfer of spend from the existing trunk road, which would be de-trunked and ownership / maintenance responsibility passed to Pembrokeshire County Council as the local highway authority.

6.1.10 The option therefore brings revenue implications for Pembrokeshire through increased maintenance costs associated with the de-trunked section of carriageway which could be in the region of 1km length.

6.1.11 Capital costs will be funded jointly, with the allocation of funding being a third Welsh Government and two thirds WEFO. The costs are drawn over the duration of the project with ERDF funding already being claimed to undertake activities such as Ground Investigation.

6.1.12 Regarding maintenance, the D&B Contractor, once appointed, will be responsible for maintenance of the Environmental Mitigation for five years post completion (forecast to be 2022 to 2027). Further detail is set out in Section 7 of Volume 2 – of the ECI Contract Works Information,

which is assumed to be similar to the contract with the D&B Contractor. The cost will be included in the tender price.

6.1.13 The relevant extract of the Works Information is:

7.2 Environmental Aftercare and Management

7.2.1 The *Contractor* shall carry out environmental aftercare and management for a period of five years following the completion of the *works*. It shall be undertaken in accordance with the agreed Construction Environmental Management Plan Aftercare (CEMPA) (written in accordance with the requirements of DMRB and associated Procedural Advice and Guidance Notes (PAGs) and IANs.) which will have been submitted to the *Employer* 6 months prior to the end of the construction period.

7.2.2 Annual Environmental Performance and Monitoring Report (AEPMR) will be prepared to monitor performance, followed by a Final Environmental Performance and Monitoring Report (FEPMR) at the end of the aftercare period.

7.2.3 Six months before the end of the aftercare period the *Contractor* shall update the CEMPA into a suitable Handover Environmental Management Plan (HEMP) written in accordance with the requirements of DMRB and associated Procedural Advice and Guidance Notes (PAGs) and IANs. The HEMP will cover the management of all environmental features (both hard and soft environmental measures).

7.2.4 The HEMP will set out the environmental maintenance and management required for the completed project for the next 10 year maintenance period and will be developed in consultation with the *Employer* and their Environmental Representatives of the Managing Agent responsible for the Trunk Road Network.

7.2.5 The *Contractor* shall consult with the *Employer* and Managing Agents Environmental Representative to ensure that the HEMP compliments the existing Route Environmental Management Plan (REMP) and is compatible with their current systems.

7.2.6 The HEMP will provide indicative costs for the management and maintenance of the environmental measures (including but not limited to, landscape, ecological, water quality and drainage, and noise and vibration measures) for the 10 year period following handover to allow the receiving agent to make reasonable adjustment to their maintenance costs. The HEMP will be submitted to the *Employer* 6 weeks before the issue of the Environmental Aftercare Certificate. The general requirements are set out in Volume 2A Appendix D/3.

6.1.14 Regarding defects to the highway, the D&B Contractor will be responsible for rectifying defects within five years after completion, at their own cost if defects are found to be as a fault of design and/or construction.

6.1.15 Welsh Government will fund ongoing maintenance of the road via the South Wales Trunk Road Agent (SWTRA). This will include, ut not be

limited to, structural inspections, highway resurfacing works, winter maintenance, road lighting maintenance and any repair works required as a result of a road collision.

6.1.16 Pembrokeshire County Council will be responsible for similar maintenance on all highways transferred to their ownership as part of the Scheme. The draft Side Roads Order details highways that are to be constructed or modified as part of the Scheme that will be adopted by Pembrokeshire County Council. The details of any detrunking works of the existing A40 carriageway are yet to be confirmed and it is the intention to have agreed the details prior to the start of Key Stage 6 and would then form part of a de-trunking package between Welsh Government and Pembrokeshire County Council.

6.1.17 The initial cost estimate has a base date of September 2018. The initial cost estimate will be refined during Stage 3 with a Scheme Cost Estimate being defined, which will form part of the Schemes economic appraisal. The Scheme Cost Estimate would be updated during Key Stage 4 of the project will be in line with this base date.

6.1.18 The Scheme is being jointly funded from Welsh Government Infrastructure Delivery Department and the ERDF.

6.1.19 Following the acceptance of a Business Case prior to the instruction to proceed with Stages 3 and 4, WEFO have confirmed that ERDF funding for the Scheme is secured, despite 'Brexit' and the UK's withdrawal from the European Union.

Affordability and risk

6.1.20 The Welsh Government has a proven track record of managing and delivering large and complex infrastructure projects. These include projects which have attracted significant contributions from the ERDF. Welsh Government will be responsible for ensuring that WEFO funding is spent as the grant required. WEFO will provide 66.6% for the delivery of the Scheme with Welsh Government funding the remaining 33.3%.

6.1.21 WEFO funding is required to be claimed by the end of 2022. The current road opening date is anticipated to be end of 2022. If the road opening date is postponed beyond the end of 2022 there is a risk that the Welsh Government will not be able to claim all the funding available for the Scheme. This could affect the deliverability of the

scheme and would require the Welsh Government to fund the remaining outstanding project costs. This risk will be managed through the following stages.

6.1.22 The executive management arrangements of the Welsh Government backed up by the professional audit and financial scrutiny mechanisms of central government will help ensure compliance with programme regulations and ensure the associated transparency and propriety of investments sanctioned under the project.

6.1.23 The budget will be reassessed by the Employer and this assessment will use the Scheme Cost Estimate that will be prepared by Arup as a base cost which will be inflated as necessary to take include items such as Contractor risk, Contractor fee percentage, Employer's risk, Employer's technical advisor cost, Employer's cost, land compensation.

6.1.24 Finally, As the Scheme is part funded by WEFO, WG only need to source 33% of monies associated with the delivery of Key Stage 6.

6.1.25 The requirements of Clause 3.17 of the Works Information Volume 2 and Appendix P Volume 2A will apply during Key Stage 6.

6.1.26 The tenderers will be required to price for risks which they "own" within the Key Stage 6. The relevant extract of the Works Information is:

7 Commercial Case

7.1.1 The Commercial Case considers whether it will prove possible to procure the Scheme and then continue with it into the future. The case considers the level and type of involvement from the private sector, as well as potential effects on the on-going viability of the option/Scheme.

7.1.2 This case will need to be updated when a new Design and Build (D&B) Contractor is procured, following completion of Key Stage 4 of the project.

7.1.3 The choice of procurement type for the project is based on a number of basic principles applied to achieve best value including:

a) Selection of Contractors on the basis of quality and price;
b) Fair Allocation of Risk;
c) Optimising Quality of Design, buildability and Sustainability;
d) Adopting a non-contractual Partnering Approach.

7.1.4 The Welsh Government have decided to follow EU Procurement regulations for the tender of a Design and Build Contract, following successful completion of the Statutory Process (Key Stage 4).

7.1.5 The Welsh Government are considering the opportunity for delivering both the A40 Llanddewi Velfrey to Pemblewin and A40 Penblewin to Redstone Cross Improvements as one Scheme. This would provide continuity and potential efficiencies in the delivery. This case will be updated at Stage 3 following further consideration of this opportunity.

7.1.6 The procurement process is in compliance with European Union Procurement Directives[43] and the corresponding UK Public Contract Regulations 2015.

Original ECI Contract 2017 - 2018

7.1.7 An OJEU Prior Information Notice (PIN) was first published in TED (Tenders Electronic Daily – Supplement to the Official Journal of the EU) on 22 December 2015, reference 2015/S 247-448808[44]. The scope of works outlined in the PIN included: *developing the outline design, preparing the necessary statutory orders and EIA documentation,*

[43] Directive 2004/18/EC
[44] http://ted.europa.eu/udl?uri=TED:NOTICE:448808-2015:TEXT:EN:HTML

publishing draft Orders (Key Stage 3), progressing the project through the statutory process including Public Inquiry if required (Key Stage 4) and, if successful, then undertaking detailed design, construction and after-care of the project (Key Stage 6).

7.1.8 In the PIN, the value of Orders was estimated at around £30,000,000 and the total Scheme costs circa £50,000,000 excluding VAT.

7.1.9 An OJEU Contract Notice was published on the Welsh Government's Sell2Wales[45] website on 25th March 2016, reference 2016/S 061-102869. The contract value was estimated at £55,000,000 – £65,000,000.

7.1.10 Those who successfully completed the PQQ were then invited to tender in June 2016, in accordance with the '*ECI Design and Build Contract – Volume 0,* Instructions *for Tenderers*'. These instructions provided guidance to tenderers on the form and assessment of tenders relating to the contract for the design development of the A40 Llanddewi Velfrey to Penblewin improvement project and the provision of assistance with the statutory procedures.

7.1.11 The Contract Notice stated that contract award would be based on the most economically advantageous tender in terms of the criteria stated in the specifications, in the invitation to tender or to negotiate or in the descriptive document. Detailed tender evaluation criteria were set out in the 'ECI Design and Build Contract – Volume 0, Instructions for Tenderers' covering quality and price.

7.1.12 The final tender assessment was based on a weighting of the Quality and Financial submissions in the ratio 50:50 respectively.

7.1.13 The contract was awarded on 3rd February 2017 to Carillion, with engineering and environmental design provided by Arup and RML.

7.1.14 In addition to the above process, Welsh Government also procured the provision of support (Employer's Agent) through a management consultancy works and services contract. An OJEU contract notice for this was published on 6th June 2015, reference 2015/S 108-196566[46].

7.1.15 The procurement process was an open procedure with an estimated

[45] Sell2Wales is the procurement portal set up by the Welsh Government
[46] http://ted.europa.eu/udl?uri=TED:NOTICE:196566-2015:TEXT:EN:HTML

contract value of £1,500,000 excluding VAT. The contract award was based on the most economically advantageous tender in terms of:

a) Project team and management (14%)
b) Project delivery - Technical (17%)
c) Project delivery - Commercial (25%)
d) Resources and programme (14%)
e) Cost. Weighting (30%)

7.1.16 The contract award decision was made on the 9th October 2015 with three offers having been received and evaluated. Arcadis (and Technical Advisor Mott Macdonald) were awarded the contract of Employer's Agent for the project, with a total final value of contract of £1,342,461.13, excluding VAT. A contract award notice was published on 6th November 2015, reference 2015/S 215-392974.

Key Stage 3 and 4 Development

7.1.17 Following the liquidation of Carillion, revised contractual arrangements were made and implemented by the Welsh Government.

7.1.18 Arcadis (and Technical Advisor Mott Macdonald) continued their contract of Employer's Agent for the project.

7.1.19 Arup (supported by sub-Contractor RML) were directly appointed to the Welsh Government to continue the development of Key Stage 3 and to support the Welsh Government through the Statutory Process (Key Stage 4).

Key Stage 5 Procurement of a D&B Contractor

7.1.20 The Welsh Government will be required to follow EU Procurement regulations for the tender of a Design and Build Contract. The procurement strategy adopted would follow the OJEU Restricted process as outlined in Figure 21.

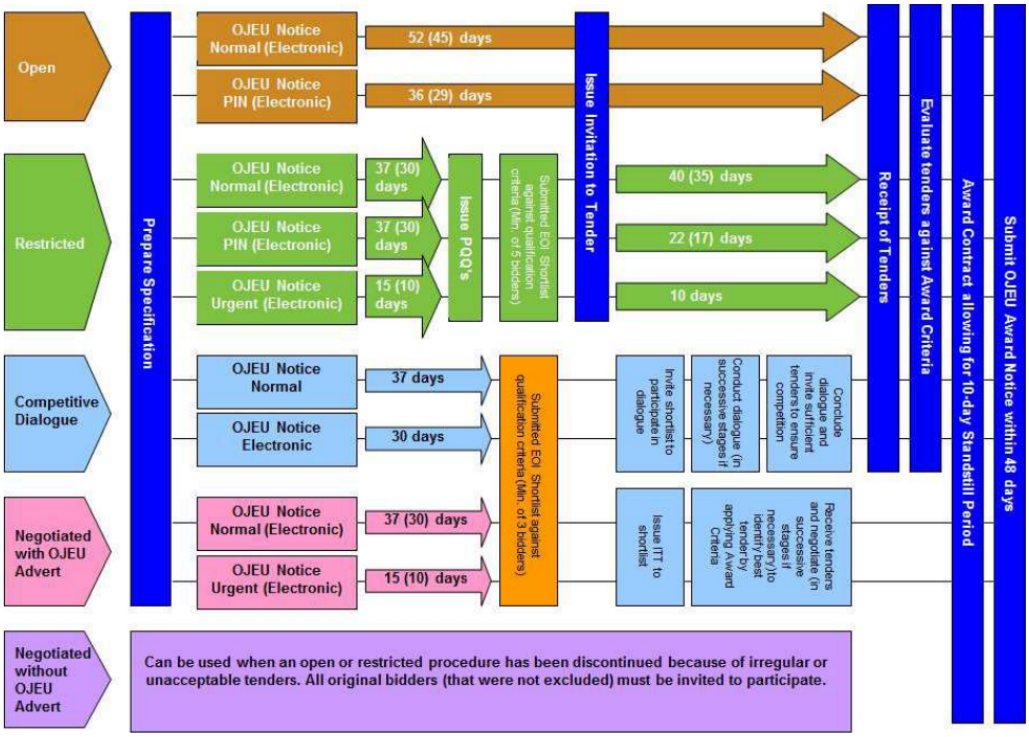


Figure 21 OJEU Process

7.1.21 The Welsh Government will conduct a PQQ process before undertaking a full Design and Build tender. The tender will likely span over 3 months / 12 weeks to enable the tenderers to sufficiently develop their design to be able to inform their tendered estimate of the overall price.

7.1.22 As per the previous ECI tender process, the evaluation of the tender will be based upon a quality submission and a financial submission. The ratio of Quality and Financial will be determined in due course but is likely to be similar to the original ECI tender, which was 50:50 Quality:Financial. There is the potential for the weightings to be amended to more heavily favour the quality or financial, but this has not been determined yet.

7.1.23 The arrangements moving forward into the conduction stage would likely be:

Employers Agent – Arcadis;

Technical Advisor to Employers Agent – Mott Macdonald;

Design and Build Contractor – To Be Confirmed via procurement. Likely to be sole entity but could be a joint venture; and

Design and Build Contractor's Designer – To Be Confirmed via procurement. Likely to be sole entity but could be a shared appointment

between Engineering Design and Environmental Design.

7.2 Contract length

7.2.1 The following timescales are anticipated for the proposed Construction Contract:

a) Anticipated contract start is May 2021;
b) Anticipated start on site for construction is Summer 2021;
c) Anticipated completion on site is Early 2023; and
d) Anticipated end of the aftercare period is Winter 2027.

7.2.2 The anticipated duration is up to seven years.

7.3 Specification of required outputs

7.3.1 The specification of outputs are included within the relevant Contracts as outlined in the following points. done in line with the relevant key stages:

7.3.2 Key Stage 3 and 4 deliverables are listed in detail within the Key Stage 3 and 4 Professional Services Contract - Volume 2 Scope of Service provided in the subsequent sections of Chapter 4: Requirements for Key Stage 3 and Chapter 5: Requirements for Key Stage 4.

7.3.3 Key Stage 6 deliverables are listed in detail in the original ECI Design and Build Contract Volume 2 Works Information as tendered. Further detailed is provided in the subsequent sections of Chapter 6: Requirements for Key Stage 6. The relevant extract of the Works Information is:

7.3.4 Key Stage 6 detailed design will be based upon Key Stage 3 and 4 design submissions. The Key Stage 6 Detailed Design submission will be sufficiently detailed to demonstrate compliance with the relevant codes and standards to enable the works to be constructed in accordance with the contract requirements and specification.

6 REQUIREMENTS FOR KEY STAGE 6

6.1 Key Stage 6 Programme Requirements

6.1.1 The table below contains the *Employer*'s programme requirements for Key Stage 6. It identifies the main submission events and the number of weeks after Contract Award when they are expected.

TABLE 6.1 Key stage 6 Event Programme:

Event	Time required
Commence Detailed Design	On *Employer*'s instruction
Submission of Key Stage 6 programme	2 weeks after commencement of Key Stage 6
Submission of *Statutory Authorities'* Works Report	4 weeks after commencement of KS6
Placing orders for *Statutory Authorities'* diversion works	In accordance with *Contractor*'s programme
Submission of Construction Quality Plan	4 weeks prior to start on site
Submission of Health and Safety Plan	4 weeks prior to start on site
CEMP (update of draft CEMP)	4 weeks prior to start on site
Contractor's Key Stage 6 Design submission including updated SU Works Report	3 weeks prior to start on site
Submission of Stage 2 Road Safety Audit	In accordance with *Contractor's* programme following completion of the detailed design
Licences and Consent applications	In accordance with *Contractor's* programme
Construction start on site	To be determined by *Contractor*
Submission of Stage 3 Road Safety Audit	3 weeks (min) prior to road opening
Road Opening	To be arranged
Completion of KS6 construction works	By May 2020
Health and Safety File (including all 'as builts' and manuals etc.)	At time of certification of Completion by the *Project Manager*.

6.1.2 Key Stage 6 activities shall commence with the start of detailed design. The *Employer* may instruct the *Contractor* to commence detailed design in advance of the end of the High Court Challenge Period but this is entirely at the discretion of the Employer.

7.4 Allocation of risk

7.4.1 The allocation of risk was originally covered in the Risk Register (2nd August 2016). Allocation of risk was also specified in the PSC and ECC contracts.

7.4.2 Allocation of risk for Key Stage 3 was covered in the *Professional* Services *Contract (PSC) for* Early *Contractor Involvement (ECI) Design and Build Contract Volume 1* at Volume 1e – clause Z.6 and Volume 1f – clause Z.6 for Key Stage 4.

7.4.3 The allocation of Key Stage 6 risk is likely to be similar to that originally covered by clause Z.9 of the Engineering and Construction Contract (ECC) for Early Contractor Involvement (ECI) Design and Build Contract Volume 1h.

7.4.4 The Project Risk Register, as discussed in Section 5.7.1 outlines foreseeable project risks, which include risks that will be allocated to the D&B Contractor. The Project Risk Register will quantify the likely cost if the risk becomes an eventuality. This Risk Register has been assessed to inform a Risk allowance and an allowance incorporated into the Scheme Budget. Section 5.9 provides a summary of several of the top risks included within the Project Risk Register.

7.4.5 Whilst the future allocation of risk involving the D&B Contractor (once appointed) has not been fully determined, at this point in time it is not unreasonable to assume that the risk allocation, and therefore Compensation Event clauses which will be removed, will be:

60.1(12) – Physical Conditions;

60.1(13) – Weather; and

60.1(19) – Force majeure.

7.5 Contractual agreements

7.5.1 The key Contractual arrangements are set out for each of the three Key Stages as outlined below.

Key Stage 3 & 4

7.5.2 For Key Stage 3 under the original ECI contract with Carillion, the conditions of contract were the core clauses and the clauses for main Option C (Target Contract), dispute resolution Option W2 and secondary Options X1, X2, X4, X9, X10, X11, X18, Y(UK)2, Y(UK)3 and Z (of the Employers) of the NEC3 Professional Services Contract April 2013.

7.5.3 Following the liquidation of Carillion and the direct appointment of Arup to the Welsh Government, the Key Stage 3 and 4 conditions of contract are the core clauses and the clauses for main Option E (Time Based Contract), dispute resolution Option W2 and secondary Options X1, X2, X9, X10, X11, X18, Y(UK)2, Y(UK)3 and Z (of the Employers) of the NEC3 Professional Services Contract April 2013.

Key Stage 6

7.5.4 For Key Stage 6, outline contractual arrangements are not currently available. The contract is likely to take the form of either NEC3 ECC or NEC4 contract with the option to be determined in due course.

7.5.5 The option choice is likely to be between Option A (Fixed Price) or Option C (Target Price).

7.5.6 Under the original ECI contract, the payment process was the PSC Main Option C (Target Contract), amended slightly in accordance with Volume 1e Clause Z.5. For Key Stage 4, the payment process was the PSC Main Option E (Time Based Contract), amended slightly in accordance with Volume 1f Clause Z.5.

7.5.7 For Key Stage 6, the payment mechanism will be defined by the contract chosen. The payment assessment period will be monthly.

8 Recommendations

8.1 Preferred Option

8.1.1 WelTAG 2017 clarifies that a preferred option should be taken forward to WelTAG Stage 3 appraisal.

8.1.2 Given the identified need for the Scheme, and taking into account the information presented within this WelTAG Stage One and Two Impact Assessment Report, the Welsh Government and its Review Group has taken the strategic decision to progress active travel improvements alongside Highway Option 2B, a southern route without junction.

8.1.3 Active travel measures will be developed in detail at the next stage of design development but they would help achieve the study objectives and contribute positively to government policy priorities. Active travel measures will therefore be implemented as part of the preferred highway option.

8.1.4 In light of the appraisal undertaken, it is clear that Highway Option 2B best address the problems, best achieves the objectives and performs best against the majority of cultural, social and economic appraisal criteria, appreciating that there would be some adverse impacts in particular on the environment. It is the preferred option as a result of stakeholder engagement, favoured by the majority of participants. This indicates it is likely to be the most acceptable to local communities, the people and businesses of Wales.

8.1.5 The Welsh Government recognises that Option 2B would be more likely to avoid objections from local residents and politicians in light of their concerns about a junction at Redstone Cross. This offers reduced risks to delivery through the statutory process.

8.1.6 WelTAG Stage 3 should be undertaken to provide a full business case in order to progress active travel and Option 2B options.

8.2 Stage 3 WelTAG

8.2.1 At the next stage of the WelTAG process, a number of areas of the appraisal will require updated in order to reflect new information and the Stage of the process. In particular, the Stage 3 Reports will seek to provide further detail on the following:

1. Traffic forecast modelling outputs;
2. Economic appraisal / wider economic impact assessment results;
3. Environmental Impact Assessment (and survey) results;
4. Walking, Cycling and Horse-riding Assessment; and
5. Further details and information around the Transport Case, Delivery, Financial and Commercial Cases.

8.3 WelTAG Stages 4 and 5

8.3.1 Should the Welsh Ministers decide to proceed with the Scheme, then at the next stage of the WelTAG process, Stage 4 is to record what is actually delivered, the wider content at the time at which the Scheme is delivered and to record the impacts that actually occur during implementation. That aims to allow for an immediate alert if there are any unintended adverse impacts during implementation and can assist in the realisation of any benefits. It also acts as a record of what is actually delivered, which is required in the Stage 5 evaluation work.

8.3.2 The aim of Stages 4 and 5 is to record what happens so that lessons can be learnt. It may lead to alterations to the current Scheme and will form valuable evidence for use in future WelTAG appraisals.

8.3.3 Records should be kept of the impacts during implementation as these will be required to evaluate both the process of implementation and the outcomes. External events which could affect the evaluation should be recorded as they occur, such as adverse weather events, changes in legislation, the outcomes regarding key risks identified at Stage 3 and any changes made to the Scheme during implementation.

8.3.4 The monitoring and evaluation plan (see section 5.12) describes the methods that will used to provide the evidence required during and post-implementation. No required ‘before’ studies have been identified given the detailed level of survey and assessment undertaken at Stage 3. If there is an unforeseen lengthy delay between this Stage 3 report

and implementation, the Welsh Government should consider updating its evidence base as appropriate.

8.3.5 If the observed impacts differ from the anticipated impacts then an interim Stage 4 report should be produced to record this, and to offer ways of maximising any unintended benefits or to mitigate any unintended adverse impacts. The final Stage 4 report will record an immediate post opening evaluation recording the actual outputs delivered and the initial impacts. This should cover the first six months of operation and be completed within 12 months' post opening or completing of the intervention.

8.3.6 Then at Stage 5 the Welsh Government should produce a record of what was delivered, an evaluation of the process of delivering the option, a record of the actual impacts compared to the anticipated impacts and an assessment into the extent to which it met the original objectives.

Welsh Government

A40 Penblewin to Redstone Cross Improvements

WelTAG Stage 1 and 2 Report

A40PRC-ARP-GEN-M02-RP-J-0003

P03 | S4

25/10/19

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Executive Summary

Overview

Welsh Transport Appraisal Guidance (WelTAG) ensures a clear audit trail of decision-making, providing the justification for the promotion, or otherwise, of transport options. It provides decision-makers with all the information they require to make a reasoned and auditable decision on all funding decisions.

This report provides a concise summary of the work undertaken during Stage 1 and 2 of this study. The Stage Report sets out the key findings from the detailed evidence collected and makes reference to the location of the detailed evidence behind the statements made.

This WelTAG Stage 1 & 2 Report provides a combined Strategic Outline Case and Outline Business Case for the proposed A40 Penblewin to Redstone Cross Improvements.

The problems

A number of problems have been identified along the Penblewin to Redstone Cross corridor, in collaboration with the A40 Llanddewi Velfrey to Penblewin Improvements study, the Review Group and informed by stakeholder engagement. The problems are:

a) The A40 Redstone Cross Junction is below modern design standards. Poor visibility and substandard junction layout can lead to severe road accidents.

b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.

c) Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to period of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.

d) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.

e) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributed to operational problems along the road.

f) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.

g) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

Problems c) and d) are recognised as being temporal in nature; with problem c) occurring when convoys of heavy goods vehicles or slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, and d) occurring largely within the summer months. It is considered that the other problems are more permanent in nature, owing to the substandard design and operation of the road.

Objectives

The objectives seek to address the problems, as well as respond to the strategic issues identified in national and local policy and programmes e.g. the need to improve connectivity to the Enterprise Zone and City Region. In developing the objectives, a review was also undertaken against the well-being goals as presented within the Well-being of Future Generations (Wales) Act 2015. They are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (including perceived safety) and reduce the number and severity of collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

Options and alternatives

Options were identified through a wide range of historic and more recent technical assessments and stakeholder engagement exercises. Appraisal of different identified options considered how the problems and objectives would be addressed, as well as key risks, adverse impacts, constraints and dependencies.

The Welsh Government determined that doing nothing would not be acceptable as it would lead to the problems continuing. A local public transport option was considered but deemed that it was not able to address the problems given the types of journey being undertaken on the A40 in the area and a lack of suitability for traffic to shift modes.

The Welsh Government is separately progressing its regional plans for public transport improvements, which are better suited for addressing regional issues and opportunities in the longer term (but would not address the identified transport problems on the A40 west of St Clears).

The appraisal process led to the recommendation to progress active travel improvements along with variations of a highway option given it would best address the problems and achieve the objectives. Two of those variations had similar appraisals and served to best address the problems, best achieve the objectives and perform best against the majority of appraisal criteria, although with slight differences in appraisal for the Schemes' impacts on environmental and cultural heritage criteria.

The Scheme and its likely impacts

The Scheme comprises a new offline route between Penblewin and Redstone Cross. It includes a proposed improved section of trunk road, consisting of two lanes in one direction, to allow overtaking, and one lane in the opposite direction.

The redundant sections of existing A40 road between Penblewin Roundabout and Redstone Cross would be reclassified and cease to be a trunk road, reverting to the local authority, providing opportunities for walking, cycling and horse-riding improvements. With the bypass of Redstone Cross taking traffic off of the existing A40, there will be reduced interface between traffic on the existing A40 and walkers, cyclists and horse riders, thereby providing a safer access route from and to Narberth to the north and reducing the potential of accidents, particularly at Redstone Cross.

The Scheme would improve network resilience and improve accessibility along the east-west transport corridor including enhancing connections with key employment, community and tourism destinations, and therefore contributing positively to prosperity. The Scheme's removal of Redstone Cross junction would improve safety and mitigate the risk of fatal and severe accidents. The Scheme would also aim to improve active travel connectivity within the community, reducing severance and providing opportunities for healthy lifestyles and promoting social inclusion.

It is acknowledged that the Scheme is likely to have adverse impacts on noise, greenhouse gases, landscape, historic environment, biodiversity, and water environment. Stage 3 will explore mitigation and enhancement measures in further detail.

Next steps

Sufficient evidence has been presented to demonstrate that the preferred option best addresses the identified problems and best achieves the objectives, as well as contributes to the well-being of future generations. It could be delivered within technical and financial constraints. As such, it is selected as the preferred option.

Given the identified need for the Scheme, and taking into account the information presented within this WelTAG Stage One and Two Impact Assessment Report, the Welsh Government and its Review Group has taken the strategic decision to progress active travel improvements alongside Highway Option 2B, a southern route without junction.

Active travel measures will be developed in detail at the next stage of design development, but they would help achieve the study objectives and contribute positively to government policy priorities. Active travel measures will therefore be implemented as part of the preferred highway option.

WelTAG Stage 3 should be undertaken to provide a full business case in order to progress active travel and Option 2B options. At the next stage of the WelTAG process, a number of areas of the appraisal will require updated in order to reflect new information and the Stage of the process. In particular, the Stage 3 Reports will seek to provide further detail on the following:

a) Traffic forecast modelling outputs;

b) Economic appraisal / wider economic impact assessment results;

c) Environmental Impact Assessment (and survey) results;

d) Walking, Cycling and Horse-riding Assessment; and

e) Further details and information around the Transport Case, Delivery, Financial and Commercial Cases.

The BCR is not the only indicator of value for money, particularly for smaller scale schemes that achieve a broad range of objectives, which is the case here. It should also be considered that the Llanddewi Velfrey to Penblewin Improvements need to be seen in the context of the overall A40 corridor improvement, of which it forms an integral component.

It is likely that the economic case for the scheme will be poor, however it is important to note that the quantitative economic analysis does not capture all the expected benefits of the Scheme. For example, the A40 is not forecast to be congested during typical operational conditions but instead experiences journey time reliability problems outside of typical operating conditions e.g. temporarily when there are agricultural vehicles or ferry traffic in platoons. That is not to say there are not likely journey time reliability benefits to be had but they cannot be captured as part of the traffic model and as such cannot be quantified.

Furthermore, the perceived (as well as actual) benefits to safety cannot be captured as a benefit within the economic case, with the improvements offering clear social benefits. The improved overtaking opportunities would also serve to improve the perception of connectivity, of which has been captured within the A40 St Clears to Haverfordwest Study (2015) to form a barrier to investment and for tourism.

A do-nothing approach would not address the safety issues at Redstone Cross junction; the driver frustration, platooning and poor journey time reliability associated with the lack of overtaking opportunities; the operational problems associated with the number of side road junctions and direct accesses off the strategic route; or the problems cause by a mix of traffic types using the road.

1 Introduction

1.1 Context

1.1.1 The Welsh Transport Appraisal Guidance (WelTAG) was first published in 2008 and was updated with new WelTAG guidance published in December 2017[1] .

1.1.2 WelTAG ensures a clear audit trail of decision-making, providing the justification for the promotion, or otherwise, of transport options. It is the mechanism for providing decision-makers with all the information they require to make a reasoned and auditable decision on all funding decisions.

1.1.3 As well as embedding the Well-being of Future Generations (Wales) Act 2015, WelTAG combines the principles of the HM Treasury Green Book and the Five Case Model for Better Business Cases, with WebTAG best practice for transport appraisal.

1.1.4 The Welsh Government has decided to progress a WelTAG 2017 Stage 1 and 2 study into possible transport improvements to the section of A40 between Penblewin and Redstone Cross (the 'Scheme').

1.2 Approach

1.2.1 This document represents the **WelTAG Stage 1 and 2 Report** comprising a **Strategic Outline Case** (SOC) and an **Outline Business Case** (OBC) for the A40 Penblewin to Redstone Cross Improvements, with its associated WelTAG Stage 1 and 2 Report and Stage 1 and 2 Impact Assessment Report (IAR).

1.2.2 Full and technical details of the evidence base and analysis work undertaken is presented within the associated WelTAG Stage 1 and 2 IAR.

1.2.3 In accordance with the WelTAG guidance, a seven-point scale was used in order to appraise the options developed as shown in Table 1 below.

[1] http://gov.wales/docs/det/policy/140923-weltag-guidance-en.pdf

Table 1 WelTAG Seven Point Assessment Scale

Large Beneficial	+++
Moderate Beneficial	++
Slight Beneficial	+
Neutral	0
Slight Adverse	-
Moderate Adverse	--
Large Adverse	---

1.3 Review Group

1.3.1 As part of WelTAG 2017, involvement is recommended to help shape the identification and appraisal of problems, objectives and possible solutions. WelTAG 2017 specifically requires a Review Group to help steer the appraisal process. A Review Group for the Scheme was established at the outset of the Stage 1 appraisal in order to help ensure that key stakeholders were identified and meet on a regular basis to be involved in any decision making.

1.3.2 The Review Group comprises the Welsh Government's Project Director, in addition to the Employer's Agent, the Designer (Arup supported by RML), and Pembrokeshire County Council as the relevant local authority. The Review Group is as outlined in Figure 1.

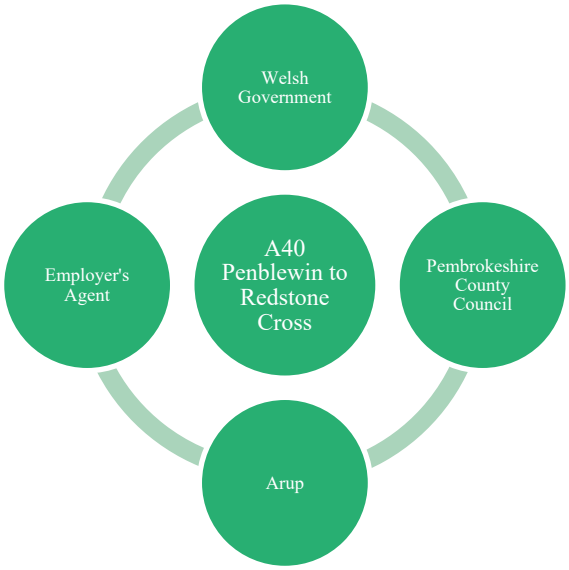


Figure 1 Review Group

1.3.3 The Review Group will meet at key milestones in each of the WelTAG Stages in order to consider the content of the WelTAG reports and actions to be taken forward to the next stage of the process. The Review Group will also play a key role in advising on the methods to be adopted in assessing impacts of the option(s) to be taken forward for subsequent Stages and should make recommendations in relation to any specific additional evidence and/or modelling requirements.

1.4 Report Structure

1.4.1 The remainder of this report is presented in line with the WelTAG 2017 guidance and utilises the Five Case Business Model (Five Cases). The report is therefore structured as follows:

Section 2: Strategic Case – presents the context to the appraisal, the problems and objectives and presents option development.

Section 3: Transport Case – considers each option in more detail and explores how these will meet the need identified in the Strategic Case.

Section 4: Management Case – establishes the make-up of the review group and considers, at a high-level, delivery arrangements which may affect the selection of options.

Section 5: Financial Case – considers affordability and long-term financial viability issues that may affect the selection of options.

Section 6: Commercial Case – outlines the commercial considerations.

Recommendations are provided in **Section 7**, which outlines the next steps in the WelTAG appraisal process.

2 History of the Scheme

2.1.1 This section provides an overview of the history of the Scheme within a strategic and local context. This section also introduces the need for the Scheme, with further detail provided within Chapter 3. This overview begins by providing the context of the Scheme within a strategic context and finalises by looking at how this particular Scheme has emerged.

2.1.2 The strategic need for improvements to the A40 in West Wales has been made clear in national policy documents since the early 2000s and has received continued ministerial support ever since.

2.1.3 In November 2001, the National Assembly for Wales published The Transport Framework for Wales. This outlined that the east-west transport corridor in West Wales had been the subject of a multi-modal study in the 1990s, which concluded that the A40 west of St Clears was in need of improvements.

2.1.4 In March 2002, the Trunk Road Forward Programme (TRFP) was published and included the A40 West of St Clears, stating:

> *'Improvement of the A40 trunk road, whether it be to single or dual carriageway standard, is beneficial in economic terms. Improvement to the road would not affect the number of people travelling on public transport significantly…*
>
> *The A40 in West Wales forms the lowest standard section of the Trans-European Road Network (TEN-T) in the United Kingdom and there are major problems associated with upgrading the freight carrying capacity of rail in this area which means that significant improvement in the foreseeable future is not viable…*
>
> *We are therefore satisfied that improvement to the A40 between St Clears and Haverfordwest is needed and that economic benefits will accrue. Upgrading the road to dual carriageway standard is likely to be justified but before a decision is finally made, we need more information on the environmental implications associated with alternative standards.'*

2.1.5 The multi-modal study[2] did consider public transport improvements including rail, bus, freight and integrated bus and rail. However, it was concluded that the costs associated with enhanced passenger services were likely to exceed revenue, thus requiring an operating subsidy. It was also acknowledged that improvements to public transport would not reduce the amount of traffic on the A40 trunk road.

2.1.6 This early work therefore steered the decision to pursue road-based enhancements on the A40 and a Route Options Report (ROR) was subsequently commissioned to explore single and dual carriageway options.

2.1.7 In relation to the section of road between Redstone Cross and Penblewin, three single carriageway options and two dual carriageway options were considered within the A40 West of St Clears Route Options Report, as shown in Table 2.

Table 2 Recommendations from the Route Options Report

Option	Recommendation	Comments
Single Carriageway Option 1 – passes south of properties at Blackmoor Hill, provides junction for these properties at far eastern end of the Scheme. 600m overtaking in each direction.	Take forward	• High cost • Demolition of 2 properties • Adverse cultural heritage impact • Very good overtaking opportunities • Beneficial noise impact on 4 properties
Single Carriageway Option 2 – move the road away from the residential properties at Blackmoor Hill, followed by a northern bypass of Redstone Cross, no overtaking opportunities.	Discard	• Highest cost option and low economic return • Highest archaeological impact • Adverse impact on Redstone Farm • Adverse cultural heritage impact
Single Carriageway Option 3 – minor re-alignment and improvement of existing A40 including single lane dualling at the Redstone Cross junction and widening the approaches	Take forward	• Low cost • Slight increase in overtaking opportunity • Demolition of 2 properties • Adverse cultural heritage impact
Dual Carriageway Option 1 – passing south of Blackmoor Hill with overbridge at Redstone Cross (properties on southern	Take forward	• High cost • Good overtaking opportunities • Demolition of 2 properties

[2] Reported within The National Assembly for Wales – The Transport Framework for Wales, 2001

Option	Recommendation	Comments
side of existing A40 would need to be acquired)		
Dual Carriageway Option 2 – runs to the north of properties at Blackmoor Hill, crossing the existing road midway between Blackmoor Hill and Redstone Cross	Discard	• Highest cost with low economic return • Highest potential archaeological impact

2.1.8 A roundabout junction was not considered appropriate from a traffic flow/turning movement consideration or in view of the likely demolition to property required and the delay to traffic flow introduced.

2.1.9 The routes that performed better in addressing the problems balanced with their likely economic, social and environmental impacts, were taken forward for further consideration in a Technical Appraisal Report (TAR) 2004, which was subsequently undertaken.

2.1.10 In July 2013, Edwina Hart, the then Minister for Economy, Science and Transport, published a written statement outlining her priorities for Transport. This statement included:

> *"Improving the A40 has been identified as a priority by the Haven Waterway Enterprise Zone Board and I intend to undertake further development of previously proposed improvements."*

2.1.11 The issue of the A40 was further expressed in November 2014 following the announcement of the closure of the Milford Haven Refinery. Reflecting on this announcement, the then Minister made the following oral Statement in Plenary:

> *"In terms of transport links… I have asked my officials to conduct further urgent work to explore additional ways to improve the A40, including the potential for dualling."*

2.1.12 The Welsh Government then commissioned a further study in 2015, the A40 St Clears to Haverfordwest Study, to re-evaluate previous development work and re-considered the strategic issues in the region, which any improvements to the A40 should help address or achieve. An Economic Activity & Location Impacts (EALI) Study as part of the 2015 work found:

a) The South West Wales region has lagged behind the other areas in Wales in terms of productivity;

b) The County was disproportionally impacted by the recession and is lagging behind the rest of Wales in terms of its recovery;

c) Unemployment is highest in the main industrial areas of Milford Haven and Pembroke Dock;

d) The south-east and south-west of the County, particularly industrial Pembroke Dock and Milford Haven have the lowest levels of attainment reflecting the wider socio-economic profiles of these areas;

e) The absence of higher education establishments in Pembrokeshire means that prospective students have to leave the County to study; and

f) Pembrokeshire is perhaps not receiving an equitable share of foreign direct investment projects and this may, in part be due to perceptions of, or the reality of, its peripheral location which are exacerbated by the current standard of the A40.

2.1.13 The 2015 EALI study also explained how a business survey in 2015 suggested:

a) Enhanced transport connectivity to employment opportunities within the Swansea Bay City Region could reduce the insularity of the Pembrokeshire travel-to-work market, and if the actual or perceived change was such that it created a demand for in-migration to the area (or increased population retention), it is possible that this could enhance the commercial viability of land;

b) The A40 is seen to be the main route for the agriculture sector and it is acknowledged that this does present some specific problems in terms of tractors moving between fields, tractors towing trailers and the movement of agricultural produce and livestock in standard commercial vehicles. There are numerous farms where the same farmer owns land north and south of the A40, which means that farmers need to use the road when travelling between their different holdings. Whilst they are believed to try and make such movements at off-peak times, this is not always possible, particularly at harvest leading to traffic disruption;

c) There is evidence to suggest that the travel time to Pembrokeshire and the perception that the area is remote is acting as a barrier to

growing the tourism market, and hence the contribution of the area towards the Welsh Tourism Strategy 2013-20. There was a strong view amongst a number of consultees that an improvement would help to tackle the perception that Pembrokeshire is 'far away' by connecting it to the dual carriageway network, thus attracting more visitors;

d) The top three issues experienced by businesses that responded to a business survey were 'Poor journey time reliability – summer only' (42 high / medium adverse impact responses), 'Vehicle platooning & lack of overtaking opportunities' (41 high / medium adverse impact responses) and 'Other congestion on the A40 in West Wales' (38 high / medium adverse impact responses). Abnormal load restrictions were not considered an issue by the highest number of businesses (45 responses); and

e) Businesses believed that an upgrade of the A40 between St Clears and Haverfordwest would have a high positive impact especially on customer / visitor numbers, marketing & promotion of their business and future investment plans in Pembrokeshire.

2.1.14 The Welsh Government have considered improvements to the A40 between St Clears and Haverfordwest to address the identified transport and corridor related problems as well as the wider strategic drivers for improvements to access and connectivity within Pembrokeshire and beyond.

2.1.15 As part of the A40 Llanddewi Velfrey to Penblewin Improvements study, a public information exhibition held in 2018 alongside a stakeholder engagement exercise, asked attendees their thoughts on the need or potential to extend the proposed improvements planned for Llanddewi Velfrey to Penblewin to further include the section to Redstone Cross. 51 responses submitted via completed comment forms supported such a need whilst only four comments expressed some reservations / concerns about the proposal to be included as part of the Scheme.

2.1.16 In August 2018 the Cabinet Secretary for Economy and Transport, Ken Skates AM, confirmed in writing to the H M Senior Coroner is response to the inquest into the death of a driver joining the A40 at Redstone Cross, that:

"I acknowledge the very sad circumstances surrounding the death…and accept that in your opinion there is a risk of future deaths at this location unless appropriate action is taken… Preliminary investigations have begun to develop further

overtaking opportunities & safety improvements along the length of the A40. This includes improvements at Redstone Cross. These additional A40 improvements are included in the update of the National Transport Finance Plan (NTFP) (Page 17 ref 'NEW2').”

2.1.17 Further to this, Arup (supported by RML) were instructed by the Welsh Government in January 2019 to develop a solution to address the transport related problems along the A40 between Penblewin Roundabout and Redstone Cross. Supporting the Penblewin Roundabout and Redstone Cross Scheme is this Welsh Transport Planning and Appraisal Guidance (WelTAG) study.

2.1.18 The problems and objectives are compatible with those from the A40 Llanddewi Velfrey to Penblewin Improvements. The concern for safety between Penblewin and Redstone Cross is particularly of significance for this Scheme, with particular concern for safety at Redstone Cross junction. The Welsh Government are considering the opportunity to deliver both the A40 Llanddewi Velfrey to Penblewin and A40 Penblewin to Redstone Cross Improvements as one Scheme.

2.1.19 The intention is currently for the two Schemes to be delivered independently with opportunities for the Schemes to be delivered together through the Construction Phase of the project.

3 Strategic Case

3.1 Overview

3.1.1 The Strategic Case considers the need for change and this section of the report presents the context in terms of legislation, policy and guidance and previous development work which should be taken into account when considering the problems, objectives and possible solutions for the Scheme.

3.1.2 Section 2 of the WelTAG Impacts Assessment Report (IAR) sets out in detail the relevant legislation, policy and guidance context for the Scheme and its wider strategic framework of A40 improvements.

3.1.3 The need for change is derived from a strategic priority for improved transport connections in West Wales to support economic prosperity, and contribute to the economic, social, cultural and environmental well-being of current and future generations.

3.1.4 The A40 in West Wales forms the lowest standard section of the Trans European Road Network in the UK and the Trunk Road Forward Programme since 2002 has identified the strategic need for improvements to the A40 corridor, West of St Clears.

3.1.5 Development work has identified the need for improvements along that section of the A40, including localised improvements between Penblewin and Redstone Cross.

3.1.6 As such, the need for change is presented at three levels:

1. Strategic (West Wales and beyond);
2. Corridor (A40 West of St Clears); and
3. Local Scheme (A40 Penblewin to Redstone Cross)

3.2 Strategic Need

3.2.1 The A40 trunk road forms part of the Trans-European Transport Network (TEN-T) in West Wales and is a strategically important link between the national motorway network and the West Wales ports including Milford Haven, Fishguard and Pembroke Dock.

3.2.2 In particular, the A40 trunk road is a strategic link to Pembrokeshire, a well-known tourist destination, with coast and countryside providing opportunities for a thriving tourism industry and a rich environment for food producers. Furthermore, the Haven Waterway Enterprise Zone in Pembrokeshire is based uniquely on existing and potential new energy sites, building on the area's established industry base.

3.2.3 Around 20% of the UK's energy supplies are received via Pembrokeshire, and the Zone remains an attractive location for energy companies with its excellent access to energy infrastructure, established supply chain and distribution infrastructure, skilled workforce and network of universities with expertise in a range of energy-related fields.

3.2.4 The Zone is also gaining a marine energy focus, given its deep-sea port facilities combined with marine conditions suited to wave and tidal stream technologies, plus the benefit of electricity grid access. A new wave energy demonstration zone was established 13km (8 miles) off the Pembrokeshire coast. The Zone, managed by Wave Hub Limited working in partnership with Marine Energy Pembrokeshire and Pembroke Port, has the potential to support the demonstration of wave arrays with a generating capacity of up to 30MW for each project. Today, however, diversity and innovation characterise the range of local businesses and the Zone is particularly keen to support companies in other sectors to locate or expand here, too.

3.2.5 Alongside new and established energy, food and tourism businesses and their extensive supply chains, life sciences, ICT and manufacturing firms are being targeted in Haven Waterway Enterprise Zone. These require good access and connections to the transport network to assist the movement of labour and goods accordingly.

Impact of doing nothing

3.2.6 The impact of no intervention would mean that the existing problems along the A40, at a strategic scale, would continue and likely worsen with the increasing traffic levels. Issues such as vehicle platooning would continue owing to the lack of overtaking opportunities, impacting on strategic connections along the TEN-T network to the ports, to key tourist destinations, and strategic employment sites such as the Haven Waterway Enterprise Zone. It is likely that poor journey time reliability, particularly in the summer, would continue to have an

adverse impact on the economy. The travel time to Pembrokeshire and the perception of the area's remoteness would continue to act as a barrier to growing the tourism market.

3.2.7 A do-nothing approach would be contrary to national policy documents, clearly citing the need for improvements along the A40 over several decades.

3.3 A40 West of St Clears Corridor

3.3.1 The A40 corridor West of St Clears provides a key road link between South East Wales and Haverfordwest, which is a gateway town as well as the focus of the tourist economy for central and north Pembrokeshire.

3.3.2 The St Clears to Haverfordwest section of the A40 has developed to connect small villages and as such many sections of the A40 pass through these communities, leading to issues around severance, air and noise concerns and safety problems.

3.3.3 The A40 accommodates a mix of traffic types, with seasonal variations. In the winter months the road carries local residents (typically car-based traffic); commercial vehicles, particularly around ferry arrival and departure times; and agricultural vehicles. In the summer months, the mix is supplemented by a higher volume of tourist traffic (increasing in some areas by over 40%) including cars and caravans.

Impact of doing nothing

3.3.4 The impact of no intervention would mean that with increasing traffic levels, the existing situation would worsen to the west of St Clears. Problems with safety, community severance, air and noise would continue to impact on local communities, commuters, freight and tourists, with the problems exacerbated during the summer months with the additional tourist traffic.

3.3.5 The need for improvements to the west of St Clears has been noted since the 1990s. A do-nothing approach would see the A40 in West Wales continue to form the lowest standard section of the TEN-T in the UK. It would also not respond to the clear need for improvements noted within the Trunk Road Forward Programme, and would not provide the infrastructure required to deliver the associated economic benefits.

3.4 A40 Penblewin to Redstone Cross Scheme

3.4.1 The local Scheme aims to provide improvements to the section of A40 between Penblewin roundabout and Redstone Cross junction within the context of wider transport interventions on the A40 corridor West of St Clears.

3.4.1 Arup (supported by RML) were instructed by the Welsh Government in January 2019 to develop a solution to address the transport related problems along the A40 between Penblewin and Redstone Cross. This Welsh Transport Planning and Appraisal Guidance (WelTAG) study supports the Penblewin Roundabout and Redstone Cross Scheme.

3.4.2 A number of problems have been identified along the Penblewin to Redstone Cross corridor, in collaboration with the A40 Llanddewi Velfrey to Penblewin Improvements study, the Review Group and informed by stakeholder engagement.

3.4.3 Accident analysis has observed that a high proportion of accidents result in fatal and serious injuries on this stretch of the A40 and that the likelihood of a fatality is ten times higher than observations on roads of a similar standard. A total of eight PIAs (personal injury accidents) have been recorded within the study area over the most recent ten-year period. The table below provides a summary of the number of vehicles involved, the number of casualties, the location and the circumstances under which each accident occurred.

Date & Time	Vehicles	Casualties	Details
30/06/2009 16:35	4	1	Occurred at Penblewin roundabout. Details of circumstances not recorded.
26/04/2010 11:55	2	1	Occurred at Redstone Cross. Details of circumstances not recorded.
08/03/2011 19:55	4	3	Occurred approximately 400m west of Penblewin roundabout. Details of circumstances not recorded.
27/01/2013 22:35	2	1	Occurred at Redstone Cross, where V1 was travelling eastbound on A40 approaching Redstone Cross when V1 has failed to take the left-hand bend & drifted across the carriageway coming into contact with V2 travelling in opposing direction.
27/06/2013 17:00	2	3	Occurred at Redstone Cross, where V1 pulled out from Redstone Road junction onto the A40 directly into path of V2 which was travelling westbound.
03/07/2013 08:30	2	2	Occurred at Redstone Cross, where V2 travelled along A40 & been indicating left (misleading). V1

Date & Time	Vehicles	Casualties	Details
			been waiting at junction of A40 with B4313 & has seen misleading signal on V2 & pulled out in front of V2 believing it to be turning left into junction.
22/05/2017 08:22	3	2	Occurred approximately 500m east of Redstone Cross, where V1 commenced to overtake unknown V3. As V1 moved to his offside he collided with V2 which was travelling in the opposing direction.
06/03/2018 13:30	2	1	Occurred at Redstone Cross, where V2 travelled towards Haverfordwest on A40. Upon approaching Redstone Cross junction, V1 exited junction from Narberth into nearside of V2 HGV & into its path. V2 swerved across carriageway pushing V1 down the road.

3.4.4 Over the ten-year period, two of the accidents were fatal, two were serious and four were slight in severity. An analysis of accident rates has found that accident severities along this stretch of the A40 are significantly higher than the average default accident rate for this type of road, as shown in the table below. This means that the rate at which fatalities and serious injuries occur on this section of road is much higher than would statistically be expected. The results also show that this section of the A40 generally has slightly lower than average accident rate. Section 3.2.58 of the Impact Assessment Report provides further detail in relation to road safety.

Severity Split	Fatal	Serious	Slight
Observed	25.0%	25.0%	50.0%
COBA-LT default, Older S2 A roads, >40mph	2.8%	15.3%	81.9%

3.4.5 Feedback received at the Public Information Exhibitions demonstrates a strong concern for safety at Redstone Cross junction including respondents having experienced near misses and / or having witnessed accidents. It is evident that there is an existing safety problem at Redstone Cross junction.

3.4.6 Journey time unreliability and platooning is a key problem experienced. This is particularly a problem when there is a ferry arrival, when agricultural vehicles are travelling along the A40 and / or when slow moving vehicles such as caravans travel along the trunk road. During the summer period, the volume of traffic and its associated problems evidence a lack of network resilience with coping with the additional traffic from tourists. A lack of overtaking opportunity along this stretch

of the A40 leads to driver frustration, risky manoeuvres and collision incidents. The Impact Assessment Report provides further detail on these issues within Section 3.2.

Impact of doing nothing

3.4.7 The impact on no intervention would mean that the existing problems would continue between Penblewin and Redstone Cross; poor journey quality during periods of traffic and platooning would continue to have adverse impacts on driver stress; and north-west connectivity and connectivity onto the A40 at Redstone Cross would continue to face severance issues. With increasing traffic flows, the existing problems are likely to worsen.

3.4.8 A do-nothing approach would also mean that there is a risk of further serious and fatal accidents at Redstone Cross and the junction's substandard nature and visibility problems would continue to be of safety concern to various transport users.

3.5 Summary of Key Issues

3.5.1 In summary, the key issues that drive the need for change on the A40 and in particular the section between Penblewin and Redstone Cross, comprise a range of actual and perceived problems:

a) The A40 mainline and Redstone Cross Junction is substandard
b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.
c) Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.
d) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.
e) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road.
f) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.

g) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

3.5.2 The associated evidence base for these issues is provided in full within the IAR.

3.5.3 Whilst there is evident support for improvements to the A40 within national and local policy, this 2017 WelTAG Study takes into account the previous development work and reconsiders the problems, objectives and potential options, to help inform decision making to progress a long term and sustainable solution for the A40 Penblewin to Redstone Cross.

3.6 Stage 1 Workshop

3.6.1 A WelTAG Stage 1, 2 and 3 has been undertaken for the A40 Llanddewi Velfrey to Penblewin Improvements.

3.6.2 As part of WelTAG Stage 1 of this study, a workshop was held on 6 March 2017 to which all members of the review group were invited. The workshop discussed the revised WelTAG process and agreed how to proceed with the Stage 1 appraisal for the Scheme. As outlined in the first section of this report, WelTAG 2017 Stage 1 requires the identification of the problem(s), objectives and possible solutions for appraisal.

3.6.3 In order to inform discussions, a draft list of problems and objectives were presented. These were based on the outcomes of previous development work and the review of relevant legislation, policy and guidance.

3.6.4 The workshop attendees discussed and agreed a list of problems that the Scheme should aim to address, with consensus that the problems whilst taking into account previous development work still remained valid problems today, including additions.

3.6.5 The workshop attendees discussed and reviewed the initial list of objectives against the 2015 Act Well-being goals, and a revised list of objectives were agreed.

3.6.6 Following agreement on the problems and objectives, the workshop

presented an indicative long list of options for the improvements which built on previous development work and included a combination of on-line and off-line options in addition to a number of non-road building options. Agreement was reached that the Stage 1 appraisal should consider a variety of options and not focus only on road building options.

3.6.7 The problems and objectives identified in this combined WelTAG Stage 1 and 2 share the same strategic principles as that of the A40 Llanddewi Velfrey to Penblewin Improvements. The local problems and objectives have been reviewed and refined to align with the Penblewin to Redstone Cross Improvements.

3.7 Stage 2 Workshop

3.7.1 A WelTAG Stage 2 workshop was held on 29 June 2019. The workshop discussed the outcomes of the WelTAG Stage 1 & 2 Study and agreed how to proceed based upon the preferred recommendation contained within this report.

3.7.2 To inform discussions, the long list and short list of options was presented. These were based on the information contained within the Design Options Report and the development work associated with this, the public information exhibition results and the review of relevant legislation, policy and guidance and WelTAG appraisal criteria.

3.7.3 Wider discussion on likely impacts against economic, social and environmental criteria helped finalise the WelTAG Stage 2 Reporting.

3.7.4 The Strategic Board decided that further consideration should be given to junction strategy during Stage 3, in relation to access from the west at Redstone Cross.

3.8 Public Information Exhibitions

3.8.1 WelTAG recommends stakeholder engagement to help shape its outcomes. As part of the study into A40 improvements between Penblewin and Redstone Cross, two Public Information Exhibitions have been held. The first exhibition was held at Llanddewi Velfrey Village Hall, on the 10th April 2019 between 2pm and 8pm and 11th April between 10am and 8pm. The second exhibition was held at Bloomfield House Community Centre, Narberth on the 30th May 2019

between 12pm and 8pm.

3.8.2 The exhibitions were held to:

a) Attract as many people as possible to each exhibition, from a range of backgrounds and interests;

b) Share our key messages about the project, openly and honestly, and provide a fair and balanced representation of the project;

c) Reduce potential opposition to the project by explaining the need for the proposals, addressing any concerns, queries or misconceptions, and putting people at ease;

d) Give the opportunity and encourage any feedback to be submitted to the Welsh Government; and

e) Educate people about the process required to progress the project.

3.8.3 Measures that were undertaken to publicise the Public Information Exhibitions included:

a) Personal Invitation Letters hand delivered throughout the local community;

b) Personal Invitation Letters via email communication or post to key identified stakeholders (e.g. the local authority); and

c) Posters displayed at prominent locations;

d) Local politicians communicated to their constituents; and

e) Articles were published in the local news.

3.8.4 95 people signed the attendance register at the first Public Information Exhibition and 170 people attended the second. Questionnaires and Verbal Record Sheets helped record feedback.

3.8.5 Details have been recorded within Public Information Exhibition Reports, held by the Welsh Government to support its evidence base for decision making.

3.8.6 Information about how the feedback has helped inform decision making is presented within the relevant sections of this report.

3.9 Public Meeting

3.9.1 A public meeting was held on 20 June 2019, organised by some local residence to discuss the options presented at the Public Information Exhibitions. The meeting was held at the Bloomfield Community Centre and was attended by 35 members of the public, including several councillors. The following views were expressed and recorded by representatives of the project team:

a) Narberth will see increased traffic which will cause it to be grid-locked;
b) Improving the road will bring increased environmental impact;
c) Redstone Road will become isolated;
d) Increased use of A478 as a route into Narberth;
e) There will be a detrimental impact on Blaenmarlais Care home;
f) A poorly designed Scheme will have a big negative impact on Narberth, whereas a well-designed Scheme will keep it as it is;
g) Noise during night of the convoy of 20 + ferry lorries;
h) If the route is ever dualled this then the impacts are only going to get worse; and
i) Any proposal will prevent the 'Secret Owl Garden' from being relocated to Noble Court.

3.10 Public Consultation

3.10.1 A Public Consultation will be undertaken during WelTAG Stage 3 to provide the public with a further opportunity to engage with and respond to proposals.

3.11 Problems

3.11.1 Evidence to support the identification of the problems is provided in Section 3 of the IAR, including:

a) Journey Times / Reliability Data (road, public transport and port);
b) Traffic Flows;
c) Traffic Forecasts;
d) Road Safety;
e) Speed Profile;
f) Social and Cultural Information;

g) Economic Activity Data;
h) Travel to Work Data; and
i) Environmental Information.

3.11.2 It should be noted that these topics involve both actual (quantified or verified) data, as well as perceived (qualitative or unverified) data. Both form evidence for considering and identifying the problems.

3.11.3 It should also be noted that the evidence base will be updated as more detailed information and data becomes available throughout the iterative WelTAG process.

3.11.4 The need for change along this section of the A40 has emerged through a large amount of previous development work, which has helped identify the problems on the corridor and identify a range of potential options that could help address the problems.

3.11.5 The 2015 A40 St Clears to Haverfordwest Study EALI Report explained that whilst the A40 corridor may be seen as an important local issue, it is unlikely that a conventional Transport Economic Efficiency (TEE) analysis would generate a positive Net Present Value (NPV) and Benefit-Cost Ratio (BCR) for a Scheme of this nature given the relatively low traffic volumes. The report clarified that EALI Guidance states that:

> *"It is important to recognise that perceptions of problems with the transport system by users, operators, the public at large and politicians can be equally as important as problems that can be quantified through analysis of data".*

3.11.6 In the case of this Scheme, the quantitative economic analysis does not capture all of the expected benefits such as those in relation to enhanced network resilience and improved prosperity are only partially reflected. For example, the A40 is not forecast to be congested during typical operational conditions but instead experiences journey time reliability problems outside of typical operating conditions e.g. temporarily when there are agricultural vehicles or ferry traffic in platoons. That is not to say there are not likely journey time reliability benefits to be had but that they cannot be captured as part of the traffic model and as such cannot be quantified.

3.11.7 Furthermore, the BCR is not the only indicator of value for money,

particularly for smaller scale scheme that achieve a broad range of objectives, which is the case here. It should also be considered that the A40 Penblewin to Redstone Cross Improvements need to be seen in the context of the overall A40 corridor improvement, of which it forms an integral component.

3.11.8 That work has informed policy development and iterations of decision making by Welsh Ministers which has led to the progression of the A40 Penblewin to Redstone Cross project.

3.11.9 At this latest stage of appraisal, an up to date review of the context and baseline information was taken into account (as presented in Section 2 and 3 of the IAR), which has helped refresh the understanding of the problems that any transport intervention should aim to address.

3.11.10 The problems identified were discussed and agreed by the Review Group, and are set out within paragraph 3.4.2. A summary of the supporting evidence is provided later in the report within Table 4.

3.12 Objectives

3.12.1 The objectives for the Scheme were developed in order to help appraise possible options.

3.12.2 The Scheme objectives as agreed by the Review Group are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (including perceived safety) and reduce the number and severity of collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

3.12.3 The objectives have taken account of particular drivers, issues and opportunities identified through the baseline review of relevant legislation, policy, guidance and the social / cultural, environmental and economic position within the study area and wider region.

3.12.4 The objectives therefore respond to the identified problems, aiming to help address them, as well as respond to the strategic issues identified in national and local policy and programmes e.g. the need to improve connectivity to the Enterprise Zone and City Region.

3.12.5 In developing the objectives, a review was undertaken against the well-being goals as presented within the 2015 Well-being of Future Generations Act.

3.12.6 This helps ensure that the Scheme objectives align to the wider sustainable development principle of the Welsh Government, and take into account the needs of Wales' future generations.

3.12.7 As aforementioned, each objective aims to address one or more of the identified problems.

3.12.8 Therefore, if a transport intervention is appraised to perform positively in addressing the objectives it is given that it would overcome the problems identified.

3.12.9 In addition, an option that performs well against the objectives would be expected to align to the Well-being of Future Generations Act well-being goals.

3.12.10 Objective 7 in particular helps to consider the impact of the scheme on carbon and the Welsh Government's declaration of a climate change emergency, with associated targets set out in its Low Carbon Wales policy.

3.12.11 The Well-being Goals (WFGA 1-7) are listed within Table 3 and the problems (1-8) are set out within paragraph 3.4.2. These are considered to align to the objectives for the Scheme and problems identified, as shown in Table 3. Given the interlinkages between the problems and objectives in the way that the objectives aim to address the problems, whilst contributing to the Well-being goals, Table 3 provides a detailed summary of the alignment of the Scheme objectives and identified problems with the Well-being Goals.

Table 3 Alignment of Scheme Objectives and corresponding Problems with the Well-being Goals

Objective and corresponding problems	Well-being Goals
Objective 1: To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations. **Problems: 1, 2, 3, 4, 5, 6, 7**	1: A prosperous Wales The objective seeks to improve connectivity along the east-west transport corridor. In achieving this objective, this would provide benefits to the economy by improving access to key employment, community and tourism sites. By improving accessibility, West Wales would become more attractive as a place to invest in, including providing potential additional employment opportunities, and attract people to live and work in the area.
	2: A resilient Wales The objective does not relate directly to the well-being goal however the aim of the Scheme is to give due consideration to the impact of transport on the environment and therefore aims to contribute to a resilient Wales.
	3: A healthier Wales The Scheme aims to improve safety of which relates to having good accessibility. The Scheme would improve the safety of movement by improving the standard of the highway network and providing opportunities for overtaking, thus reducing the likelihood of a collision occurring. Moreover, the Scheme would improve connections to essential services such as to a hospital, GP surgery of dentist.
	4: A more equal Wales Through improving connectivity within West Wales and improving the perception of the area in terms of its accessibility, the Scheme would contribute to improving the economy of a relatively deprived area in comparison to other areas across Wales.

Objective and corresponding problems	Well-being Goals
	5: A Wales of cohesive communities Improving accessibility along the east-west corridor would enable communities to become more connected. The Scheme would also improve safety for communities by improving the safety of the highway network and also by providing improvements to active travel connectivity.
	6: A Wales of vibrant culture and thriving Welsh Language The Scheme would contribute positively to this objective by providing enhanced connectivity to cultural facilities, this includes improving accessibility to the region for tourists; therefore, helping to maintain a thriving culture in West Wales. The Scheme would also improve connections to Welsh Language institutions such as to Welsh Language schools.
	7: A globally responsible Wales The aim of the Scheme is to give due consideration to the impact of transport on the environment and therefore aims to contribute to a globally responsible Wales. The A40 forms part of the TEN-T network of which provides an important link for international connectivity via the ports. The Scheme objective does not specifically relate to this Well-being goal.
Objective 2: To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock. **Problems: 1, 2, 3, 4, 5, 6, 7**	1: A prosperous Wales The Scheme would contribute to improving prosperity and providing better accessibility to key areas by enhancing connectivity and resilience to key employment and tourism destinations. Improved overtaking opportunities and thus more reliable journey times would contribute to helping improve the perception of Pembrokeshire for both businesses and tourists.
	2: A resilient Wales A resilient Wales is about maintaining and enhancing a biodiverse natural environment with healthy functioning ecosystems of which support economic resilience in conjunction with social and economic resilience. The Scheme aims to improve prosperity and also to give due consideration to the impact of transport on the environment, therefore the Scheme aims to contribute to a resilient Wales.

Objective and corresponding problems	Well-being Goals
	3: A healthier Wales A key driver of the Scheme relates to safety and accessibility. The Scheme aims to provide better access to key locations; a key consideration of accessibility is being able to safely travel. By addressing the existing safety concerns at Redstone Cross junction and by improving overtaking opportunities and therefore reducing the likelihood of risky manoeuvres being made, the Scheme would positively contribute to a healthier Wales. The Scheme also provides the opportunity for benefits to be experienced for walking, cycling and horse riding.
	4: A more equal Wales Through improving connectivity within West Wales and improving the perception of the area in terms of its accessibility, the Scheme would contribute to improving the economy of a relatively deprived area in comparison to other areas across Wales.
	5: A Wales of cohesive communities Providing better access to key locations would enable communities to become more connected. The Scheme would also improve safety for communities by improving the safety of the highway network and also by providing improvements to active travel connectivity.
	6: A Wales of vibrant culture and thriving Welsh language The Scheme would contribute positively to this objective by providing enhanced connectivity to cultural facilities, this includes improving accessibility to the region for tourists; therefore, helping to maintain a thriving culture in West Wales. The Scheme would also improve connections to Welsh Language institutions such as to Welsh Language schools.
	7: A globally responsible Wales The aim of the Scheme is to give due consideration to the impact of transport on the environment and therefore aims to contribute to a globally responsible Wales. The A40 forms part of the TEN-T network of which provides an important link for international connectivity via the ports. The Scheme objective does not specifically relate to this Well-being goal.

Objective and corresponding problems	Well-being Goals
Objective 3: To reduce community severance and provide health and amenity benefits **Problems: 1, 2, 3, 4, 6**	1: A prosperous Wales Improvements to the safety of the highway network would lead to the provision of health benefits with a reduced likelihood of collisions occurring and less driver frustration experienced. The Scheme's contribution to affecting safety and journey time reliability will improve access to key economic sites such as strategic employment sites and tourism destinations, thus contributing to a prosperous Wales.
	2: A resilient Wales This objective demonstrates the Scheme's commitment to providing health and amenity benefits. Active travel enhancements to the local area will provide the opportunity for more active travel journeys to be made locally; walking, cycling or horse riding would have a better impact on the environment compared to travelling by car for example. The Scheme will nonetheless largely provide benefits to those travelling by car.
	3: A healthier Wales This objective strongly relates to the Well-being goal as a key element of the Scheme is addressing a need to improve safety. By improving the standard of the highway network and addressing safety issues at Redstone Cross junction, the Scheme contributes to building a healthier Wales. Improvements to connectivity via walking, cycling and horse riding will also contribute positively to a healthier Wales.
	4: A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5: A Wales of cohesive communities By improving safe connectivity to the A40 and thus reducing the severance issues currently experienced at Redstone Cross, the Scheme would enable improved connectivity for communities and provide improvements to active travel connectivity.
	6: A Wales of vibrant culture and thriving Welsh language There is no direct link between the Scheme objective and this Well-being goal.
	7: A globally responsible Wales There is no direct link between the Scheme objective and this Well-being goal.

Objective and corresponding problems	Well-being Goals
Objective 4: To improve the Redstone Cross Junction safety (including perceived safety) and reduce the number and severity of collisions. **Problems: 1, 2, 3, 4, 5, 6**	1 A prosperous Wales By improving safety and reducing the number and severity of collisions, there will be beneficial impacts on productivity, on the emergency services and on journey time reliability, all benefits would contribute towards a prosperous Wales.
	2 A resilient Wales There is no direct link between the Scheme objective and this Well-being goal.
	3 A healthier Wales This Scheme objective strongly links with this Well-being goal as by improving safety and reducing the number and severity of collisions would have a positive impact on people's physical health. The improvements to safety would also provide benefits for the perception of safety, benefitting people's mental health due to reduced driver stress.
	4 A more equal Wales The severity of collisions at this location is proportionately worse than other, similar roads by comparison. Those using Redstone Cross are therefore putting their selves at risk more so in comparison to similar roads, thus by improving safety, the Scheme is contributing towards a more equal Wales.
	5 A Wales of cohesive communities By improving safety, the Scheme would enable improved connectivity for communities and provide improvements to active travel connectivity, contributing towards a Wales of cohesive communities.
	6 A Wales of vibrant culture and thriving Welsh language Through improvements to safety, accessibility is improved for journeys to cultural and Welsh language education facilities.
	7 A globally responsible Wales By improving safety along the A40 of which forms a part of the TEN-T network, accessibility will improve for all users including those travelling via the ports, thus enhancing international connectivity.

Objective and corresponding problems	Well-being Goals
Objective 5: To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles. **No specific problems identified however the Scheme aims to improve active travel connectivity to provide enhancements to walking, cycling, horse riding in the local community.**	1 A prosperous Wales By improving active travel connectivity for residents and visitors to the area, enhanced and / or additional routes have the potential to increase active travel journeys, contributing to improvements to health and productivity, with a positive impact on health and care services in the long term.
	2 A resilient Wales Active travel improvements would provide enhanced opportunities for active travel journeys to be made. Journeys that were previously made by car and are now made by active travel would have a positive impact on the environment, contributing to a resilient Wales. The Scheme nonetheless has the potential to encourage more journeys by car on a strategic scale, thus negatively impacting on a resilient Wales. It is anticipated that in the long term, as vehicle technology improves, the environmental impact from cars will reduce.
	3 A healthier Wales This Scheme objective and Well-being goal strongly align with each other. The Scheme aims to provide enhancements to active travel connectivity of which will provide more opportunity for healthy lifestyles, thus contributing to a healthier Wales.
	4 A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5 A Wales of cohesive communities Improvements to active travel through the Scheme would provide the opportunity for communities to feel more connected, and also provide improvements to safety for the local community.
	6 A Wales of vibrant culture and thriving Welsh language This Well-being goal aims at promoting and protecting culture such as encouraging people to participate in sports and recreation. By improving active travel connectivity, the Scheme contributes to this Well-being goal.

Objective and corresponding problems	Well-being Goals
	7 A globally responsible Wales Active travel improvements would provide enhanced opportunities for active travel journeys to be made. Journeys that were previously made by car and are now made by active travel would have a positive impact on the environment, contributing to a globally responsible Wales. The Scheme nonetheless has the potential to encourage more journeys by car on a strategic scale, thus negatively impacting on a resilient Wales. It is anticipated that in the long term, as vehicle technology improves, the environmental impact from cars will reduce.
Objective 6: To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs. **Problems: 1, 2, 3, 4, 5, 6, 7**	1 A prosperous Wales Although the Scheme itself is unlikely to encourage modal shift, it would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability along the A40 corridor. Improved connectivity would provide benefits for commuting along the corridor, benefitting social inclusion and contributing towards a prosperous Wales.
	2 A resilient Wales There is no direct link between the Scheme objective and this Well-being goal.
	3 A healthier Wales The Scheme aims to enhance opportunities for active travel and therefore promote social inclusion and integration with the local transport network, therefore contributing towards a healthier Wales.

Objective and corresponding problems	Well-being Goals
	4 A more equal Wales The World Bank Group defines social inclusion as 'the process of improving the terms for individuals and groups to take part in society, and the process of improving the ability, opportunity, and dignity of those disadvantaged on the basis of their identity to take part in society'[3]. The Scheme has aimed to encourage engagement with the local community and stakeholders throughout the study's development. The exhibitions and consultations have been held to include out-of-office hours for example, to maximise attendance and engagement. The Scheme's Public Liaison Officer is also available on a weekly basis to respond to queries in the local community. Moreover, the Scheme aims to improve active travel connections meaning that walkers, cyclists and horseriders would experience benefits of the Scheme, promoting social inclusion. The Scheme's aim to improve safety would also contribute to a more equal Wales as the community is currently disadvantaged by the safety issues present at Redstone Cross.
	5 A Wales of cohesive communities The engagement undertaken, as outlined above, has enabled the public and stakeholders to put forward their opinions and ideas and thus has provided the community opportunities to consider how and if improvements to transport should be considered between Redstone Cross and Penblewin Roundabout. By addressing safety concerns and providing active travel improvements would also contribute positively to a Wales of 'attractive, viable, safe and well-connected communities.'
	6 A Wales of vibrant culture and thriving Welsh language By promoting social inclusion and accessibility, the Scheme contributed to improving access to cultural and Welsh language facilities. As noted previously, although the Scheme itself is unlikely to encourage modal shift, it would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability along the A40 corridor

[3] The World Bank Group – Social Inclusion - https://www.worldbank.org/en/topic/social-inclusion

Objective and corresponding problems	Well-being Goals
	7 A globally responsible Wales By improving active travel improvements, the Scheme aims to enable more journeys to be made on foot, by bicycle or by horse riding. It is nonetheless noted that the Scheme would promote social inclusion on a strategic scale by improvements to journey time reliability for motor vehicles.
Objective 7: Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon. **No specific problems however the objective relates to the aim of the Scheme to deliver a sustainable improvement. The Scheme will take steps to reduce or offset waste and carbon where possible.**	1 A prosperous Wales By delivering a project that is sustainable, the Scheme would contribute to a prosperous Wales by ensuring that the environment's natural resources are protected or enhanced where practicable, contributing towards a prosperous Wales.
	2 A resilient Wales This Scheme objective and this well-being goal strongly interconnect as delivering a project that is sustainable and takes steps to reduce or offset waste and carbon that will contribute positively to a resilient Wales; a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems.
	3 A healthier Wales By aiming for a sustainable project in which reduces or offsets waste and carbon, the Scheme aims to reduce any potential adverse health impacts of the Scheme and providing enhancements for health where possible. Mitigation measures for the waste and carbon impact of the Scheme will be set out for the construction and operation phases.
	4 A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5 A Wales of cohesive communities There is no direct link between the Scheme objective and this Well-being goal.
	6 A Wales of vibrant culture and thriving Welsh language There is no direct link between the Scheme objective and this Well-being goal.

Objective and corresponding problems	Well-being Goals
	7 A globally responsible Wales This Well-being goal is embedded within this Scheme objective. In line with the Future Generations (Wales) Act 2015, the Scheme aims to take account of whether the improvements that could be provided to the economic, social, environmental and cultural well-being of Wales, would also make a positive contribution to global well-being.
8: Give due consideration to the impact of transport on the environment and provide enhancement when practicable. **No specific problems however the objective relates to the aim of the Scheme to give due consideration to the impact of transport on the environment throughout option development.**	1 A prosperous Wales This Scheme objective links with this well-being goal due to the importance of the environment for a strong economy. The environment provides resources to the economy, and so by reducing the environmental quality of a place, economic growth can be adversely affected by lowering the quantity and quality of resources, or due to health impacts[4].
	2 A resilient Wales This Scheme objective and this well-being goal strongly interconnect as mitigating environmental impacts and enhancing when practicable will contribute positively to a resilient Wales; a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems.
	3 A healthier Wales The aim of the Scheme is to also improve the active travel network locally. The northern options would sever a Public Right of Way (PRoW) however it is considered that the associated impacts would be mitigated through diversions and reinstatements. Moreover, all proposed options would allow the existing A40, of which would no longer exist as a trunk road, to perform as a local access route and provide safer opportunities for active travel movements. Mitigation and enhancement measures for the impact on the environment e.g. biodiversity and the water environment would also be in place.
	4 A more equal Wales There is no direct link between the Scheme objective and this Well-being goal.
	5 A Wales of cohesive communities There is no direct link between the Scheme objective and this Well-being goal.

[4] The Organisation for Economic Co-operation and Development (OECD) – Global Forum on Environment and Economic Growth - https://www.oecd.org/economy/greeneco/global-forum-on-environment-2016.htm

Objective and corresponding problems	Well-being Goals
	6 A Wales of vibrant culture and thriving Welsh language There is no direct link between the Scheme objective and this Well-being goal.
	7 A globally responsible Wales The Scheme would inevitably have environmental impacts including on the landscape, biodiversity and soils. The aim of the Scheme nonetheless is to minimise environmental impact of the Scheme and provide enhancement where practicable.

3.12.12 This demonstrates the positive interrelationship between them.

3.13 Options

Long List of Options

3.13.1 A great deal of development work has previously been undertaken and informed both the location of planned improvements and the preferred design of any highway improvements along the A40 between St Clears and Haverfordwest. This is summarised below.

3.14 Shortlist of Options

3.14.1 The Stage 1 WelTAG builds on the previous development work and further appraises options that take into account the outcomes of the previous development and consultation work, in addition to a do minimum option and a public transport intervention.

3.14.2 The Review Group agreed that the options to be considered as part of the WelTAG Stage 1 appraisal were to include:

- **Do Minimum**

Limited intervention reflecting the existing situation in the future, with the addition of any planned or committed measures as identified in the Pembrokeshire LDP.

- **Active Travel**

Active travel options aimed at improving local connectivity including walking, cycling and horse riding. Complementary active travel measures would be investigated and designed during WelTAG Stage Three, in conjunction with a WCH Assessment and Review Report.

- **Public Transport**

Increase frequency of bus services.

- **Highway Options – Southern Route**

RSX1a

Offline straight alignment between Penblewin and Redstone Cross, with online ghost island junction improvement at Redstone Cross. Vertical tie-in west of Redstone Cross to improve geometry and visibility at the junction.

RSX1b

Offline straight alignment between Penblewin and Redstone Cross, with online ghost island junction improvement at Redstone Cross. Vertical tie-in east of Redstone Cross. No improvement to mainline vertical geometry through the junction.

RSX1c

Offline alignment minimising separation between proposed and existing A40. Online ghost island junction improvement at Redstone Cross. Vertical tie-in east of Redstone Cross Junction. No improvement to mainline vertical geometry through the junction.

RSX1d

Offline alignment between Penblewin and Redstone Cross south of existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Offline junction improvement south of existing Redstone Cross Junction.

RSX1e

Redstone Cross Junction Improvement works only. No improvements to A40 mainline west of the junction.

RSX1f

Offline alignment between Penblewin and Redstone Cross south of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). No Junction provided for Redstone Cross. Side road diversions and underpass provided for north-south connectivity between Narberth & Bethesda.

RSX1g

Offline alignment between Penblewin and Redstone Cross south of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). No junction provided for Redstone Cross. Overbridge provided for north-south connectivity between Narberth & Bethesda.

RSX1h

Offline alignment between Penblewin Roundabout and Redstone Cross south of the existing alignment. Offline roundabout constructed to the south of the existing Redstone Cross Junction.

- **Highways Options – Northern Route**

RSX2a

Single carriageway offline alignment to the north of existing Redstone Farm, with offline junction improvement north of Redstone Cross.

RSX2b

Offline alignment between Penblewin Roundabout and Redstone Cross north of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Overbridge provided along Bethesda Road to maintain north – south connectivity between Narberth – Bethesda. New side road provision connecting the A478 south of Penblewin with the existing A40.

RSX2c

Offline alignment between Penblewin Roundabout and Redstone Cross north of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Offline junction improvement north of existing Redstone Cross Junction.

RSX2d

Offline alignment (long option) between Penblewin Roundabout and Redstone Cross north of the existing alignment Vertical tie-in west of Jacob's Park. Overbridge spanning across the new alignment providing north – south connectivity between Narberth – Bethesda.

RSX2e

Offline alignment between Penblewin Roundabout and Redstone Cross to the north of the existing alignment. Vertical tie-in west of Redstone Cross (approximately at access to Jacob's Park). Offline roundabout to the north of existing Redstone Cross Junction.

3.14.3 Each of the options was subject to WelTAG Stage 1 appraisal, with a description of each option, how it would tackle the identified problems, how it would meet the objectives, as well as key risks, adverse impacts, constraints and dependencies.

3.14.4 An overview of the sifting exercise of the long list to the shortlist is provided within Section 4.2 of the IAR. To summarise, a number of options were not recommended to be shortlisted for reasons such as not addressing highway safety concerns, impact on property, limitations for improvements to active travel, and not providing sufficient improvements to the standard of the A40

3.14.5 To summarise, three options were first recommended to be taken forward for further detailed appraisal. Active travel should form complementary measures alongside any of the four shortlisted highway route options. The shortlisted options therefore are presented as follows:

a) Active travel, supporting:
b) Option 1A: Northern highway route (Ref RSX2b);
c) Option 1B: Northern highway route (Ref RSX2c);
d) Option 2a: Southern highway route (Ref RSX2d).

3.14.6 The first Public Information Exhibition presented the identified problems, objectives and options, as above, in April 2019. Feedback from the exhibition attendees showed no clear preference between the options. With regards to alternative options, suggestions were made for a roundabout to replace Redstone Cross junction; traffic calming measures; alterations to the Southern Option (an underpass or bridge / no junction); and improvements to the existing junction layout.

3.14.7 Following feedback received and further route development from highway engineering specialists, Option 2B was developed.

3.14.8 A second Public Information Exhibition was held to present the four highway options to the public in May 2019. A summary of the feedback received is presented below:

a) 52% of respondents preferred an option with no junction at Redstone Cross whilst 26% preferred an option with a junction. 22% of respondents left the response blank or provided an alternative response.
b) There was a clear preferred option with 72 respondents stating their preference for Option 2B (Southern Route without a Redstone Cross Junction). The second most preferred route was Option 1B (Northern Route without a Redstone Cross Junction). This demonstrates that the two most favoured options did not include a junction at Redstone Cross. 15 respondents preferred Option 1A (Northern Route with Junction) and 13 respondents

preferred Option 2A. 5 respondents chose both Option 1B and 2B (favouring options without a Junction) and 3 respondents chose both Option 1A and 2A (favouring options with a Junction). 7 respondents chose No option or left the response blank.

c) 60% of respondents felt all options have been considered. Feedback suggesting alternatives and additions to the proposal included a roundabout to replace Redstone Cross junction, traffic calming measures and the provision of a slip road.

Option 1A – Northern Route with staggered T-junction at Redstone Cross

Description

3.14.9 The conceptual design seeks to divert the mainline carriageway to the south of the existing A40 runs through an area of woodland, a watercourse and negatively impacts nearby properties at Redstone Cross.

3.14.10 The horizontal alignment runs north of the existing A40. This design option avoids going through the environmentally sensitive areas to the south of the existing highway alignment.

3.14.11 An alignment to the north of the existing A40 carriageway has a detrimental effect on land use as it impacts farms and land holdings. It also severs private means of access and public footpaths which is avoided in the conceptual design option.

3.14.12 The route also runs in close proximity to the setting of a Scheduled Ancient Monument, with the potential for more archaeological findings along the trace of the route.

3.14.13 With the north alignment there is a reduced volume of earthworks with a better cut and fill balance when compared to the conceptual design.

3.14.14 The mainline alignment in this vicinity is fully compliant with the DMRB with no departures from standard.

3.14.15 The option provides benefit to the buildability and risk in relation to deliverability and safe by design in the short term as it proposes to construct the Redstone Cross junctions offline in comparison to the online approach with the conceptual design.

3.14.16 An illustration is provided in Figure 2.

Option 1B – Northern Route (no Redstone Cross Junction)

Description

3.14.17 The conceptual design seeks to divert the mainline carriageway to the south of the existing A40 runs through an area of woodland, a watercourse and negatively impacts nearby properties at Redstone Cross.

3.14.18 The horizontal alignment runs north of the existing A40. This design option avoids going through the environmentally sensitive areas to the south of the existing highway alignment.

3.14.19 An alignment to the north of the existing A40 carriageway has a detrimental effect on land use as it impacts farms and land holdings. It also severs private means of access and public footpaths which is avoided in the conceptual design option.

3.14.20 The route also runs in close proximity to the setting of a Scheduled Ancient Monument, with the potential for more archaeological findings along the trace of the route.

3.14.21 With the north alignment there is a reduced volume of earthworks with a better cut and fill balance.

3.14.22 The mainline alignment in this vicinity is fully compliant with the DMRB with no departures from standard.

3.14.23 The option removes the constraint of the junction therefore allows for a greater length of 2+1. This has the benefit of reducing driver frustration and improving journey time reliability.

3.14.24 Removing the junction will eliminate risks associated with the junction turning manoeuvres from the Scheme. North–south connectivity between Narberth and Bethesda will be maintained by the provision of an overbridge along the current alignment of Bethesda Road.

3.14.25 It provides benefit to the buildability and risk in relation to

deliverability and safe by design in the short term as it proposes to construct the Redstone Cross junctions offline in comparison to the online approach with the conceptual design.

3.14.26 An illustration is provided in Figure 3.

Option 2A – Southern Route (with Redstone Cross Junction)

Description

3.14.27 The horizontal alignment runs south of the existing A40, leading in a generally south-westerly direction from Penblewin roundabout. The alignment runs to the south of the existing Redstone Cross junction (between Redstone Cottages and Blaenmarlais Care Home) and re-joins the existing A40 near the entrance to Jacob's Park.

3.14.28 A vertical constraint would be at Redstone Road due to the need to provide an at-grade junction at this location to provide access to Bethesda & Redstone Road. The junction would be a staggered ghost island junction.

3.14.29 In comparison with the norther routes, the option has a slightly better cut and fill material balance due to the slightly reduced earthwork embankment between Redstone Junction and Penblewin roundabout. This is achieved by running the mainline alignment south of the existing Redstone Cross junction, thereby removing the vertical tie-in constraint located immediately to the east of the existing Redstone Cross junction in the conceptual design. The embankment height would still be significant (approx. 10 metres).

3.14.30 The option goes through the environmentally sensitive woodland area.

3.14.31 It does avoid the demolition of property at Redstone Cross as the new junction is proposed at a new location to the south of the existing junction.

3.14.32 The mainline alignment in this vicinity is fully compliant with the DMRB with no departures from standard.

3.14.33 This option provides benefits to the deliverability and 'Safe by Design' safety benefits in the short term as a greater length of the mainline, as

well as the proposed Redstone Cross junction, are constructed offline in comparison to the online construction of the junction improvement proposed within the conceptual design.

3.14.34 An illustration is provided in Figure 4.

Option 2B – Southern Route (no Redstone Cross Junction)

Description

3.14.35 The horizontal alignment is very similar to Option 2A, however due to the omission of a junction at Redstone Cross, it does not tie-in vertically into Redstone Road. Instead, the road travels underneath Redstone Road and ties back in vertically near the access to Jacob's Park.

3.14.36 An overbridge is proposed along Redstone Road to maintain the north-south connectivity between Narberth and Bethesda. There would be no junction on the A40 mainline at Redstone Cross.

3.14.37 A new side road would be constructed from Penblewin to allow access onto the existing A40 leading to Redstone Road & Bethesda.

3.14.38 The design crosses environmentally sensitive land which includes mature trees and a watercourse which would be affected. The option goes through the environmentally sensitive area.

3.14.39 It avoids land take from nearby property at Redstone Cross as the new junction is proposed at a new location to the south of the existing junction.

3.14.40 It provides a significantly better earthworks balance than the northern routes due to the cutting required to take the road below Redstone Road. This also reduces the volume of material required to import for the embankment between Redstone Cross and Penblewin. The embankment height between Redstone Cross and Penblewin roundabout is significantly lower than the conceptual design, therefore reducing the visual impact.

3.14.41 The mainline alignment of this option is fully compliant with the DMRB with no departures from standard. However, in order for the

road to drop below Redstone Road, there are relaxations in the vertical alignment.

3.14.42 The removal of the junction from the A40 mainline allows for a greater length of 2+1 carriageway cross-section provision. This will allow for overtaking sections in both directions instead of eastbound only (as specified in the conceptual design). This will reduce driver frustration as a greater length of safe overtaking opportunities will be provided.

3.14.43 This option provides benefits to the deliverability and 'Safe by Design' safety benefits in the short term as a greater length of the mainline, as well as the proposed Redstone Cross junction, are constructed offline in comparison to the online construction of the junction improvement proposed within the conceptual design.

3.14.44 The benefits of this option compared to 2A include:

a) Reduced disruption during construction for the construction of the proposed A40 alignment;
b) Reduced hazards associated with Redstone Cross junction by removing the junction from the Scheme; and
c) Provide a greater length of 2+1 sections which improve journey time reliability and reduce driver frustration.

3.14.45 An illustration is provided in Figure 5.

Figure 2 Option 1A - Northern Route with staggered T-junction at Redstone Cross

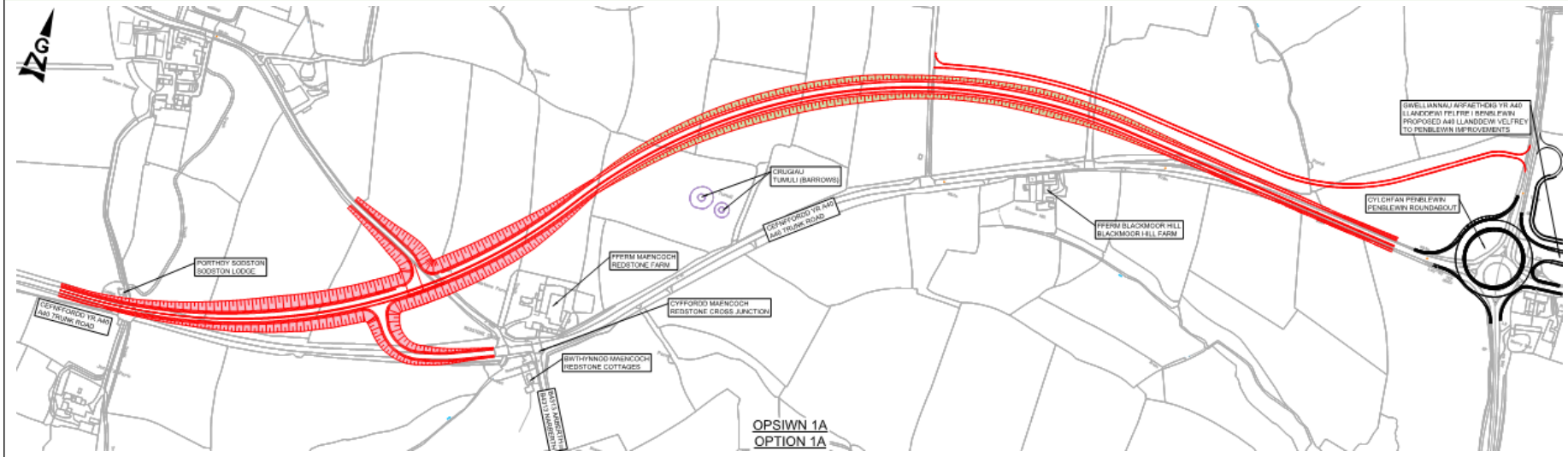


Figure 3 Option 1B - Northern Route (no Redstone Cross Junction)

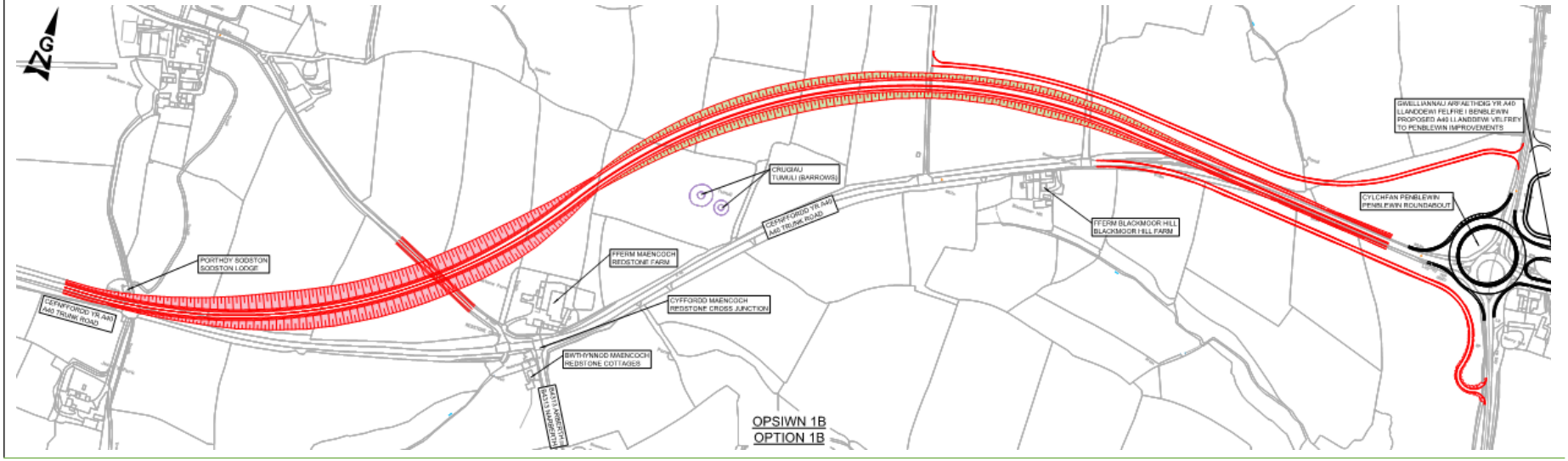


Figure 4 Option 2A - Southern Route with staggered T-junction at Redstone Cross

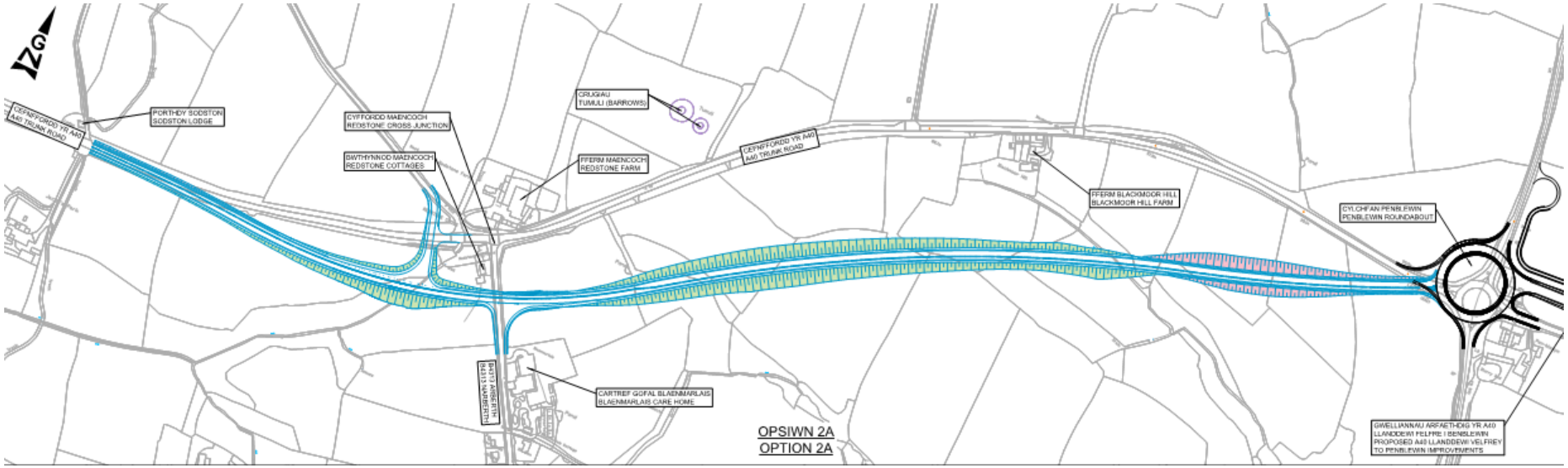
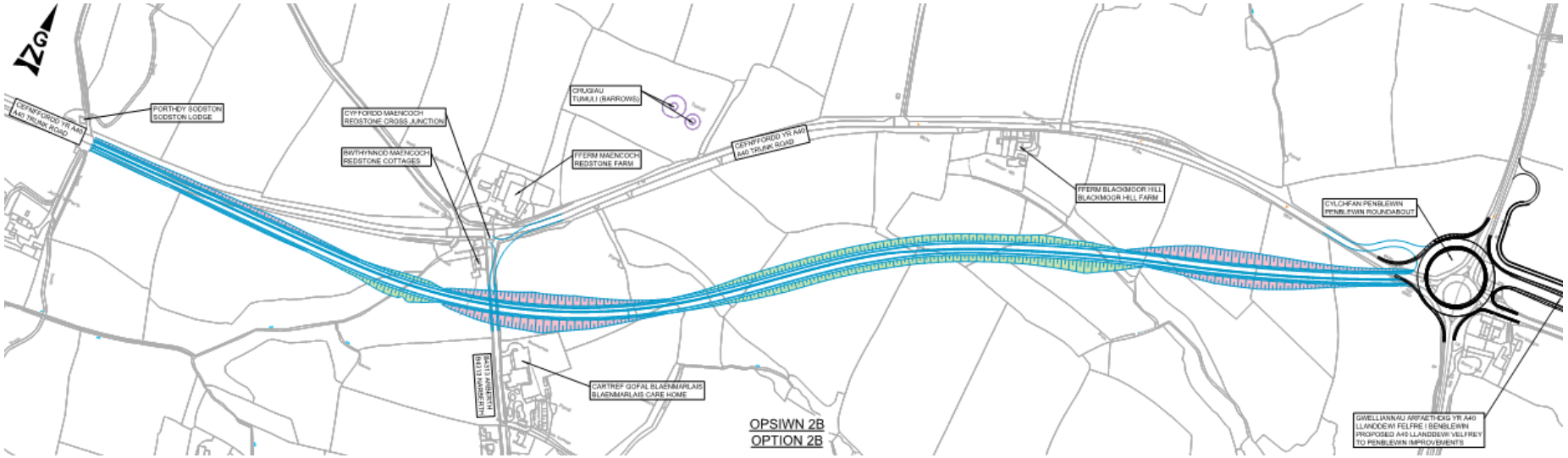


Figure 5 Option 2B - Southern Route (no Redstone Cross Junction)



How are the Problems addressed?

3.14.46 The table below outlines how the problems would be addressed by the shortlist.

Table 4 How the proposed options would address the problems

Problem	How the Problem is addressed
1. The A40 mainline and Redstone Cross junction is substandard.	All options are designed to the requirements within the Design Manual for Roads and Bridges (DMRB). In particular the standards "Highways Link Design-TD9/93", "Design of Wide Single 2+1 Roads-TD70/08" and "Geometric Design of Major/Minor Priority Junctions-TD42/95". Option 2A would require a departure from standard for the layout of the Staggered T- Junction arrangement. The allowable (to standard) arrangement contained within TD70, is for a right/left junction stagger. The proposed layout reverses this layout, which would be a right/left stagger, which requires a departure from standard. Option 2B has a marginally reduced standard, due to a reduction in vertical geometry (crest curve), which is an allowable relaxation within the standard. This is to allow the proposed realigned A40 to pass beneath Redstone Cross Road. Redstone Cross Road would pass over the top on an overbridge. The number and severity of collisions having been recorded at Redstone Cross junction highlights a safety concern. In addition to this, many respondents as part of the Public Information Exhibitions voiced their safety concerns including related to witnessing collisions and near-misses. Concerns also related to any proposed staggered junction at this location. Options 1B and 2B would therefore remove the junction onto the A40. It is nonetheless considered that Options 1A and 2A would provide significant improvements to the current situation.
2. Limited overtaking opportunities lead to poor journey time reliability and driver frustration.	Options 1B and 2B provide the longest extent of 2+1 carriageway and therefore maximise safe overtaking opportunities within this section of the trunk road which in turn will positively contribute to improved resilience and journey time reliability. These options would provide approximately 1.2km of 2+1 overtaking opportunity. There is potential for these options to provide opportunities for overtaking (two lanes) for both directions at different sections of the route. In addition, Options 1B and 2B do not include provision for a staggered junction at the location of Redstone Cross, which means transport users travelling east-west do not need to negotiate / slow down at this location. Options 1A and 2A would provide approximately 0.9km of 2+1 carriageway. The two lanes could be provided in either

Problem	How the Problem is addressed
	direction however it is not possible to provide overtaking opportunities (two lanes) for both directions owing to the length of the route. All options would provide significantly enhanced overtaking opportunities along the A40, improving east-west connectivity by improving journey times and journey time reliability, and reducing likelihood of driver frustration.
3. Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.	Through the provision of enhanced overtaking opportunities, the likelihood and/or length of platooning is reduced. All options present a significantly enhanced opportunity for vehicles to overtake slow-moving vehicles such as heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles. By improving overtaking opportunities, all options present benefits to journey time reliability. Moreover, many agricultural vehicles travelling between the existing Redstone Cross Junction and Penblewin Roundabout would utilise the detrunked route (the existing A40), thus removing a proportion of slow-moving traffic away from the new A40, reducing the likelihood of platooning to a greater extent. Options 1B and 2B remove direct access to and from Redstone Cross, by removing the junction. This increases the lengths of overtaking available, which benefits the strategic road network and improves journey time reliability. Local traffic would access Redstone Cross via Penblewin and utilise the existing A40 carriageway. This would increase journey times for local traffic travelling to/from the west.
4. Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.	Seasonal spikes in traffic volumes especially during the summer months are clearly evidence within the Impact Assessment Report. Providing enhanced overtaking opportunities would allow for improved journey time reliability and enhanced highway capacity; of which would reduce the likelihood and severity of traffic problems during the summer period.
5. There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational	All options would reduce the number of side road junctions and direct accesses onto the A40, with Option 1B and 2B removing all accesses between Redstone Cross junction and Penblewin Roundabout. By removing these junctions and accesses, there is a reduced likelihood of traffic slowing down as well as a reduced conflict between vehicles on the A40 and vehicles joining the A40. There is less overtaking opportunity provided within Options 1A and 2A owing to the proposed Redstone Cross junction.

Problem	How the Problem is addressed
problems along the road.	

How are the Objectives addressed?

3.14.47 The appraisal of the performance of the options against the objectives is informed by the appraisal as presented within the IAR. This will be updated at Stage 3 for a preferred option, which will be informed by the appraisal but with a more detailed evidence base.

O 1	**To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.** As a key east-west route, the options will improve accessibility along the A40 to key towns such as Haverfordwest and Carmarthen. This will provide associated benefits for car-based journeys as well as accessibility for those using public transport. This would improve accessibility to key employment, community and tourism destinations. The potential benefits are maximised given the high dependency on the private car in light of the socio-demographic and geographical context of the region. Options 1B and 2B provide the longest extent of 2+1 carriageway and therefore maximises safer overtaking opportunities within the section of the trunk road which in turn will positively contribute to improved resilience and journey time reliability. These options would provide approximately 1.2km of 2+1 overtaking opportunity. There is potential for these options to provide opportunities for overtaking (two lanes) for both directions at different sections of the route. In addition, Options 1B and 2B do not include provision for a staggered junction at the location of Redstone Cross, which means transport users travelling east-west do not need to negotiate / slow down at this location. Options 1A and 2A would provide approximately 0.9km of 2+1 carriageway. The two lanes could be provided in either direction however it is not possible to provide overtaking opportunities (two lanes) for both directions owing to the length of the route. Both 1A and 2A include a staggered junction. This would require traffic to negotiate joining, crossing and leaving the junction of which would increase the likelihood of east-west traffic needing to slow down and thus slightly reducing strategic connectivity benefits in comparison to Options 1B and 2B of which do not include a Redstone Cross junction.	Option 1A ++ Option 1B +++ Option 2A ++ Option 2B +++

O 2	**To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.** As a key east-west route, the options will improve accessibility along the A40 to key towns such as Haverfordwest and Carmarthen as well as key employment areas. Maximising the extent of 2+1 carriageway would provide the maximum benefit in terms of journey reliability and wider prosperity. Options 1B and 2B would provide 1.2km of overtaking opportunity compared to 0.9km for Options 1A and 2A. It is therefore considered that Options 1B and 2B would provide greater benefits for strategic connectivity when compared to Options 1A and 2A. Providing no junction onto the new A40 at Redstone Cross would enable maximised strategic benefits for connectivity as vehicles would not need to negotiate vehicles joining the carriageway from the north and south. It would also provide transport users with improved opportunities to overtake slow moving vehicles. Without a new Redstone Cross junction, some transport users would be adversely affected, for example, those living and working within proximity of the existing Redstone Cross junction and along Redstone Road. With Option 1B and Option 2B, transport users would need to take a longer journey to join the A40 in comparison to the current situation. An initial economic assessment has been undertaken for the four short-listed options. The BCR results indicate that Option 2A provides the best BCR. Option 2B provides similar strategic benefits but with a local disbenefit. Feedback received at the Public Information Exhibitions suggested that whilst some respondents stated a negative impact on accessibility to the A40, more comments were received in support for no Redstone Cross junction as part of proposals. 73 respondents stated their preference for no junction whilst 36 stated their preference for a junction. It is noted that 31 respondents did not provide a response or provided an alternative response. Many respondents cited their safety concerns for any staggered junction at Redstone Cross during both events; this included safety concerns for the existing situation and Options 1A and 2A. With all this considered, it is anticipated that Option 1B and 2B would provide greater outcomes for this objective because of the routes' connectivity benefits on a strategic scale. A large number of respondents also preferred the removal of the Redstone Cross junction.	Option 1A + Option 1B ++ Option 2A + Option 2B ++

O 3	**To reduce community severance and provide health and amenity benefits** It is considered that all options would reduce community severance and provide health and amenity benefits largely due to the removal of a significant proportion of traffic off the existing A40. This would allow the existing A40, of which would be no longer be a trunk road, to perform as a local access route and also provide safer opportunities for active travel movements. Options 1B and 2B would remove direct access onto the new A40 at the location of the existing Redstone Cross junction. Although some respondents stated a desire for the maintained connection onto the A40 at this location, more respondents stated their preference for no junction. This demonstrates that no junction may not create significant concerns about severance for many of the local community. It is nonetheless noted that removing a direct connection would increase journey times e.g. for locals and for those accessing Redstone Cross industrial park. Options 1B and 2B would retain a north-south connection. Options 1A and 1B would sever direct access onto the A40 from unnamed roads to the north of the A40 however accesses would be created to run parallel to the new route, with a new access connecting to the A478 to the north of Penblewin roundabout. These new access routes would provide a longer route for accessing the A40 to the west, however the routes would no longer have a junction onto a trunk road. Options 1A and 2A provide access from both the north and the south onto the new A40 via a staggered junction designed to modern design standards. This would maintain direct access onto the A40 at this location however from feedback received from the community, a junction at this location was not favoured by most respondents, with many comments relating to concerns for any staggered junction. The option to use the new Redstone Cross junction would nonetheless be preferable to some of the community, and with the junction designed to modern design standards, this would provide an improvement upon its existing situation. All options would maintain north-south connectivity between Narberth and Bethedsda. Options 1B and 2B would facilitate this connection via an overbridge as opposed to a staggered junction. Although the staggered junction would be designed to modern design standards and would be an improvement on its existing situation, an overbridge would produce more benefits as transport users do not need to negotiate the crossing against the traffic. Overall, it is considered that all options would reduce community severance and provide health and amenity	Option 1A + Option 1B ++ Option 2A +

	benefits. It is nonetheless noted that Option 1B and 2B would revise the junction arrangement, creating more benefits for north-south connectivity. Active travel movements would be enhanced within the local area most through Options 1B and 2B as walkers, cyclists and horse riders would not need to cross the A40 for north-south movements.	Option 2B ++
O 4	**To improve the Redstone Cross Junction safety (and perceived safety) and reduce the number and severity of A40 mainline collisions.** Maximising the lengths of 2+1 carriageway means that Options 1B and 2B provide greatest benefit in terms of removing direct accesses onto the trunk road and providing the maximum extent of safe, unambiguous overtaking opportunities, reducing the likelihood of collisions through risky manoeuvres. Potential conflict is removed to a slightly greater extent with Options 1B and 2B, given no intermediate junctions. Options 1B and 2B would therefore remove the junction onto the A40; an option supported by most respondents during stakeholder engagement. It is however the case that Options 1A and 2A would provide a significant improvement upon the existing situation. Given that a majority of collisions identified over the study period within the study area have been recorded at Redstone Cross, all of the options would provide significant improvements to safety. This would include improvements to perceived safety. It is anticipated that Options 1B and 2B would provide slightly greater benefits owing to the increased overtaking opportunities and there being no junction at this location for vehicles to negotiate.	Option 1A ++ Option 1B +++ Option 2A ++ Option 2B +++

O 5	**To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles** Options 1A and 1B would sever one PRoW however it is considered that associated impacts will be mitigated through diversions and reinstatements. The parallel access road along the western section of the new road would help maintain local accesses. The options also provide the opportunity to improve / enhance walking, cycling and horse-riding links within the local community through diversions of existing routes and provision of new routes. The measures would be established as part of WelTAG Stage 3 with a WCH Assessment and Review likely to then be available. All options would reduce the traffic flow along the existing A40, and thus provide opportunities for safer and more pleasant active travel journeys. Options 1B and 2B would provide greater benefits for active travel connectivity between Narberth and Bethesda, as walkers, cyclists and horse riders are able to cross the new A40 via an overbridge, and therefore do not need to negotiate the traffic along the A40.	Option 1A 0 Option 1B + Option 2A 0 Option 2B +
O 6	**To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs** Although the options are unlikely to encourage modal shift they would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability. Access to local communities would also be benefited by improved highway and WCH conditions.	Option 1A + Option 1B + Option 2A + Option 2B +
O 7	**To deliver a project which is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon** Although the options would not encourage modal shift to	Option 1A --

	more sustainable transport options, it would, through maximising overtaking opportunities, provide sustainability benefits in terms of the overall efficiency of journeys as well as improving access to key employment areas, supporting economic growth and social inclusion. However, the highway options would all involve contruction carbon impacts. Option 2B would have less adverse impact given its improved conditions for operational traffic, reducing the impact of vehicle emissions.	Option 1B -- Option 2A -- Option 2B -
O 8	**Give due consideration to the impact of transport on the environment and provide enhancement when practicable** There would be land take required for all route options with associated environmental impacts on the landscape, biodiversity, soils etc. which requires further survey and assessment. However, this needs to be balanced against the opportunities for mitigation and enhancement and wider Scheme benefits. Options 2A and 2B travel through more environmentally-sensitive land, however Options 1A and 1B travel through more cultural heritage-sensitive land.	Option 1A -- Option 1B -- Option 2A -- Option 2B --

3.15 Well-being Objectives

3.15.1 Whilst much of the previous development work and associated decision making leading up to this latest WelTAG study precedes the Well-being of Future Generations (Wales) Act 2015 (WFGA), WelTAG 2017 Supplementary Guidance sets out that:

> "*When using WelTAG it is essential to comply with the duties set out in the Well-being of Future Generations (Wales) Act 2015. They are to follow the sustainable development principle through following the five ways of working and set well-being objectives that maximise contribution to the seven well-being goals*."

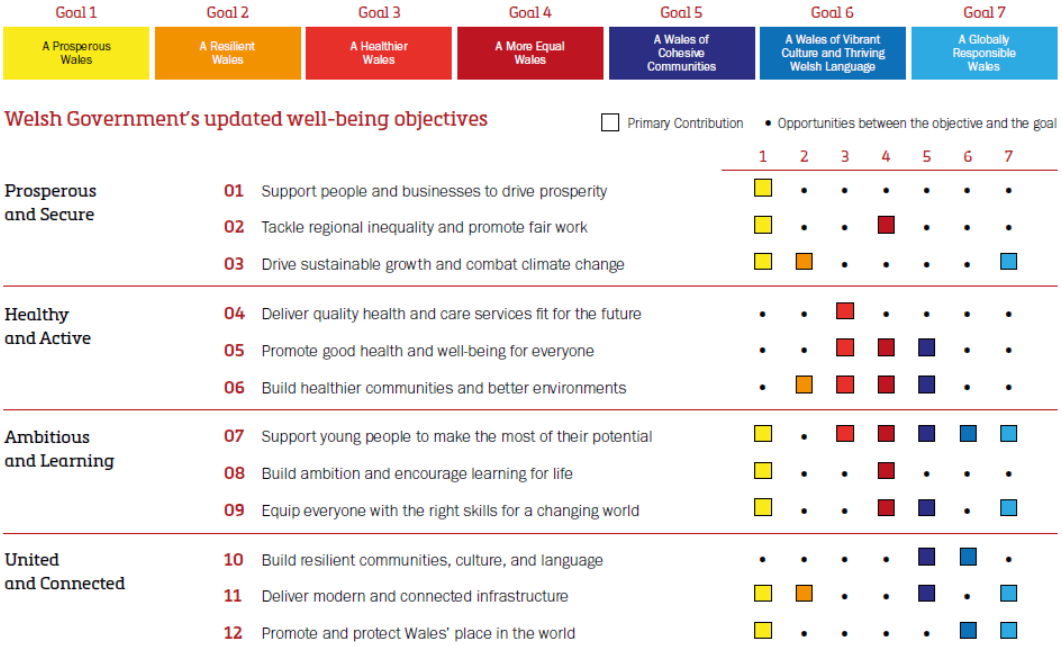
3.15.2 The WFGA places a duty on 44 public bodies in Wales places a duty on 44 public bodies in Wales, including Welsh Ministers, to carry out sustainable development. This means that each public body must work to improve the economic, social, environmental and cultural well-being of Wales. To do this they must set and publish well-being objectives designed to maximise their contribution to each of the seven well-being goals. Public bodies must then take action to make sure they meet the objectives they set.

3.15.3 WelTAG 2017 guidance explains how it is important that the way the WelTAG framework is used for thinking about proposed changes to the transport system, helps public bodies fulfil their well-being duty. It is essential therefore that the sustainable development principle of the WFGA is applied to the way the WelTAG framework is used.

3.15.4 The WFGA well-being goals have been taken into account as part of the objectives for this Scheme (see section 4.3 of the IAR). In developing the objectives, a review was undertaken against the well-being goals as presented within the 2015 Act. This ensures that the Scheme objectives align to the wider sustainable development principle of the Welsh Government, and take into account the needs of Wales' future generations. For example, Scheme Objective 7 is to: 'Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon', which is clearly aligned to the national well-being goal to create 'A globally responsible Wales'. As such, an option that performs well against the objectives is expected to contribute to the well-being goals.

3.15.5 As is set out in section 4.5 of the IAR, the preferred option performs well against all but one of the Scheme objectives, and as such is expected to contribute positively to the well-being goals.

3.15.6 A review has been undertaken of the preferred option to help demonstrate how its implementation would contribute to the well-being goals, by considering the Welsh Government's well-being objectives. The Welsh Government's well-being objectives were last updated in its Well-being Statement published alongside its Prosperity for All: The National Strategy document. Table 1 of the Well-being Statement sets out the Welsh Government's contribution to the well-being goals, explaining how each of its 12 well-being objectives aligns to its four cross cutting themes and contributes to one or more of its seven well-being goals:



3.15.7 It is clear that a positive contribution to a well-being objective would align to the cross-cutting strategies and result in a positive contribution to one or more of the well-being goals. As such, a commentary of how the preferred option would contribute to the well-being objectives is provided below.

Table 5 Alignment between Well-being objectives and the Preferred Option

Well-being Objective	How the preferred option would contribute
Support people and businesses to drive prosperity	The Scheme would address the transport problems on the network, improving journey reliability and improving journey times at times of incidents and delays, as well as enhance accessibility to employment areas including those at Milford Haven, Pembroke Dock and the Haven Waterway Enterprise Zone. Improved access to employment opportunities and enhanced conditions for the movement of people and goods along the TEN-T strategic route would support people and businesses to drive prosperity and reduce inequality.
Tackle regional inequality and promote fair work	
Drive sustainable growth and combat climate change	Although the option would not encourage modal shift to more sustainable transport options, it would, through maximising the opportunity to overtake provide benefits in terms of the overall efficiency of journeys as well as improving access to key employment areas, support economic growth. Increased journeys are likely to result in increased GHG. The new road infrastructure will also produce embodied carbon in addition to the operational GHG emissions. Adverse operational

Well-being Objective	How the preferred option would contribute
	carbon effects could be offset in the longer term once ultra-low emission vehicle technology has a higher uptake. Active travel improvements aim to improve opportunities for walking, cycling and horse riding, therefore on a local scale, making sustainable journeys more attractive to the community.
Deliver quality health and care services fit for the future	The Scheme would not directly contribute to this objective but would help improve accessibility to health and care services. The Scheme also provides the opportunity to improve / enhance walking, cycling and horse-riding links. This would help increase physical fitness, which would benefit health and care services in the longer term.
Promote good health and well-being for everyone	The Scheme would help to improve the active travel network locally by providing enhancements for walking, cycling and horse riding. The Scheme would also remove a significant proportion of traffic from the existing A40, of which would no longer exist as a trunk road, and allow for safer, more attractive opportunities to make active travel movements. In terms of building better environments, the Scheme will look to incorporate mitigation and enhancement measures for the Scheme's impact on the environment.
Build healthier communities and better environments	
Support young people to make the most of their potential	The Scheme would address the transport problems on the network, improving journey reliability and improving journey times at times of incidents and delays. That would improve accessibility to education services and other opportunities for learning and development, including employment areas such as the Haven Waterway Enterprise Zone (with innovative opportunities at new and established energy, food, tourism, life sciences, ICT and manufacturing firms). The construction phase of the Scheme would also offer opportunities for local recruitment and training, including apprenticeships for young people. Furthermore, addressing the transport problems would also help parents to better plan their journeys to work, which in turn would help parents spend more time with their children.
Build ambition and encourage learning for life	
Equip everyone with the right skills for a changing world	
Build resilient communities, culture and language	The Scheme would provide slight benefits for journeys to key public transport hubs through improvements to journey time reliability and would support prosperity with improved access to employment opportunities and tourist destinations. That would help retain the existing population and provide opportunities for young people to stay

Well-being Objective	How the preferred option would contribute
	living and working in the area, which has above national average levels of Welsh speakers.
Deliver modern and connected infrastructure	The proposed solution would provide a high-quality road built to modern standards, which would replace the worst section of TEN-T in the UK. The improvements would reduce the current actual and perceived barriers to investment in the region and it would provide an improved connection to key employment areas and communities in South West Wales, forming part of the wider A40 enhancements, of strategic importance to the Welsh Government.
Promote and protect Wales' place in the world	

3.15.8 From the appraisal above, it is clear that the proposed solution would result in opportunities to help achieve the well-being objectives, thus aligning positively to the cross-cutting strategies, contributing to the well-being goals, and helping Welsh Ministers satisfy their duties and obligations under the 2015 Act.

3.15.9 The Act also outlines five key ways of working that the Welsh Government is obliged to take account of and its objectives have been framed by the ways of working:

3.15.10 A review of how the project would embed the five ways of working is provided in the Delivery Case.

4 Transport Case

4.1 Introduction

4.1.1 The **Transport Case** considers how the proposed solution (options) will meet the need identified in the **Strategic Case** and the objectives set. The assessment considers potential impacts under the following key themes:

a) Social and cultural
b) Environmental; and
c) Economic.

4.2 Options Assessment

4.2.1 As stated earlier, WelTAG Stage 1 recommended the following options to be taken forward for further appraisal at Stage 2:

a) Active travel, supporting:
b) Northern highway route (Ref RSX2b) – referenced as Option 1A;
c) Northern highway route (Ref RSX2c) – referenced as Option 1B;
d) Southern highway route (Ref RSX1d) – referenced as Option 2A; and
e) Southern highway route (Ref RSX1g) – referenced as Option 2B.

4.2.2 These options were put forward by the Review Group and as appraised in the Design Options Report to help progress towards a preferred option.

4.2.3 Full and technical details of the evidence base and analysis work undertaken is presented within Section 3 and 4 of the WelTAG Stage 1 and 2 IAR. A summary of the key evidence presented is shown below:

Transport Network

a) The A40 West of St Clears forms the lowest standard section of the TEN-T in the UK;
b) The A40 provides a key highway link between south-east Wales and Haverfordwest, a gateway town to the ports of Milford Haven, Fishguard and Pembroke Dock, as well as the Pembrokeshire tourist economy;
c) The A40 accommodates a mix of traffic types, with seasonal variations. In the winter months, the road carries local residents

(typically car-based traffic); commercial vehicles, particularly around ferry arrival and departure times; and agricultural vehicles. In the summer months, the mix is supplemented by a higher volume of tourist traffic (increasing in some areas by over 40%) including cars and caravans;

d) Redstone Cross junction forms a staggered junction of which is not built to modern highway standards;

e) Public transport services are largely not competitive with car-based transport on the longer routes;

f) It is a priority of Pembrokeshire County Council and the Welsh Government to help ensure that the infrastructure is in place in order to make the ports and associated Haven Waterway Enterprise Zone as attractive as possible to future investment;

g) There is limited formal active travel infrastructure within the local area;

h) Journey time reliability has been identified as one of the key problems associated with the A40 between St Clears and Haverfordwest. The long stretches of single carriageway and alignment of the road limits safe overtaking opportunities and causes platooning behind slow moving vehicles (e.g. HGVs, agricultural vehicles and caravans);

i) The relatively higher journey times during the morning, evening and inter-peak compared to the off-peak are likely to be the result of lack of overtaking opportunities rather than traffic congestion resulting from road sections or junctions exceeding their theoretical capacity;

j) Improvements between Penblewin and Slebech Park have helped to relieve the problem of lack of overtaking opportunities to an extent, however there continues to be long stretches to the west of Penblewin where overtaking opportunities are limited, including around the study area;

k) Traffic flows have fluctuated over the past couple of decades, over a 19-year period, traffic growth has increased by 18%;

l) It is clear that there are significant seasonal variations in traffic volumes, with a clear trend towards higher traffic volumes during the summer and lower traffic volumes during the winter, reflecting the prominence of Pembrokeshire as a tourism destination;

m) Historically there has been safety concerns along the A40 St Clears to Milford Haven with eight PIAs recorded within the study area for the most recent ten-year period, two of which were fatal, two were serious and four were slight in severity. In comparison to the average accident rate, the severity of accidents on this section of the A40 is particularly skewed towards fatalities, with likelihood of a fatality ten times higher than observations on roads of similar standard;

Social and Cultural

a) Pembrokeshire is one of the most rural counties in Wales with a population density of 76 people per square kilometre compared to the Welsh average of 149.2;

b) Rushacre Enterprise Park is located within approximately 700m south of Redstone Cross junction, off Redstone Road; other local facilities are clustered within Narberth;

c) In line with national and regional averages, a vast majority of workers in the study area travel to work by car, taxi or motorbike, with car ownership within the study area higher than a national and regional level. Residents of the study area are more likely to travel longer distances to work in comparison to Pembrokeshire and Wales as a whole;

d) The Welsh Index of Multiple Deprivation shows that the local area experiences relatively high rates of deprivation in terms of access to services;

Environmental

a) The study area is within a Noise Action Plan Priority Area, which comprises Redstone Cross and extends for approximately 600m east;

b) The study area is located in an area rich in archaeological and cultural heritage, including a Scheduled Ancient Monument to the north of the existing A40 north east of Redstone Cross. A full non-invasive geophysical survey and an archaeological walkover survey of the land to the north and south of the existing A40 have identified the likely remains of a significant number of previously unrecorded barrows and associated bronze age features along the ridge to the north of the existing A40. There have been no similar features identified to the south;

c) According to the Predictive Agricultural Land Classification Map, the study area predominantly comprises of sub-grade 3b moderate quality agricultural land with some small areas of sub-grade 4 poor quality agricultural land as well as non-agricultural land. To the south of Redstone Cross, Narberth is classified as urban;

Economic

a) Pembrokeshire is a relatively low-wage economy, recording median gross weekly earnings that are significantly below the national average on both a resident and workplace basis. This is despite Census data showing that Pembrokeshire has a relatively highly-qualified workforce in comparison to Wales as a whole; and

b) Strategic developments and regeneration initiatives relevant to the study include the formation of the Swansea Bay City Region; the further growth of the Haven Waterway Enterprise Zone; the

growth plans for Pembroke Port and the Port of Milford Have; and Pembrokeshire County Council Local Development Plan proposals, of which include an employment allocation for Rushacre Enterprise Park Extension and a number of housing allocations.

4.2.4 Table 6 provides a comparative analysis of the options considered at Stage 2. Following the well-being, summary narrative considers the relative performance of the options in meeting the objectives and in relation to key social and cultural, environmental and economic considerations.

Table 6 Appraisal Summary Table – Comparative Analysis

	Do Minimum	**Option 1A**	**Option 1B**	**Option 2A**	**Option 2B**
Social & Cultural					
Physical Activity	0	+	++	+	++
Journey Quality	-	+	++	+	++
Accidents	-	++	+++	++	+++
Security	-	+	++	+	++
Commuting and Other users	-	+	++	+	++
Reliability impact on Commuting and Other users	-	++	+++	++	+++
Access to Services	-	+	++	+	++
Affordability	0	0	0	0	0
Severance	-	+	++	+	++
Option and non-use values	-	+	++	+	++
Environment					
Noise	0	-	-	-	-
Air Quality	0	+	+	+	+
Greenhouse gases	0	--	-	--	-
Landscape	-	--	--	--	-

	Do Minimum	Option 1A	Option 1B	Option 2A	Option 2B
Townscape	N/A	N/A	N/A	N/A	N/A
Historic Environment	-	---	---	-	-
Biodiversity	0	--	--	--	--
Water Environment	0	-	-	--	--
Economic					
Business users & transport providers	-	+	++	+	++
Reliability impact on Business users	-	++	+++	++	+++
Regeneration	0	0	0	0	0
Wider Impacts	-	++	+++	++	+++
Public Accounts					
Cost to Broad Transport Budget	0	+++	+++	+++	+++
Indirect Tax Revenues	0	+	++	+	++
Objectives					
O 1		++	+++	++	+++
O 2		+	++	+	++
O 3		+	++	+	++
O 4		++	+++	++	+++
O 5		0	+	0	+
O 6		+	+	+	+
O 7		--	--	--	-
O 8		--	--	--	--

4.2.5 Appraisal undertaken at Stage 2 makes it clear that Options 2B and 2A would best address the problems, best achieve the objectives and perform best against the majority of cultural, social and economic appraisal criteria, appreciating that there would be some adverse impacts in particular on the environment.

4.2.6 As explained in sections 4.2.4-4.2.16 of the IAR, stakeholders have expressed strong support for Option 2B e.g. for perceived safety reasons.

4.2.7 The Welsh Government recognised that Option 2B would be more likely to avoid objections from local residents and politicians in light of their concerns about a junction at Redstone Cross. This offers reduced risks to delivery through the statutory process.

4.3 Summary

4.3.1 Options 1B and 2B best address most of the objectives, with limited variations including accidents and journey time reliability change benefits when compared with each other.

4.3.2 None of the options would address the environment focused Objectives 7 (Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon) or Objective 8 (Give due consideration to the impact of transport on the environment and provide enhancement when practicable), although further survey work, Environmental Impact Assessment and mitigation strategies are anticipated/needed at Stage 3.

4.3.3 The options perform poorly against the environmental criteria, but with Option 2A performing best against the greenhouse gases, landscape and historic environment. Option 2A performs worse than Options 1A and 1B in relation to impacts on the water environment.

4.3.4 Options 1B and 2B best address all of the social and cultural appraisal criteria through best addressing issues such as journey quality, accidents and access to employment and services. By removing the Redstone Cross junction, greater network resilience is provided to the strategic network.

4.3.5 Options 1B and 2B also perform well against the economic appraisal criteria in comparison to the other options. Benefits include improvements to journey time reliability and accidents. All options score poorly in terms of their impact on land, the capital costs and revenue costs, with Option 2B having a slightly less adverse impact on capital and revenue costs than two of the other options.

4.4 Sustainable Development Principle

4.4.1 In accordance with the 2017 WelTAG guidance, the objectives have taken into account the well-being goals as set out in the Well-being of Future Generations (Wales) Act 2015.

4.4.2 As set out at Figure 1, the well-being goals include:

1. A prosperous Wales
2. A resilient Wales
3. A healthier Wales
4. A more equal Wales
5. A Wales of cohesive communities
6. A Wales of vibrant culture and thriving Welsh Language
7. A globally responsible Wales

4.4.3 The Options would contribute to most of the well-being goals as follows:

a) A Prosperous Wales: Enhancing network resilience and improving accessibility to key employment, community and tourism destinations will support prosperity, for example increased productivity would create a more attractive Pembrokeshire to work in and to invest in.

b) A resilient Wales: Whilst all options would have an adverse impact on biodiversity and the natural environment, throughout the project, mitigation and enhancement measures are integrated within Scheme development.

c) A healthier Wales: Improving accessibility to health services will contribute to a healthier Wales. Moreover, complementary active travel measures are integrated within Scheme development. Whilst it is anticipated that there will be adverse noise and air quality impacts for certain areas, it is anticipated there will also be benefits for other areas.

d) A Wales of cohesive communities: By improving accessibility, connectivity between communities will be enhanced. Moreover, removing a large proportion of traffic off the existing A40, benefits for both active travel and car movements would improve, enhancing community cohesion.

e) A Wales of vibrant culture and Welsh Language: Options would also improve accessibility to cultural facilities, whilst the WelTAG Scheme itself has been developed in line with Welsh Language guidance, providing exhibition materials in both English and Welsh for example.

f) A globally responsible Wales: All options are developed to minimise the environmental impact of the Scheme, alongside addressing the problems and meeting the other objectives of the Scheme.

4.4.4 The Welsh Government and other public bodies are required to publish their own well-being objectives, seeking to achieve the above well-being goals. A detailed assessment of how the preferred option may align to the sustainable development principle, taking into account the well-being goals, objectives and ways of working, will be provide at WelTAG Stage 3, when sufficient detailed information is available to inform that assessment.

4.4.5 At this stage, the appraisal indicates that Option 2B is most likely to perform best compared to the other options in contributing towards the well-being goals and any well-being objectives, given it performs best against the majority of cultural, social and economic appraisal criteria, appreciating that there would be some adverse impacts on the environment.

5 Management Case

5.1.1 The Management Case considers delivery arrangements for the project to include management during the lifetime of the project moving forward. It demonstrates that the project is achievable and outlines the arrangements that have been put in place or will be considered further at the next stage (WelTAG Stage 4). It is considered that the proposed Scheme is deliverable based on the information available at this stage.

5.1.2 This case will need to be updated when a new Design and Build (D&B) Contractor is procured, following completion of Key Stage 4 of the project.

5.1.3 The project will likely be delivered using the NEC Engineering and Construction Contract. These types of contract have been successfully used on a number of Schemes including the A40 Penblewin to Slebech Park, A477 St Clears to Red Roses and A465 Heads of the Valley Dualling, Sections 2 and 3.

5.1.4 The Scheme is split into three key stages which cover design, statutory process, construction and aftercare in accordance with the Welsh Government's Transport Division's Key Stage Approval Process. The KSA process provides a staged financial approval system to manage the process of projects from inception, through to construction and initial maintenance and complies with the principles of PRINCE2 project management (Figure 6):

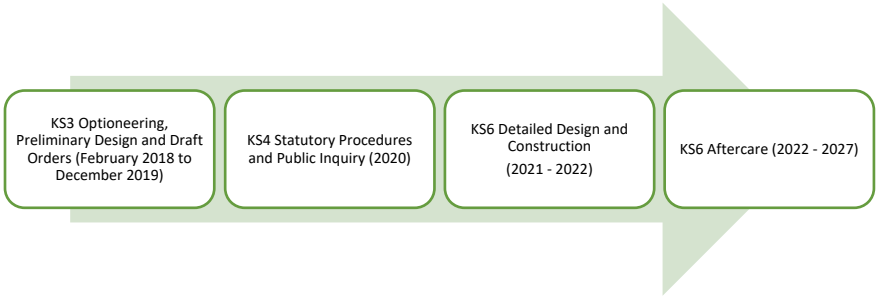


Figure 6 Project Timeline

Key Stage 3

5.1.5 Key Stage 3 (KS3) includes Optioneering, Preliminary Design and setting of land required for the Scheme and associated Statutory Orders required to obtain land via Compulsory Purchase Order (CPO) and any

need to designate new sections of road as trunk road. This will be delivered by Arup / RML.

5.1.6 KS3 is planned to run from January 2019 until January 2020 and involves the development of the outline design and Outline Business Case, preparation of a Scheme Cost Estimate, publication of draft Orders documentation and associated environmental documentation such as the Environmental Statement.

5.1.7 The table below (Table 7) identifies the illustrative dates associated with Key Stage 3 programme.

Table 7 Outline Key Stage 3 Programme

Event	Time in weeks after contract award
1. Commencement of Key Stage 3 Services	21 January 2019
2. Issue WelTAG Stage 1 & 2 Report to WG	05 July 2019
3. Completion of WelTAG Stage 3	24 October 2019
4. Submission of Final Draft Orders to Employer	31 October 2019
5. Employer's Approval of Preliminary Design	20 December 2019
6. Publish Draft Line and Side Road orders (End of KS3)	22 January 2019

5.1.8 An Environment Statement and other technical assessments are submitted alongside the draft Orders for the Scheme. Statutory Orders are prepared by Welsh Ministers and published in draft. The draft Orders for the Scheme include the following:

a) A draft Line Order to provide for the new section of trunk road and the reclassification of the existing A40 (de-trunking);

b) A draft Side Roads Order to deal with local highway issues (including roads, footpaths, bridleways, byways and cycleways) and private access issues. Side Roads Orders can relate to closure, diversion, improvement or new provision; and

c) A draft Compulsory Purchase Order, which provides for the acquisition of the land and rights required.

Key Stage 4

5.1.9 Key Stage 4 (KS4) is from publication of Draft Orders through a statutory process to Notice to Proceed to Construction. A Public Local Inquiry may be held if deemed necessary by the Welsh Government. This will be delivered by Arup / RML. KS4 is planned to run from January 2020 to January 2021 and involves completion of statutory processes, including publication of the draft Orders, Orders

Exhibitions, dealing with objections, and representations, preparation for and conduct of the Public Inquiry (if required), finalising the Orders and preparing Contract Documentation ready for the procurement of the Design and Build (D&B) Contractor. Table 8 below identifies the illustrative key dates associated with Key Stage 4 programme requirements.

Table 8 Outline Key Stage 4 Programme

Event	Time in weeks following start of KS4
Start of Key Stage 4	0
Publication of draft CPO	3
Public Orders Exhibition	3
End of Objection/Comment Periods	6
State of Public Inquiry	22
Inspector's report received	32
Review of SASICOM Annex IV (if required)	-
Minister's Decision Letter (approx. 3-4 months after receipt of Inspector's Report depending on complexity of issues)	42
Confirmation of Orders (approximately 3-4 weeks after Minister's decision)	44
High Court Challenge Period begins	44
End of High Couth Challenge Period	50
Notice to Treat	52

Key Stage 5

5.1.10 Key Stage 5 (KS5) will proceed subject to the satisfactory completion of the statutory procedures, the availability of finance and the Minister's decision as to whether the Orders should be made.

5.1.11 During KS5 a Design and Build (D&B) Contract will be procured in compliance with European Union Procurement Directives[5] and the corresponding UK Public Contract Regulations 2015. Further detail of this is provided within Section 7 of this Report.

Key Stage 6

5.1.12 KS6 involves detailed design and construction of the Scheme including an environmental and landscape aftercare period. The suppliers for this stage of the project are unknown and will be chosen following the procurement process carried out in KS5.

[5] Directive 2004/18/EC

5.1.13 KS6 is planned to run from 2021 and involves the detailed design / construction period for all works, plus environmental, landscape and ecological aftercare and management (up to 2027). KS6 also includes Gateway Review No. 3, preparation of the KSA7 and Completion Report. Table 9 below contains the illustrative programme requirements for Key Stage 6, including the main submission events and anticipated timing.

Table 9 Outline Key Stage 6 Programme

Event	Timing
Commence detailed design	On WG's instruction
Submission of Key Stage 6 programme	2 weeks after commencement of KS6
Submission of Statutory Authorities' diversion works	In accordance with Contractor's programme
Submission of Construction Quality Plan	4 weeks prior to start on site
Submission of Health and Safety Plan	4 weeks prior to start on site
CEMP (update of Pre-CEMP)	4 weeks prior to start on site
Contractor's KS6 Design submission including updated SU Works Report	3 weeks prior to start on site
Submission of Stage 2 Road Safety Audit	In accordance with the Contractor's programme following completion of detailed design
Licences and Consent applications	In accordance with Contractor's programme
Construction start on site	To be determined by Contractor
Submission of Stage 3 Road Safety Audit	3 weeks (min) prior to road opening
Road opening	To be arranged
Completion of KS6 construction works	69 weeks after Key Stage 6 starting date
Health and Safety File (including all 'as built' and manuals etc.)	At time of certification of Completion by the Project Manager

Construction Programme

5.1.14 The construction programme has not yet been defined. This case will be updated during Stage 3 and will include further information on the proposed Construction Programme.

5.1.15 This section outlines an indicative construction sequence and the likely key construction activities. The details of the construction programme would be updated by the appointed D&B Contractor shortly after award.

5.1.16 A description of the outline construction programme will be included within the Environmental Statement Chapter 2.

Overall Duration

5.1.17 Detailed design and construction works are currently planned to commence in 2021 and continue for around 16 months.

5.1.18 Maintenance and aftercare of the environmental aspects of the Scheme remain the responsibility of the Contractor for five years after the completion of the Works (likely to be up to 2027).

Sequence of Operations

5.1.19 Following the issue of the Notice To Proceed To Construction, there would be a period when the detailed design will be developed. Prior to work starting on site, property precondition surveys and vegetation surveys would be carried out. Early construction activities would be undertaken.

5.1.20 The site would be made secure as early as possible by the erection of permanent fencing. Where this is not possible, temporary fencing would be erected. Site clearance work would commence with vegetation clearance. Main site accesses would be established at either end of the Scheme at the junction locations;

5.1.21 Bulk earthworks would mainly be carried out in the summer season but would take advantage of any periods of dry weather in the other seasons. Pre-earthworks drainage would follow the earthworks sequence. Mainline pavement would commence in 2022 and intermittently continue through to completion.

5.1.22 Structures would be progressed throughout the construction period. Subject to agreement with a Contractor, the construction sequence would help ensure that the Scheme would be built with minimum disruption to the local environment, local population and the travelling public.

5.1.23 The latter stages of construction would include: Mainline, side road and tie-in pavement works, installation of street furniture, such as traffic signs and street lighting and landscaping and planting of soft estate.

Contract Management Plan

5.1.24 The appointed D&B Contractor would likely operate an Integrated Management System (IMS) which will form the foundation for the management of the Scheme. The system would be accredited to appropriate British and international standards.

In accordance with the IMS, a Contract Management Plan (CMP) would be developed for the Scheme. The objective of the CMP would be to provide a coordinated approach to the management of the Works and to clearly define policy, standards, processes, procedures, organisation, roles and responsibility and key performance indicators.

5.1.25 Under the overall control of the CMP would be:

a) Health and Safety Management; (see Section 2.12 of the Environmental Statement);

b) Construction Environmental Management Plan (CEMP) (see Section 2.13 of the Environmental Statement);

c) Quality management (see Section 1.14 of the Environmental Statement); and

d) Public Relations (See Section 2.15 of the Environmental Statement).

5.1.26 The Register of Environmental Actions and Commitments (REAC) would be an appendix to the CEMP. The REAC will be developed throughout Key Stage 3 and will continue to be developed through Key Stage 4 taking into account any changes. This will become a requirement of the D&B Contractor during Key Stage 6.

Governance, organisational structures and roles

5.1.27 The core parties involved in the delivery of the project are:

a) Welsh Government (the Employer) – representing the Welsh Ministers. The project is being led by the Transport group which sit within the Economy and Transport Division, with the Project Director and Project Engineer as the main points of contact.

b) Arcadis (Employer's Agent) – acting as the Welsh Government's representative, providing financial, project management, contract and technical advice (support from Mott MacDonald) throughout the project.

c) Arup / RML– employed by the Welsh Government to carry out the preliminary environmental and engineering design for the preferred route, as well as undertake all activities necessary for the publication of orders. They will also support the Welsh Government through the Statutory process. Their involvement in the project will cease at the end of Key Stage 4.

d) Project Manager and Supervisor: under the NEC ECC Contract. During Key Stage 6 of the contract the role will be undertaken by Arcadis and Mott MacDonald as delegated by Welsh Government.

5.1.28 D&B Contractor: During Key Stage 5 of the project a D&B Contractor will be procured by the Welsh Government (refer to Section 7.3). The D& B Contractor will be responsible for the delivery of the detailed design and construction (Key Stage 6) and aftercare (Key Stage 7) of the Scheme. Figure 7 below sets out a typical organisational structure for the delivery of Key Stage 6 – Detailed Design and Construction.

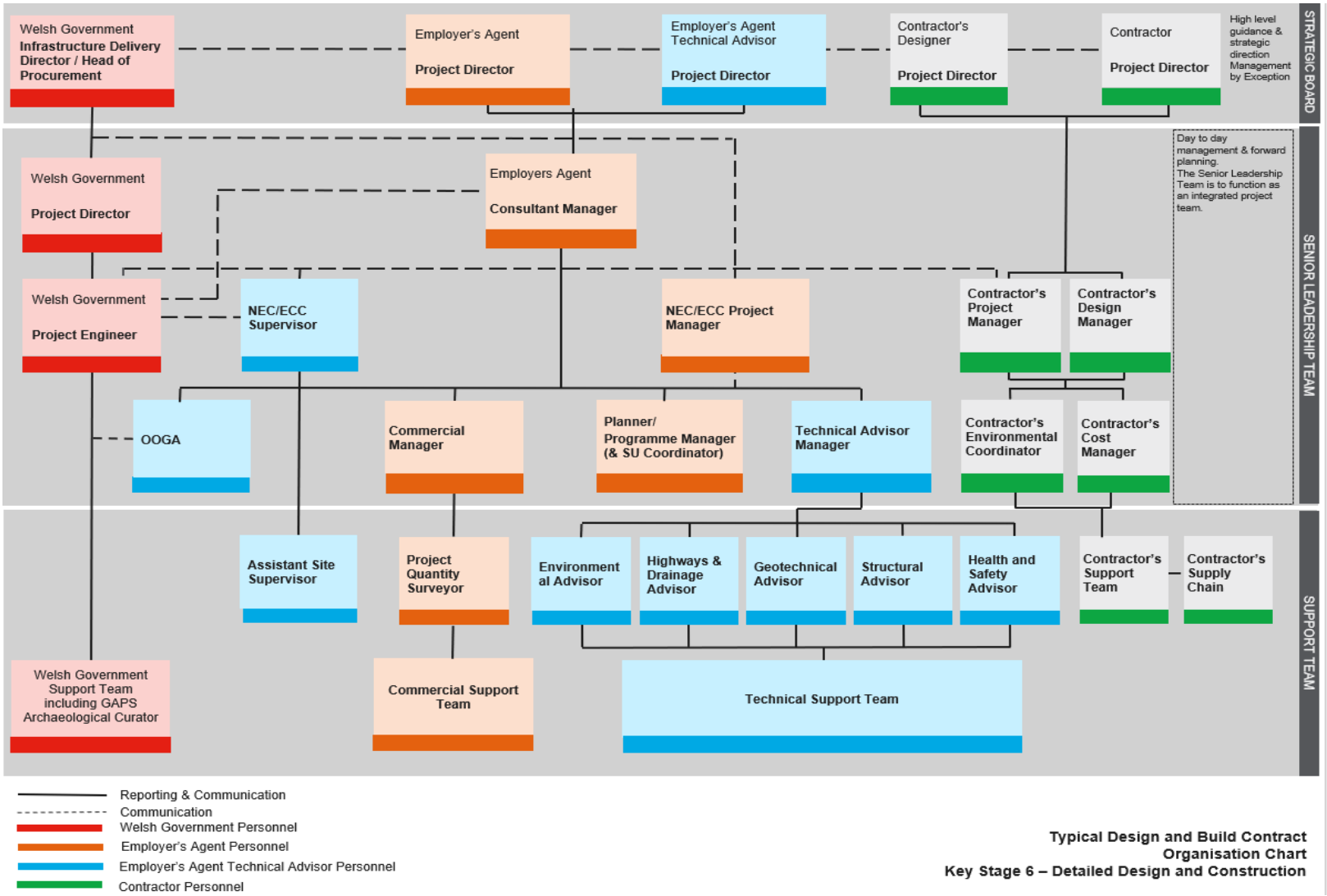


Figure 7 Organisational Structure

6 Financial Case

6.1.1 The Financial Case considers the affordability and long-term financial viability of the option(s). Consideration is given to both capital and annual revenue requirements.

6.1.2 This case will need to be updated when a new Design and Build (D&B) Contractor is procured, following completion of Key Stage 4 of the project.

6.1.3 An initial Scheme Cost Estimate has been undertaken and is likely to represent a worst case in advance of the appointment of a new D&B Contractor, largely given all of the risk currently sits with the Employer. The base year prices have also been updated to 2018 prices.

6.1.4 The initial cost Estimate for the Scheme is likely to be between £14,700,000 and £17,800,000, as follows:

Table 10 Scheme initial cost summary

Component	Estimate
Preparation	£300,000 to £500,000
Supervision	£700,000 to £1,000,000
Construction	£12,500,000 to £14,500,000
Land	£1,200,000 to £1,800,000
Total (excluding VAT and inflation to completion)	**£14,700,000 to £17,800,000**

6.1.5 Optimism Bias has been included within the indicative costs outlined above. These initial cost estimates will be updated once further information is available and the Scheme has been developed in more detail during Stage 3. There will also be an updated Risk and Optimism Bias at Stage 3.

6.1.5.1 These costs are assumed on the basis that this Scheme would be delivered separately to the A40 Llanddewi Velfrey to Penblewin Improvements Scheme. The intention is currently for the two Schemes to be delivered independently with opportunities for the Schemes to be delivered together through the Construction Phase of the project. The main advantages/opportunities of delivering construction as one scheme are: optimised project delivery programme, reduced

Construction Preliminary Costs and Overhead Costs, optimised design/construction for certain elements for such things as earthworks movements and balancing, consistency in one Contractor delivering all works (no interface).

6.1.6 It should be acknowledged that the cost estimate is likely to change with the appointment of a D&B Contractor. At that stage the cost could reduce, should risk be shared, and a result of greater cost certainty and with local market conditions being taken into account.

6.1.7 The procurement of the D&B Contractor will include requirements for them to implement Welsh Government Policy as outlined in the following guidance: "Community Benefits: Delivering Maximum Value for the Welsh Pound" and "the Welsh Procurement Policy Statement (WPPS)". This would maximise opportunities in: Training and Employment; Supply Chain and SMEs; work with local schools and colleges; and contributing to community regeneration. This would be part of the requirements for the D&B Contractor and they will be required to make commitments through the procurement process. Through implementation of this policy it is anticipated that much of the cost could be spent in Wales, of which about half could be spent in the local area.

6.1.8 The new trunk road would also have revenue implications in terms of maintenance costs, which would be the responsibility of the Welsh Governments Network Management team. Some of the revenue cost would be covered by a transfer of spend from the existing trunk road, which would be de-trunked and ownership / maintenance responsibility passed to Pembrokeshire County Council as the local highway authority.

6.1.9 The option therefore brings revenue implications for Pembrokeshire through increased maintenance costs associated with the de-trunked section of carriageway which could be in the region of 1km length.

6.1.10 Capital costs will be funded jointly, with the allocation of funding being a third Welsh Government and two thirds WEFO. The costs are drawn over the duration of the project with WEFO funding already being claimed to undertake activities such as Ground Investigation.

6.1.11 Regarding maintenance, the D&B Contractor, once appointed, will be responsible for maintenance of the Environmental Mitigation for five

years post completion (forecast to be 2022 to 2027). Further detail is set out in Section 7 of Volume 2 – of the ECI Contract Works Information, which is assumed to be similar to the contract with the D&B Contractor. The cost will be included in the tender price.

6.1.12 The relevant extract of the Works Information is:

7.2 Environmental Aftercare and Management

7.2.1 The *Contractor* shall carry out environmental aftercare and management for a period of five years following the completion of the *works*. It shall be undertaken in accordance with the agreed Construction Environmental Management Plan Aftercare (CEMPA) (written in accordance with the requirements of DMRB and associated Procedural Advice and Guidance Notes (PAGs) and IANs.) which will have been submitted to the *Employer* 6 months prior to the end of the construction period.

7.2.2 Annual Environmental Performance and Monitoring Report (AEPMR) will be prepared to monitor performance, followed by a Final Environmental Performance and Monitoring Report (FEPMR) at the end of the aftercare period.

7.2.3 Six months before the end of the aftercare period the *Contractor* shall update the CEMPA into a suitable Handover Environmental Management Plan (HEMP) written in accordance with the requirements of DMRB and associated Procedural Advice and Guidance Notes (PAGs) and IANs. The HEMP will cover the management of all environmental features (both hard and soft environmental measures).

7.2.4 The HEMP will set out the environmental maintenance and management required for the completed project for the next 10 year maintenance period and will be developed in consultation with the *Employer* and their Environmental Representatives of the Managing Agent responsible for the Trunk Road Network.

7.2.5 The *Contractor* shall consult with the *Employer* and Managing Agents Environmental Representative to ensure that the HEMP compliments the existing Route Environmental Management Plan (REMP) and is compatible with their current systems.

7.2.6 The HEMP will provide indicative costs for the management and maintenance of the environmental measures (including but not limited to, landscape, ecological, water quality and drainage, and noise and vibration measures) for the 10 year period following handover to allow the receiving agent to make reasonable adjustment to their maintenance costs. The HEMP will be submitted to the *Employer* 6 weeks before the issue of the Environmental Aftercare Certificate. The general requirements are set out in Volume 2A Appendix D/3.

6.1.13 Regarding defects to the highway, the D&B Contractor will be responsible for rectifying defects within five years after completion, at their own cost if defects are found to be as a fault of design and/or construction.

6.1.14 Welsh Government will fund ongoing maintenance of the road via the South Wales Trunk Road Agent (SWTRA). This will include, ut not be limited to, structural inspections, highway resurfacing works, winter maintenance, road lighting maintenance and any repair works required as a result of a road collision.

6.1.15 Pembrokeshire County Council will be responsible for similar maintenance on all highways transferred to their ownership as part of the Scheme. The draft Side Roads Order details highways that are to be constructed or modified as part of the Scheme that will be adopted by Pembrokeshire County Council. The details of any detrunking works of the existing A40 carriageway are yet to be confirmed and it is the intention to have agreed the details prior to the start of Key Stage 6 and would then form part of a de-trunking package between Welsh Government and Pembrokeshire County Council.

6.1.16 The initial cost estimate has a base date of September 2018. The initial cost estimate will be refined during Stage 3 with a Scheme Cost Estimate being defined, which will form part of the Schemes economic appraisal. The Scheme Cost Estimate would be updated during Key Stage 4 of the project will be in line with this base date.

6.1.17 The Scheme is being jointly funded from Welsh Government Infrastructure Delivery Department and the ERDF.

6.1.18 Following the acceptance of a Business Case prior to the instruction to proceed with Stages 3 and 4, WEFO have confirmed that ERDF funding for the Scheme is secured, despite ‘Brexit’ and the UK’s withdrawal from the European Union.

Affordability and risk

6.1.19 The Welsh Government has a proven track record of managing and delivering large and complex infrastructure projects. These include projects which have attracted significant contributions from the ERDF. Welsh Government will be responsible for ensuring that WEFO funding is spent as the grant required. WEFO will provide 66.6% for the delivery of the Scheme with Welsh Government funding the remaining 33.3%.

6.1.20 WEFO funding is required to be claimed by the end of 2022. The current road opening date is anticipated to be end of 2022. If the road

opening date is postponed beyond the end of 2022 there is a risk that the Welsh Government will not be able to claim all the funding available for the Scheme. This could affect the deliverability of the scheme and would require the Welsh Government to fund the remaining outstanding project costs. This risk will be managed through the following stages.

6.1.21 The executive management arrangements of the Welsh Government backed up by the professional audit and financial scrutiny mechanisms of central government will help ensure compliance with programme regulations and ensure the associated transparency and propriety of investments sanctioned under the project.

6.1.22 The budget will be reassessed by the Employer and this assessment will use the Scheme Cost Estimate that will be prepared by Arup as a base cost which will be inflated as necessary to take include items such as Contractor risk, Contractor fee percentage, Employer's risk, Employer's technical advisor cost, Employer's cost, land compensation.

6.1.23 Finally, As the Scheme is part funded by WEFO, WG only need to source 33% of monies associated with the delivery of Key Stage 6.

6.1.24 The requirements of Clause 3.17 of the Works Information Volume 2 and Appendix P Volume 2A will apply during Key Stage 6.

6.1.25 The tenderers will be required to price for risks which they "own" within the Key Stage 6. The relevant extract of the Works Information is:

3.17 Risk Management

3.17.1 The *Contractor* shall manage risk on the project in accordance with the procedures set out in the Latest version of the Value for Money Manual – risk Analysis and Management. This shall include the use of graphical presentations of risk drawn down.

3.17.2 The *Contractor* shall set up a risk workshop early in Key Stage 3 to review the Risk Register submitted with the tender and update as necessary. The Contractor shall review and update the Risk Register as a minimum every 3 months (or at such shorter times as directed by the *Employer*) during Key Stage 3 & 4 and 1 month during KS6 and carry out/manage the actions identified.

3.17.3 The Risk Register will be discussed at each Progress Meeting and include the following:

(i). A description of the key risks to the Project delivery/cost;
(ii). The likely effect/cost of each risk (quantified);
(iii). The organisation best placed to remove/manage each risk;
(iv). Target dates for action; and,
(v). Hazards with implications under the CDM Regulations.

3.17.4 At intervals not exceeding 6 months the Technical Advisor shall carry out, a risk identification and assessment exercise and shall report the results of such exercise to the *Employer.* The *Contractor* shall arrange and take part in a Risk Workshop which will include other advisors appointed by the *Employer* where appropriate. The risks identified shall be taken into account in the preparation of cost estimates in a manner to be agreed with the *Employer.*

7 Commercial Case

7.1.1 The Commercial Case considers whether it will prove possible to procure the Scheme and then continue with it into the future. The case considers the level and type of involvement from the private sector, as well as potential effects on the on-going viability of the option/Scheme.

7.1.2 This case will need to be updated when a new Design and Build (D&B) Contractor is procured, following completion of Key Stage 4 of the project.

7.1.3 The choice of procurement type for the project is based on a number of basic principles applied to achieve best value including:

a) Selection of Contractors on the basis of quality and price;
b) Fair Allocation of Risk;
c) Optimising Quality of Design, buildability and Sustainability;
d) Adopting a non-contractual Partnering Approach.

7.1.4 The Welsh Government have decided to follow EU Procurement regulations for the tender of a Design and Build Contract, following successful completion of the Statutory Process (Key Stage 4).

7.1.5 The Welsh Government are considering the opportunity for delivering both the A40 Llanddewi Velfrey to Pemblewin and A40 Penblewin to Redstone Cross Improvements as one Scheme. This would provide continuity and potential efficiencies in the delivery. This case will be updated at Stage 3 following further consideration of this opportunity.

7.1.6 The procurement process is in compliance with European Union Procurement Directives[6] and the corresponding UK Public Contract Regulations 2015.

Original ECI Contract 2017 - 2018

7.1.7 An OJEU Prior Information Notice (PIN) was first published in TED (Tenders Electronic Daily – Supplement to the Official Journal of the EU) on 22 December 2015, reference 2015/S 247-448808[7]. The scope of works outlined in the PIN included: *developing the outline design,*

[6] Directive 2004/18/EC
[7] http://ted.europa.eu/udl?uri=TED:NOTICE:448808-2015:TEXT:EN:HTML

preparing the necessary statutory orders and EIA documentation, publishing draft Orders (Key Stage 3), progressing the project through the statutory process including Public Inquiry if required (Key Stage 4) and, if successful, then undertaking detailed design, construction and after-care of the project (Key Stage 6).

7.1.8 In the PIN, the value of Orders was estimated at around £30,000,000 and the total Scheme costs circa £50,000,000 excluding VAT.

7.1.9 An OJEU Contract Notice was published on the Welsh Government's Sell2Wales[8] website on 25th March 2016, reference 2016/S 061-102869. The contract value was estimated at £55,000,000 – £65,000,000.

7.1.10 Those who successfully completed the PQQ were then invited to tender in June 2016, in accordance with the '*ECI Design and Build Contract – Volume 0,* Instructions *for Tenderers*'. These instructions provided guidance to tenderers on the form and assessment of tenders relating to the contract for the design development of the A40 Llanddewi Velfrey to Penblewin improvement project and the provision of assistance with the statutory procedures.

7.1.11 The Contract Notice stated that contract award would be based on the most economically advantageous tender in terms of the criteria stated in the specifications, in the invitation to tender or to negotiate or in the descriptive document. Detailed tender evaluation criteria were set out in the 'ECI Design and Build Contract – Volume 0, Instructions for Tenderers' covering quality and price.

7.1.12 The final tender assessment was based on a weighting of the Quality and Financial submissions in the ratio 50:50 respectively.

7.1.13 The contract was awarded on 3rd February 2017 to Carillion, with engineering and environmental design provided by Arup and RML.

7.1.14 In addition to the above process, Welsh Government also procured the provision of support (Employer's Agent) through a management consultancy works and services contract. An OJEU contract notice for this was published on 6th June 2015, reference 2015/S 108-196566[9].

[8] Sell2Wales is the procurement portal set up by the Welsh Government
[9] http://ted.europa.eu/udl?uri=TED:NOTICE:196566-2015:TEXT:EN:HTML

7.1.15 The procurement process was an open procedure with an estimated contract value of £1,500,000 excluding VAT. The contract award was based on the most economically advantageous tender in terms of:

a) Project team and management (14%)
b) Project delivery - Technical (17%)
c) Project delivery - Commercial (25%)
d) Resources and programme (14%)
e) Cost. Weighting (30%)

7.1.16 The contract award decision was made on the 9th October 2015 with three offers having been received and evaluated. Arcadis (and Technical Advisor Mott Macdonald) were awarded the contract of Employer's Agent for the project, with a total final value of contract of £1,342,461.13, excluding VAT. A contract award notice was published on 6th November 2015, reference 2015/S 215-392974.

Key Stage 3 and 4 Development

7.1.17 Following the liquidation of Carillion, revised contractual arrangements were made and implemented by the Welsh Government.

7.1.18 Arcadis (and Technical Advisor Mott Macdonald) continued their contract of Employer's Agent for the project.

7.1.19 Arup (supported by sub-Contractor RML) were directly appointed to the Welsh Government to continue the development of Key Stage 3 and to support the Welsh Government through the Statutory Process (Key Stage 4).

Key Stage 5 Procurement of a D&B Contractor

7.1.20 The Welsh Government will be required to follow EU Procurement regulations for the tender of a Design and Build Contract. The procurement strategy adopted would follow the OJEU Restricted process as outlined in Figure 8.

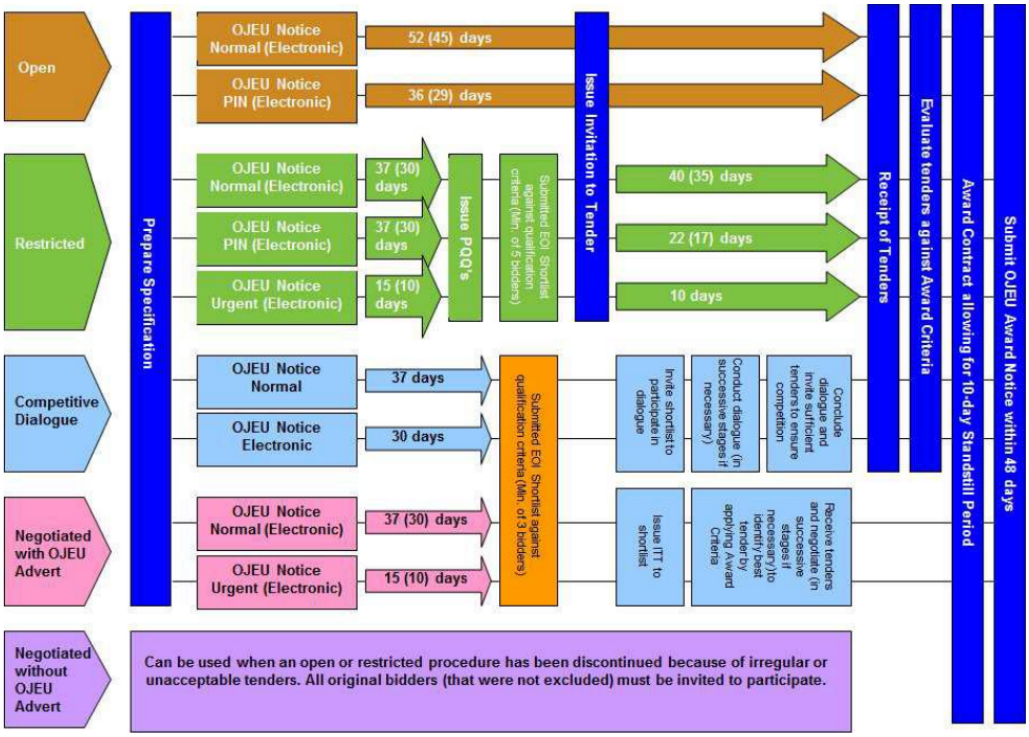


Figure 8 OJEU Process

7.1.21 The Welsh Government will conduct a PQQ process before undertaking a full Design and Build tender. The tender will likely span over 3 months / 12 weeks to enable the tenderers to sufficiently develop their design to be able to inform their tendered estimate of the overall price.

7.1.22 As per the previous ECI tender process, the evaluation of the tender will be based upon a quality submission and a financial submission. The ratio of Quality and Financial will be determined in due course but is likely to be similar to the original ECI tender, which was 50:50 Quality:Financial. There is the potential for the weightings to be amended to more heavily favour the quality or financial, but this has not been determined yet.

7.1.23 The arrangements moving forward into the conduction stage would likely be:

Employers Agent – Arcadis;

Technical Advisor to Employers Agent – Mott Macdonald;

Design and Build Contractor – To Be Confirmed via procurement. Likely to be sole entity but could be a joint venture; and

Design and Build Contractor's Designer – To Be Confirmed via procurement. Likely to be sole entity but could be a shared

appointment between Engineering Design and Environmental Design.

Contract length

7.1.24 The following timescales are anticipated for the proposed Construction Contract:

a) Anticipated contract start is May 2021;
b) Anticipated start on site for construction is Summer 2021;
c) Anticipated completion on site is Early 2023; and
d) Anticipated end of the aftercare period is Winter 2027.

7.1.25 The anticipated duration is up to seven years.

Specification of required outputs

7.1.26 The specification of outputs are included within the relevant Contracts as outlined in the following points. done in line with the relevant key stages:

7.1.27 Key Stage 3 and 4 deliverables are listed in detail within the Key Stage 3 and 4 Professional Services Contract - Volume 2 Scope of Service provided in the subsequent sections of Chapter 4: Requirements for Key Stage 3 and Chapter 5: Requirements for Key Stage 4.

7.1.28 Key Stage 6 deliverables are listed in detail in the original ECI Design and Build Contract Volume 2 Works Information as tendered. Further detailed is provided in the subsequent sections of Chapter 6: Requirements for Key Stage 6. The relevant extract of the Works Information is:

7.1.29 Key Stage 6 detailed design will be based upon Key Stage 3 and 4 design submissions. The Key Stage 6 Detailed Design submission will be sufficiently detailed to demonstrate compliance with the relevant codes and standards to enable the works to be constructed in accordance with the contract requirements and specification.

6 REQUIREMENTS FOR KEY STAGE 6

6.1 Key Stage 6 Programme Requirements

6.1.1 The table below contains the *Employer*'s programme requirements for Key Stage 6. It identifies the main submission events and the number of weeks after Contract Award when they are expected.

TABLE 6.1 Key stage 6 Event Programme:

Event	Time required
Commence Detailed Design	On *Employer*'s instruction
Submission of Key Stage 6 programme	2 weeks after commencement of Key Stage 6
Submission of *Statutory Authorities'* Works Report	4 weeks after commencement of KS6
Placing orders for *Statutory Authorities'* diversion works	In accordance with *Contractor*'s programme
Submission of Construction Quality Plan	4 weeks prior to start on site
Submission of Health and Safety Plan	4 weeks prior to start on site
CEMP (update of draft CEMP)	4 weeks prior to start on site
Contractor's Key Stage 6 Design submission including updated SU Works Report	3 weeks prior to start on site
Submission of Stage 2 Road Safety Audit	In accordance with *Contractor's* programme following completion of the detailed design
Licences and Consent applications	In accordance with *Contractor's* programme
Construction start on site	To be determined by *Contractor*
Submission of Stage 3 Road Safety Audit	3 weeks (min) prior to road opening
Road Opening	To be arranged
Completion of KS6 construction works	By May 2020
Health and Safety File (including all 'as builts' and manuals etc.)	At time of certification of Completion by the *Project Manager*.

6.1.2 Key Stage 6 activities shall commence with the start of detailed design. The *Employer* may instruct the *Contractor* to commence detailed design in advance of the end of the High Court Challenge Period but this is entirely at the discretion of the Employer.

Allocation of risk

7.1.30 The allocation of risk was originally covered in the Risk Register (2nd August 2016). Allocation of risk was also specified in the PSC and ECC contracts.

7.1.31 Allocation of risk for Key Stage 3 was covered in the *Professional* Services *Contract (PSC) for* Early *Contractor Involvement (ECI) Design and Build Contract Volume 1* at Volume 1e – clause Z.6 and Volume 1f – clause Z.6 for Key Stage 4.

7.1.32 The allocation of Key Stage 6 risk is likely to be similar to that originally covered by clause Z.9 of the Engineering and Construction Contract (ECC) for Early Contractor Involvement (ECI) Design and Build Contract Volume 1h.

7.1.33 The Project Risk Register, as discussed included within the Impact Assessment Report, outlines foreseeable project risks, which include risks that will be allocated to the D&B Contractor. The Project Risk Register will quantify the likely cost if the risk becomes an eventuality. This Risk Register has been assessed to inform a Risk allowance and an allowance incorporated into the Scheme Budget. Section 5.9 provides a summary of several of the top risks included within the Project Risk Register.

7.1.34 Whilst the future allocation of risk involving the D&B Contractor (once appointed) has not been fully determined, at this point in time it is not unreasonable to assume that the risk allocation, and therefore Compensation Event clauses which will be removed, will be:

60.1(12) – Physical Conditions;

60.1(13) – Weather; and

60.1(19) – Force majeure.

Contractual agreements

7.1.35 The key Contractual arrangements are set out for each of the three Key Stages as outlined below.

Key Stage 3 & 4

7.1.36 For Key Stage 3 under the original ECI contract with Carillion, the conditions of contract were the core clauses and the clauses for main Option C (Target Contract), dispute resolution Option W2 and secondary Options X1, X2, X4, X9, X10, X11, X18, Y(UK)2, Y(UK)3 and Z (of the Employers) of the NEC3 Professional Services Contract April 2013.

7.1.37 Following the liquidation of Carillion and the direct appointment of Arup to the Welsh Government, the Key Stage 3 and 4 conditions of contract are the core clauses and the clauses for main Option E (Time Based Contract), dispute resolution Option W2 and secondary Options X1, X2, X9, X10, X11, X18, Y(UK)2, Y(UK)3 and Z (of the Employers) of the NEC3 Professional Services Contract April 2013.

Key Stage 6

7.1.38 For Key Stage 6, outline contractual arrangements are not currently available. The contract is likely to take the form of either NEC3 ECC or NEC4 contract with the option to be determined in due course.

7.1.39 The option choice is likely to be between Option A (Fixed Price) or Option C (Target Price).

7.1.40 Under the original ECI contract, the payment process was the PSC Main Option C (Target Contract), amended slightly in accordance with Volume 1e Clause Z.5. For Key Stage 4, the payment process was the PSC Main Option E (Time Based Contract), amended slightly in accordance with Volume 1f Clause Z.5.

7.1.41 For Key Stage 6, the payment mechanism will be defined by the contract chosen. The payment assessment period will be monthly.

8 Recommendations

8.1 Preferred Option

8.1.1 WelTAG 2017 clarifies that a preferred option should be taken forward to WelTAG Stage 3 appraisal.

8.1.2 Given the identified need for the Scheme, and taking into account the information presented within this WelTAG Stage One and Two Impact Assessment Report, the Welsh Government and its Review Group has taken the strategic decision to progress active travel improvements alongside Highway Option 2B, a southern route without junction.

8.1.3 Active travel measures will be developed in detail at the next stage of design development, but they would help achieve the study objectives and contribute positively to government policy priorities. Active travel measures will therefore be implemented as part of the preferred highway option.

8.1.4 In light of the appraisal undertaken, it is clear that Highway Option 2B best address the problems, best achieves the objectives and performs best against the majority of cultural, social and economic appraisal criteria, appreciating that there would be some adverse impacts in particular on the environment. It is the preferred option as a result of stakeholder engagement, favoured by the majority of participants. This indicates it is likely to be the most acceptable to local communities, the people and businesses of Wales.

8.1.5 The Welsh Government recognises that Option 2B would be more likely to avoid objections from local residents and politicians in light of their concerns about a junction at Redstone Cross. This offers reduced risks to delivery through the statutory process.

8.1.6 WelTAG Stage 3 should be undertaken to provide a full business case in order to progress active travel and Option 2B options.

8.2 Stage 3 WelTAG

8.2.1 At the next stage of the WelTAG process, a number of areas of the appraisal will require updated in order to reflect new information and the Stage of the process. In particular, the Stage 3 Reports will seek to provide further detail on the following:

a) Traffic forecast modelling outputs;
b) Economic appraisal / wider economic impact assessment results;
c) Environmental Impact Assessment (and survey) results;
d) Walking, Cycling and Horse-riding Assessment; and
e) Further details and information around the Transport Case, Delivery, Financial and Commercial Cases.

8.2.2 A key risk of the Scheme relates to time constraints. Should the current road opening date be postponed beyond the end of 2022, there is a risk that the Welsh Government will not be able to claim all the funding available for the Scheme.

8.2.3 It is considered that issues concerning stakeholder and public acceptability are minimal given the engagement to date. Highway Option 2B has presented itself as the preferred option during the second Public Information Exhibition, by a significant proportion of respondents. This indicates it is likely to be the most acceptable to local communities, the people and businesses of Wales. The project team will continue to engage with the local community through Stage 3 to identify further opportunities for enhancement and to help to address any concerns.

8.3 WelTAG Stages 4 and 5

8.3.1 Should the Welsh Ministers decide to proceed with the Scheme, then at the next stage of the WelTAG process, Stage 4 is to record what is actually delivered, the wider content at the time at which the Scheme is delivered and to record the impacts that actually occur during implementation. That aims to allow for an immediate alert if there are any unintended adverse impacts during implementation and can assist in the realisation of any benefits. It also acts as a record of what is actually delivered, which is required in the Stage 5 evaluation work.

8.3.2 The aim of Stages 4 and 5 is to record what happens so that lessons can be learnt. It may lead to alterations to the current Scheme and will form

valuable evidence for use in future WelTAG appraisals.

8.3.3 Records should be kept of the impacts during implementation as these will be required to evaluate both the process of implementation and the outcomes. External events which could affect the evaluation should be recorded as they occur, such as adverse weather events, changes in legislation, the outcomes regarding key risks identified at Stage 3 and any changes made to the Scheme during implementation.

8.3.4 The monitoring and evaluation plan (see section 5.12) describes the methods that will used to provide the evidence required during and post-implementation. No required 'before' studies have been identified given the detailed level of survey and assessment undertaken at Stage 3. If there is an unforeseen lengthy delay between this Stage 3 report and implementation, the Welsh Government should consider updating its evidence base as appropriate.

8.3.5 If the observed impacts differ from the anticipated impacts then an interim Stage 4 report should be produced to record this, and to offer ways of maximising any unintended benefits or to mitigate any unintended adverse impacts. The final Stage 4 report will record an immediate post opening evaluation recording the actual outputs delivered and the initial impacts. This should cover the first six months of operation and be completed within 12 months' post opening or completing of the intervention.

8.3.6 Then at Stage 5 the Welsh Government should produce a record of what was delivered, an evaluation of the process of delivering the option, a record of the actual impacts compared to the anticipated impacts and an assessment into the extent to which it met the original objectives.

Welsh Government

A40 Penblewin to Redstone Cross Improvements

A40 ES Screening & Scoping Report

A40PRC-RML-EAC-M02-RP-LE-0001

P06 | S4

20/04/20

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 The Project

1.1 Context

1.1.1 In December 2004, the Welsh Government announced the outcome of the A40 West of St Clears study into the consideration of both single carriageway and dual carriageway improvements to the A40 between St Clears and Haverfordwest. This study concluded that the A40 needed improvement[1].In January 2019 Welsh Government appointed Arup supported by RML to progress all works necessary to facilitate design development, environmental impact assessment and publication of draft Orders for a WS2+1 solution between Penblewin Roundabout and Redstone Cross.

1.2 Project history

1.2.1 In December 2004, the Minister announced the publication of his Addendum to the 2002 Trunk Road Forward Programme (TRFP) and this included two major single carriageway improvement schemes for the A40 west of St Clears. The improvements would use the 2+1 configuration allowing overtaking on the two-lane direction, with overtaking prohibited in the one lane direction and would be delivered in the following phases:

a) A40 Penblewin - Slebech Park
b) A40 Llanddewi Velfrey - Penblewin.

1.2.2 The first of these projects, Penblewin - Slebech Park, was completed in March 2011.

1.2.3 In July 2013, Edwina Hart AM CStJ MBE, Minister for Economy, Science and Transport, published a written statement outlining her priorities for Transport. The statement included the following:

> *"Improving the A40 has been identified as a priority by the Haven Waterway Enterprise Zone Board and I intend to undertake further development of previously proposed improvements."*

[1] Parsons Brinckerhoff, December 2004: Welsh Assembly Government A40 West of St Clears Route Options Report Volume 1 Rev 10;
Parsons Brinckerhoff Ltd, December 2004: Welsh Assembly Government A40 West of St Clears Technical Appraisal Report Volume 1 Rev 7 and 2;
Parsons Brinckerhoff, December 2003: A40 West of St Clears Economic Assessment Report.

1.2.4 On 12 November 2014, in providing an update on the closure of the Murco Refinery in Milford Haven, the Minister made an oral Statement in Plenary:

> *"In terms of transport links, I have instructed my officials to accelerate to the fullest extent possible the programme for delivering improvements at Llanddewi Velfrey."*

1.2.5 In June 2015, in a written statement on the A40 Improvement Study the Minister noted *"It is my intention to progress delivery of the A40 Llanddewi Velfrey to Penblewin scheme as soon as possible…"*

1.3 The problems

1.3.1 The following problems have been identified in collaboration with the A40 LLanddewi Velfrey to Penblewin Improvements Scheme and early public engagement for the A40 Penblewin to Redstone Cross Improvements Scheme:

a) The A40 mainline and Redstone Cross Junction is substandard
b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.
c) Occasional convoys of heavy goods vehicles from the ferry ports and slow moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.
d) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.
e) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road.
f) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.
g) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

1.4 Scheme objectives

1.4.1 A number of strategic transport planning objectives have been developed iteratively during the previous A40 Improvement Schemes, and specifically the A40 Llanddewi Velfrey to Penblewin. During the early stages of the A40 Penblewin to Redstone Cross Improvements Key Stage 3, these objectives were refreshed to consider both the strategic and local transport planning aspects for the Redstone Cross Area. The scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (and perceived safety) and reduce the number and severity of A40 mainline collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

2 Purpose of this report

2.1 Context

2.1.1 This combined Screening and Scoping Report describes the approach taken with regards to determining whether a Statutory Environmental Impact Assessment (EIA) is required and provides information in support of a decision about which environmental factors[2] are to be examined within a Statutory EIA. The scoping exercise should inform the assessment process and determine the appropriate assessment levels. More detail of the requirements of screening and scoping are set out in the following sections.

2.1.2 The project would be delivered in accordance with the Design Manual for Roads and Bridges (DMRB): Volume 11 Environmental Assessment guidance (published in 2008). In 2018 the full DMRB was withdrawn by Highways England with the intention to progressively replace each volume with a revision. As the revised documents have not yet been published for each environmental topic (now referred as 'factors'). The technical content of Volume 11 remains as useful guidance and so this report has been developed in accordance with the requirements of DMRB Volume 11 Section 2 Part 3 (HD47/08) and IAN 126/09(W).

2.2 Screening

2.2.1 The applicable determining legislative instruments are the Highways Act 1980 and the EU Directive 2014/52/EU of 2014 (which amended the 2011 Directive); and the Environmental Impact Assessment (Miscellaneous Amendments relating to Harbours, Highways and Transport) Regulations 2017.

2.2.2 In accordance with the provisions under the EIA Regulations, a determination must be made to confirm whether a proposed project constitutes an EIA development i.e. whether an EIA process is required, and a statutory Environmental Statement (ES) must be prepared and accompany the consent process for a proposed scheme.

[2] The revised Design manual for Roads and Bridges requires the term 'topic' in this context to be replaced with 'Factor'. In this report the term 'Factor' is used with a capital letter to highlight the change.

2.2.3 The following information is provided within this report (as required by Directive 2011/92/EU as amended by Directive 2014/52/EU) as transposed through the Highways Act (1980) and The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017, which came into force in December 2017. This screening report gives due consideration to the specific requirements Article 4, Annex IIA and Annex III.

2.2.4 Article 4(4) states:

> *"Where Member States decide to require a determination for projects listed in Annex II, the developer shall provide information on the characteristics of the project and its likely significant effects on the environment. The detailed list of information to be provided is specified in Annex IIA. The developer shall take into account, where relevant, the available results of other relevant assessments of the effects on the environment carried out pursuant to Union legislation other than this Directive. The developer may also provide a description of any features of the project and/or measures envisaged to avoid or prevent what might otherwise have been significant adverse effects on the environment."*

2.2.5 Annex II.A requires:

2.2.6 A description of the project, including in particular:

a) *a description of the physical characteristics of the whole project and, where relevant, of demolition works;*
b) *a description of the location of the project, with particular regard to the environmental sensitivity of geographical areas likely to be affected.*
c) *A description of the aspects of the environment likely to be significantly affected by the project.*
d) *A description of the measures and/or features which are proposed to avoid or prevent significant adverse effects.*
e) *A description of any likely significant effects, to the extent of the information available on such effects, of the project on the environment resulting from:*
    i. *the expected residues and emissions and the production of waste, where relevant;*
    ii. *the use of natural resources, in particular soil, land, water and biodiversity.*

f) The criteria of Annex III shall be taken into account, where relevant, when compiling the information.

2.2.7 The above requirements are addressed in this document.

2.3 Scoping

2.3.1 The Scoping element of this report is prepared to request a Scoping Opinion from Welsh Government, under the framework of the Highways Act 1980, Highways (Assessment of Environmental Effects) Regulations 1999 and The Highways (Environmental Impact Assessment) Regulations 2007 (as amended to transpose Council Directive No. 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, and subsequent Council Directive No. 97/11/EC M2 and Directive No. 2003/35/EC M3 of the European Parliament and Council), 2011 European Directive 2011/92/EU, and the most recent 2014 Directive (as amended) 2014/52/EU. The latter amendments were recognised in the publication of the EIA Regulations 2017.

2.3.2 Scoping is used to inform and activate discussion with the statutory consultees (through Environmental Liaison Group meetings (ELG)) with respect to defining the assessment activities. The process also assists in making sure the environmental assessment is proportionate, by identifying those environmental factors which are likely to result in significant environmental effects.

2.3.3 Scoping is used to:

a) inform option, design and planning decisions;

b) influence the design process with a view to 'designing out' adverse effects where possible;

c) identify environmental design principles and initial mitigation measures and environmental enhancements.

d) inform the decision about whether a project can proceed as planned or whether the design needs to change;

e) provide justification, supported by evidence, for scoping in/out environmental factors from further environmental assessment;

f) define what level of environmental assessment (simple or detailed) shall be undertaken for those environmental factors (or any elements) scoped in;

g) specify the environmental assessment methodology and further data collection and survey requirements;

h) identify the study area for those environmental factors (or any elements) scoped in;

2.4 Reasons for a combined Screening and Scoping report

2.4.1 This combined report has been prepared to address both the EIA Screening and EIA Scoping exercises that have been carried out for the project. Firstly, screening a project to determine if an EIA is required then, secondly defining the scope of environmental topics that the EIA should encompass, are separate decisions carried out in accordance with criteria set out in statute and regulation. Once these separate decision-making processes are complete, they are conventionally covered in separate reports. However, there is no specific requirement to prepare separate reports in the EU Directive 2014/52/EU of 2014, the EIA Highways Act 1980, or the Environmental Impact Assessment (Miscellaneous Amendments relating to Harbours, Highways and Transport) Regulations 2017.

2.4.2 Under the Highways Act the screening process results in the publication of a Record of Determination which is a succinct two, or three page summary to inform officials and Ministers in Welsh Government of the need, or otherwise, for an EIA. A separate Record of Determination will still be published as the legal document and signed by a Welsh Government Minister to allow the EIA to proceed to publication with draft Orders.

2.4.3 There are a several benefits of taking the combined approach:

a) This single report has been structured to combine the content of both separate reports so that repetition of information is minimised.

b) The programme for the project requires completion of the draft Orders and the environmental statement within a restricted duration and so reducing the number of documents that are published helps to save time and reduce costs.

3 The Project

3.1.1 The Scheme lies on the A40 Trunk Road entirely within the eastern portion of the County of Pembrokeshire in South West Wales.

3.1.2 The Welsh Transport Planning Appraisal Guidance (WelTAG) process has been employed to develop a long list of options including active travel, public transport and highways options. All options have been assessed in terms of their potential ability to meet the need identified in the strategic case and the objectives set to determine a short list of options. Further details can be found within within Section 4 and in the scheme WelTAG reporting.

3.1.3 The short-listed highway options are located within two key corridors. These options would commence to the west of the existing Redstone Cross Junction on the A40 and terminate at Penblewin Roundabout on the A40 Trunk Road. These options are described in Section 4. A plan showing the location of the four routes being considered is provided in Appendix 1.

Place names within the vicinity of the Scheme

3.1.4 Appendices 1 and 2 include annotated plans that show the routes and some of the key places. Appendix 3 includes plans that set out some of the key constraints. The eastern extents of all the proposed routes considered, terminate at Penblewin Roundabout. Penblewin Farm is located immediately south east of the Penblewin Roundabout.

3.1.5 Redstone Cross is towards the western end of the proposed routes and is a junction between the A40, the B4314 Redstone Road from Narberth and the B4313 from Bethesda. Redstone Farm lies immediately north of the crossroads and Redstone Cottages lie to the south. Redstone Cross is a small outlying ribbon settlement which includes the Blaemarlais Care Home, Blaen-ffynnonau Farm and numerous other houses.

3.1.6 Redstone Bank lies further south and this area is occupied by a caravan park and a small industrial estate, all of which are accessed via Redstone Road. Redstone Road passes along the top of a ridge known as the Redstone Ridge.

3.1.7 Approximately halfway along the existing A40 trunk road is Blackmoor Hill Farm. This is two semi-detached dwellings that lie immediately adjacent to the south of the A40.

3.1.8 To the northwest of Redstone Cross is Sodston House and Sodston Farm. A driveway serves Sodston House and extends south to the A40, where a former lodge house sits on the edge of the road. A ridge of higher ground extends east from Sodston House as far as Penblewin and this is known as Sodston Ridge.

3.1.9 A recent road improvement has taken place to the west of the proposed Scheme and this commences at the Robeston Wathen roundabout to bypass the villages of Robeston Wathen and Canaston Bridge.

3.1.10 To the east of Penblewin roundabout lies the village of Llanddewi Velfrey. An improvements scheme is proposed for the A40 to bypass Llanddewi Velfrey, starting at the Penblewin Roundabout, passing to the north of Llanddewi Velfrey and re-joining the existing A40 road at Bethel Chapel. To the east of Bethel is a steep hill known as Pencawse Hill

Southern Routes

3.1.11 The proposed Scheme would tie in with the A40 to the west of Redstone Cross and with the roundabout at Penblewin. The 1.8km Scheme includes 1.0km of 2+1 carriageway across agricultural pastureland and woodland to the south of the existing A40 trunk road. Replacing the existing Redstone Cross junction with either a new staggered junction to the south. or a bridge carrying the B4313 over the A40 with no junction with the A40 at Redstone.

Northern Routes

3.1.12 The proposed Scheme would tie in with the A40 to the west of Redstone Cross and with the roundabout at Penblewin. The 1.85km 2+1 carriageway Scheme crosses agricultural pastureland to the north of the existing A40 trunk road. Replacing the existing Redstone Cross junction with, either a new staggered junction to the north, which would provide 1.2km 2+1 carriageway; or a bridge carrying the B4313 over the A40 with no junction with the A40 at Redstone, which would provide 1.5km of 2+1 carriageway.

3.1.13 A Preferred Route will be announced by Welsh Ministers once consideration of the options is completed. A Design Options Report has been prepared and WelTAG Stage 1 and 2 reports will be published.

4 CONSIDERATION OF ALTERNATIVES

4.1 History of the Scheme

4.1.1 In March 2002, the Trunk Road Forward Programme (TRFP) outlined that *Improvement of* the *A40 trunk road, whether it be to single or dual carriageway standard, is beneficial in economic terms'* and stated that *'The A40 in West Wales forms the lowest standard section of the Trans-European Road Network in the United Kingdom'*. This early work steered the decision to pursue road-based enhancements on the A40 and a Route Options Report (ROR) was subsequently commissioned in 2004 to explore single and dual carriageway options between St Clears and Fishguard.

4.1.2 Each of the options were appraised using the STAG appraisal guidance and the 2004 ROR concluded that a number of route options could be discarded on the basis of cost, environmental impact and not addressing the identified problems; whilst other routes that would address the problems and performed better in the appraisal process, were taken forward for further consideration in a Technical Appraisal Report (TAR) later in 2004.

4.1.3 As part of the 2004 studies, several horizontal route alignments were developed to determine optimum routes that would minimise agricultural severance, avoid sensitive ecological features and large earthworks. In the same year, a Design Manual for Roads and Bridges (DMRB) Stage 2 Environmental Appraisal Report (EAR) was also completed and a Business Case was developed and formed the basis of a submission to the Assembly Minister.

4.1.4 Following the findings of the appraisal within the 2004 studies, the Welsh Government announced the publication of an addendum to the 2002 Trunk Road Forward Programme and this included two major improvement schemes for the A40 west of St Clears, at A40 Penblewin to Slebech Park improvement - completed in March 2011; and A40 Llanddewi Velfrey to Penblewin improvement. Neither of these proposed schemes included the Redstone Cross to Penblewin section of the A40.

4.1.5 In July 2013, Edwina Hart, Minister for Economy, Science and Transport, published a written statement outlining her priorities for Transport. This statement included:

> *"Improving the A40 has been identified as a priority by the Haven Waterway Enterprise Zone Board and I intend to undertake further development of previously proposed improvements."*

4.1.6 The proposals for A40 improvements were further expressed by the Welsh Government in November 2014 following the announcement of the closure of the Milford Haven Refinery. Reflecting on this announcement, the Minister made the following oral statement in Plenary:

> *"In terms of transport links… I have instructed my officials to accelerate to the fullest extent possible the programme for delivering improvements at Llanddewi Velfrey. I have also asked my officials to conduct further urgent work to explore additional ways to improve the A40, including the potential for dualling."*

4.1.7 A study in 2015 considered six options for improvement of the A40 applying the Welsh Transport Planning and Appraisal Guidance (WelTAG). At the time of publication in 2015, the Redstone Cross junction improvement was being considered as a single carriageway improvement (not 2+1) for inclusion in the proposed scheme of improvements from Penblewin to Llanddewi Velfrey (Penblewin roundabout and Bethel Chapel), but no decision was made. Whilst a two-lane single-carriageway road includes one lane in each direction, a 2+1 carriageway provides two lanes in one direction, to allow overtaking, and one lane in the opposite direction. The overtaking lane alternates to allow safe overtaking opportunities in for directions.

4.1.8 The 2015 study considered options:

Option 1 included changes to the junction but without any 2+1 overtaking sections. Approximately 1km of the scheme would be offline from Penblewin roundabout and would merges back into the existing A40 at a new junction layout at Redstone Cross.

Option 2 included changes to the junction and 1.2 kms of 2+1 offline overtaking opportunity. Approximately 1km of the scheme would be offline from Penblewin roundabout and would

merges back into the existing A40 at a new junction layout at Redstone Cross.

Option 3 dual-carriageway for the corridor from St Clears to Haverfordwest with many of the 200 accesses onto the existing road stopped-up. From Penblewin the route would extend to the south of Blackmoor Hill and Redstone Cross and re-join the existing A40 at the west end of the Robeston Wathen Bypass.

4.1.9 The study concluded by recommending the A40 Llanddewi Velfrey to Penblewin improvement Scheme, using the 2+1 configuration. However, the improvements to Redstone Cross junction were not included.

4.1.10 In February 2017, the Welsh Government appointed Carillion - with Arup and RML as their technical advisors - to develop the design of the proposed A40 Llanddewi Velfrey to Penblewin Improvements up to publication of draft Orders. The contract required the team to build on the previous work, and to carry out a WelTAG Appraisal in accordance with the new 2017 draft Guidance. The WelTAG appraisal approach was applied to identify the problems on the existing A40, Scheme objectives and solutions to be incorporated within the Scheme.

4.1.11 Following the liquidation of Carillion in January 2018, a new contract was awarded to Arup - supported by RML - to complete the WelTAG process and to continue with developing the Scheme. The team were asked to undertake some preliminary planning of a scheme for improvements at Redstone Cross.

4.1.12 During the Public Consultation for the Llanddewi Velfrey to Penblewin Scheme in May 2017, the public were invited to comment on the principle of improvements at the junction. There was considerable public support. The Scheme was taken no further at that stage.

4.1.13 With Key Stage 3 work on the Penblewin to Llanddewi Velfrey Scheme concluding with publication of Draft Orders in early 2019, Welsh Government instructed Arup and RML to recommence work on the proposed Improvements at Redstone Cross junction, commencing with a WelTAG (2017) Appraisal.

4.2 Alternatives under consideration

4.2.1 The three options considered in the 2015 study involved offline improvements that straightened the A40 west of Penblewin roundabout and passed to the south of Redstone Cross. In February 2019 the Arup RML team commenced with an appraisal of the 2015 alignment and a range of nine other options. Some of the key environmental constraints on the options are shown on the Constraints Drawing in Appendix 3.

4.2.2 The alternative options included some on the north side of the existing A40 and some on the south. Appendix 1 illustrates the long list of options considered. The descriptions below commence at Penblewin:

Southern Route Options

Option 1a Alignment based on the Design Options Report 2015. Refer to the **Dark Blue** line shown on the plan in Appendix 1. Offline straight alignment between Penblewin Roundabout and Redstone Cross, with online ghost island junction improvement at Redstone Cross.

This option would tie-in vertically 350m west of Redstone Cross to improve geometry and visibility at the junction

While the eastern end would require a short section of cutting, most of the route would be on embankment, including where the road passes through Redstone Cross Junction. This would require demolition of two properties at Redstone Cross.

Option 1b Offline straight alignment between Penblewin Roundabout and Redstone Cross, with online ghost island junction improvement at Redstone Cross. Refer to the **Pink** line shown on the plan in Appendix 1.

This option would tie-in vertically east of Redstone Cross, therefore there would be no improvement to mainline vertical geometry through the junction. As such this would be substandard when assessed against current DMRB all-purpose highway design standards.

The eastern end of the scheme would be approximately at grade, rising onto embankment over low-lying land, before returning to grade to pass through Redstone Cross. The construction of Redstone Cross junction would require demolition of two properties at Redstone Cross.

The route would tie into the existing A40 horizontally approximately 280 metres to the west of Redstone Cross Junction.

Option 1c

An offline alignment minimising separation between the existing A40 and the proposed alignment to the south, with online ghost island junction improvement at Redstone Cross. The foot of the embankment would pass close to Blackmoor Hill Farm. Refer to the **Orange/Brown** line shown on the plan in Appendix 1.

This option would tie-in vertically east of Redstone Cross Junction, therefore there would be no improvement to mainline vertical geometry through the junction. As such this would be substandard when assessed against current DMRB all-purpose highway design standards.

The eastern end of the scheme would commence at grade at Penblewin roundabout, before extending onto an embankment as far as Redstone Cross Junction, where it would pass through Redstone Cross Junction at grade, requiring the demolition of two properties.

The route would tie into the existing A40 horizontally, approximately 170 metres to the west of Redstone Cross Junction.

Option 1d

Offline alignment between Penblewin and Redstone Cross, including offline junction improvement south of existing Redstone Cross Junction. Refer to the **Red** line shown on the plan in Appendix 1.

Commencing at Penblewin the scheme would pass into a cutting allowing it to cross the low-lying land on an embankment that is lower than the aforementioned southern options. The route would

curve to the south of Redstone Cross to provide an offline junction improvement.

The route would tie into the existing A40 horizontally, approximately 470 metres to the west of Redstone Cross Junction.

There would be no demolition of property and the route would be approximately 90 metres further from Blackmoor Hill Farm than Option 1c.

Option 1e — Redstone Cross Junction Improvements works only. This scheme would include no improvements to the A40 mainline to the west of the existing Redstone Cross Junction. Refer to the **Green** line shown on the plan in Appendix 1.

Option 1f — Offline alignment as per Option 1c, however without a junction provision at Redstone Cross. Refer to the **Black** line shown on the plan in Appendix 1.

There would be no junction with the B4313, which would therefore, be diverted along the south side of the new road before passing beneath it where the mainline embankment height would provide sufficient headroom. On the north side the B4313 would re-join the old de-trunked A40 to link back to Redstone Cross Junction.

The route would tie into the existing A40 horizontally, approximately 600 metres to the west of Redstone Cross and require no demolition of property.

Option 1g — Offline alignment between Penblewin and Redstone Cross. Refer to the **Mauve** line shown on the plan in Appendix 1.

Commencing at Penblewin the scheme would pass into a cutting allowing it to cross the low-lying land on an embankment that is even lower than Option 1d. The route would curve to the south of Redstone Cross and continue under the line of Redstone Road in cutting. The B4313 Redstone Road would be carried over the trunk road on a bridge with no junction with the A40. To the north of the bridge the 'B' road would

continue to the east of Redstone Cross and then follow the de-trunked A40 to Penblewin Roundabout.

The route would tie into the existing A40 horizontally, approximately 470 metres to the west of Redstone Cross Junction.

There would be no demolition of property and the route would be approximately 90 metres further from Blackmoor Hill Farm than Option

Northern route options

Option 2a — Offline single carriageway alignment commencing approximately 100 metres west of Blackmoor Hill Farm, diverging from the existing A40 to the north. Refer to the **Turquoise dashed** line shown on the plan in Appendix 1.

The alignment would be roughly at grade for the eastern 400 metres and would then cross slightly elevated land in cutting to re-join the original road approximately 100 metres west of Sodston Lodge. A ghost island junction would be provided linking the B4313 to the north and to the detrunked A40 at Redstone Cross to the south. This route would pass through and destroy two barrows, which form a Scheduled Ancient Monument.

Option 2b — This option takes the line of the original A40 westwards from Penblewin Roundabout for about 400 metres and then takes a left-hand curve on embankment to pass to the north of Redstone Cross. Refer to the **Yellow dashed** line shown on the plan in Appendix 1.

It passes to the north of the Scheduled Ancient Monument and then changes to a right-hand curve into a cutting through higher ground. The curve brings the alignment back to the existing road about 100 metres west of Sodston Lodge. An overbridge would carry the B4313 over the new A40 carriageway.

There would not be a junction with the existing A40 at Redstone Cross.

Option 2c — This option would be very similar to Option 2b but there would be a ghost island junction with the B4313

to the west of Redstone Cross and no bridge. Refer to the **Bright Pink dashed** line shown on the plan in Appendix 1.

Option 2d — Offline alignment between Penblewin Roundabout and west of Sodston Lodge. This option takes the line of the original A40 westwards from Penblewin Roundabout for about 400 metres before diverting to pass north of the Scheduled Ancient Monument and Sodston Lodge. Refer to the **Grey dashed** line shown on the plan in Appendix 1.

An overbridge would carry the B4313 over the new A40 carriageway, connecting to the existing junction at Redstone Cross. Side road diversions required.

The route would tie into the existing A40, approximately 400 metres to the west of Sodston Lodge.

Four selected options

4.2.3 Following some early optioneering the nine options were reduced to four, based on two horizontal alignments, for more detailed consideration. Plans showing these shortlisted options are included in Appendix 2.

4.2.4 Table 4.1 below sets out an initial assessment of the environmental implications of the four options, where these were significant deciding factor in route selection. Appendix 1 is a plan showing the long-listed routes considered. Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001) to show how the northern and southern route options would be influenced by environmental constraints.

Table 4.1 Environmental aspects of the four options

Environmental aspects of options	Option 1d southern	Option 1g southern	Option 2b northern	Option 2c northern
Water environment	The option would cross 4 minor watercourses that feed into SAC.		The scheme would cross 1 minor watercourse that feeds an SAC	
Nature conservation	Clearance of woodland, hedges and areas of un-improved grassland. Road on embankment would provide capacity for adequate mitigation for bats and other mobile species		Clearance of hedges and severance of bat flightlines. Road in cutting at west end would not allow adequate mitigation of impacts on bats and other mobile species	
Landscape and visual	Requires clearance of woodland and disruption of landform. Less visible from setting because set low in landscape.		Requires formation of a deep cutting and a long embankment and clearance of substantial hedgerows on a visually prominent elevated landform.	
Archaeology and cultural heritage	No known archaeological sites in the area and low risk of new sites being found. The routes would pass close to the Blaenmorlias Care Home, which is a listed building, and would affect the setting.		Passes close to a Scheduled Ancient Monument which is considered likely to be in a setting containing Bronze Age remains of national significance. There is a possible standing stone on the route which would be destroyed.	
Community assets	Takes the trunk road closer to a care home at Redstone.		Moves the trunk road further from a care home at Redstone.	
Agriculture	Avoids better quality farmland and follows field boundaries.		Takes better quality farmland and cuts through the middle of fields.	
Noise and vibration	Moves source of trunk road traffic noise away from Redstone Cross and Blackmoor Hill Farm but closer to the care home.		Moves source of trunk road traffic noise away from Redstone Cross and Blackmoor Hill Farm and the care home.	
All travellers	Improves safety at Redstone Cross. Allows detrunked A40 to become an WCHR route. Does not sever links to properties north of the A40.		Option 2b improves safety for all users of the B4313 at Redstone Cross but no access possible from A40 to Sodston and Narberth with. Option 2c, improves safety for vehicle users at Redstone Cross, but not WCHRs Options severs links to properties and a Public Right of Way north of the A40 but allow detrunked A40 to become an WCHR route with a new link provided.	
Materials	Cut and fill balance requires a greater nett import of fill than the other Options 2b and 2c.		Requires less import than 1d with a better cut and fill balance.	

Preferred Route

4.2.5 This screening and scoping exercise has been completed without a clear preferred route. The routes are described in Chapter 5.

4.3 Characteristics of the setting

4.3.1 The Scheme lies between Carmarthen in Carmarthenshire and Haverfordwest in Pembrokeshire. The Preseli Hills lie 12km to the north and Carmarthen Bay is 10km to the south. One kilometre to the west are the upper reaches of the Afon Cleddau, while the closest boundary of the Pembrokeshire Coast National Park (PCNP) lies 6km away to the south-west. The immediate setting is entirely rural with the Scheme passing through hedged pastureland and woodland.

4.3.2 Appendix 3 includes the Constraints Plan which sets out some of the key constraints that have influenced the selection of a route.

4.3.3 The A40 Trunk Road has been undergoing a programme of improvements over several years. The nearest of these being the Llanddewi Velfrey to Penblewin Improvements, located immediately commencing where this Scheme finishes, at Penblewin Roundabout and continuing east for 4.3 kms to end at the top of Pengawse Hill, near Bethel Chapel. It is possible that construction of these two schemes could occur concurrently, or consecutively, and there is potential for the consequences of construction of both Schemes to combine (cumulative effects).

Landscape setting

4.3.4 The setting of the Scheme is a rural, lowland agricultural landscape with a dispersed population and scattered small villages. The landform is undulating with convex upper slopes and small valleys formed by winding flashy watercourses and narrow damp floodplains. The land consists mainly of improved or semi-improved grassland used for grazing, silage/haylage with fields divided by hedges and hedge banks with small linear belts of woodland mainly alongside the watercourses or on the steeper slopes. To the east of Penblewin the topography gradually becomes more pronounced with long steep-sided ridges and wider valleys.

Settlement

4.3.5 The scheme is in a rural setting with dispersed settlement. At Redstone Cross there is a scattered group of farms and other residential properties, with ribbon development associated with Narberth along the B4313 to south. There are seven residential properties located beside the existing A40, including two at Redstone Farm, two properties beside the Narberth Road, two properties at Blackmoor Hill Farm and Penblewin Farm. Lying over 1km to the south, Narberth is the largest town in the area, providing some essential community facilities. Other smaller settlements in the area are Llanddewi Velfrey (2.7km) and Whitland (7.7km) to the east, Clynderwen (2.5km) to the north and Robeston Wathen (3.4km) to the west. There are railway stations at Clynderwen and Whitland on the railway line between Fishguard, Milford Haven and Carmarthen.

Watercourses

4.3.6 There are five watercourses directly under the Scheme corridors or within the immediate setting as shown in A40PRC-ARP-EGN-M02-DR-LE-0001 in Appendix 3, these are described from west to east and all seem to arise from springs close to the existing A40 road:

a) A small un-named watercourse which appears to arise near to Redstone Cross and then flows south west to meet the Eastern Cleddau at Caneston Bridge. The Eastern Cleddau is part of a marine Special Areas of Conservation (SAC).

b) The Afon Marlais which appears to arise from springs and pools just to the east of Redstone Cross to flow eastwards to Pant-y-gorphwys on the Narberth Road. From here it flows east to converge with the Afon Taf near Whitland. The estuary of the Afon Taf is part of a marine Special Areas of Conservation (SAC).

c) A very minor un-named watercourse arising from springs and pools just to the west of Blackmoor Hill Farm. This forms the southern edge of seasonally wet fields and flow east as a tributary of (d) below;

d) A minor un-named watercourse arising from springs and pools just to the south of Blackmoor Hill Farm. This forms the northern edge of the seasonally wet fields and flows east as a tributary of the Afon Marlais which it meets just to the west of Pant-y-gorphwys on the Narberth Road.

e) A minor unnamed and probably seasonal watercourse arising to the north west of Penblewin roundabout and crossing under the A40 around 400 metres west of the roundabout. This merges with

watercourse a) above just to the west of Pant-y-gorphwys on the Narberth Road;

Habitats and protected species

4.3.7 There are five Special Areas of Conservation (SAC) within 10km of the Scheme and a further two SACs designated for bats within 30km of the site. There is one Special Protection Area (SPA) within 10km of the site, but no Ramsar Sites are present within this 10km distance. There are no other locally designated nature conservation sites.

4.3.8 The habitats along the route of the A40 in the area support populations of European Protected Species (EPS), including greater and lesser horseshoe bats, otter, dormouse and barn owl. There are also populations of badger and reptiles. These habitats include wet woodland along stream-sides, hedges and scrub woodland, improved grassland, and semi and unimproved grassland. The latter include some areas of seasonally wet fields.

Heritage Designations

4.3.9 There are a 12 Listed Buildings (LB) within 500m of the existing A40, which would also be within 500m of the northern and southern routes. There are 3 Grade II Listed Buildings at Cilrath Fach to the north of Redstone Cross, 1 at Sodstone Manor and 2 at Sodston House to the north east, with 2 more at Blaen Marlais and two at Blaen-ffynnonau beside the Narberth Road to the south of Redstone.

4.3.10 The historic core of Narberth, which includes the site of Narberth Castle, lies 1.4 km to the south of Redstone Cross is designated as a Conservation Area.

4.3.11 There is a Scheduled Ancient Monument (SAM), to the north of the existing A40 north east of Redstone which covers a group of barrow mounds in a field within 30 metres of the A40. There are 11 SAMs within 5km, for example:

a) Caerau Gaer a prehistoric defensive enclosure located 1.9km to the east-southeast of Penblewin

b) Llanddewi Gaer Promontory Fort located 2.4km to the east southeast of Penblewin

c) Narberth Castle located 1.7km south of Redstone Cross

d) Caneston Wood Iron Age domestic enclosure 1.9km southwest of Redstone Cross

e) Bush Inn Camp Prehistoric Promontory Fort located 3.3 km west of Redstone Cross

f) Vaynor Gaer Prehistoric Defensive Ringwork located 1.7km north east of Redstone Cross.

4.3.12 There are a range of non-designated archaeological sites recorded in the Historic Environment Record (HER) within the setting of the route options. A standing stone is located close to the barrows within the SAM and it is believed that 'cattle scratching post' could have originated as a Standing Stone in the area and could possibly have been relocated to its current position. On the north side of the A40 the Medieval field pattern is partially preserved as hedges.

Landscape Designations

4.3.13 Within the 5km study area, there is one Registered Historic Park and Garden, Blackaldern, to the south of the Scheme near Narberth. There are no Historic Landscape Areas. The Pembrokeshire Coast National Park, which includes the Eastern Cleddau Valley and surrounding landscape approaches to the west within 3.8 km.

Prevailing weather conditions

4.3.14 The area receives a typical maritime climate characterised by weather that is often cloudy, wet and windy, but mild. Air quality is good, and the Scheme does not pass through or near any Air Quality Management Areas (AQMA).

4.3.15 Weather conditions are typical for the region, with an annual rainfall of 1,038mm, with November being the wettest month of the year. Over the year, the mean annual temperature is 11^{o}C ranging from a low of 4^{o}C and a high of 19^{o}C. The coldest month on average is February. The prevailing winds are from the west and south-west with wind speeds averaging 12mph over the year. The windiest month is December.

Noise Action Plan Priority Areas (NAPPA)

4.3.16 There is a candidate Noise Action Plan Priority Areas (NAPPA) at Llanddewi Velfrey. There are further NAPPAs elsewhere on the A40.

4.4 The problems of the existing road

Accident record

4.4.1 The Penblewin to Redstone Cross section of the A40 is relatively short has no intermediate junctions (other than a few minor property accesses) and has relatively low traffic flows, slightly in excess of 10,000 Annual Average Daily Traffic (AADT). In that context the number of Personal Injury Accidents (PIA) recorded is very low, with only 8 occurring in the 10 years analysed (July 2008 to June 2018). These included five at Redstone Cross, two between Redstone Cross and one at Penblewin roundabout

4.4.2 The severity split of accidents is very skewed towards more severe injuries than is the average UK wide. The observed accident rate for the A40 is lower than the default rate for this standard of road. When accidents occur, there is a significantly increased likelihood of more serious injuries or fatalities compared to this standard of road elsewhere in the UK. The only notable accident cluster on this section of the A40 is at the Redstone Cross staggered T-junction, with 63% of all accidents on this section occurring at this junction over the last 10 years.

Problems identified by consultations

4.4.3 The following problems have been identified in collaboration with the A40 LLanddewi Velfrey to Penblewin Improvements Scheme and early public consultation. The Project Objectives (Section 4.5) and Environmental Objectives (Section 4.5.1) are cross-referenced below to demonstrate how the Welsh Government intend to address the identified problems. The statement 'data gathered for the Scheme' refers to the LVP WelTAG Stage 1 Impact Assessment Report (IAR).

a) The A40 mainline and Redstone Cross Junction is substandard.

Evidence: The road is substandard with limited safe overtaking opportunities. See accident data set out in paragraphs 3.4.1 and 3.4.2. Poor visibility at the junction and insufficient deceleration lengths and junction stagger.

Scheme Objectives: 01, 03, & 04

Environmental Objectives: all

b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.

Evidence: The A40 currently offers limited areas which allow safe unambiguous overtaking opportunities. There is inconsistency in the level of overtaking provision between the eastbound and westbound directions.

Journey time reliability is a problem when drivers are delayed behind a slow-moving vehicle and cannot overtake. The types of accidents occurring demonstrate the risks drivers take because they are frustrated by lack of overtaking opportunities. 43% of accidents on the A40 occurred due to vehicles veering onto the opposite side of the carriageway.

The 2015 study and associated business survey confirmed that there is a perception that the employment areas in the region are remote as a result of the low standard of accessibility by road, including the lack of safe overtaking opportunities, which causes delays when there are slow moving vehicles, creating increased journey times

Scheme Objectives 01, 02 & 04, 06 & 08

Environmental objectives: all

c) Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated by limited overtaking opportunities.

Evidence: Traffic data (see section 3.2 of the IAR) shows a small peak in traffic in the eastbound direction which links in with the arrival of ferry traffic.

Speeds along the A40 vary when activity at the Port is high, with industrial and commercial vehicles, as well as tourists using the A40 as a strategic link.

Platooning, exacerbated by the mix of traffic including large agricultural vehicles, causes delays.

Journey time unreliability is worst on Friday PM peaks, caused by long distance commuters returning home to the County and weekend visitors arriving.

Scheme Objectives 01, 02, 03, 06, & 08

Environmental Objectives 1iv, v, vi, vii, viii, 2i, iii, iv, v, viii.

d) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.

Evidence: Journey speeds and unreliability of journey times are a greater problem in summer months when there is an increase in traffic levels caused by tourists.

Traffic data (see section 3.2 of the IAR) shows traffic volumes in August are some 26% higher than the annual average.

This increase in traffic volumes and associated increase in slow moving vehicles such as caravans is known to exacerbate some the journey time unreliability and safe overtaking problems on the A40.

Scheme Objectives 01, 02, 03, 06, & 08

Environmental Objectives 1 vi, vii, viii, 2i, iii, iv, v, viii.

e) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problem when traffic slows to allow vehicles turn off the road, or with slow moving vehicles pull out into the road.

Evidence: Within the 1.62km section of the Scheme there are approximately 18 accesses or side roads directly onto the trunk road. This contributes to journey time unreliability and risk of accidents when traffic joins or leaves the main carriageway. Data gathered for the Scheme demonstrates how existing visibility splays at priority junctions along the A40 and conflicts between vehicles approaching behind those waiting to turn from the main A40 carriageway with substandard design issues may have contributed to fatalities and serious accidents occurring.

Scheme Objectives 01, 02, 04

Environmental Objectives 1 viii,

f) A mix of traffic types, including agricultural vehicles, using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.

Evidence: data gathered for the Scheme shows a traffic make-up of 74% cars, 18% LGV and 8% HGV. The A40 is also used by slower moving agricultural vehicles as well as seasonal tourist traffic (including caravans). This make up contributes to problems associated with platooning and overtaking.

Scheme Objectives 01, 02, 04, 05, 06 & 08

Environmental Objectives 1 vi, vii, viii, 2i, iii, iv, v, viii.

g) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

Evidence: data gathered for this Scheme shows higher than average car ownership and lower than average numbers of households without access to a car. Public transport data illustrates that services in the study area are generally infrequent and operate short hours of service; this, combined with non-competitive journey times when compared car-based journeys makes public transport an unattractive journey choice.

Scheme Objectives 01, 02, 03, 04, 06, 07, 08

Environmental Objectives 1 vii, x, 2 i, v, viii

4.5 Scheme objectives

4.5.1 A number of strategic transport planning objectives have been developed iteratively during the previous A40 Improvement Schemes, and specifically the A40 Llanddewi Velfrey to Penblewin. During the early stages of the A40 Penblewin to Redstone Cross Improvements Key Stage 3, these objectives were refreshed to consider both the strategic and local transport planning aspects for the Redstone Cross Area. The scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (and perceived safety) and reduce the number and severity of A40 mainline collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

4.6 Environmental Objectives

a) Avoid or mitigate impact to provide:

i. Minimise net loss of important habitat.
ii. Maintenance of existing habitat connectivity.
iii. No adverse impact on biodiversity.
iv. Protection of watercourses and water quality.
v. Effective landscape integration.
vi. Effective visual screening of the new road.
vii. An overall reduction in visual impact caused by through traffic.
viii. Safe carriageway crossings.
ix. Zero waste to landfill.
x. Minimal carbon footprint.
xi. Protect farms and other local businesses.
xii. Avoid or mitigate impact on cultural heritage to provide no permanent adverse impact on historic environment assets.
xiii. Minimise adverse noise impacts for noise sensitive receptors.

b) Benefits to be achieved by the Scheme

i. Overall reduction in traffic noise for residential properties.
ii. Habitat creation and improved habitat connectivity integrated effectively with the landscape through good design.
iii. Improve the impact of road drainage on water quality.
iv. Improve access to, and enhance enjoyment of, the landscape and of any visible historic assets associated with the road corridor.
v. Enabling walking cycling and healthy lifestyles.
vi. Support education, learning and community involvement by maximising educational opportunities based on cultural and natural heritage assets.
vii. Research effective soil and vegetation management as a means of reducing whole life cost of the soft estate.
viii. Support community life and economic viability through enhanced cohesion and destination creation.

c) ***We want to achieve mitigation and benefits by aligning with the seven goals and five ways of working set out in the Well-being of Future Generations Act:***

i. Compliance with legislation.

ii. Delivery of Welsh Government policy.

iii. Work effectively together throughout the development of the project.

iv. To offer a full and open exchange of information and views during project development to make sure that the right project for Wales is published.

v. To work together to develop deliverable and effective environmental mitigation.

5 DESCRIPTION OF THE SCHEME

5.1.1 Plans showing the shortlisted options are included in Appendix 2. Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

5.2 Southern Route Options

5.2.1 A 1.7 km length of the A40 Trunk Road would be improved. Currently the road is a single carriageway with few places for overtaking. The road provides restricted forward visibility and there are several accesses opening straight onto the carriageway from fields, farms and private property road. During the summer, the amount of traffic can increase considerably compared to the winter. The following description of the scheme includes the term 'Chainage' (abbreviated to Ch.) to refer to the distance, in metres, from the tie in at the western end of the Scheme.

5.2.2 The proposed improvements include a 800m length of new road bypassing Redstone Cross and providing a new staggered junction. There will also be a 1.0km length of 2+1 carriageway allowing overtaking

5.2.3 The Scheme would commence approximately 500 metres west of Redstone Cross (Chainage 0.00 (Ch.)) as the A40 climbs a shallow gradient towards Redstone Cross. The Scheme would leave the line of the existing A40 and draw gradually to the south. At approximately Ch.400 the road would cross a small wooded watercourse on an embankment and enter the proposed ghost island/ staggered T-junction. The detrunked length of existing A40 road would extend from Redstone Cross to Blackmoor Hill on the north side.

5.2.4 Continuing east the route would commence a gentle left-hand bend to cross the B4313 south of Redstone Cross in cutting. For the option with a staggered junction, the southern arm of the staggered cross roads would link to the B4313 to Narberth at Ch. 520. For the option without a junction, the B4313 would be carried over the A40 on a bridge. To the north side of the road would be properties at Redstone Cross and to the south the Blaen Marlais Care Home.

5.2.5 The Scheme would continue the gentle left-hand curve to around Ch.800 where it would reach the highest point, with the road gradually

transferring from cutting to embankment and a downward alignment to cross lower-lying land occupied by woodland. At Ch.860 it would cross a second small watercourse. This embankment would continue eastwards, entering a shallow right-hand bend which would continue to Ch.1,450. The maximum height of this embankment would be around 9 metres above ground level. At Ch. 1,700 a third watercourse would be crossed. After another 400 metres the embankment would cross an area of low-lying wet ground and a fourth small watercourse. This length of road on a descending alignment would gradually transitioning to an ascent. At Ch. 1450 the road would pass into a cutting as it climbs to the Penblewin roundabout.

5.2.6 The existing A40 would be detrunked between Redstone Cross and Penblewin roundabout. The road would continue to serve Blackstone Farm and nearby properties as a means of access, but to the east it would no longer be a public road.

5.3 Northern Route Options

5.3.1 The proposed improvements consist of a 1.9km length of new road bypassing Redstone Cross to the north. The route would provide a minimum of one length of 2+1 carriageway to allow for overtaking. The northern route options are shown in Appendix 2.

5.3.2 The Scheme would commence approximately 500 metres west of Redstone Cross, near Sodston Lodge (Chainage 0.00 (Ch.)) where the A40 from Caneston climbs a shallow gradient towards Redstone Cross. The Scheme would leave the line of the existing A40 on a left-hand bend and draw gradually to the north and into a cutting typically 6 to 8 metres deep. At approximately Ch.500 the road, still in cutting would cross the line of the B4313 just to the north of Redstone Cross. A bridge would be required to carry the side road over the proposed carriageway.

5.3.3 From the bridge for the B4313 the route would continue for another 250 metres in cutting to cross the high ground of the Sodston Ridge. The edge of the cutting would pass within 30 to 50 metres of Redstone Farm. As it rises from cutting the alignment would take a long righthand bend on an embankment typically 3 to 5 metres high then Tapering gradually as the route descends towards Penblewin roundabout. The most easterly 300 metres would be an on-line improvement of the existing road.

5.3.4 There would be no junction to allow access to the A40 from the B4313. The existing A40 would be detrunked between Redstone Cross and Blackmoor Hill Farm. The existing road would continue to serve Blackmoor Hill Farm, means of access to fields and as a link to the A478.

5.3.5 Two Private Means of Access to properties to the north of Blackmoor Hill Farm would be severed by the Scheme and a new Private Means of Access would be provided for these properties.

5.3.6 An alternative northern route would provide a ghost island/ staggered T-junction instead of an overbridge between chainages 0+380 and 0+520. Providing connectivity between the B4313 to the north and the existing A40 to the south.

5.4 Characteristics of potential impacts

Geology and soils

5.4.1 The underlying rock is of adequate quality to form embankment and cutting slopes of 1:2. If further development work and receipt of Geotechnical Investigations require the slopes to be revised to 1: 2.5 this would increase land take over the more normal slopes of 1:2.

5.4.2 The Scheme would permanently require around 4 to 5 hectares of land. As a result of soil wetness, soils in the setting are subgrade 3b 'Moderate' quality, with patches of Grade 4 'Poor' quality and Grade 5 'Non-agricultural[3]. The northern route is entirely within subgrade 3b, while the southern route is within areas of subgrade 3b, grade 4 and 5. There would be some adverse effects on these soils which would need to be stored on land beside the scheme and spread in suitable dry conditions. In order to confirm the baseline conditions at the site, a ground investigation shall be undertaken.

Road drainage and the water environment

5.4.3 The Scheme could disrupt or otherwise adversely affect groundwater. The northern route in cutting could affect groundwater, while the southern route would cross four minor watercourses which emerge as springs along the Sodston ridge on the north side of the existing A40

[3] Predictive Agricultural Land Classification (ALC) for Wales (2017)

and would be culverted to pass under the Scheme. During construction of the Scheme, waterborne silt disturbed during earthworks, could have an adverse effect on watercourses, downstream, or on the Special Areas of Conservation (SAC), which lie downstream.

Nature Conservation (biodiversity)

5.4.4 A review of both statutory and non-statutory designated sites for nature conservation has shown there are four Special Areas of Conservation (SAC) within 10km of the Scheme, the closest being the Cleddau Rivers SAC which lies 1.3km to the west. Pembrokeshire Bat Sites and Bosherton Lakes SAC lies 7km to the west of the site and there are a further two SACs designated for bats within 30km. The Eastern Cleddau River Site of Special Scientific Interest (SSSI) which forms part of the Cleddau Rivers SAC also lies 1.3km to the west. There are four further SSSIs within 5km of the site: Bryn Bank Quarry SSSI, Llanfallteg Track Section SSSI, Milford Haven Waterway SSSI and Robeston Wathen Quarries SSSI. There are no non-statutory locally designated sites for nature conservation within the 2km.

5.4.5 Both the northern and southern options would result in the loss and fragmentation of mature hedgerows and improved and semi-improved grassland fields. The hedgerows are likely to form part of a wider network of green corridors for the movement of bats across the landscape including those which are the qualifying features of the nearby internationally designated bat SACs (greater horseshoe bat, lesser horseshoe bat and barbastelle bat). Any mature trees along the hedgerows may potentially provide roosting habitat for bats and barn owl. The hedgerows are also suitable to support hazel dormouse and a diverse assemblage of breeding birds. Together with the grassland habitats they also provide suitable foraging habitat for badgers, reptiles, amphibians and other notable species.

5.4.6 The southern option would also result in the loss and fragmentation of two areas of semi-natural broadleaved woodland and a number of freshwater streams. The majority of the woodland comprises wet woodland since it is largely associated with the valleys of the small freshwater streams. There are also areas of marshy grassland in these lowland areas. The woodlands and freshwater streams along the southern route option are likely to form part of an important green corridor for the movement of bats including those which are the qualifying features of the nearby internationally designated bat SACs;

greater horseshoe bat, lesser horseshoe bat and barbastelle bat. The freshwater streams may also support otter and water vole. A main badger sett and a number of outliers are known to lie along the southern route alignment. The marshy grassland present along the southern alignment may also be important for invertebrates.

5.4.7 Due to the lower-lying topography of the southern option there are better opportunities for providing multi-species crossings under the proposed route to provide safe passage for species including those which are the qualifying species of the SACs. This would be more difficult to achieve with the northern option which are mostly at grade.

5.4.8 A Statement to Inform an Appropriate Assessment (SIAA) Report will be produced which will outline the outcome of an Assessment of Implications (of Highways and/or Roads Projects) on European Sites (Including Appropriate Assessment) (AIES), assessing the construction and operational impacts on the qualifying species of the SACs.

5.4.9 Landscape and views

5.4.10 Summer and winter landscape and visual surveys will be completed in 2019. Preliminary desk-based assessments show that the route options would be visible from the south, while the northern option would be on top of the Sodston ridge and visible from some elevated viewpoints within the Preseli Hills to the north as well.

5.4.11 Pembrokeshire Coast National Park lies in excess of 7 km to the north, west and south. The northern portion, which contains the Preseli Hills is over 11km to the north and whilst there is a potential view of the Scheme from the higher peaks of the Preseli Hills, the distance makes a view of the Scheme very unlikely.

5.4.12 The northern route option alignment requires cuttings and embankments that would disrupt the open elevated topography of the Sodston ridge. These changes to the landform could be visible to scattered properties to the north south and east. The southern route option crosses low lying land in a valley, the route would cut through woodland, hedges and agricultural land. These changes to landform would be visible locally from a limited number of properties.

5.4.13 A tree survey was also completed in July 2017. Trees in woodland and in hedges would be felled where these fall within the construction area

of the Scheme. This would also include any trees identified in detailed preconstruction surveys, diseased or hazardous because they are dead or unstable. At this stage, the exact numbers of trees to be felled cannot be determined, although the southern option would require felling of more trees and woodland.

Archaeology and cultural heritage

5.4.14 A desk study of known heritage sites has been undertaken and a geophysical survey of the Scheme footprint will be carried out in 2019. The work to date has considered north and southern route options. There would be no direct effect on SAMs or Listed Buildings. There are no Historic landscapes that would be affected and the setting of a Registered Park and Garden is unlikely to be affected by either route option.

5.4.15 The northern route option would pass within 50 metres of a group of barrows designated as a SAM. In the view of Cadw, construction of a road in this location would constitute a modern intrusion into the setting of the monument. The cumulative effect of the new and existing roads would result in the barrows lying between a road system, effectively interrupting the surrounding agricultural landscape setting and causing a moderate to high adverse impact on the aesthetic values of the monument. There is a high potential for associated undesignated archaeological remains beyond the scheduled area which could be of national importance. The southern route option is considered to have a beneficial impact on the SAM by removing traffic from the immediate setting.

5.4.16 A number of hedgerows will be affected by the route options and an assessment of Historic Hedgerows, as defined in the Hedgerow Regulations 1997, will be carried out in 2019.

Community and Private Assets

5.4.17 A desk study of community assets has been completed and will be confirmed by a drive through survey. A series of farm interviews will be completed if necessary to confirm the details of farm businesses. Questionnaires were distributed to landowners and responses collated. There is no ‘best and most versatile land’ (Grades 1, 2 and 3a) affected by the Scheme.

5.4.18 There are no community assets or facilities other than land that would be adversely affected by either scheme. The removal of traffic on the existing A40 through Redstone Cross would significantly reduce community severance for this small community. The southern route option would be closer to a care home beside the B4313 to the south of the A40 than the existing or northern route.

5.4.19 The Scheme would adversely affect farm businesses by taking land and severing or affecting access routes to fields. The northern route would sever private means of access to three properties and would cause greater severance to farmland and farm businesses than the southern route.

Air Quality

5.4.20 Air quality monitoring was carried out in 2017 for the A40 Llanddewi Velfrey to Penblewin Scheme. Monitoring data from this survey is relevant and appropriate for the Scheme. The Scheme does not pass through any Air Quality Management Areas and predicted background air quality concentrations are low.

5.4.21 During construction, the extensive earthworks and earthmoving that would be required for the Scheme could generate air borne dust with adverse effects on the local population. When construction is complete, this effect would diminish. When the new road is open to traffic, most residents in the Redstone Cross or living near to the routes should also benefit from improvements in air quality as a consequence of moving the sources of NO_x from vehicle emissions further from residential properties.

5.4.22 Air quality is not considered to be a significant impact of the Scheme, although there is potential for some local improvements close to the existing A40.

Noise and Vibration

5.4.23 Baseline noise monitoring will be undertaken at a number of receptor locations along the existing A40 and the proposed scheme route for each option (or the preferred scheme options) during 2019. These locations will include any representative receptors that have the potential to be adversely affected by noise levels or changes in noise levels due to the scheme for each option (or the preferred scheme

option).

5.4.24 Noise and vibration from construction activity could have an adverse effect on the local population. Whilst residents in Redstone Cross would benefit from reductions in traffic noise, once the new road is open to traffic, several properties would be closer to traffic on the new route and so could suffer some adverse effects.

5.4.25 The impact of noise and vibration on residents is considered unlikely to be significant. At Redstone Cross the southern route option has the potential to have a beneficial effect on residents, but could adversely affect tranquillity for some residential properties on the south side. Wildlife would be similarly affected by traffic noise, with the Scheme passing through previously undisturbed areas of habitat.

All travellers

5.4.26 A desk study has identified only one Public Rights of Way (PRoW), a bridleway, exists within the area of the route options. This PRoW meets the north side of the A40 close to Blackmoor Hill Farm and extends north to join the A478 at Bryn Hill. Counting and observation surveys will be carried out in 2019.

5.4.27 The northern route option will require the PRoW to be stopped-up, or diverted, to a crossing point, which might be at Penblewin or Redstone Cross.

5.4.28 The existing A40 would be detrunked and could provide a walking, cycling and horse-riding route from Redstone to Penblewin. In accordance with the Active Travel (Wales) Act 2013, the Scheme could provide benefits to local people through the development of circular footpath and cycle routes, improved conditions for pedestrians and cyclists in the village and along the detrunked road.

Materials

5.4.29 The Scheme has not been designed in enough detail to identify the cut and fill balance. The northern route would require less imported material than the southern route because there is a better balance between the volume of rock and soil excavated from proposed cuttings and the volume that would be required to form embankments and for soiling completed landscape areas.

5.4.30 There is capacity for excavated fill material - that is unsuitable for embankment construction - to be used in landscape measures. In the interests of providing low fertility verges, topsoil would be used in specific areas where high fertility is required. This would result in a surplus of topsoil.

5.4.31 Other bulk construction materials such as aggregate for concrete and materials for construction of the carriageway would be brought to the Scheme from suitable quarries or other sources.

5.4.32 Under current legislation and understanding, waste material is considered to be '*any substance or object which the holder discards or intends or is required to discard.*' The term 'discard' includes the disposal, recovery or recycling of a substance. Waste categories are likely to include vegetation, redundant road signs, lighting columns, excess topsoil, and surface planings from redundant carriageway. Waste would be managed in accordance with the Waste Hierarchy with as much as possible reused within construction. Waste that cannot be reused would be taken to a local recycling facility. Quantities of waste requiring disposal are anticipated to be relatively small.

Population and Human Health

5.4.33 A health assessment looks at how impacts arising from a proposed development are likely to result in changes to health determinants, i.e. factors that influence health and well-being, and therefore influence health outcomes within the local population. In relation to the Scheme, there is potential for the health of the population within local communities to be influenced as a result of predicted likely environmental, social and economic Scheme impacts. For example, the route options under consideration would be designed to reduce journey times, improve road safety, reliability and resilience, improve air quality and reduce noise disturbance for the areas adjacent to the existing A40 and are therefore likely to influence the health and well-being of the local population. The Scheme could impact on assets which influence health outcomes such as provision, quality and accessibility of public rights of way for non-motorised users.

5.4.34 There is likely to be little difference in terms of health effects between the northern and southern route options. This is due to the similarities in relation to severance, noise and air quality exposure nearby residential properties are likely to experience in each case.

5.4.35 These health effects, which are focused on the final state of the Scheme, are likely to be beneficial for the population due to the improvements that are proposed. However, during construction, there may be potential for adverse effects on health due to construction noise, road journey disruption and access restrictions. These would need to be investigated and any mitigation measures identified in order to reduce the adverse effects to below significant levels and to enhance beneficial effects.

Climate Change

5.4.36 Climate change impacts are considered across three aspects:

a) Greenhouse gas emissions – the potential greenhouse gas emissions associated with the construction and operation of the proposed development;

a) Climate change resilience – the effectiveness and feasibility of adaptation measures integrated into the proposed development to avoid or reduce hazards and/or increase resilience of the proposed development to climate change impacts; and

b) In-combination climate change impacts – the combined effect of the proposed development and potential climate change impacts on the receiving environment during construction and operation.

5.4.37 A carbon assessment will be undertaken in 2019 to quantify the whole life carbon footprint of the project based on the preliminary design. This included capital, operational and user carbon emissions.

5.4.38 The carbon assessment showed that emissions from vehicles using the road account for most emissions over the project life. These emissions are slightly higher with the Scheme (compared to without the Scheme) due to an increase in average speeds, based on the traffic forecast models, and a very slight increase in vehicle kilometres travelled due to the alignment of the proposed road.

5.4.39 In terms of climate change resilience, the key risks are likely to be associated with flooding, which should be mitigated through the Flood Risk Assessment.

5.4.40 In term of in-combination climate change impacts, it is likely that mitigation measures proposed in each factor would reduce the in-combination impacts to below levels considered significant.

Heat and Radiation

5.4.41 The Infrastructure Planning (EIA) Regulations 2017 introduced the requirement for the emission of heat and radiation to be considered. The Scheme does not introduce any new sources of heat and radiation during construction or operation. In addition, there are no sensitive receptors (for example, hospitals or schools) within the route corridor. Hence the Scheme would not create any new sources of heat and radiation. On that basis, with no sensitive receptors, the Scheme is not considered likely to increase the generation or release of heat and radiation.

Risk of Major Accident and Disaster

5.4.42 The Scheme is not considered likely to increase the risk of major accidents and disasters, or the effects of such events on the environment.

5.4.43 The potential risks of major accident or disaster in the area of the Scheme considered to be relevant are the effects of severe heavy snow, or transport accidents that could result in closure of the road or cause pollution events because of spillages from the road. Whilst there is evidence of landslips in the wider area, the Scheme would be constructed with the risk of land instability taken into consideration so that embankment and cuttings slopes would be stable.

5.4.44 The current section of the A40 is substandard and limited overtaking opportunities. There is a public perception that the existing staggered junction in dangerous. This is supported by records of accidents, including fatalities. There have been 8 accidents along this stretch of the A40 between July 2008 and June 2018, with the majority (5) at Redstone Cross. A higher than average proportion of these resulted in severe injury or fatality. By reducing the potential for accidents by improving the junction, or by removing the junction altogether, the scheme could reduce the risk and occurrence of accidents.

5.4.45 The Scheme is designed to current standards, with the aim of reducing the risk of accidents by the removal of side road junctions. The procedures for dealing with heavy snowfall, major road accidents and pollution within the road are well-established and the road would not be closed for long periods. Alternative routes - using other roads - exist for diverted traffic. The 2+1 carriageway provides a length of safe, unambiguous overtaking opportunities. This would reduce the number

of risky manoeuvres on the road and generally contribute to reducing the potential of accidents.

5.5 Possible mitigation

5.5.1 At this early stage of the project the requirements for mitigation are unknown, but the application of some kinds of mitigation can be proposed based on the preliminary opinions of the environmental specialists involved.

5.5.2 For sites likely to be disturbed by the Scheme, mitigation in advance of construction works but implemented by the construction contractor, would include archaeological investigations such as a watching brief during soil stripping, trial trenching, detailed investigations and recording of sites. Mitigation to adverse effects on the settings of heritage sites could include landscape planting and minor earthworks.

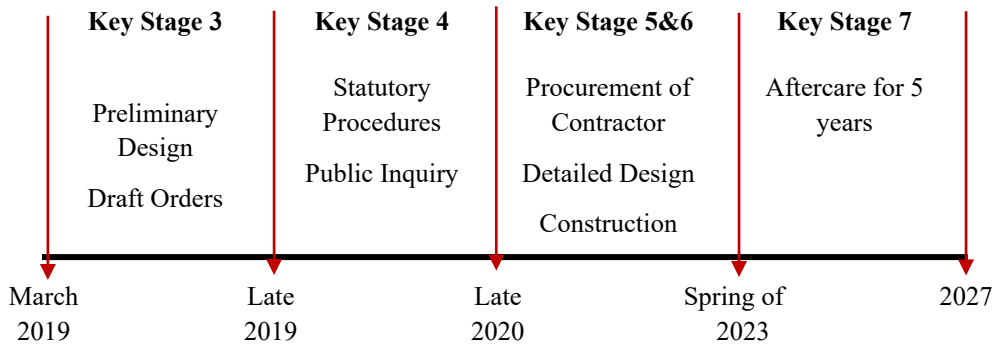
5.5.3 The Scheme is considered likely to have a significant impact on ecology and nature conservation, particularly in the context of the greater and lesser horseshoe bats. The impacts would be greatest during construction. Mitigation is likely to include the provision of underpasses to provide connectivity across the road. Compensation habitat in the form of woodland and hedge planting is likely to be needed and this would serve as mitigation provide screening and integration into the landscape, and reinstatement of grassland on disturbed areas would be provided.

5.5.4 Silt control during construction and pollution control penstocks on balancing ponds should control waterborne pollution which might otherwise adversely affect the various SAC downstream of the Scheme.

5.5.5 The northern route might also require mitigation for the severance of private means of access to fields and farms would mitigate some of the impacts of the Scheme. An underpass at Redstone Cross could be provided to allow WCHR access across the road.

5.5.6 No specific noise mitigation is currently being considered, A low noise surfacing is proposed for the entire A40 route within the Scheme where noise and engineering benefits are considered beneficial. It is possible that some noise mitigation in the form of vertical barriers would be needed in sensitive locations.

5.6 Project Programme



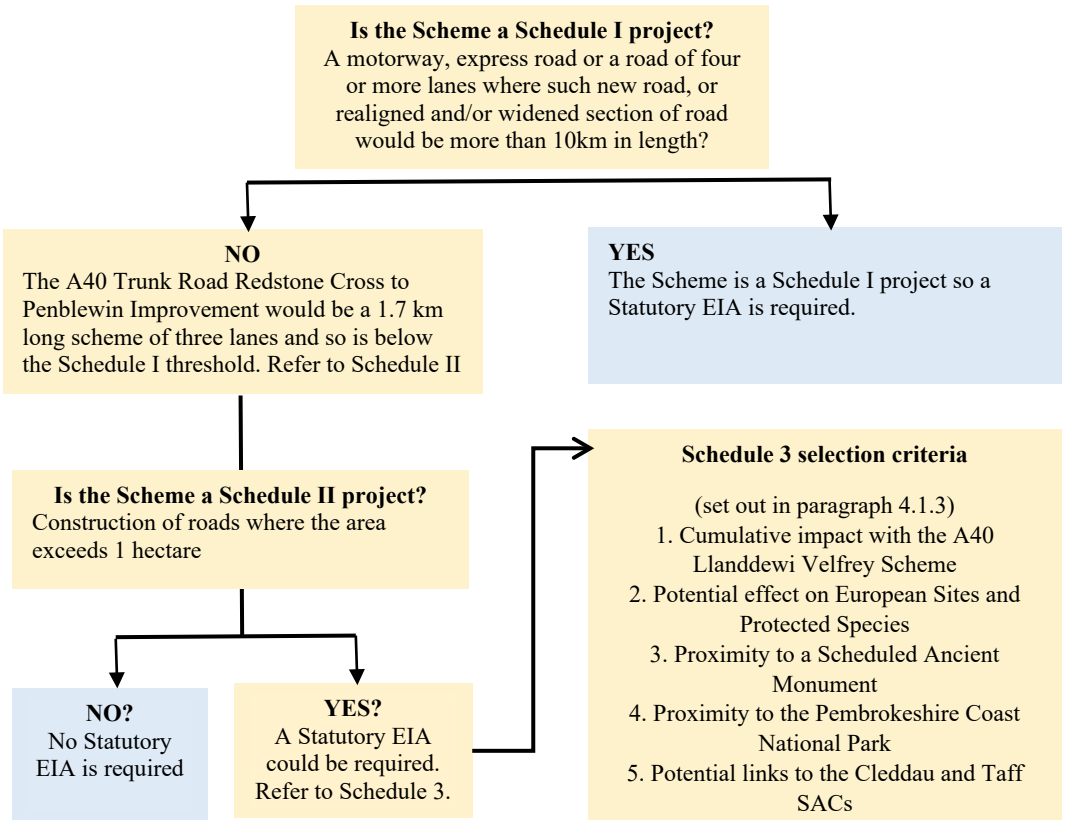
6 THE SCREENING PROCESS

6.1 Legal requirements

6.1.1 Although the proposed project does not constitute an Annex I project, Annex II projects are defined as all projects not listed within Annex I of the EIA Directive that are not considered to be strictly maintenance projects. In order to confirm whether the project is considered a 'relevant project' under EIA Regulations, the thresholds of size and environmental sensitivity are applied. Essentially an Annex II 'relevant project' is defined as:

> *'a project for constructing or improving a highway where the area of the completed works together with any area occupied during the period of construction or improvement by requisite apparatus, equipment, machinery, materials, plant, spoil heaps or other such facilities exceeds 1 hectare or where any such area is situated in whole or in part in a sensitive area.'*

Diagram 6.1: Screening of a Project under the EIA Directive 2017



6.1.2 The proposed project is not situated within a '*sensitive area'*, as defined by the EIA Regulations as amended. The project size does exceed 1 hectare and thus the proposed project is classified as a '*relevant project'*. All '*relevant*' Annex II projects require a determination to be undertaken to confirm whether the project is considered likely to have a significant environmental effect. This examines the characteristics of the proposed project in terms of its location and the potential impacts that may arise and is informed by the selection criteria in Annex III of the EIA Directive.

6.1.3 Annex III selection criteria for screening decisions

1. Characteristics of projects

The characteristics of projects, having regard in particular to:

a) the size of the project;
b) the cumulation with other projects;
c) the use of natural resources;
d) the production of waste;
e) pollution and nuisances; and
f) the risk of accidents, having regard in particular to substances or technologies used.

Annex III Criteria include:

2. Location of project

The environmental sensitivity of geographical areas likely to be affected by projects, having regard in particular to:

a) the existing land use;
b) the relative abundance, quality and regenerative capacity of natural resources in the area; and
c) the absorption capacity of the natural environment, paying particular attention to the following areas:
    i. wetlands;
    ii. coastal zones;
    iii. mountain and forest areas;
    iv. nature reserves and parks;
    v. areas classified or protected under legislation (including European sites);
    vi. areas in which environmental quality standards laid down in a legislation of the Communities have already been exceeded;
    vii. densely populated areas; and

viii. landscapes of historical, cultural or archaeological significance.

3. The potential impact

The potential significant effects of projects, in relation to criteria set out under 2. Location of project, above, having regard in particular to:

a) the extent of the impact (geographical area and size of the affected population);
   i. the impact on other member States;
   ii. the magnitude and complexity of the impact;
   iii. the probability of the impact; and
   iv. the duration, frequency and reversibility of the impact.

7 POLICY CONTEXT

7.1 European and National Legislation and Policy

7.1.1 This section of the Scoping Report outlines the relevant legislative and policy framework with an overview of guidance and strategy documents. These documents are considered as part of the 'Legislative and Policy Context' chapter of the ES.

7.1.2 Consideration of European and national legislation is a requirement of the EIA regulations so that the Scheme can be seen in the policy context and any problems caused, conflicts created and benefits to be derived can be identified and understood. Design Manual for Roads and Bridges (DMRB) Volume 11 states that the ES should *'indicate briefly the degree to which transport and environmental policies, and related transport appraisals, Environmental Reports published in accordance with the requirements of the SEA Directive and the Overseeing Organisation, and other relevant policies would be supported by the project.'. The ES will refer to matters such as predicted economic benefits or safety improvements.*

7.1.3 Specific policy considerations and methods are further considered in relevant the sections and chapters covering the individual factors in the ES.

EIA Legislation

7.1.4 The EIA legislative framework in Wales originates from European Council Directive 85/337/EEC as amended by EC Directive 97/11/EC and the Public Participation Directive 2003/35/EC.

7.1.5 Then came the 2011 European Directive 2011/92/EU, and the most recent 2014 Directive (as amended) 2014/52/EU. These are known, collectively, as the EIA Directive. The Directive requires EIA to be undertaken in support of an application for development consent for certain types of scheme.

7.1.6 The most recent Directive (2014/52/EU) requires Member States to transpose its requirements into national law by 16 May 2017 and sets out arrangements for a transitional period from the regime laid down by Directive 2011/92/EU.

7.1.7 These transitional measures require that the provisions of Directive 2011/92/EU should apply to schemes for which the EIA process has been initiated within the transitional period.

7.1.8 For highways schemes, the requirements of the EIA Directive are currently transposed by the Highways Act 1980, as amended by The Highways (Assessment of Environmental Effects) Regulations 1999 and The Highways (Environmental Impact Assessment) Regulations 2007 and The EIA Regulations 2017.

7.1.9 The 2017 regulations come into effect on the 5 December 2017 and change the information that is required in the screening of Schedule 2 developments, and in what should be included in an ES. A minimum period for public consultation of 30 days has been included.

Environment (Wales) Act 2016

7.1.10 The Environment (Wales) Act primary purpose is as follows:

a) To promote sustainable management of natural resources
b) To require the Welsh Ministers to meet targets for reducing emissions of greenhouse gases from Wales.
c) To ensure Waste is processed separately and effectively.

Well-being of Future Generations (Wales) Act 2015

7.1.11 The Well-being of Future Generations Act requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities and each other, and to prevent persistent problems such as poverty, health inequalities and climate change.

Planning (Wales) Act 2015

7.1.12 The Planning (Wales) Act makes provision about sustainable development in the exercise of functions relating to development planning and applications for planning permission.

Active Travel Act, 2013

7.1.13 The Active Travel (Wales) Act requires local authorities in Wales to map and plan suitable routes for active travel, and to build and improve

their infrastructure for walking and cycling every year. It creates new duties for highways authorities to consider the needs of walkers and cyclists and make better provision for them. It also requires both the Welsh Government and local authorities to promote walking and cycling as a mode of transport so that local communities rely less on cars when making short journeys.

Planning Policy Wales

7.1.14 Planning Policy Wales (Edition 10 – December 2018) is intended to 'help ensure that the planning decisions taken in Wales, no matter how big or how small, are going to improve the lives of both our current and future generations. It will support changing the way we live and work, and the buildings and environment of Wales today, building a better environment to accommodate current and future needs'. Section 3.57 addresses the need for adequate and efficient infrastructure.

Green Corridors

7.1.15 In July 2018, the Minister introduced a new policy and announced a programme of work and activities to improve the landscape and environmental quality of the urban and rural transport network. The initiative is to deliver against the Economic Action Plan 'Prosperity for All'.

Technical Advice Notes

7.1.16 Welsh Government have prepared a number of Technical Advice Notes to provide guidance on specific technical considerations within the consenting process. These are referenced where applicable under the relevant factors within the ES and would include:

a) Technical Advice Note 5 Nature Conservation and Planning, 2009
b) Technical Advice Note 11 Noise, 1997
c) Technical Advice Note 18 Transport, 2007
d) Technical Advice Note 23 Economic Development, 2014

Wales Transport Strategy, 2008

7.1.17 Published by Welsh Assembly Government, the overarching aim of the Wales Transport Strategy is to promote sustainable transport networks that safeguard the environment while strengthening the country's

economic and social performance. The strategy has been prepared in the context of the One Wales Programme, which is a progressive agenda for Wales.

National Transport Finance Plan, 2015

7.1.18 Published by Welsh Government, the National Transport Finance Plan lists the schemes the Welsh Government plan deliver across the different areas of transport policy for which it is responsible. The Plan is not a policy document in itself but provides a framework of schemes pursuant to policy aims set out in the Wales Transport Strategy 2008. Improvements to the A40 are included within the Plan.

Trunk Road Forward Programme, 2002, 2004 and 2008

7.1.19 Published by Welsh Government, the Trunk Road Forward Programme seeks to improve the economic and social conditions in Wales, through increasing efficiency and accessibility in all areas. The Forward Programme indicated the Welsh Government's intentions for road schemes that were expected to cost £1m or more. The A40 St Clears to Haverfordwest was identified in the Forward Programme within the 'East – West (south) strategic corridor'.

7.2 Regional Policy

Joint Transport Plan for South West Wales 2015-2020

7.2.1 The Joint Transport Plan for South West Wales 2015-2020 is the culmination of collaborative working between Carmarthenshire County Council, Neath Port Talbot County Borough Council, Pembrokeshire County Council and the City and County of Swansea. This collaborative working is closely linked with wider initiatives under the Swansea Bay City Region concept. The plan provides the framework for improving connectivity to, from and within the region for the period 2015 – 2020.

South West Wales Tourism Strategy, 2004-2008

7.2.2 The South West Wales Tourism Strategy presents a plan to provide an inclusive and common focus along with a set of shared objectives which can help guide the future development and promotion of tourism throughout the region. A major component of supporting tourism within

the region is the improvement of the strategic highway network serving it.

7.3 Local Policy

Pembrokeshire County Council Local Development Plan, 2013

7.3.1 Pembrokeshire County Council Local Development Plan- 'Planning Pembrokeshire's Future' was adopted on 28 February 2013 and provides the framework for town and country planning decisions to be made up until 2021 on how land is used and developed. The development plan is amplified by supplementary planning guidance which is also referenced, where relevant, and includes: Biodiversity: How biodiversity can be protected and enhanced in the development process, 2014.

7.3.2 A review of this plan commenced in May 2017, and Pembrokeshire County Council is now working on a Replacement Local Development Plan for Pembrokeshire (LDP2 2021-2033). It is anticipated that this Plan will be adopted in 2021 and will run until 2033.

Pembrokeshire Coast National Park Local Development Plan, 2010

7.3.3 Pembrokeshire County Council Local Development Plan is the adopted Development Plan for the area. The Plan was adopted on 29 September 2010 and provides the framework for town and country planning decisions to be made up until 2021 on how land is used and developed.

Pembrokeshire Destination Management Plan, 2013-2018

7.3.4 Published in 2013, by Destination Pembrokeshire Partnership, the Pembrokeshire Destination Management Plan is designed to act as a development guide for all Pembrokeshire based organisations, businesses and employees in tourism related roles. The plan aims to improve the tourist offer in the region in order to stave off competition from elsewhere in the UK.

7.4 Habitat Regulations Assessment

7.4.1 The UK is bound by the terms of the EC Habitats Directive, EC Birds Directive and the Ramsar Convention. The aim of the Habitats Directive is to conserve natural habitats and wild species across Europe by establishing a network of sites known as Natura 2000 sites.

7.4.2 Under Article 6 (3) of the Habitats Directive, an 'Appropriate Assessment' is required where a plan or project is likely to have a significant effect upon a European site, either individually or in combination with other projects.

7.4.3 In preliminary consultations, it was identified that the Scheme could have significant effects in relation to Natura 2000 sites. Subsequently, as part of the ecological impacts, a separate document is prepared as part of the Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010 and in consultation with NRW. The Screening stage of this assessment would set out the potential effects of the scheme in the absence of any mitigation. This is in accordance with requirements established in case law[4].

7.4.4 The HRA would assess potential impacts of the Scheme on the relevant Natura 2000 sites and the need for an Appropriate Assessment is assessed during the EIA in consultation with the relevant statutory consultees.

[4] Case Law: People over Wind Decision: Court of Justice of the European Union(CJEU) 13th April 2018 Case C323/17 with regards to the Habitats Directive.

8 CONSULTATIONS

8.1 Previous consultations

8.1.1 The sequence of consultations is set out chronologically below.

8.1.2 Early studies for this Scheme began in 2006 and involved consultations with statutory consultees and the local community. The public consultation for these early studies took place in September 2006 and views were sought on the four different route options that had been developed. The results showed that there was support for improvements between Penblewin and Ffynnon, and for a bypass to Llanddewi Velfrey.

8.1.3 The consultations in 2006 included meetings to discuss the options with Pembrokeshire County Council, Carmarthenshire County Council, Countryside Council for Wales (Haverfordwest and Llandeilo), Environment Agency (now Natural Resources Wales (NRW)) and the Pembrokeshire Coast National Park. The purpose of these meetings was to discuss their requirements for any environmental assessment. An environmental scoping workshop was held during the consultations to enable the environmental team to present the scoping proposals.

8.1.4 Welsh Government decided to progress with the Scheme and appointed an design team in February 2017. NRW (now incorporating the Environment Agency Wales and Countryside Council for Wales) were consulted about this Scheme during early route selection stages of the A40 Llanddewi Velfrey improvements project in 2017.

8.1.5 The option to improve the Redstone to Penblewin scheme were taken to a Public Information Exhibition held in Llanddewi Velfrey Community Hall over two days in April 2017. The public were invited and over 170 people attended. The results showed that there was considerable interest in the proposal. The public were not invited to comment on a route for the Scheme.

8.1.6 A Public Information Exhibition (PIE) was held in April 2019 at which the three options shown in Appendix 1 were shown. A further PIE was held in May 2019 with an additional option presented to reflect public views expressed at the April meeting

8.1.7 A formal Public Consultation on the Preferred Route will be held later in 2019. The public and Statutory Consultees will be invited to make comment. These comments will be taken into consideration resulting in modifications to the design.

8.1.8 A programme of ELG meetings is planned and these will build on the established relationships created with the statutory consultees at previous meetings held between April 2017 and November 2018 for the A40 Llanddewi Velfrey Improvements. These were attended by the Natural Resources Wales (NRW), Cadw, Pembrokeshire County Council (PCC), South Wales Trunk Road Agency (SWTRA) and Welsh Government. The ELG were invited to attend the two public exhibitions held in April and October 2017. A key outcome of the first ELG meeting in April 2017 was the development of a set of project environmental objectives for the Llanddewi Velfrey project. The intention is to carry these objectives forward for the Redstone Scheme and invite the ELG to confirm or amend these as appropriate. The proposed objectives and those set out in Section 4.6.

8.1.9 A separate meeting with NRW to discuss protected species surveys was also held in November 2018 at which the NRW were invited to comment on the initial plans for the Redstone Scheme and to comment on the scope of further ecological surveys.

Future Consultations

8.1.10 Future ELG meetings will be held on a quarterly basis once progress on the Scheme has progressed towards detailed design and construction. Draft Orders and the Environmental Statement will be published in. early 2020.

9 CONTENT AND STRUCTURE OF ES

9.1 Contents

9.1.1 The content of the EIA will include environmental Factors in the list set out in Table 1. This range of Factors that were addressed as part of this scoping exercise are those factors set out in the Design Manual for Roads and Bridges (DMRB) Volume 11 published in 2008 and The EIA Regulations 2017 (collectively referred to hereafter as the EIA Regulations. The list below includes the subjects which are recommended in the guidance[5] as well as utilising previous experience, baseline studies and EIA best practice.

9.1.2 The 2017 EIA Regulations require an assessment to consider the following additional environmental Factors:

a) Biodiversity – with attention to species and habitats protected under the Birds and Habitats Directive;
b) Population and human health;
c) Land, soil, water, air and climate;
d) Material assets, cultural heritage and the landscapes;
e) Vulnerability of the Project to the risk of Major Accidents and/or Disasters which may cause environment effects;
f) Heat and Radiation;

9.1.3 The EIA will assess the potential significant impacts associated with the Scheme. The individual EIA subjects/Chapters and the proposed order are listed in Table 9.1.

9.1.4 Volume 1: Main text, will be supported by Volume 2: Figures and Volume 3: Technical Appendices (where appropriate). A Non-Technical Summary (NTS) will also be provided.

[5] Welsh Transport Planning and Appraisal Guidance - WelTAG - June 2008

Table 9.1 Factor that could be included in the ES

Chapter	Factor
1	Introduction
2	Scheme Description
3	Assessment of Alternatives
4	EIA Methodology
5	Legislation and Policy Context
6	Geology and Soils
7	Road Drainage and Water Environment
8	Nature Conservation (Biodiversity)
9	Landscape and Visual
10	Archaeology and Cultural Heritage
11	Community and Private Assets (excluding agriculture)
12	Community and Private Assets: Agricultural Assessment
13	Air Quality
14	Noise and Vibration
15	All Travellers
16	Materials
17	Population and Human Health
18	Climate Change
19	Heat and Radiation (Scoped out)
20	Risk of Major Accident and Disaster (Scoped out)
21	Cumulative Effects
22	Management of Environmental Effects
23	Conclusions

9.2 Proposed Structure of the environmental factor chapter

9.2.1 The sections below describe the proposed structure and content of the technical ES chapters, along with the proposed methodologies for defining proposed mitigation measures and assessing impacts.

Section #.1 – Subject introduction

9.2.2 Brief section stating the name of the organisations responsible for undertaking the impact assessment and the scope of the factor being considered.

9.2.3 To Include a list of figures and appendices.

Section #.2 – Relevant Guidance

9.2.4 A brief section outlining legislation, policy and guidance of relevance to the assessment. This will set a background for the methodology and is not part of the impact assessment.

Assumptions and gaps in information

9.2.5 This section will also state the relevant assumptions made in undertaking the assessment and/or identify if/where information gaps exist (if any).

Section #3 – Study Area

9.2.6 A description of how the study area has been derived

Section # 4 - Baseline Conditions

9.2.7 This section will include a factor-specific description of the existing environment which will provide the basis against which the impacts of the indicative development will be assessed. National or local policies will be referred to, where necessary or appropriate. This will include details of surveys undertaken and their scope.

Section #5 - Assessment Methodology

9.2.8 The purpose of an EIA is to identify and evaluate the environmental effects associated with the proposed development. These effects are assessed based on their magnitude (following mitigation) and the sensitivity of the receiving environment.

9.2.9 The determination of impact significance will be undertaken against the environmental baseline and be based on the significance matrix included.

Significance

9.2.10 Impact significance is based on a combination of the impact magnitude and sensitivity of receptor. There is no statutory definition of significance, but the guidance set out in DMRB Volume 11 Section 2

Determining Significance of Environmental Effects (2008) will be used.

9.2.11 The determination of significance will be based on best practice, which can be factor-specific, but will use the standard terms listed above. It is important that the ES chapter can justify the determined levels of impact significance. Therefore, it is recommended that the significance matrix from DMRB guidance is used (where appropriate) to ensure that it is clear to the reader how significance has been derived, based on the stated levels of impact magnitude and receptor sensitivity.

9.2.12 Table 9.2 includes descriptors of effects, for the environmental value of an environmental resource. These descriptors will be used throughout the EIA process, providing a uniform approach environmental value (sensitivity).

Table 9.2 Environmental Value (or Sensitivity) and typical descriptors

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

9.2.13 The outlined assessment methodology seeks to ensure that the following questions, where relevant, should be considered in evaluating the significance of potential effects:

g) Which receptors/resources would be affected and in what way?
h) Is the receptor/resource of a local, regional, national or international importance, sensitivity or value?
i) Does the effect occur over the long or short term; is it permanent or temporary and increase or decrease with time?
j) Is the change reversible or irreversible?
k) Are environmental and health standards (e.g., local air quality standards) being threatened?
l) Are feasible mitigating measures available?

9.2.14 For each factor, the likely environmental change arising from the

Scheme would be identified and compared with the baseline (the situation without the Scheme). Impacts are divided into those occurring during the construction and operation phases and the size, or magnitude of the impact assessed. As a general guide, the definitions set out in Table 2.2 of HA205/08 would been taken into account (except where factor guidance requires otherwise). This includes a five-point scale for assigning impact magnitude as shown in Table 9.3.

Table 9.3 The five-point scale for assigning impact magnitude

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

Based on Table 2.1 of HA205/08 (Highways et al., 2008e)

9.2.15 The DMRB Table 'Arriving at the Significance of Effect Category' is given in Table 9.4.

9.2.16 The following terms will also be used to aid the description of the impact:

Beneficial – positive impacts;

Adverse – negative impacts;

Short/Medium/Long Term – length of the impact;

Permanent – impact cannot be reversed;

Temporary – impact can be reversed;

Direct – are effects that are a direct result of the proposed development;

Indirect – are effects that may be 'knock-on' effects of direct effects.

Table 9.4 Arriving at the Significance of Effects Descriptors

		MAGNITUDE OF IMPACT (DEGREE OF CHANGE)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
ENVIRONMENTAL VALUE (SENSITIVITY)	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Section #6 – Assessment of Potential Effects

9.2.17 This section will identify where the Scheme has the potential to cause environmental effects associated with the proposed development.

Section #.7 - Mitigation measures

9.2.18 Mitigation is proposed where significant effects are identified, with the aim of avoiding, reducing, or compensating for potential adverse effects and maximising potential beneficial effects. The most effective form of mitigation measure

9.2.19 EIA is an iterative process that develops in parallel with the design so that the Scheme can, where feasible, be modified and adjusted to avoid, minimise and mitigate for environmental impacts. The proposals for the development are generally designed and updated to incorporate mitigation measures and their delivery is therefore, more certain. Measures to mitigate impacts associated with construction are normally based on accepted industry standards, resulting in a high degree of certainty over their delivery.

9.2.20 The approach is to present the mitigation measures in each technical chapter, prior to the assessment of impacts. The purpose of this is to

avoid the ES describing numerous potential impacts that have actually been designed out of the Scheme or will be avoided through standard construction measures. This reduces the length of the ES, avoids confusion and demonstrates the benefits of any mitigation.

9.2.21 Mitigation will generally be:

Standard mitigation measures – e.g. construction mitigation with a high degree of certainty over delivery i.e. measures to be included in a draft Construction Environmental Management Plan (CEMP);

Actionable mitigation measures - those that require a controlling mechanism or legal undertaking to be implemented but are under the control of the 'applicant' and therefore, have a good certainty over delivery; or,

Enhancement Measures – those that are over and above the requirements of mitigating the impacts. These will be proposed to support the purposes of the Active Travel Act.

9.2.22 Mitigation measures will be included in the Register of Environmental Actions and Commitments (REAC), which will be included in the ES as an appendix to Chapter 2, Scheme Description. The REAC is a record of matters that were agreed with consultees and other stakeholders where some specific action or mitigation is required during preconstruction, construction or operation of the road. The REAC also indicates who is responsible for the commitment and provides a reference to where, in the various documents that were produced, there is a record of what is required and is to be achieved.

9.2.23 Proposed mitigation that can be shown on a plan will be included on the Environmental Masterplan.

10 GEOLOGY AND SOILS

10.1 Introduction

10.1.1 This chapter will cover geology and soils, with emphasis on geological features, geomorphological features and land contamination. Potential impacts of the Scheme on groundwater due to the geology and soils are included. However, potential impacts on groundwater associated with drainage and discharge proposals are considered within Chapter 11 Road Drainage and the Water Environment. The effects on the agricultural resource of soils are considered within Chapter 15 Community and Private Assets. Waste and management of materials is considered in Chapter 17 Materials.

10.1.2 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

10.2 Relevant Guidance

Legislation

10.2.1 Geological sites of national importance are principally afforded protection under the Wildlife and Countryside Act 1981 (as amended) or the National Parks and Access to the Countryside Act 1949 by designation as SSSI or NNR. The Joint Nature Conservation Committee (JNCC) is a public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation. On the Defra website, the JNCC state that the aim of their Geological Conservation Review (GCR) for the selection of non-statutory designated Earth Science sites was:

> *"to identify the best, most representative, earth science sites in Great Britain, with a view to their long-term conservation. Geological Conservation Review (GCR) and Earth Science Conservation Review (ESCR) sites are non-statutory sites identified by the statutory nature conservation agencies as having national or international importance for earth science conservation on the basis of their geology, palaeontology, mineralogy or geomorphology. Although GCR/ESCR identification does not itself give any statutory protection, many GCR/ESCR sites have been notified as SSSIs/ASSIs"*

10.2.2 Environmental legislation implemented as either Acts or Regulations provide separate legislative drivers to manage contamination. The main legislative drivers for managing risks to human health and the environment from land contamination are:

a) Part IIA of the Environmental Protection Act (1990);

a) Contaminated Land (Wales) Regulations (2006 as amended in 2012);

b) Environment Act (1995); and

c) Environmental Permitting (England and Wales) Regulations (2016).

10.2.3 In Wales, Part IIA of the Environmental Protection Act, as introduced by Section 57 of the Environment Act 1995, came into effect in September 2001 with the implementation of the Contaminated Land Regulations 2000 (now superseded by The Contaminated Land (Wales) Regulations 2006/2012). Under Part IIA of the Environmental Protection Act, sites are identified as 'contaminated land' if they are causing, or if there is a significant possibility of causing significant harm to human health or significant pollution of controlled waters (as defined by Section 104 of the Water Resources Act 1991).

10.2.4 The Well-being of Future Generations (Wales) Act 2015[6] requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities and each other, and to prevent persistent problems such as poverty, health inequalities and climate change.

10.2.5 The Environment (Wales) Act 2016[7] sets out a framework for the sustainable management of natural resources together with an accompanying Natural Resources Policy Statement. In general terms, the legislation advocates the use of a risk assessment approach to the assessment of contamination and requirements for remediation. Additional key legislation and guidance that should be considered for any such assessment in relation to contamination and the water environment includes:

a) Water Resources Act 1991 as amended in Wales by the Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009;

[6] Well-being of Future Generations (Wales) Act 2015
[7] Environment (Wales) Act 2016

b) EU Water Framework Directive (WFD) 2000/60/EC (as amended in 2008);

c) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 which implements the Water Framework Directive (2000/60/EC);

d) The Water Framework Directive (Standards and Classification) Directions England and Wales 2015;

e) The Groundwater Regulations (England and Wales) 2009, which transpose the EC Groundwater Directive 80/68/EC into UK law;

f) Groundwater Daughter Directive (GWDD) (2006/118/EC);

g) Department for Environment Food and Rural Affairs (Defra) (2015), The Water Framework Directive (Standards & Classification) Directions (England and Wales); and

h) The Environmental Damage (Prevention and remediation) (Wales) (amendment) (EU exit) Regulations 2009.

National and Regional Policy

10.2.6 Planning Policy Wales[8] sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with Planning Policy Wales provide the national planning policy framework for Wales.

10.2.7 Planning Policy Wales puts emphasis on the delivery of sustainable development and improving the social, economic, environmental and cultural wellbeing of Wales, as required in particular by the Planning (Wales) Act 2015 and the Well-being of Future Generations (Wales) Act 2015.

10.2.8 The Planning (Wales) Act 2015[9] makes provision about sustainable development in the exercise of functions relating to development planning and applications for planning permission

Relevant Policies

10.2.9 Strategic Policy (SP) 1 Sustainable Development: Requires all development proposals to demonstrate how positive environmental impacts will be achieved and adverse impacts minimised.

[8] Planning Policy Wales, Edition 10, Welsh Government, December 2018
[9] Planning (Wales) Act 2015

10.2.10 SP6 Minerals: Mineral resources such as hard rock and sand and gravel will be maintained and where known to be present at outcrop locations these will be safeguarded from permanent development to ensure a continuous supply of minerals in support of local, regional and national development.

10.2.11 General Policy (GN) 1 General Development Policy: Development will be permitted on the condition that it would not cause or result in unacceptable harm to health and safety and would not have a significant adverse impact on water quality.

10.2.12 GN 22 Prior Extraction of the Mineral Resource: Consideration for extraction of safeguarded mineral resources from an area of a new permitted development should be made, wherever appropriate in terms of economic feasibility and environmental and other planning considerations prior to the commencement of the development. The Good Practice Guidance Note on LPD policy GN.22[10] provides a list of considerations, where no extraction of mineral resources would be required.

10.2.13 GN 23 Mineral Working: Proposals for mineral working and extensions of existing sites will be permitted where the demand cannot be met from secondary or recycled materials, or existing reserves, or there is provision for landscaping, groundwater protection, a beneficial after-use, restoration and/or post-closure management of the site.

Habitat Regulations Assessment

10.2.14 The UK is bound by the terms of the EC Habitats Directive, EC Birds Directive and the Ramsar Convention. The aim of the Habitats Directive is to conserve natural habitats and wild species across Europe by establishing a network of sites known as Natura 2000 sites.

10.2.15 Under Article 6 (3) of the Habitats Directive, an 'Appropriate Assessment' is required where a plan or project is likely to have a significant effect upon a European site, either individually or in combination with other projects. In preliminary consultations, it was identified that the scheme could have significant effects in relation to Natura 2000 sites. Subsequently, as part of the ecological impacts, a separate document would be prepared as part of the Assessment of the

[10] Good Practice Guidance Note. LPD policy GN. 22- prior extraction of the mineral resource, Pembrokeshire County Council

Implications on European Sites (AIES) under the Conservation of Habitats and Species Regulations 2017 (as amended) and in consultation with NRW. This shall be addressed as part of the Ecology and Nature Conservation chapter of the ES.

10.2.16 The geology and soils chapter shall include an assessment of the significance of potential effects on Natura 2000 receptors.

Published Guidance

10.2.17 The assessment will be undertaken with due consideration of the following guidance:

a) Geotechnics and Drainage, Earthworks, Managing Geotechnical Risks DMRB Volume 4, Section 1, Part 2 HD22/0811

b) Environmental Assessment, Environmental Assessment Techniques, DMRB Volume 11, Section 3, Part 11 Geology and Soils12

c) Model Procedures for the Management of Land Contamination (CLR11)13

d) Construction Industry Research and Information Association R132: A Guide for Safe Working on Contaminated Sites14

e) CIRIA SP73: Roles and Responsibility in Site Investigations15

f) BS5930: 2015: Code of Practice for Site Investigations including Amendment 2, issued16

g) BS10175:2011 + A1 2013: Code of Practice for Investigation of Potentially Contaminated Sites17

h) The Environment Agency's approach to groundwater protection 18

i) CIRIA 552: Contaminated Land Risk Assessment, A guide to good practice19

[11] Design Manual for Roads and Bridges, Volume 4, Section 1, Part 2, HD22/08, Highways Agency, Scottish Government, Welsh Assembly Government, Department for Regional Development Northern Ireland, 2008
[12] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 11: Geology and Soils, Highways Agency, 1993.
[13] Model Procedures for the Management of Land Contamination (CLR11), Environment Agency and Defra, 2004.
[14] A Guide for Safe Working on Contaminated Sites (R132), Construction Industry Research and Information Association (CIRIA), 1996.
[15] Roles and Responsibility in Site Investigations (SP73), Construction Industry Research and Information Association (CIRIA), 1991.
[16] BS5930:2015 Code of Practice for Site Investigations including Amendment 2, British Standards Institution, 2015.
[17] BS10175:2011+A2 2017 Investigation of Potentially Contaminated Sites, Code of Practice, British Standards Institution, 2017.
[18] The Environment Agency's approach to groundwater protection, Version 1.2. Environment Agency, 2018
[19] Contaminated Land Risk Assessment, A guide to good practice (C552), Construction Industry Research and Information Association (CIRIA), 2001

j) CIRIA 733: Asbestos in soil and made ground: a guide to understanding and managing risks20

k) Eurocode 7 (BS EN 1997-121 & EN 1997-222) and all relevant Normatives;

l) Natural Resources Wales (formerly Environment Agency Wales) Pollution Prevention Guidelines of relevance in relation to protection of soils and waters (note that a number of these PPGs have now been withdrawn and have been updated with published GPPs – Guidance for Pollution Prevention). Relevant PPGs and where available GPPs shall be considered.

10.3 Study Area

10.3.1 The study area for the geology and soils assessment will cover the construction land take and permanent land-take. The study area will include all potential contaminated land sites that intersect the Scheme and those sites that have plausible pollutant linkages that may be intercepted by the proposed alignment, typically within approximately 250m[23] of the route corridor, although potential pollutant linkages will be considered on a case by case basis.

10.3.2 The study area for geology shall be based along a corridor following the route, however geological and geomorphological features of relevance shall be considered outside of the route corridor where considered relevant.

10.4 Work Undertaken to Date

10.4.1 A Preliminary Sources Study has been undertaken for both the Northern and Southern Alignments[24,25]. The Annexes to these documents set out proposals for ground investigation to inform the geotechnical design and assessment of land contamination aspects of these parts of the scheme extension.

10.4.2 A ground investigation was undertaken as part of the Llanddewi

[20] Asbestos in soil and made ground: a guide to understanding and managing risks (C733), Construction Industry Research and Information Association (CIRIA), 2014
[21] BS EN 1997-1: 2004 and Amendment 1: 2013: Eurocode 7 Geotechnical Design. General Rules British Standards Institution, 2013.
[22] BS EN 1997-2: 2007 UK National Annex to Eurocode 7 Geotechnical Design. Ground Investigation and Testing, British Standards Institution, 2007.
[23] Guidance for the Safe Development of Housing on Land Affected by Contamination, RD66, EA, NHBC and CIEH, 2008
[24] A40 Llanddewi Velfrey to Penblewin Redstone Cross Improvements, Supplementary Preliminary Sources Study Report, A40LVP-ARP-HGT-J01-RP-C-001, P03, Arup December 2017
[25] A40 Penblewin to Redstone Cross Improvements, Supplementary Preliminary Sources Study Report RCE Northern Alignment, A40PRC-ARP-HGT-M02-RP-C-000, P01.1, April 2019

Velfrey to Penblewin roundabout section of the main A40 scheme. This is reported in the Ground Investigation Report for that part of the scheme[26]. The ground investigation does not extend along either of the alignments proposed for the Scheme.

10.4.3 At the time of writing, no ground investigations are known to have been undertaken in the immediate vicinity of either the Northern or Southern Route Options and no ground investigations have been carried out to-date specifically for these alignments.

10.4.4 Intrusive ground investigations are to be undertaken for the proposed alignments to inform the geotechnical design and enable contaminated land assessments to be undertaken. The ground investigations are proposed to be undertaken in accordance with the aims as set out in the Annexes to the PSSR reports and are to be completed in 2019.

10.5 Baseline Conditions

Northern Route

10.5.1 The 2019 PSSR provides an overview of the historical development and geology underlying the proposed Northern Alignment of the Scheme. An overview of the hydrological and hydrogeological setting of the Northern Alignment of the Scheme is also provided.

10.5.2 In addition to the PSSR, a review of a Landmark Envirocheck report[27] covering the scheme area and consultation of the Lle Welsh Government Data Portal[28] has been undertaken. No SSSIs, RIGs, geological exposures or other geomorphological features have been identified on the Northern Alignment.

10.5.3 The PSSR identifies that historically, the Northern Alignment of the Scheme has been used as agricultural land and there has been little development either on or off the proposed Northern Alignment since 1888. An unnamed road alignment corresponds to the existing A40 Alignment on historical maps.

10.5.4 An old quarry and reservoir are shown approximately 400m to the north of the existing alignment. Three springs are shown on the 1953 map

[26] A40 Llanddewi Velfrey to Penblewin Improvements, Ground Investigation Report, A40lvp-ARP-VGT-SWI-RP-C-001, Arup 2017
[27] Evirocheck Report, Site at St Clears / Sancler, Reference 358432, November 2015
[28] http://lle.gov.wale (Accessed in March 2019)

near the historical reservoir (which is not shown on plans post-dating 1971). A spring is also shown adjacent to the road alignment approximately 600m east of Redstone Cross. A marsh is shown on the 1961 map, approximately 250m north of Blackmoor Hill Farm.

10.5.5 The geological plans show that natural superficial deposits are largely absent from the Northern Alignment, and it is typically directly underlain by bedrock. A small area of glacial till is shown beneath the Northern Alignment some 300m east of Redstone Cross.

10.5.6 No artificial deposits are depicted on the geological plans, however there is potential for made ground to be encountered in areas of infilled land, including historical reservoirs, and made ground associated with the existing road infrastructure.

10.5.7 The bedrock is shown to predominantly comprise the Slade and Redhill Mudstone Formation. Beneath the glacial till, present to the east of Redstone Cross, bedrock comprises the Llandeilo Flags Formation and Mydrim Shales Formation. To the west of Redstone Cross bedrock comprises the Portfield Formation and Haverford Mudstone formation.

10.5.8 The proposed Northern Alignment is shown to cross over two faults, located some 250m and 850m west of Penblewin Roundabout. The dip of the underlying bedrock is shown to vary in both direction and dip angle which suggests the underlying bedrock is folded, as well as faulted across the Scheme area.

10.5.9 With respect to geomorphology, the Supplementary PSSR states:

"The topography of the area with valley features and watercourse, as well as the presence of glacial till indicates the area has been affected by glaciation"

10.5.10 The supplementary PSSR states that no main rivers are located on or near the proposed or existing alignment. No surface water features cross or lie on the Northern Alignment, however a number of small watercourses are noted to the south and north of the existing highway. Unnamed tertiary tributaries of the Longford Brook are located north of the proposed alignment with the closest within 50m of the proposed alignment. A tributary of Afon Marlais is also located approximately 120m to the south.

10.5.11 A well is located approximately 125m south of the proposed alignment near Blackmoor Hill Farm. Two ponds are also present 150m to the north-west of Redstone Cross junction.

10.5.12 The Northern Alignment of the Scheme is underlain by bedrock formations that are classified as Secondary B aquifers, except for the Llandeilo Flags Formation, which is designated a Secondary A aquifer. Glacial till is classed as unproductive stratum in terms of groundwater. No source protection zones are located within 1km of the Northern Alignment.

10.5.13 The Supplementary PSSR does not identify statutory or non-statutory designated sites in the vicinity of the Northern Alignment of the Scheme.

10.5.14 Two tumuli are noted immediately north of the present-day alignment of the A40. These are recorded as Scheduled Monuments. The proposed Northern Alignment runs approximately 100m to the north of these.

10.5.15 The PSSR identified two recorded BGS mineral sites near the Northern Alignment of the scheme. A sandstone site located some 450m to the north of Blackmoor Hill Farm, and a clay and shale site located 300m north of Redstone Cross Junction. Operation of these sites have ceased.

10.5.16 Potentially infilled land is noted approximately 60m and 250m north of the alignment and some 215m south of the Northern Alignment.

10.5.17 The Supplementary PSSR identifies limited sources of contamination on or in the vicinity of the Northern Alignment. Redstone Forge Garage was present near Redstone Cross Junction. Whilst now inactive, this is considered a potential source of contamination; particularly hydrocarbons. Agricultural land uses (accidental spillages of fuel, waste storage), use of the existing road infrastructure (accidental spillages of fuel) and potential made ground associated with the road infrastructure and/or agricultural use of land or infilled features are considered sources of contamination.

Southern Alignment

10.5.18 The 2017 Supplementary PSSR provides an overview of the historical development and geology underlying the proposed Southern Alignment of the Scheme. An overview of the hydrological and hydrogeological

setting of the Southern Alignment is also provided.

10.5.19 In addition to the PSSR, a review of a Landmark Envirocheck report[29] covering the scheme area and consultation of the Lle Welsh Government Data Portal[30] has been undertaken. No SSSIs, RIGs, geological exposures or other geomorphological features have been identified on the Southern Alignment.

10.5.20 The PSSR identifies that historically, the Southern Alignment of the Scheme has been used as agricultural land since the late 1880s. Several historical quarries are in the vicinity of the proposed Alignment with the nearest quarry, which has been reported to present as a pond, located just north of the proposed Southern Alignment. Several springs and wells are shown in the vicinity of the Southern Alignment, the nearest being a well to the immediate south of Redstone Cross junction (1888). A forge is shown at Redstone Cross junction on the 2006 plan.

10.5.21 The geological plans show the central part of the proposed Southern Alignment to be underlain by Glacial Till deposits, with the remainder of the alignment directly underlain by bedrock.

10.5.22 The Supplementary PSSR reports that

"No alluvial deposits are shown on the geological maps but these are likely to be present due to the watercourse crossing the proposed route.

Although the site appears relatively undeveloped apart from agricultural industry, there is the potential for Made Ground to be encountered. Particularly as there are numerous historic quarries in the local vicinity, some of which may have been infilled."

10.5.23 Made Ground associated with the existing road infrastructure is also anticipated.

10.5.24 The bedrock is shown to predominantly comprise the Slade and Redhill Mudstone Formation, and limestones of the Mydrim Shales Formation and Llandeilo Flags Formation. Mudstones of the Portfield Formation and Haverford Mudstone Formation (undifferentiated) are present at the western reaches of the proposed Southern Alignment.

10.5.25 The proposed Southern Alignment is shown to cross over two faults.

[29] Evirocheck Report, Site at St Clears / Sancler, Reference 358432, November 2015
[30] http://lle.gov.wale (Accessed in March 2019)

The dip of the underlying bedrock is shown to vary considerably in both direction and dip angle which suggests the underlying bedrock is folded, as well as faulted across the Scheme area.

10.5.26 With respect to geomorphology, the PSSR states:

> *"The topography of the area with valley features and watercourses, as well as presence of glacial till indicates the area has been affected by glaciation."*

10.5.27 The Supplementary PSSR identifies five watercourses ('tertiary rivers') within 100m of the proposed Southern Alignment, one of these (a tributary of the Afon Marlais) cross the proposed Southern Alignment. A tributary of the Narbeth Brook is shown to cross the Southern Alignment on OS maps; however this water course was not observed during the walkover of the Alignment. Historical maps also identify several springs in the vicinity of the Scheme. A well (1888) and two ponds are located in close proximity to the Southern Alignment, with numerous other ponds in the wider vicinity of the scheme. The Supplementary PSSR reports, "*the presence of ponds highlights the potential for unknown historic quarrying and other extractive industries in the immediate vicinity which have since been infilled*."

10.5.28 The Southern Alignment is underlain by Secondary B aquifers, except for the Llandeilo Flags Formation, which is designated a Secondary A aquifer. Glacial till is shown to be an unproductive stratum in terms of groundwater. No source protection zones are located within 1km of the Southern Alignment of the Scheme.

10.5.29 The Supplementary PSSR does not identify statutory or non-statutory designated sites in the vicinity of the Southern Alignment.

10.5.30 The PSSR identified two recorded BGS mineral sites near the Northern Alignment of the scheme. A sandstone site located some 450m to the north of Blackmoor Hill Farm, and a clay and shale site located 300m north of Redstone Cross Junction. Operation of these sites have ceased.

10.5.31 Potentially infilled land is noted approximately 60m and 250m north of the alignment and some 215m south of the Northern Alignment.

10.5.32 The Supplementary PSSR identifies limited sources of contamination on or in the vicinity of the Northern Alignment. Redstone Forge Garage was present near Redstone Cross Junction. Whilst now inactive, this is

considered a potential source of contamination; particularly hydrocarbons. Agricultural land uses (accidental spillages of fuel, waste storage), use of the existing road infrastructure (accidental spillages of fuel) and potential made ground associated with the road infrastructure and/or agricultural use of land or infilled features are considered sources of contamination.

10.5.33 Two tumuli are present immediately north of the present-day alignment of the A40. These are recorded as Scheduled Monuments. The proposed Southern Alignment runs to the south of the present day alignment and therefore these features shall not be disturbed by the works.

10.6 Proposed Scope of Baseline Studies

10.6.1 Existing and proposed ground investigation information shall be reviewed from the following sources:

a) The British Geological Survey borehole records database.

b) Factual reports prepared following completion of the proposed ground investigation for the Scheme alignment.

c) The Welsh Assembly Geotechnical Data Management System.

d) Consultation with statutory bodies and agencies (NRW and Pembrokeshire County Council Pollution Control team) including information on designated contaminated land sites, private water supplies and local authority managed historical landfill sites.

e) Recorded contaminated land, pollution incidents and areas of landfill will be reviewed from NRW data contained within the Landmark Envirocheck report for the main A40 scheme.

f) Assessment of soil resources is not proposed as part of this chapter; refer to Section 14 Community and Private Assets for further details.

Identification of Sensitive Receptors

10.6.2 Sensitive receptors will be identified based on the review of the information, as detailed above. Receptors relevant to this topic area may include:

a) Areas of designated geological or geomorphological interest (including RIGS, SSSIs, and Local Nature Reserves);

b) Soils;

c) Sensitive human receptors;

d) Controlled waters such as surface and groundwater that may be affected by the release or migration of contaminants; and

e) Ecological receptors that may be affected by the release or migration of contaminants.

10.6.3 Identification of receptors and consideration of their sensitivity will be undertaken in accordance with the DMRB Volume 11, Section 3, Part 11[31] and Volume 11, Section 2, Part 5[32]. The assessment in relation to potentially contaminated land will be in accordance with the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination[33].

Issues Proposed to be Scoped Out

10.6.4 It is proposed that those contaminated land sites identified as being fully outside the study area will be scoped out of requiring further assessment.

10.7 Methodology for Assessment of Effects

10.7.1 A detailed assessment is to be undertaken. The assessment will include consideration of possible effects on the geology and geomorphology, including mineral resources beneath the proposed route of the Scheme. The assessment will also consider general effects posed by potential contaminated land along the proposed route.

10.7.2 A detailed review of available maps, plans and observations from the walkover of the scheme area shall be undertaken, in addition to review of ground conditions encountered during the ground investigation. This will identify geological and geomorphological features. The features shall be assessed in accordance with their sensitivity and the magnitude of impact that the scheme shall have on them. This will be used to assess the significance of the effect, as set out in HA 205/08[34].

10.7.3 From review of the data to be obtained through the proposed ground investigations and other desk based sources, the extent of potentially contaminated land will be inferred. As part of the contamination assessment, conceptual site models (CSMs) shall be prepared for

[31] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 11: Geology and Soils, Highways Agency, 1993.
[32] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5, HA205/08, Highways Agency, 2008.
[33] Model Procedures for the Management of Land Contamination (CLR11), Environment Agency and Defra, 2004.
[34] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5, HA205/08, Highways Agency, 2008.

locations identified as potentially contaminated. These shall be developed in accordance with the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination. Assessments will be carried out for potential effects during both the construction and operation phases. The conceptual site models will be used to establish the risks posed by each location and the need or otherwise for further assessment. The need for further focused assessment will be considered where existing or suspected contaminated land may have an effect, i.e. by creating or altering pollutant linkages between sources of potential contaminants and sensitive receptors such as humans, ecological receptors, surface water and groundwater bodies.

10.7.4 Assessment of effects in relation to contamination will be undertaken in accordance with industry best practice, comprising CLR11 and CIRIA 552. The process comprises a tiered approach which starts with a simple preliminary risk assessment identifying plausible pollutant linkages (Source-Pathway-Receptor) followed by, should potential risks be identified, a generic quantitative risk assessment (Tier 2). Should unacceptable risks be identified and in accordance with the guidance, a Detailed Quantitative Risk Assessment (DQRA) shall then be carried out (Tier 3). Consideration shall be given to whether risks may be presented to human health and/or the environment (including surface water and groundwater) in both the construction and operational phases of the Scheme. This shall be determined on a location specific basis as part of the environmental impact assessment.

10.7.5 Where pollutant linkages dictate, additional assessments will be prepared as necessary, including remedial options appraisals and piling risk assessments (if required).

10.7.6 Potential interrelationships exist between the ES chapters concerned with materials, drainage and water environment, air quality (dust), ecology, landscape and cultural heritage. The assessment of effects will take into account these interrelationships. However, the principal effects specific to these topic areas will be assessed within the relevant chapters, even where the effects are on or from geology and land contamination.

10.8 Assessment of Potential Effects

10.8.1 The overall assessment of the environmental effects on geology and

soils for the Scheme will be carried out in accordance with the guidance set out in DMRB Volume 11, Section 3, Part 11[35], whilst the detailed assessment on the magnitude of impacts and significance criteria for effects will be undertaken using the methodology outlined in DMRB Volume 11, Section 2, Part 5[36].

Geology and Geomorphology

10.8.2 No protected areas with respect to geology or geomorphology have been identified within the study area. Rock exposures as a result of cuttings in the eastern part of the Southern Alignment and cuttings in the western area of the Northern Alignment may have beneficial effects of geological interest.

10.8.3 The introduction of the Scheme would limit access to the mineral resources identified beneath the proposed alignments. An embankment is proposed in the west of the Southern Alignment, and therefore this will prevent future access to the underlying rock, which is considered a mineral resource at the western extremity of the Southern Alignment. The proposed cutting in the west of the Northern Alignment would result in removal and effective use of mineral resources, in line with the LPD requirements[37] .

Land Contamination

10.8.4 The published geology does not indicate the presence of made ground beneath either alignment, however, a review of the current land use and historical development indicates there is potential for localised areas of made ground within both proposed extension alignments. These would primarily be associated with the existing road infrastructure, agricultural activities, and/or historical infilled quarries and gravel pits (present at various locations along and in the vicinity of both extension alignments). Made ground materials are possible sources of contamination.

10.8.5 The potential effects with respect to human health and controlled waters would be assessed based on the results of the proposed ground investigation(s) and the significance of the effect of the scheme

[35] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 11: Geology and Soils, Highways Agency, 1993.
[36] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5, HA205/08, Highways Agency, 2008.
[37] Local Development Plan. Planning Pembrokeshire's Future (up to 2021), Pembrokeshire County Council, Adopted 28th February 2013.

determined. No significant contamination is however anticipated.

10.9 Mitigation Measures

10.9.1 The design is being progressed on the basis that all soils would be retained on site for reuse where feasible. Measures would be taken to establish acceptable reuse criteria and procedures defined for ensuring that the suitability of material can be demonstrated and verified. A discovery strategy would be developed to enable unforeseen ground conditions to be addressed if or when encountered during construction. Inter-relationships with the Materials chapter relating to soil reuse will be considered.

10.9.2 No negative effects with respect to geology and geomorphology are currently anticipated and therefore no mitigation measures are expected to be required at this stage.

10.9.3 Subject to the assessments, typical good pollution control and health and safety practice is likely to be sufficient to mitigate any potential effects from the presence of made ground during construction. Should any areas of contamination be identified and the significance of effect require mitigation, this would be undertaken through completion of a remediation strategy and verification plan specific to the pollutant linkages identified.

10.9.4 The reuse of site won or import of materials to the Scheme will be managed by a verification system applied through the Specification for Highway Earthworks Series 600. Only materials found suitable for use would be used for construction. Suitability for use would be assessed based on potential risk posed to identified receptors (i.e. end users and controlled waters) during construction and operation.

11 ROAD DRAINAGE AND WATER ENVIRONMENT

11.1 Introduction

11.1.1 The section describes and characterises the existing surface and ground water resources in the proximity of the Scheme. It sets out the methodology to be used by Arup for the assessment of potential impacts to surface waters, groundwater and flood risk due to the Scheme during the construction and operational phases.

11.1.2 The assessment methodology follows the guidance set out in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10: HD 45/09 Road Drainage and the Water Environment (November 2009), subsequently referred to in the report as HD 45/09.

11.1.3 Potential impacts on groundwater due to the mobilisation of existing pollutants are considered within Chapter 9 Geology and Soils of this Scoping Report. Potential impacts to protected species or habitats that are reliant on the water environment are considered within Chapter 11 Ecology and Nature Conservation of this Scoping Report.

11.1.4 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

11.2 Relevant Guidance

European Legislation

11.2.1 **Water Framework Directive (WFD) 2000/60/EC**: provides a framework for integrated management of inland surface waters and groundwater, and to achieve long-term protection of water resources. The Directive requires all inland, estuarine and coastal waters to reach 'good' status by 2015.

11.2.2 **Groundwater Daughter Directive 2006/118/EC**: a daughter directive of the WFD, it establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater.

11.2.3 **Floods Directive 2007/60/EC**: requires Member States to identify

areas at risk of fluvial/coastal flooding, draw up flood risk maps and establish flood risk management plans focused on prevention, protection and preparedness.

11.2.4 **Urban Wastewater Treatment Directive 91/271/EEC (as amended) (UWWT Directive (consolidated)):** concerns the collection, treatment and discharge of urban waste water and certain industrial sectors.

National Legislation

11.2.5 **Environmental Protection Act 1990**: makes provision to control pollution arising from industrial and other processes for waste management.

11.2.6 **Water Industry Act 1991**: relates to water supply and the provision of wastewater services in England and Wales.

11.2.7 **Land Drainage Act 1991 (as amended**): requires that a watercourse be maintained by its owner. The Act provides functions to internal drainage boards and local authorities to manage watercourses and provide consenting powers for proposed works to watercourses associated with development.

11.2.8 **Water Resources Act (England and Wales) 1991 (Amended 2009):** sets out the responsibilities of Natural Resources Wales (NRW) and the Environment Agency (EA) in relation to water pollution, resource management, flood defence, fisheries, and navigation.

11.2.9 **Environment Act 1995**: sets new standards for environmental management, such as requiring national strategies for air quality and waste. It also deals with the establishment of an Environment Agency (including Natural Resources Wales and the Scottish Environmental Protection Agency).

11.2.10 **Water Act 2003:** amends the Water Resources Act 1991 and the Water Industry Act 1991 to make provision with respect to compensation under Section 61 of the Water Resources Act 1991.

11.2.11 **Water Resources (Abstraction and Impounding) Regulations SI 2006/641**: contain provisions relating to the licensing of abstraction and impounding of water in England and Wales.

11.2.12 **Flood Risk Regulations 2009:** transposes the EC Floods Directive (2008/60/EC) into domestic law in England and Wales. The regulations designate a Local Lead Flood Authority (LLFA) and imposes duties on NRW and LLFAs to prepare preliminary flood risk assessments, flood risk maps and flood risk management plans.

11.2.13 **Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009:** are based on the 'polluter pays' principle and impose obligations on operators of economic activities requiring them to prevent, limit or remediate environmental damage. They apply to damage to protected species, natural habitats, sites of special scientific interest (SSSIs), water and land and implement Directive 2004/35/EC, on environmental liability.

11.2.14 **The Groundwater (England and Wales) Regulations 2009:** implement parts of the WFD that apply to groundwater (such as the Groundwater Directive). They supplement the Environmental Permitting Regulations 2010 and existing water pollution legislation.

11.2.15 **Flood and Water Management Act 2010:** makes provision for the management of risks in connection with flooding and coastal erosion.

11.2.16 **The Water Framework Directive (Standards and Classification) Directions England and Wales 2015**: presents the environmental standards to be used in the river basin management planning process.

11.2.17 **Well-being of Future Generations (Wales) Act 2015**: strengthens existing governance arrangements for improving the social, economic, environmental and cultural well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. The Act ensures that when making decisions public bodies take into account the impact they could have on people living in Wales in the future.

11.2.18 **The Groundwater (Water Framework Directive) (Wales) Direction 2016:** this sets out instructions to NRW on obligations to protect groundwater, including requirements to monitor and set thresholds for pollutants, add new pollutants to the monitoring list and the information reported to the European Commission.

11.2.19 **The Environmental Permitting Regulations 2016**: amend the Environmental Permitting (England and Wales) Regulations SI

2010/675 in order to extend the requirement for an environmental permit to flood risk activities in addition to polluting activities included under the previous regulations. The new permitting requirements for flood risk activities replaces the current "flood defence consent scheme", allowing NRW to concentrate on higher risk activities.

11.2.20 **Environment (Wales) Act 2016:** puts in place the legislation needed to plan and manage Wales' natural resources in a more proactive, sustainable and joined-up way. The Act clarifies the law relating to shell fisheries, marine licencing, flood risk management and land drainage in Wales.

11.2.21 **Water Environment (Water Framework Directive) (England and Wales) Regulations 2017**: transposes the Water Framework Directive (2000/60/EC) into domestic law in England and Wales.

11.2.22 **The Water Abstraction and Impounding (Exemptions) Regulations 2017:** specify enactments in the Water Resources Act 1991 so that nothing in those provisions can prevent the grant of an abstraction licence. They provide for some further exemptions from the licensing restrictions.

11.2.23 **The Water Supply (Water Quality) Regulations 2018:** provide the framework for public drinking water quality provided by water companies and licensed water suppliers. The Drinking Water Inspectorate, acting on behalf of the Secretary of State, enforces the legislation.

National Planning Policy

11.2.24 **The Wales Spatial Plan (WSP)** sets out the planning agenda for Wales at the spatial level. Its main principle is that development should be sustainable and protect water resources and manage flood risk.

11.2.25 **Planning Policy Wales Edition 10 (December 2018):** sets out the land use planning policies of the Welsh Government. It outlines design approaches and techniques that improve water efficiency and minimise adverse impacts on water resources, surface water quality, the ecology of rivers and groundwater. It also ensures that new development is not exposed unnecessarily to flooding.

11.2.26 **Technical Advice Note (TAN) 5: Nature Conservation and Planning (2009):** gives advice as to the consideration of impacts on

designated sites in relation to the water environment.

11.2.27 **Technical Advice Note (TAN) 15: Development and Flood Risk (2004):** provides technical guidance in relation to development and flooding. It advises on development and flood risk and provides a framework for the assessment of flooding.

11.2.28 **Welsh Government: Taking Wales Forward 2016-2021**: sets out the priorities of Welsh Government. It includes priorities relating to reductions in carbon emissions, delivering improvements to trunk roads and investment in flood defence / water management.

Regional Management Plans

11.2.29 **Western Wales River Basin Management Plan (RBMP) 2015:** a plan, managed by NRW, which sets out the programme of measures needed to achieve the objectives of the WFD over the next six year period (2015-2021).

11.2.30 **Western Wales Flood Risk Management Plan (FRMP) 2015**: gives an overview of the flood risk in the Western Wales River Basin District and sets out intended priorities to manage and reduce flood risk over the next 6 year and beyond.

Local Planning Policy

11.2.31 **Pembrokeshire Local Development Plan (LDP) 2013-2021**: the following policies are considered relevant as part of this assessment:

GN1 General Development Policy, Point 8;

GN2 Sustainable Design, Point 3;

GN3 Infrastructure and New Development;

GN23 Minerals Working, Point 4; and

GN24 Recycled Waste Materials and Secondary Aggregates, Point 5.

11.2.32 **Pembrokeshire Local Flood Risk Management Strategy 2012**: as the lead local flood authority (LLFA), Pembrokeshire County Council have responsibility for 'local flood risks', which includes the risk of flooding from ordinary watercourses, surface runoff and groundwater. The Council have published a draft Flood Risk Management Strategy that

details responsibilities, measures, objectives and assessments of flood risk.

Relevant Guidance

11.2.33 A review plan for the Environment Agency's Pollution Prevention Guidelines (PPGs) is currently underway, replacing them with a guidance series Guidance for Pollution Prevention (GPPs). These will provide environmental regulatory guidance directly to Wales. Where PPGs have not yet been replaced, they are are still promoted as best practice in order to minimise pollution impacts during construction. The relevant PPGs and GPPs include:

a) PPG 1: Understanding your environmental responsibilities – good environmental practices;

a) GPP 2: Above ground oil storage tanks;

b) PPG 3: Use and design of oil separators in surface water drainage systems;

c) GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;

d) GPP 5: Works and maintenance in or near water;

e) PPG 6: Working at construction and demolition sites;

f) PPG 7: Safe storage – The safe operation of refuelling facilities;

g) GPP 8: Safe storage and disposal of used oils;

h) GPP 13: Vehicle washing and cleaning;

i) PPG 18: Managing fire water and major spillages;

j) GPP 21: Pollution incident response planning;

k) GPP 22: Dealing with spills; and

l) GPP 26: Safe storage – drums and intermediate bulk containers.

11.2.34 CIRIA Guidance used for the assessment includes:

Control of Water Pollution from Construction Sites – Guide to Good Practice (SP156);

Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (C532);

Control of Water Pollution from Linear Construction Projects – Technical Guidance (C648); and

Environmental good practice on site (C692);

Groundwater control: design and practice (second edition) (C750);

The SuDS Manual (C753).

11.3 Study Area

11.3.1 The study area for the assessment will include the geographical extent of the full scope of the works, all surface and groundwater bodies within 500m and high-value water bodies over 500m, up to the point of potential effect from the Scheme. The furthest extent of the study area will be limited to the point on a receiving watercourse or groundwater body whereby the significance of the effect of any potential impact is deemed to be neutral.

11.3.2 The 500m buffer has been selected based on professional judgement of the potential impacts posed by the Scheme. It is in line with study areas for assessments of the impact on the water environment undertaken for other highway construction projects. Water bodies outside the 500m buffer will be identified during the assessment, based on professional judgement of their value and connectivity to the Scheme area.

11.4 Work Undertaken to Date

11.4.1 This scoping report has been informed by:

a) A desktop survey of freely available mapping, aerial imagery and water environment data; and

b) A site walkover on 29th & 30th June 2017 by a geomorphologist and water quality professional.

11.5 Baseline Conditions

11.5.1 The initial baseline information included in the following sections has been gathered by a combination of desk-based study and a walkover survey of the study area as defined above. As part of the development of the Environmental Statement, this initial baseline will be supplemented with additional information during the general design of the Scheme and consultation with relevant bodies.

Surface Water

11.5.2 A desk study of freely available mapping and aerial imagery has

identified the following surface water features in the study area:

a) Two unnamed tributaries of Longford Brook are within the 500 m study area and the catchment is at its closest 50 m from the southern Scheme and parts of the northern Scheme are within the catchment, to the north of Blackmoor Hill .

b) The Afon Marlais and a number of its unnamed tributaries are within 500 m of the study area. The Afon Marlais itself is at its closest 80m from the Scheme's western edge, whilst one of its tributaries would be crossed by the Southern route. The catchment is parallel to the southern boundary of the existing route of the A40.

c) A tributary of Narbeth Brook, which, although not evident during the site visit, is shown on OS mapping to rise 20m south of the existing A40 at Redstone Farm and would cross the Scheme.

d) Eight ponds at grid references SN11031 16205, SN11030 16002, SN11466 16002, SN11466 15978, SN10537 16322, SN10498 16380, SN10536 16321 and SN12166 17054 are within 500 m of the Scheme.

e) Springs at multiple locations. As the proposed route spans the watershed between multiple catchments, the watercourses described above arise across the study area, with the majority indicated on OS mapping as being spring-fed.

11.5.3 There are no gauging stations present on the watercourses in the vicinity of the Scheme. Therefore, flow data for these watercourses is not available from the National River Flow Archive[38] or the NRW river levels website[39].

Groundwater

11.5.4 The bedrock underlying the Scheme is classified as a Secondary A and B aquifer and with superficial deposits; where present in the valley bottoms[40], classed as unproductive strata. The bedrock and superficial aquifers are designated as being of high vulnerability to groundwater pollution due to their high-leaching soils being able to easily transmit pollution[41].

11.5.5 There are no Source Protection Zones within the study area.

[38] National River Flow Archive. Accessed at: www.nrfa.ceh.ac.uk on 21st February 2019.
[39] Natural Resources Wales: River Level Map. Accessed at: https://naturalresources.wales/riverlevels?lang=en on 21st February 2019.
[40] BGS GeoIndex Onshore Aquifer Designation Wales map. Accessed at http://mapapps2.bgs.ac.uk/geoindex/home.html on 21st February 2019.
[41] BGS GeoIndex Onshore Groundwater Vulnerability Wales map. Accessed at http://mapapps2.bgs.ac.uk/geoindex/home.html on 21st February 2019.

11.5.6 Potential users (receptors) of groundwater in the study area are:

a) A well at Pant-y-gorphwys approximately 450 m south of proposed route;
b) A well close to Bryn Hill approximately 500 m north of proposed route;
c) A well to the south of Redstone Farm, marked on OS mapping, to the south of the existing A40; and
d) A well at Caermaenau Fawr, approximately 350m to the north of the western end of the Scheme.

Water Framework Directive

11.5.7 The study area includes three WFD surface water bodies and two WFD groundwater bodies. These are:

a) Longford Brook – HW to confluence with E. Cleddau river water body;
b) Marlais – headwaters to confluence with Taf river water body;
c) Narbeth Brook - headwaters to conf with E. Cleddau river water body;
d) Tywi, Taf and Gwendraeths groundwater body; and
e) Cleddau and Pembrokeshire groundwater body.

11.5.8 The current status, failing elements and reasons for failure of each of these WFD water bodies is summarised in Table 11.1 (surface water) and Table 11.2 (groundwaters)[42].

11.5.9 The Cleddau Rivers SAC is approximately 1.1 km at its closest point to the north of the Scheme. The Longford Brook and Narberth Brook both flow into the Cleddau River SAC. The SAC is approximately 1.8 km downstream of where the Scheme crosses a tributary of the Narberth Brook and 2.5 km downstream of the source of the Longford Brook tributary, to the north of the scheme. The SAC is designated due to the presence of Bullhead, River Lamprey, Brook Lamprey, Otter and Sea Lamprey, along with rare habitats including rivers with floating vegetation often dominated by water-crowfoot, active raised bogs and alder woodlands on floodplains. Potential impacts to the site and associated ecology will be addressed in the nature conservation chapter of the Environmental Statement and the Assessment of the Implications

[42] Natural Resources Wales. 2018 Cycle 2 Interim Classification Data. Available at: http://waterwatchwales.naturalresourceswales.gov.uk/en/

on European Sites (AIES).

Table 11.1 A breakdown of the status of WFD river water bodies potentially affected by the Scheme

WFD Waterbody	Taf -Felin Cwrt to Gronw	Marlais - headwaters to confluence with Taf	Narbeth Brook - headwaters to conf with E. Cleddau
ID	GB110060036283	GB110060029240	GB110061030660
Longford Brook - HW to conf with E. Cleddau	Marlais - headwaters to confluence with Taf	No	No
GB110061030680	GB110060029240	Moderate	Good
No	No	NA	NA
Moderate	Good	Moderate	Good
Good by 2021	NA	Good	Good
Moderate	Good	Ammonia (Phys-Chem)	NA
Good	Good	Unknown	NA
NA	NA		
Fish	NA		

Table 11.2 A breakdown of the status of WFD groundwater bodies potentially affected by the Scheme

WFD Waterbody	Tywi, Taf and Gwendraeths	Cleddau and Pembrokeshire
ID	GB41002G200500	GB41002G200400
HMWB/AWB	No	No
Overall Status	Poor	Poor
Objective	Poor by 2015	Good by 2021
Chemical Status	Poor	Poor
Quantitative Status	Good	Good
Driver of failure to achieve Good status	Chemical Dependent Surface Water Body Status	Chemical GWDTEs test
Reason for not achieving Good status	Point source pollution from abandoned mines.	Unknown

Flood Risk

11.5.10 The route of the Scheme is classified as not presenting a risk of flooding from rivers and sea, based on NRW's flood map viewer[43].

[43] NRW Risk of Flooding from Rivers & Sea Map. Accessed at https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en on 21st February 2019.

11.5.11 Limited areas in the vicinity of watercourse (Afon Marlais tributary) crossing the Scheme are classified as have a low to high surface water flood risk[44], whereas the crossing of the Narberth Brook tributary has a low to medium flood risk. A low risk of surface water flooding equates to a chance of flooding of between 1 in 1000 and 1 in 100 years, whilst a medium risk equates to a chance of between 1 in 100 and 1 in 30 years. High means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%).

11.5.12 The Western Wales Flood Risk Management Plan and Pembrokeshire County Council's Flood Risk Management Strategy do not indicate any measures to reduce flood risk in the study area.

11.6 Proposed Scope of Baseline Studies

Identification of Baseline

11.6.1 The road drainage and water environment baseline data for the study area will be obtained from a combination of desktop study, walkover survey, a groundwater levels survey and consultation with relevant bodies.

11.6.2 As part of the development of the full environmental statement chapter, additional information will be obtained from:

a) Groundwater monitoring reports; and

b) Consultation with relevant bodies, including Natural Resources Wales and Pembrokeshire County Council.

11.6.3 Ground investigation will be undertaken as part of the scheme design. This will include soakaway testing at proposed attenuation pond locations, spot surface water sampling at proposed discharge points and groundwater level monitoring, sampling and analyses along the route. The results of these investigations will inform the assessment of impacts.

11.6.4 The baseline will describe the existing condition of surface and groundwater bodies, flood risk and road drainage layout within the study area. The importance or sensitivity to change will be considered for each water feature. Table 11.3 sets out the attribute for each water feature considered in defining the baseline. This has been adapted from HD 45/09 to also take account of WFD attributes.

[44] NRW Surface Water Flood Risk Map. Accessed at https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en on 21st February 2019.

Table 11.3 Surface water features, their attributes and indicators of quality (adapted from HD 45/09)

Feature	Attribute/ Service	Indicator of quality	Possible measure
Watercourse	Water Supply/quality	Amount used for water supply (potable); Amount used for water supply (industrial/agricultural); Chemical water quality.	Location and number of abstraction points; Volume abstracted daily; Physio-chemical quality elements of WFD ecological status; Supporting hydrological regime element of WFD ecological status.
	Dilution and removal of waste products	Presence of surface water discharges and effluent discharges.	Daily volume of discharge (treated/untreated)
	Recreation	Access to watercourse; Use of watercourse for recreation.	Length of watercourse used for recreation (fishing, water sports) and number of clubs
	Biodiversity	Biological water quality	WFD ecological status class
		Fisheries quality	Fish Status; Supporting hydromorphological element of WFD ecological status, includes geomorphology
	Value to economy	Value of use of watercourse	Length of watercourse used for recreation commercially; Number of people employed; Length of river bank developed; Length of watercourse fished commercially.
	Conveyance of flow	Presence of watercourses	Number and size of watercourses
Floodplain	Conveyance of flood flows	Presence of floodplain; Flood flows.	Developed area within extent of floodplain affected; Existing flood risk/flood return period; Location/importance of flood flow routes.
Groundwater	Water Supply/quality	Amount used for water supply (potable); Amount used for water supply (industrial/agricultural).	Location and number of abstraction points; Volume abstracted daily; Location and grade of source protection zone; WFD groundwater quantitative chemical status.
	Soakaway	Presence of soakaways or other discharges to the ground.	Location and number of discharge points; and daily volume discharged.
	Vulnerability	Groundwater vulnerability.	Classification of aquifer vulnerability.

Feature	Attribute/ Service	Indicator of quality	Possible measure
	Economic value	Extent of use for abstractions.	Number of people employed.
	Conveyance of flow	Presence of groundwater supported watercourses; Potential for groundwater flooding; Groundwater interception by road structures or drainage.	Changes to groundwater recharge, levels or flows; Number and size of watercourses.
	Biodiversity	Presence of groundwater supported wetlands.	Changes to groundwater recharge, levels or flows; Status or classification of wetland.

11.7 Assessment Methodology

11.7.1 The assessment will be undertaken in accordance with DMRB guidance HD 45/09, Road Drainage and the Water Environment (2009) which provides the methodology and criteria for identifying likely impacts of a proposed road scheme on the water environment and predicting their magnitude and the significance of the resulting effects. There are four topic areas assessed as part of the HD 45/09 approach:

a) Determining the effect from routine highway runoff on the quality of surface watercourses;

b) Determining the effect from routine highway runoff on the quality of groundwater resources;

c) Predicting the likelihood of an accidental spillage causing pollution to receiving water bodies; and

d) Assessing flood risks.

11.7.2 In addition to the topic areas set out in HD 45/09 further assessment will be carried out where other impacts have been identified, including:

a) Assessment of the potential effects on the water environment due to construction related impacts, using a source – pathway – receptor-based assessment; and

b) A WFD compliance assessment to consider any potential impacts on WFD quality elements (e.g. hydromorphology), which may cause a deterioration in the status of a waterbody or prevent it from reaching good status in the future.

c) Assessment of effects on the groundwater resource due to the proposed excavation of highway cuttings, the creation of embankments and any potential impacts on groundwater levels.

11.7.3 HD 45/09 provides a standard methodology for the assessment of each topic area, which has four key steps:

Step 1 Identification of water features within the study area and an assessment of the importance/value/sensitivity of each of these receptors;

Step 2 Identification of potential impacts to the water features identified in Step 1, from construction and/or operation. Under the WFD, an impact is defined as causing a deterioration in the status of a water body or preventing a water body from reaching Good status in the future;

Step 3 Assessment of the potential magnitude of any construction or operation impacts on the receptor; and

Step 4 Assessment of the overall significance of any effects to receptors due to impacts, using the matrix.

11.7.4 Specific methods required by HD 45/09, which only have relevance to particular construction or operation impacts, are detailed in following sections for construction and operation.

Methodology for Construction Impacts

11.7.5 The assessment of construction impacts will follow the guidance set out in HD 45/09, which recommends that construction impacts are considered using the source – pathway – receptor approach and defers specific guidance of bridge/highway construction impacts to CIRIA 648 Control of Water Pollution from Linear Construction Projects.

11.7.6 The potential impacts of construction on surface water will be assessed based on the planned construction methods and sequencing and after discussion with the contractor. Potential impacts that will be considered include:

Potential surface water impacts: impacts to surface water quality from sediment runoff, spillages, or discharges, impacts to flood risk, and impacts on fish or eel passage/spawning due to noise, light, vibration or physical modification.

Potential groundwater impacts: changes to groundwater levels (such impacts will be assessed together with impacts due to operation of the Scheme), and impacts on groundwater quality due to spillages and discharges during construction.

11.7.7 Where construction methods are not available, standard construction practices will be assumed. Cumulative impacts as a result of construction phasing will also be assessed.

Methodology for Operational Impacts

11.7.8 An assessment of the potential impacts during operation will be undertaken for the five assessment components as set out below.

11.7.9 **Surface Water Quality:** An assessment of the potential impacts of routine runoff on surface waters will be undertaken to determine whether there is an environmental risk and if pollution mitigation measures are needed. In accordance with HD45/09, The Highways Agency Water Risk Assessment Tool (HAWRAT), will be used to assess short term risks from intermittent discharge (i.e. first flush) and the tool outputs will also be compared against Environmental Water Quality Standards (EQS's) to assess the potential for annual cumulative impacts. Although a Highways Agency (now Highways England) tool, the methodology employed by HAWRAT remains applicable for highways in Wales.

11.7.10 The methodology assesses the impact of road drainage water with any pollutants it contains, based on the predicted traffic volumes, the carriageway surface area and the local climate conditions. The impact assessment methodology dealing with water quality considers potential dilution within the receiving watercourse and the morphology and sensitivity of the watercourse and any protected sites downstream of the discharge point. Baseline surface water quality monitoring is not required for the HAWRAT method. However, it is prudent to collect baseline information to confirm that the operational phase drainage design of the scheme provides sufficient treatment measures to ensure there is no adverse effect upon the wider water environment.

11.7.11 **Geomorphology:** a qualitative assessment of possible impacts on the river geomorphology will be undertaken based on a suitably qualified river geomorphologist or engineer's understanding of the potential for impacts to the watercourse flow dynamics and sediment transport processes and the subsequent effects this this might have on the ecological potential of the water body.

11.7.12 Where possible, the 1 and 2D results of the flood modelling will be used to gain insight into the impacts of the proposals on flow dynamics

during flood events. These types of impacts will be assessed based on experience of previous schemes and a theoretical understanding of flow.

11.7.13 Potential geomorphological responses to any anticipated changes in flow dynamics will then be evaluated. Where possible, the assessment will be supported by consultation with NRW officers with appropriate experience of fluvial geomorphology.

11.7.14 **Groundwater Quality:** Annex I of HD 45/09 provides a methodology (Method C) to assess the potential impact on the quality of groundwater resources from routine runoff discharges to the ground. This risk assessment procedure is based on the source-pathway-receptor (S-P-R) protocol. The principles of this approach will be applied to the discharge of road drainage where:

a) The source comprises the road drainage water with any pollutants it contains as it enters any unlined ditch or watercourse, attenuation pond or soakaway discharge system that in accordance with HD 45/09 has potential to transmit water through the ground to groundwater;

b) The pathway represents the processes that may modify the pollutants during transmission through the discharge system and the ground until the actual 'point of entry' to groundwater; and

c) The receptor is the groundwater.

11.7.15 For there to be a risk of impact to groundwater, all elements of the S-P-R model have to be present to create a pollutant linkage. In accordance with HD 45/09, a pathway to the groundwater receptor is only considered to be feasible if the receiving watercourse at the proposed outfall has a Q95 flow of less than 0.001m^3/s.

11.7.16 **Hydrogeology and Groundwater Resources:** a specific methodology for the assessment of potential effects of the Scheme on hydrogeology and groundwater resources is not covered by HD 45/09. The proposed method of assessment will include the following:

a) Use of desk study information, the findings from site walkover studies and ground investigations to develop a ground model, including the likely groundwater levels across the Scheme.

b) Identification of any sensitive receptors that are reliant on the current groundwater levels, such as NRW designated groundwater Source Protection Zones, existing abstraction wells, or spring lines that feed surface water courses.

c) Identification of potential features or activities that are proposed for the Scheme that may result in an impact on groundwater levels, such as the long-term dewatering of highway cuttings.

d) Assessment of the potential impacts on the receptors. For the proposed highway cuttings, this would include hydrogeological calculations of the likely drawdown of the water table.

11.7.17 **Accidental Spillage: t**he operational pollution effects from accidental spillage will be calculated using Method D from the HD 45/09 guidance. When considering the risk of spillages, the calculated spillage risk return period must not be greater than 1 in 100 years, or 1 in 200 years where spillage could affect protected areas for conservation such as Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs) and Special Area of Conservation (SACs).

11.7.18 For assessment of the risk posed by accidental spillage, in line with HD 45/09 guidance, if the annual probability that a spillage would cause a serious pollution incident to a water body is less than 1%, then the risk posed is considered acceptable and no further assessment has been carried out.

11.7.19 The risk is assessed initially without any mitigation measures. If mitigation measures are needed to reduce the probability, a reduction factor is applied, depending on the type of mitigation applied.

11.7.20 **Flood Risk:** the assessment of potential flood impacts will be undertaken in accordance with the principles of DMRB and TAN15. The 1 in 100 year and 1 in 1000 year probability flood events will be assessed and an additional allowance to account for future climate change will be applied to the 1 in 100 year flood event, following agreement on the allowance with NRW and Pembrokeshire CC. The principles of any modelling methodology will be agreed with NRW prior to the commencement of any modelling.

Significance Criteria

11.7.21 The significance of effects on the water environment will be based on the methodology contained within the HD 45/09 guidance, Annex IV. The importance or sensitivity of the affected receptor is combined with the magnitude of any effects to define the significance of the effects.

11.7.22 Potential effects not covered by this guidance, chiefly related to

geomorphology and WFD compliance, will be assessed using the supplementary methods explained in the sections above.

11.7.23 Effects deemed to be moderate or above will be considered significant in the assessment.

11.8 Assessment of Potential Effects

11.8.1 Linear construction projects, such as roads, have the potential to intersect surface and groundwater features and create pollution sources or pathways that are not present under existing conditions.

11.8.2 Potential effects of roads on the water environment can be split into direct or indirect effects and occur as a result or construction, operation or a combination of construction and operation. Typically, these effects are grouped into temporary, short-term construction effects and permanent, long-term operational effects, although short and long-term effects can occur as a result of both construction and operation activities.

11.8.3 The assessment will consider the following potential effects on the water environment during construction:

a) Pollution of receiving waters as a result of accidental spillage or the runoff of sediments or contaminants from construction areas;

b) Changes in the flow or levels of surface and groundwater features, including private water supplies, and associated effects on dependant features (i.e. springs, wetlands and groundwater-fed watercourses); and

c) Changes in flood risk and conveyance of drainage.

11.8.4 The assessment will consider the following potential effects on the water environment during operation:

a) Pollution of waters receiving road runoff, including routine runoff and in the event of accidental spillage on the carriageway;

b) Changes in the flow or levels of surface and groundwater features, including private water supplies, and associated effects on dependant features (i.e. springs, wetlands and groundwater-fed watercourses);

c) In channel sediment transfer or movement, often as a result of modification to the existing surface water network; and

d) Fluvial flooding as a result of increased surface water runoff and changes to surface water and floodplain capacities.

11.8.5 The mobilisation of existing contaminants is another potential effect during both construction and operation and will be considered in the assessment of Chapter 9 Geology and Soils.

11.8.6 The impact on designated sites with hydrological linkages will be assessed in the Chapter 11 Ecology and Nature Conservation.

Potential impacts of the northern route

11.8.7 The northern route is proposed either side of the ridgeline, passing into the three river catchments. There are no watercourse crossings and no flood zones are crossed within this route. Therefore, no further specific risks to the surface water environment apply to this route than those stated above.

11.8.8 As stated in the Section 10.5, a well is located approximately 125m south of the proposed alignment near Blackmoor Hill Farm. Two ponds are also present 150m to the north-west of Redstone Cross junction. The construction and operational impacts of the northern scheme will be considered in the assessment.

Potential impacts of the southern route

11.8.9 The Southern route includes surface water crossings at an unnamed tributary to Marlais - headwaters to confluence with Taf and A tributary of Narbeth Brook, shown on OS mapping to rise 20m south of the existing A40 at Redstone Farm and would cross the Scheme. Construction risks associated with working within the watercourse and operational risks due to hydrological impact of the culvert will be included within the assessment.

11.8.10 Section 10.5, identifies a well and two ponds are located in close proximity to the Southern Alignment, with numerous other ponds in the wider vicinity of the scheme. Groundwater monitoring and investigation will inform the potential impact of the scheme on these features.

11.9 Mitigation Measures

11.9.1 A CEMP will be required during the construction stage to detail the procedures and methods that must be followed to minimise the potential environmental effects of construction activities. The CEMP would also describe the procedures in the event of an environmental emergency such as a fuel or chemical spillage.

11.9.2 A robust surface water drainage system should be provided to ensure discharge from the Scheme does not increase flood risk elsewhere up to and including the 1 in 100 annual probability rainfall events, allowing for climate change effects. If online improvements are proposed, consideration must also be given to the ability of existing drainage systems to receive any additional flows. In sections where offline improvements are proposed, consideration must be given to the provision of new drainage systems that provide sufficient attenuation and restrict the rate and volume of discharge to a rate agreed with Pembrokeshire County Council as the LLFA.

11.9.3 Isolated sections of the Scheme are identified to be at risk of surface water flooding due to natural depressions in topography and overland flow paths, typically associated with the watercourses that are crossed by the scheme. In order to protect the proposed route alignment, consideration should be given to maintaining these overland flow paths and localised raising of ground levels to mitigate the potential impact of surface water flooding on the highway and to its users.

11.9.4 Any widening of existing highway culverts must maintain hydraulic capacity and, where possible, explore opportunities to provide betterment.

11.9.5 Any new crossings of watercourses should strive to provide clear span bridges where practicable. Alternatively, any new culverts must maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB guidance, and be sensitive to ecological requirements.

11.9.6 Surface water runoff from highway schemes typically contains high levels of sediment and hydrocarbons that can pollute surface water and groundwater features through direct migration or via the surface water drainage system. A robust treatment system will therefore be required.

Little is known regarding existing drainage arrangements and water treatment provision. The works may provide an opportunity to provide betterment. Multi-stage proposals that maximise passive treatment using Sustainable Drainage Systems (SUDS) would be considered.

12 NATURE CONSERVATION

12.1 Introduction

12.1.1 This section sets out the proposed approach to the assessment of effects on ecology and nature conservation in terms of sites designated for their nature conservation importance (international, national and local), the habitats present, and the protected or otherwise notable species which they support. It identifies the main nature conservation constraints to enable an informed decision on the level and approach to the assessment to be established.

12.1.2 During the EIA process, the potential effects of both the construction and operational phases of the Scheme will be considered, and these effects avoided and mitigated so far as practicable. The significance of the likely ecological and nature conservation effects will also be assessed.

12.1.3 The effects of the Scheme on European Sites will also be considered in parallel to the EIA through the AIES process as set out in Design Manual for Roads and Bridges (DMRB) Volume 11, Section 4, Part 1.

12.1.4 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

12.2 Relevant Guidance

12.2.1 The following guidance, initiatives and plans are relevant and will be considered during the assessment:

a) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine 2018 (Chartered Institute of Ecology and Environmental Management);

b) Guidelines for Baseline Ecological Assessment (Institute of Environmental Assessment, 1995);

c) DMRB Volume 11, Section 3, Part 4: Ecology and Nature Conservation (Highways Agency 1993);

d) DMRB Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment (Highways Agency 2010).

e) DMRB Interim Advice Note 116/08 (W) Nature Conservation in Relation to Bats (Highways Agency, 2008).

f) DMRB Volume 11, Section 4, Part 1: Assessment of Implications (of Highways and/or Roads Projects) on European Sites (Including Appropriate Assessment);

g) Technical Advice Note (TAN) 5: Nature Conservation and Planning45;

h) The UK Post-2010 Biodiversity Framework46;

i) Welsh Transport Planning and Appraisal Guidance: WelTAG;

j) Trunk Road Estate Biodiversity Action Plan 2004-2014;

k) The State of Birds in Wales (RSPB Cymru, BTO Cymru, the Wildfowl and Wetlands Trust, the Welsh Ornithological Society and Countryside Council for Wales);

l) Otter Road Casualties in South Wales: Recommendations for Mitigation: A report by the Cardiff University Otter Project;

m) Birds of Conservation Concern 3: The Population Status of Birds in the United Kingdom, Channel Islands and the Isle of Man;

n) Pembrokeshire Biodiversity Action Plan (Pembrokeshire County Council); and

o) Action Plan for Pollinators (Welsh Government).

References

12.2.2 The following documents and guidance will be used as appropriate for the assessment.

a) Bibby, C., Burgess, N.D., Hill, D., & Mustoe, S. (2000) Bird Census Techniques – Second Edition. Academic Press, London, England.

b) Bright PW, M. P.-J. (2006). Dormouse Conservation Handbook, 2nd Edition. Peterborough: English Nature.

c) P. Chanin (2003). Monitoring the Otter (Lutra lutra). Conserving Natura, English Nature, Peterborough., vol. Rivers Monitoring Series No. 10.

d) CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

e) Collins, J. (2016). Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). London: The Bat Conservation Trust.

f) Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016) The Water Vole Mitigation Handbook (Mammal Society Mitigation

[45] https://gov.wales/topics/planning/policy/tans/tan5/?lang=en
[46] http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf

Guidance Series). Eds Fiona Mathews and Paul Chanin. Mammal Society, London.

g) English Nature (2001). Great Crested Newt Mitigation Guidelines. English Nature, Peterborough.

h) Froglife (1999). Froglife Advice Sheet 10: Reptile survey; an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife, London.

i) Gent, T., & Gibson, S. (2003). Herpetofauna Workers' Manual. Peterborough: JNCC.

j) Harris, S., Cresswell, P. and Jefferies D. (1989) Surveying Badgers. Occasional Publication No 9, The Mammal Society, London.

k) Highways Agency (2010). Design Manual for Roads and Bridges (DMRB) Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment.

l) Highways Agency (2001). Design Manual for Roads and Bridges. Volume 10: Environmental Design and Management, Section 4: Nature Conservation. HA 59/92.

m) Highways Agency (1999). Design Manual for Roads and Bridges. Volume 10: Section 4, Part 3 Nature Conservation in Relation to Bats.

n) Highways Agency (2008). Design Manual for Roads and Bridges. Interim Advice Note 116/08 Nature conservation in relation to bats.

o) Highways Agency (1999). Design Manual for Roads and Bridges. Volume 10: Section 4, Part 4 Nature Conservation in Relation to Otters. London.

p) Highways Agency (1993). Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 4 Ecology and Nature Conservation.

q) Institute for Environmental Assessment (IEA) (1995). Guidelines for Baseline Ecological Assessment. London: E & FN Spon.

r) Joint Nature Conservation Committee (2010). Handbook for Phase 1 Habitat Survey - a Technique for Environmental Audit. Peterborough: Joint Nature Conservation Committee (JNCC).

s) Joint Nature Conservation Committee (2006). National Vegetation Classification: Users' Handbook. Peterborough.

t) Shawyer, C. R. (2011) Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.

u) J. W. Wilkinson, D. Wright, A. Arnell and B. Driver, "Assessing population status of the great crested newt in Great Britain," Natural England Commissioned Reports, Number 080, 2011.

12.3 Study Area

12.3.1 In accordance with the relevant guidance, the ecology desk study area for the Scheme will extend to 30 km for Special Areas for Conservation (SACs) designated for bats, 10 km for other internationally designated sites, 2 km for nationally designated such as Sites of Special Scientific Interest (SSSIs) and 1 km for locally designated Sites of Importance for Nature Conservation (SINCs).

12.3.2 For records of protected species, the desk study area will extend to a 5km radius (10km for bat roost records) and for species of conservation concern or which are otherwise notable this will be a 1 km radius.

12.3.3 The proposed study area for the different ecological field surveys will depend on the likely zone of influence of the project on the habitats or species concerned. The study area for each survey type will be included in the Sections below and is given as a buffer from the central alignments of the scheme options. As the design of the scheme progresses, this buffer will be revised to include the footprint of the scheme options plus any access routes, compounds or laydown areas, where known.

12.4 Work Undertaken to Date

12.4.1 An Extended Phase 1 Habitat Survey was undertaken in July 2017 between Penblewin Roundabout and Redstone Cross.

12.4.2 Static bat activity monitoring data was collected at six locations between Penblewin Roundabout and Redstone Cross in June, July and August 2017. The static monitoring was undertaken for five consecutive nights each month at each of the six locations covering the following periods:

a) 23-28 June 2017
b) 18-23 July 2017
c) 16-21 August 2017.

12.4.3 In March 2019 all waterbodies within 250 metres were subject to a Habitat Suitability Index (HSI) assessment for great crested newts (GCN).

12.5 Baseline Conditions

12.5.1 There are a number of statutory designated sites within the desk study area (as defined in 12.3.1 above). These are shown in the Table 12.1.

Table 12.1 Designated sites within the desk study area

Designation	**Approximate distance of closest point to the RCE Scheme and orientation**
International Sites within 10km	
Afonydd Cleddau / Cleddau Rivers SAC	1.3km W
Pembrokeshire Marine / Sir Benfro Forol SAC	5.1km W
Yerbeston Tops SAC	7.8km SW
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC	7.9km W
Other SACs Designated for Bats between 10km and 30km	
Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru SAC	17.4km S
North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC	18.8km N
National sites within 2km	
Afon Cleddau Dwyreiniol / Eastern Cleddau River SSSI	1.3km NW

12.5.2 There are no non-statutory designated sites within 1km of the scheme options.

12.5.3 The Phase 1 Habitat Survey carried out in July 2017 identified habitats which included freshwater streams, semi-natural broadleaved woodland, wet woodland and marshy grasslands. Much of the survey area also comprised semi-improved and improved grassland fields grazed by cattle or used for silage. These were bordered by the strips of woodland or hedgerows, many of which were mature intact hedges.

12.5.4 The habitats present have potential to support otters and water voles, roosting, foraging and commuting bats, dormice, a diverse assemblage of breeding birds, badgers and reptiles. A number of complexes of farm buildings and other buildings were identified which had potential to support roosting bats and one farm building at Blackmoor Hill Farm was confirmed as a bat roost. Several badger setts, some with multiple sett entrances were also found.

12.5.5 The protected species surveys which have been carried out as part of

the main A40 Llanddewi Velfrey to Penblewin Scheme in 2016, 2017 and 2019 have identified the presence of the following legally protected species and notable habitats:

a) Broad-leaved woodlands
b) Dormice;
c) Otters;
d) Bat roosts on and within the vicinity of the Scheme and several bat species including lesser horseshoe, greater horseshoe and barbastelle bat, foraging within the vicinity of the Scheme;
e) Great crested newts and other amphibians;
f) Reptile populations;
g) Badger setts;
h) A common breeding bird assemblage.

12.5.6 The HSI assessments carried out in March 2019 identified one waterbody which was suitable to support breeding GCN 240m northeast of the proposed Penblewin Roundabout. Unfortunately, no further access for presence absence surveys was granted during the 2019 survey season. This pond however has been the subject of eDNA surveys carried out in April 2016 as part of the baseline surveys for the A40 Llanddewi Velfrey to Penblewin. The eDNA result for this pond was the only one which came back positive. The population size class surveys which followed in May 2016 found two probable GCN eggs. The torch-light surveys were limited by the presence of duckweed and the complete number of surveys could not be carried out due to access constraints. GCN presence / likely absence surveys using traditional methods were carried out in 2017 as part of the baseline surveys for the A40 Llanddewi Velfrey to Penblewin and found no evidence of GCN (A40 Llanddewi Velfrey to Penblewin ES Chapter 8 Ecology & Nature Conservation: Report Ref A40LVP-ARP-EBD-SWI-RP-LE-0003). Due to the 2016 survey results it is not possible to scope GCN out of the assessment.

12.6 Proposed Scope of Baseline Studies

12.6.1 Additional surveys required in 2019 to inform the Ecological Impact Assessment (EcIA), development of mitigation proposals and inform any protected species licence applications required for the construction of the Scheme are as follows.

Desk Study

12.6.2 A data search from the West Wales Biodiversity Information Centre (WWBIC) will be obtained which will include locally designated sites and records of protected and notable species. Search distances will be the same as described in paragraph 12.3.1 and 12.3.2.

Phase 1 Habitat Survey

12.6.3 An update Extended Phase 1 Habitat Survey will be carried out in accordance with the Handbook for Phase 1 Habitat Survey (JNCC, 2010). All habitats within a survey buffer of 250m from the central alignments of the scheme options will be included. The survey will take account of any changes in habitats since the first survey in July 2017. The survey will include a search for badger signs, a great crested newt (GCN) habitat suitability index (HSI) assessment of any standing water (see species sections below), a hedgerow survey and invasive species survey.

National Vegetation Classification survey (NVC)

12.6.4 The Phase 1 Habitat Survey carried out in July 2017 identified areas of woodland and marshy grassland along the route of the Scheme. These habitats which fall within a 50-metre buffer of the central alignments will be subject to an NVC survey to identify plant communities which may be considered Priority Habitats listed in response to Section 7 of the Environment (Wales) Act 2016.

Hedgerow Survey

12.6.5 A Hedgerow Regulations Assessment will be carried out to on all hedgerows which fall within a 50-metre buffer of the central alignments of the scheme options to determine if any hedgerows should be considered Important under the Hedgerow Regulations Act 1997.

Bat Roosts

12.6.6 Visual inspections of buildings, bridges and other structures which fall within a 50-metre buffer of the central alignments of the scheme options will be carried out to identify potential roost features (PRF) for bats. Any buildings, bridges or other structures which have low, moderate or high PRFs or confirmed roosts will be subject to dusk emergence and

/or dawn re-entry surveys to determine the presence or likely absence of roosts or to characterise confirmed roosts respectively. Ground level tree assessments will be carried out on all trees which fall within a 50-metre buffer of the central alignments of the scheme options. Those trees with moderate or high PRFs will be subject to tree climbing inspections. Following the climbing inspections if the absence of bats cannot be ruled out dusk emergence and /or dawn re-entry surveys will be carried out. All roost surveys will be carried out in accordance with the Bat Conservation Trust (BCT's) Good Practice Guidance (Collins, 2016). As stated in 12.3.3, the survey buffers for all survey types, will be revised as the scheme design progresses to include the scheme footprint, proposed access routes, site compounds and laydown areas.

Bat Activity

12.6.7 Two walked activity transects, one covering the northern scheme options and one covering the southern scheme options will be completed each month from April to October 2019. The transects will be designed to focus on habitat features of likely interest for bats along the scheme options. The transect surveys will be supplemented with static detector monitoring at twelve locations; six locations along the northern scheme options and six locations along the southern scheme options (the same locations used in the 2017 survey). All bat activity surveys will be carried out in accordance with the Bat Conservation Trust (BCT's) Good Practice Guidance (Collins, 2016).

Otter & Water Vole

12.6.8 All watercourses and areas of suitable adjacent habitats within 500 metres of the centrelines of the proposed scheme options will be subject to surveys for signs of otter and water vole. Three survey visits will be carried out in spring, summer and autumn 2019. The survey for signs of otter will be carried out in accordance with best practice guidance (Chanin, 2003) and the DMRBs Nature Conservation in Relation to Otters (Highways Agency 1999). The methodology for water vole survey will follow the guidance set out in The Water Vole Mitigation Handbook (Dean et al, 2016). Repeat visits and camera trap monitoring will be used to verify the status of potential otter breeding sites and resting places, as required.

Dormouse

12.6.9 Dormouse nest tube surveys will be carried out in suitable habitat within 100 metres of the centrelines of the proposed scheme options. The tubes will be installed in March and then be checked on a monthly basis from April to November 2019 by a suitably experienced ecologist who holds or is accredited on a dormouse survey licence from Natural Resources Wales. The methodology will follow the guidance set out in the Dormouse Conservation Handbook (Bright et al, 2006) with recognition to the now withdrawn DMRB guidance on dormice.

12.6.10 Breeding Bird Surveys

12.6.11 Breeding bird surveys will be carried out in the months of April, May and June 2019 using the standard Bird Census Technique (BCT) (Bibby, et al., 2000). Walked transects will be designed to cover habitats likely to be of most interest to breeding birds within a 100-metre buffer of the centrelines of the proposed scheme options.

12.6.12 A barn owl survey comprising an appraisal of habitats and inspection of suitable trees and buildings will be undertaken within a 250-metre buffer of the centrelines of the proposed scheme options. The surveys will be carried out in accordance with the methodologies set out in the Barn Owl Survey Methodology and Techniques (Shawyer, 2011).

Reptiles

12.6.13 A seven-visit presence / likely absence survey of all suitable habitat within a 50-metre buffer of the centrelines of the proposed scheme options will be carried out between April and September 2019. All visits will be undertaken in suitable weather conditions and the methodology will follow standard best practice guidance (Froglife, 1999) and (Gent, T., & Gibson, S. 2003).

Badgers

12.6.14 The proposed badger surveys will involve a walkover of the proposed route options out to a radius of at least 100 metres from the centrelines to search for setts, paths, latrines and other signs of badgers in accordance with the guidance set out in (Harris et al, 1989). The surveys will confirm the location and status of setts identified during the 2017 Phase 1 Habitat Survey. Repeat visits and camera trap monitoring will

be used to verify the status of setts, as required. Territory mapping using bait marking may also be required.

12.6.15 Section 7 Species

12.6.16 No specific surveys are proposed for species listed in response to Section 7 of the Environment (Wales) Act 2016 (Section 7 Species). It will therefore be assumed that species such as hedgehog, polecat, and a common assemblage of invertebrates are present within the study area.

12.7 Assessment Methodology

Scope of Proposed Assessment

12.7.1 The assessment of effects will follow a methodology primarily taking account of the following guidance:

a) DMRB Volume 11, Section 2, Part 5: HA205/08 Assessment and Management of Environmental Effects; and

b) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management (CIEEM, (2018)

12.7.2 The Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018) are the current industry standard for ecological assessment and are therefore considered to be current good practice. The assessment of impacts on ecological receptors will therefore be undertaken in line with the CIEEM guidance in terms of the assessment of the significance of effects. The scope of the assessment will consider the potential effects outlined below.

12.8 Assessment of Potential Effects

12.8.1 The assessment of the effects of the Scheme will include those arising from:

a) the permanent and temporary land take required to accommodate the Scheme;

b) construction; and

c) operation.

12.8.2 The potential effects of the permanent land take for the Scheme would primarily arise from habitat loss which, as well as resulting in the loss of habitat of intrinsic value in its own right, would reduce the area available for foraging and nesting animals. Reducing the area can reduce viability of the habitat and lead to a reduction in the diversity of plant and animal communities present. The integrity of the habitat could therefore be altered, and the conservation status of species affected.

12.8.3 In addition to land take, the new road, highway fencing, drainage and bridge/culvert alterations have the potential to create a barrier to movement of species between areas of habitat ('habitat fragmentation'). Mitigation to any barrier identified will be incorporated into the design.

Assessment of Significance of Effect

12.8.4 In accordance with the CIEEM guidelines, a significant impact, in ecological terms, is defined as 'an impact (whether negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area, including cumulative and in-combination impacts'. It is important to note however that in accordance with the CIEEM guidelines, the actual determination of whether an impact is ecologically significant is made irrespective of the value of the receptor in question. In this respect the CIEEM methodology differs from some other approaches to EIA.

12.8.5 The value of a feature that will be significantly affected is used to determine the geographical scale at which the impact is significant, e.g. an ecologically significant impact on a feature of county importance will be considered to represent a significant impact at a county level. This in turn is used to determine the implications in terms of legislation, policy and /or development management.

12.8.6 Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success of the mitigation, are the factors to be considered against legislation, policy and development management in determining the Scheme.

12.9 Mitigation Measures

12.9.1 The wider landscape through which the Scheme would be constructed includes sites designated at the highest level for their nature

conservation value, including four SACs. It is essential the Scheme avoids effects on these sites so far as practicable, and, where the effects cannot be avoided, that appropriate and effective mitigation is provided. The avoidance and mitigation measures will be developed as part of the Scheme design and in the light of the results of the ecological surveys.

12.9.2 Due to the likely presence of a number of legally protected species including otter, water vole, dormice, bats, badgers, reptiles and breeding birds the design of the Scheme and landscape proposals will need to take into account measures to mitigate for the loss of habitat of these species and to ensure their continued passage across the scheme. Mitigation in terms of vegetation clearance methods would also be required for breeding birds, amphibians and reptiles.

12.9.3 As referred to above, the Welsh Government has particular responsibilities with respect to the conservation and enhancement of SSSIs under Section 28 of the Wildlife and Countryside Act 1981 (as amended) and of biodiversity under the Environment (Wales) Act 2016. Since 2015, it also has responsibilities under the 'A Resilient Wales' goal' (one of seven well-being goals) under the Well-being of Future Generations (Wales) Act 2015; to maintain and enhance a biodiverse natural environment with healthy functioning ecosystems. The ES will include both mitigation and enhancement measures for the Scheme to address these obligations.

12.9.4 The Scheme would include a number of mitigation and enhancement measures which will be developed during the EIA process. These are likely to include but not be limited to:

a) Measures to allow species passage across the scheme will be devised, to include: stream culverts which are at least 1.8m in diameter to allow passage for bats (as well as otters), underpasses comprising dry culverts for badgers as well as provisions for dormice such as connectivity pipes through embankments.
b) Barriers, in the form of otter and badger fencing, to reduce the risk of the relevant mammal species entering the road corridor;
c) The design of the Scheme, its drainage and construction will take into account amphibians and also ensure the potential for these species becoming trapped in the drainage system is minimised.
d) Measures to reduce the potential to cause harm to species during construction
e) Measures to mitigate for habitat loss and for loss of connectivity;

f) Compensatory planting for dormice through the landscape design of the scheme at a ratio of 2:1 habitat creation to loss minimum.

g) Where invasive plant species are present mitigation measures will be adopted to manage the presence of such species including the control of the species in accordance with existing guidelines such as the relevant Environmental Agency guidance.

h) A 5-year aftercare scheme for the soft estate to ensure establishment and undertake maintenance of ecological measures.

12.9.5 Any effects of the scheme on European Protected Species (EPS) including bats, otters, dormouse, great crested newts will be dealt with under mitigation licences obtained from NRW. The mitigation outlined in the method statements for such licences must be followed to avoid a breach of the Habitats Regulations 2017 (as amended). Any effects on water voles and badgers, will be mitigated under water vole and badger mitigation licences from NRW.

12.9.6 Such licences can only be obtained following the granting of Orders under the Highways Act 1980 for the Scheme.

12.9.7 Mitigation and enhancement measures will be discussed with the attendees of the Environment Liaison Group (ELG).

13 LANDSCAPE AND VISUAL

13.1 Introduction

13.1.1 This section of the report describes the scope of the landscape and visual assessment (LVIA). References to national and local planning policies to be considered are included as well as the approach to the assessment of likely significant effects of the preferred route and approaches to mitigation.

13.1.2 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

13.2 Relevant Guidance

National Planning Policy

13.2.1 The current land use planning policies for the Welsh Government are set out in Planning Policy Wales Edition 10 (December 2018). It is intended to 'help ensure that the planning decisions taken in Wales, no matter how big or how small, are going to improve the lives of both our current and future generations'. Section 3.57 addresses the need for adequate and efficient infrastructure.

13.2.2 Planning Policy Wales Edition 10 (PPW) also supports the use of Natural Resources Wales' LANDMAP data system as an important information resource.

13.2.3 PPW is supplemented by a series of topic based Technical Advice Notes (TANs). The relevant TANs include:

TAN10 'Tree Preservation Orders';

TAN 12 'Design' and;

TAN 18 Transport.

Local Planning Policy

13.2.4 The Pembrokeshire Local Development Plan (LDP), adopted in February 2013 guides planning and development in the county up to 2021. Of relevance are the following policies:

GN.37 'Protection and Enhancement of Biodiversity';

GN.38 'Protection and Enhancement of the Historic Environment' and;

GN.39 'Transport Routes and Improvements'.

Neighbouring Authorities

13.2.5 The Scheme may be visible from outside of the region covered by the Pembrokeshire LDP, with potential long distant views of the preferred route from adjacent areas.

13.2.6 The relevant policies of adopted Local Development Plans of Pembrokeshire Coast National Park (September 2010 to 2021), will be considered as part of the assessment.

Other relevant guidance

13.2.7 The assessment will be carried out in accordance with methodology set out within 'Interim Advice Note 135/10 (W) Landscape and Visual Effects Wales Only' (Welsh Government 2014) (hereafter referred to as IAN 135/10 (W)), which replaces guidance within Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 5 (Highways Agency).

13.2.8 Other relevant documents referred to include:

a) Landscape Character Assessment for Wales published by Natural Resources Wales a high-level mapping for all Wales.

b) LANDMAP, maintained by Natural Resources Wales, including guidance notes:

c) Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3)
(The Landscape Institute and Institute of Environmental Managers and Assessment, 2013);

d) Photography and Photomontage in LVIA (Landscape Institute 2011); and

e) Roads in Lowland Areas: A Design Guide (Highways Directorate, Welsh Office 1993).

13.3 Study Area

13.3.1 The study area for the baseline assessment includes the extents of the Scheme and the wider area. A limit is proposed of 5 km from the centre line of the proposed alignment. It is accepted that long distance views beyond a distance 5 km may be available to ridges and upland areas and it is proposed that an assessment is made from promoted or important viewpoints in outlying areas.

13.4 Work Carried Out to Date

13.4.1 Welsh Government have been reviewing improvement options for the A40 between St Clears and Haverfordwest for several years. Previous work includes WelTAG Stage 1 assessment carried out by WSP ¦Parsons Brinckerhoff and TACP in 2015 which updated an earlier study carried out by Parsons Brinckerhoff in 2004. For the purpose of the EIA, previous work will be reviewed.

13.5 Baseline Conditions

Landscape Designations

13.5.1 In the study area of the Scheme there are a range of landscape designations, but the Scheme options being considered would not have a direct impact on any designated landscape.

13.5.2 At its nearest point at Canaston, Pembrokeshire Coast National Park is 4 km to the west of Redstone Cross. Long distant views of the scheme options may be available from ridges and south facing slopes of the Mynydd Preseli area of the National Park, more than 12 km due north.

13.5.3 The Milford Haven Waterway Landscape of Historic Interest overlaps the Daugleddau part of the Pembrokeshire Coast National Park at closest 4km away. The Preseli Landscape of Historic Interest overlaps the Mynydd Preseli part of the Pembrokeshire Coast National Park over 12 km away.

13.5.4 At just over 2km south of Redstone Cross, Blackaldern is the nearest Park and Garden of Special Historic Interest. It is predicted that

intervening hills to the east of Narberth would interrupt visibility. At about 8km due west of Redstone Cross are Slebech Park and Picton Castle.

Landscape Context

13.5.5 Countryside Council for Wales (now Natural Resources Wales), produced a regional character map for Wales in 2006. The Scheme and the majority of the study area is located within Landscape Character Area 44: Taf and Cleddau Vales. This is predominantly an area of undulating farmland made up of lowland escarpments, hills and river valleys. The Preseli Hills are about 12 km due north of the A40, and the shore of Carmarthen Bay is about 10 km due south.

13.5.6 The A40 crosses the Cleddau Ddu at Canaston Bridge then gradually climbs onto higher ground as it travels eastward. From Robeston Wathen through to the village of Llanddewi Velfrey the road follows ridge lines. Between Redstone Cross and Penblewin roundabout the A40 follows the higher land of Sodston/Redstone ridge. Extensive views northward of the Preseli Hills and the broad ridge that separates the Eastern Cleddau and the Afon Taf rivers are available from the higher ground of this ridge where gaps in vegetation allow. Distant views southward from the road are restricted by higher ground to the south of Narberth.

13.5.7 Settlements tend to be clustered where main roads and railways meet. Narberth (1.2km southwest) and Whitland (7.9km east) are the largest settlements located within the study area. Clunderwen (2.6 km north), Llanddewi Velfrey (2.8 km east), Llandissilio (5km north), Llanfallteg (3.9km north east) and Templeton (4km south) are amongst the main villages. Settlement of the land in between the main transport routes consists of a dispersed hamlets, farms and rural dwellings served by a network of minor roads. There is a small group of dwellings and a farm at Redstone Cross, another farm at Penblewin, with two dwellings at Blackmoor Hill Farm midway between. 360 metres or more to the north of the A40 there are three farms reached by long access tracks. These lie over the crest of the ridge on north and east facing slopes.

13.5.8 Landcover is a mosaic of predominantly pasture with patches of arable land, woodland and the settlements. Field boundaries tend to be a mixture of traditional Pembrokeshire hedge banks, managed hedges and hedgerows with trees. Managed field boundaries give the area an

open aspect that enable views to the north and south. Where hedgerows have been allowed to grow, views are restricted to a smaller area. To the north of the A40 the ridge land cover is intensively cultivated grassland contained by hedges. To the west these tend to be bigger and fuller grown, while to the east they are more trimmed. To the south of the A40 there is a landscape formed around small watercourses with lower, wetter land occupied by marshy grassland and woodland. Otherwise the fields are down to pasture with hedges, some of which are tall and full.

Landscape Receptors

13.5.9 Sensitive landscape receptors will be identified following guidance within IAN 135/10 (W) and GLVIA3. To begin with a review of the landscape resource within the study will be carried out, using the relevant guidance. The LVIA will utilise the LANDMAP spatial datasets.

13.5.10 The susceptibility of the landscape to accept change is assessed on its vulnerability to degradation through the introduction of new and/or loss of existing elements as a result of the Scheme. The ability of a landscape to accommodate change depends on the physical nature of the areas affected and their vulnerability, not necessarily the quality of the landscape. For example, a high-quality landscape with an interesting varied landform and dense woodland cover would have a higher capacity to accommodate changes than a flat open landscape.

13.5.11 LANDMAP Aspect Areas are assessed using the evaluation data to determine their sensitivity to potential effects. Those Aspect Areas that are directly affected by the development, usually containing wholly or partly the development area or lying next to the development area are those most likely to suffer significant change.

13.5.12 Site based assessment will be carried out to consider the local character and quality of the elements or components that make up the landscape. A judgement of landscape value will be made that also takes into consideration designations of ecological and archaeological significance.

13.5.13 Judgements of the relationship between the susceptibility to change attached to landscape receptors and their value are used to determine the landscape sensitivity. IAN 135/10 (W) suggests three categories of

'high', 'medium' and 'low' to describe the sensitivity of the landscape. The landscape character units defined as 'high' are considered particularly vulnerable to change and those categorised as 'low' are considered able to accept change of the type proposed.

Visual Receptors

13.5.14 People that may experience a change in view, the places where views are experienced, and the activity of the visual receptors inform the visual assessment. Representative viewpoints will be identified within the study area for receptor groups and noteworthy viewpoints.

13.5.15 Sensitive visual receptors will be identified following guidance within IAN 135/10 (W) and GLVIA3. Sensitive visual receptors are likely to be individual and groups of dwellings, users of public rights of way or visiting popular visitor attractions. IAN 135/10 (W) suggests three categories of 'high', 'medium' and 'low' to describe the sensitivity of visual receptors.

Viewpoints

13.5.16 The Scheme would cause changes to the landscape and so a number of viewpoints will be considered in the assessment. Due to the topography and the distribution of hedges and woodland, views of the Scheme would not be extensive. Viewpoints that are being considered for inclusion in the landscape and visual assessment are set out in Table 13.1.

Table 13.1 Designated Viewpoints

Viewpoint	Location and description
1	Long distance view from the Preseli Hills
2	View from Caneston within the National Park
3	View from Llawhaden
4	View Robeston Wathen
5	View from B4313 in Redstone Bank
6	View from Penblewin Roundabout
7	View from sunken lane near Blaenffynnonau Farm
8	View from the Scheduled Ancient Monument
9	View from Blackmoor Hill Farm
10	View from beside Sodston House Lodge
11	View from Great Vaynor

13.6 Proposed Scope of Baseline Studies

13.6.1 The Scheme could have significant adverse landscape and visual impacts and would require detailed assessment.

Landscape Effects

13.6.2 In accordance with Annex 1 of IAN 135/10 (W), the study area for the assessment of landscape effects would cover the Scheme site and the wider landscape context within which the Scheme might influence landscape character.

13.6.3 The baseline study will include a combination of desk work based on LANDMAP and field survey. Landscape character classification will involve the sorting of the landscape into areas of consistent and recognisable character. A brief summary of the LANDMAP aspect areas affected by the development are set out in Table 13.2 LANDMAP Aspect Areas.

Table 13.2 LANDMAP Aspect Areas

Aspect	Qualities
Visual and Sensory	One aspect area directly affected has been evaluated as being of moderate character and scenic quality, attractive yet typical of rural Pembrokeshire. The north-facing slopes extend the visual influence of transport corridor to the Eastern Cleddau and Afon Taf river valleys, which were evaluated as having high character and scenic qualities.
Cultural Landscape	Aspect areas directly affected were assessed as high quality despite low and moderate evaluation of rarity and sensitivity. The Scheme could have a visual influence on distant areas that were evaluated as outstanding quality.
Historic Landscape	One aspect area directly affected has been assessed as being of high quality due to the diversity of archaeological remains and built heritage. The Scheme could have a visual influence on distant areas that have been evaluated as outstanding and high quality.
Geological Landscape	One aspect area directly affected has been assessed as being of high quality. The area includes rock formations considered to be of national importance.
Landscape Habitats	Aspect areas directly affected have been evaluated as being of moderate quality.

13.6.4 Existing vegetation that would be directly affected the Scheme works would be surveyed using a review of aerial photography and field surveys.

13.6.5 A photographic record of elements that represent character areas will be included.

Visual Effects

13.6.6 In accordance with Annex 2 of IAN 135/10 (W), the study area of the assessment of visual effects will extend to the whole area from which the Scheme could be visible.

13.6.7 A Zone of Theoretical Visibility (ZTV) will be produced to show the indicative extent of the surrounding area from which views of the Scheme would be available. The ZTV will be based on a digital terrain model that does not take into account the screening effects of surface features such as buildings and substantial vegetation. Site surveys will test the ZTV and the assess screening effect of surface features.

13.7 Assessment Methodology

Scope of Proposed Assessment

13.7.1 IAN 135/10 (W) contains a range of criteria for the assessment of magnitude of change, sensitivity of receptor and significance of effect for landscape and visual effects. These will be used in the assessment.

13.7.2 Direct landscape effects associated with the Scheme are likely to include physical change to the landform and surface features, fragmentation of land parcels and communities and the introduction of moving traffic into rural areas. Indirect landscape effects are likely to include the influence of road traffic on the tranquillity of surrounding areas.

13.7.3 Direct visual effects associated with the Scheme are likely to include changes in view and their composition for viewers. Indirect visual effects are likely to include changes to the way people use places.

13.7.4 Landscape and visual effects will be assessed for the construction phase of the Scheme, and will include the following:

a) Site clearance and disruption of field boundaries and vegetation;
b) Earthworks construction of embankments and/or excavation of cuttings;
c) Construction of ancillary elements such as flood water attenuation areas;
d) Movement of construction and haulage vehicles;
e) Location of site compounds and welfare units and;

f) Prominent lighting of night-time working.

13.7.5 Assessments will be made of the Year 1 effects in winter before any mitigation planting has become established, and will include the following:

a) View of embankments, cuttings and roadside verges;
b) Traffic, road surface and structures;
c) Signage, including safety barriers and;
d) Night time effect of vehicle headlights, new road lighting and sign lighting.

13.7.6 Year 15 effects in summer after mitigation planting has matured enough to satisfy its design function will include the following:

a) Enduring views of traffic, signage and structures and;
b) Residual lighting impacts.

13.8 Assessment of Potential Effects

Landscape

13.8.1 The assessment will consider construction and operational effect on each landscape character area identified during the baseline study. In accordance with Annex 1 of IAN 135/10 (W), the magnitude and nature of impact will be estimated as one of five levels of severity; major, moderate, minor, negligible (which could be adverse or beneficial), and no change.

13.8.2 The output of the landscape character assessment will determine the landscape sensitivity. It will depend on the value of the receiving landscape and its ability to accept the proposed road improvement. The landscape sensitivity will be assessed as one of three levels; high, medium or low.

13.8.3 The significance of effect will be determined by considering together the magnitude of impact and the landscape sensitivity. The result would range from neutral to very large (which could be detrimental or beneficial).

Visual Impact

13.8.4 The assessment will include consideration of construction and operational effects on views from different receptor groups that include residential properties, community facilities, commercial properties, public rights of way and selected viewpoints.

13.8.5 In accordance with Annex 2 of IAN 135/10 (W), the assessment will consider the short/medium term effect during the winter of Year 1, and the medium/long term effect during summer of Year 15. The magnitude and nature of impact will be estimated as one of five levels of severity; major, moderate, minor, negligible (which could be adverse or beneficial), and no change.

13.8.6 The magnitude of impact would then be considered together with the sensitivity and activity of the visual receptors and a subsequent category of significance of effect would then be established, ranging from neutral to very large (again could be adverse or beneficial).

Potential impacts of the northern route

13.8.7 The northern route option is expected to have an impact on the landform of the Redstone/Sodston Ridge and on views. The eastern end of the route, on embankment and on the top of the ridge, would affect views to the north, east and to the south. There are some long views to high land to the south of Narberth and to ridges to the north. The western end of the route would be in cutting through the ridge so the adverse effect of the road on views would be less significance with traffic and the road hidden in the ground from most viewpoint. It is possible that distant views from the Preseli Hills would be available, but only with good visibility. The embanked length of the route could offer wide long views to the north which would provide added interest for the traveller.

Potential impacts of the southern route

13.8.8 The southern route option crosses low lying land in a valley between ridges. The route, on embankment, would be elevated above the valley floor, but the surrounding landform and established hedges and trees would provide screening that would limit distant views. Views north would be limited to the top of the Sodston/Redstone Ridge. Views to the south would be mostly limited by higher ground including Redstone Bank.

13.9 Proposed mitigation

13.9.1 A scheme of mitigation would include modification of the earthworks to integrate the engineering with the adjacent landform. Hedge and tree planting would be used to link the road with adjacent landscape features and where possible the visible extent of permanent land take would be minimised. Trees and landform would also be used to provide visual screening. All features of environmental mitigation and enhancement, such as noise, drainage or ecological measures, will be designed to form a cohesive and integrated whole to be shown in the Environmental Masterplan.

14 ARCHAEOLOGY & CULTURAL HERITAGE

14.1 Introduction

14.1.1 This section of the Scoping Report describes the scope of the archaeology and heritage assessment. References to national and local planning policies to be considered are included as well as the approach to the assessment of likely significant effects of the preferred route and approaches to mitigation. Archaeology and cultural heritage is the evidence relating to earlier and existing cultures that may be found within the perimeter of a project. Design Manual for Roads and Bridges (DMRB) defined three subject areas as follows:

Archaeological Remains are materials created or modified by past human activities that contribute to the study and understanding of past human societies and behaviour.

Historic Buildings are architectural or designed or other structures with a significant historical value.

Historic Landscapes are defined by perceptions that emphasise the evidence of the past and its significance in shaping the present landscape.

14.1.2 Cultural heritage encompasses all these, and other linguistic and cultural practises valued by contemporary society.

14.1.3 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

14.2 Relevant Guidance

14.2.1 The requirements for a project are set out in DMRB Vol 11 Sec 3 Part2, Annex 8, paragraph 8.2. This implies that the Design Organisation, will report to and confirm with Transport Wales and Cadw on the scope of assessment proposed.

14.2.2 The Design Organisation, will be responsible for agreeing the Scheme Design, assessment reports, archaeological designs and mitigation measures with Transport Wales and Cadw. The Design Organisation will also consult with the regional archaeological trust and obtain up to date information from its site and monuments record. The organisation

in this case is the Dyfed Archaeological Trust which maintains the Historic Environment Record (HER).

14.2.3 National legislation and guidance that is relevant to the cultural heritage for this area comprises:

a) Ancient Monuments and Archaeological Areas Act 1979 (Ref 10.2);
b) Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref 10.3);
c) Planning Policy Wales edition 10 (July 2018);
d) Historic Environment (Wales) Act 2016;
e) Settings of Historic Assets in Wales, Cadw May 2017;
f) Conservation Principles for the Sustainable Management of the Historic Environment in Wales, Cadw 2011;
g) Welsh Office Circular 1/98: Planning and the historic environment directions by the Secretary of State for Wales (Ref 10.5);
h) Technical Advice Note 24: The Historic Environment, Welsh Government 2017
i) Chartered Institute for Archaeologists 'Standards and guidance for historic environment desk-based assessment' (2017) (Ref 10.8).

14.2.4 The Pembrokeshire Local Planning Development Plan, adopted February 2013, contains a proposed policy relevant to the historic environment, '*GN.38 Protection and Enhancement of the Historic Environment: development that affects sites and landscapes of architectural and/or historical merit or archaeological importance, or their setting, will only be permitted where it can be demonstrated that it would protect or enhance their character and integrity'*.

14.2.5 The requirements for a Design and Build project are set out in DMRB Vol 11 Sec 3 Part 2. This implies that the Design Organisation, will report to and confirm with Transport Wales and Cadw on the scope of assessment proposed.

14.2.6 The Design Organisation will be responsible for agreeing the Scheme Design, assessment reports, archaeological designs and mitigation measures with Transport Wales and Cadw. The Design Organisation will also consult with the regional archaeological trust and obtain up to date information from its site and monuments record. The organisation in this case is the Dyfed Archaeological Trust which maintains the Historic Environment Record (HER).

14.2.7 The assessment will be presented as a chapter for inclusion in the ES. All work will be prepared in accordance with Chartered Institute of Field Archaeologists Standard and Guidance for Historic Environment Desk-Based Assessment, January 2017 and DMRB Vol 11 Section 3 Part 2.

Consultations

14.2.8 There will be consultations with interested parties including Cadw and the Dyfed Archaeological Trust Planning Service. Following an evaluation of the setting of heritage assets consultations will be undertaken with all relevant statutory consultees, including the Welsh Historic Gardens Trust, where assets and their settings are affected.

14.2.9 Cadw has been consulted regarding the potential impact to the setting of the Redstone Cross round barrows, a Scheduled Ancient Monument (PE154).

14.3 Study Area

14.3.1 Information on all designated assets within 5km of the project limits will be collected and used for background information and any potential impact. Undesignated heritage assets within 500m of the project will be collected and assessed for impact.

14.4 Work Undertaken to Date

14.4.1 No surveys have been undertaken for the project to date. Some data has been collected from publicly available sources to assist with initial route design in previous studies by others on behalf of Welsh Government. All information on heritage assets on the route is the result of previous general data collection.

14.4.2 A desk-based assessment and detailed surveys are required as part of the provisions of the contract and to meet standard requirements.

14.5 Baseline Conditions

14.5.1 Information obtained to date, indicates that there are a range of heritage assets along the project corridor. Further assets can be expected to be identified in the greenfield sections of the project, while other assets are

known near to the on-line sections.

14.5.2 The archaeological and cultural heritage assets contained within the area covered by the route option is varied. Most assets are from the last two hundred years, with a range of assets in the area stretching back through the medieval to the Prehistoric period. A Gazetteer of cultural heritage features, drawn from, is presented in Tables 14.1 and 14.2.

Neolithic (4000 BC to 2200 BC)

14.5.3 Although Mesolithic and probably earlier, people had used this area, it is not until the Neolithic that evidence of man is known. This is limited to a couple of isolated findspots and the Llan burial chamber in Lampeter Velfrey. In the study area, there must be further locations of Neolithic activity, but they have yet to be identified.

Bronze Age (2500 BC to 700 BC)

14.5.4 Evidence of Bronze Age use of the area is shown by large numbers of round barrows the area. These are often found in concentrations such as Redstone in the west of the area. These represent a belief in the afterlife shown by the burials within them. Bronze Age society was relatively mobile; burial mounds being a fixed point the landscape, located on relatively high points. Five groups of burial mounds have been designated as Scheduled Ancient Monuments in the surrounding landscape, although some of these will be outside the 5km study area for designated assets.

14.5.5 Evidence of domestic use of the area is shown by the frequent discovery of burnt mounds. These are collections of burnt fire shattered stone in a matrix of charcoal rich soil. They are typically found in close association with springs or small watercourses. Radiocarbon dating normally shows them to be of Bronze Age date, although some are earlier, and they can be as late as the Post-Roman era. On excavation, these features are usually associated with a small water-filled trough. Experimental archaeology shows that water in these troughs can be brought to boiling point by throwing stones into the trough. This can then be used for cooking or possibly, some form of sauna. These features are very common Wales, Ireland and Scotland. All the features in the study area were found by Ordnance Survey surveyors who identified many in the region during the early 20th century. It is likely that many more of these insignificant features await discovery in the

area, as shown by over 50 found during construction of the recent pipeline across South Wales.

Iron Age (800 BC to AD 43)

14.5.6 This period is characterised by a more settled economy featuring defended enclosures. These often contained houses enclosed by defensive bank and ditch. Some were formed by cutting off ridges with an earth bank to create a promontory fort. There are several of these in the western study area using the ridges along the meanders of the East Cleddau River Valley. The economy of these people is thought to be based on herds of cattle and sheep which required protection. There are many other similar enclosures known only from cropmarks in the area. Although these features originate in the Iron Age, many continue to be used through the Roman period and it is likely that some continued even into the post Roman period.

Roman (AD 43 to AD 410)

14.5.7 The most obvious evidence of Roman activity in the study area is the line of the road running west from Whitland along the north of the study area. This was well constructed with evidence of two periods of construction. It can be traced towards the Roman fort at Wiston, just outside study area. Though the road is likely to have had its origins in the military period, it indicates strong interest in West Wales. No other assets of Roman date have been identified, although activity has been recorded in some of the Iron Age locations adjacent to the study area. This is typical and is probably repeated throughout locations in the study area.

Early Medieval (AD 410 to AD 1066)

14.5.8 The adoption of Christianity during the Roman period can be seen in the discovery of inscribed crosses in several locations dating to the early medieval. Domestic settlement probably continued or re-established itself in the defended enclosures, although new centres of settlement probably began, possibly in the locations used by later farms and, consequently, are difficult to identify.

Medieval (1066 to 1540)

14.5.9 Llanddewi Velfrey, Lampeter Velfrey and Crinow were part of the

commote of Efelffre, a pre-Norman territorial unit, which was the origin of the suffix Velfrey.

14.5.10 The medieval period is characterised by castles and churches with associated settlement that signified a settled landscape with a developed farming system. To the east was the Whitland Abbey, which is most associated with being the place where Hywel Dda drew up his laws around 940. It functioned as a Cistercian monastery between the 12th and 16th centuries.

14.5.11 The period saw the early development of market towns such as Narberth, and some of the larger villages began to develop such as Lampeter Velfrey, Clunderwen and Llandissilio. The villages were set in a landscape of long rectangular fields, parts of which can be seen in the present-day landscape.

Post-medieval (1540-1901)

14.5.12 The strong social and cultural division of West Wales, the Landsker line, probably was at its strongest in this period. Though it originates from the settlement of Flemings in South Pembrokeshire in the 12th century, the clearest evidence for the linguistic provision comes from names, records and civil transactions of the later period. The study area lies north of the Landsker division and firmly in the Welsh speaking area, as shown by inscriptions on gravestones in the two main chapels, Bethel and Ffynnon, close to the proposed road alignment.

14.5.13 Communications were prominent in this period. The line of the A40 was adopted as a turnpike between Whitland and Penblewin operated by the Whitland Trust. A later development was railway line from Carmarthen to Haverfordwest erected in 1854 along the north of the study area. Whitland was the junction for lines to Pembroke Dock, Tenby, Fishguard and Cardigan. The station became a marshalling yard and was a focal point in the transport of agricultural products to industrial areas. The construction of a milk processing factory gave a huge impetus to the development of the town. This was in contrast the town of Narberth, isolated from both the A40 and the railway leading to a slower growth.

14.5.14 The village of Llanddewi Velfrey appears to have its origins close to the Church of St Davids. During the Victorian period, it moved more toward the line of the present day A40 as shown by historic maps. This

resulted in the development of a strip settlement along the A40.

Summary of Heritage Assets

14.5.15 Appendix 4 Table 14.1 lists the designated assets, both scheduled ancient monuments and listed buildings that lie with 5km of the project limits.

14.5.16 The potential effects on cultural and built heritage include physical impacts upon archaeological features and the historic landscape, visual and noise impacts on the setting of archaeological features and on the setting of built heritage features, and the historic landscape.

14.5.17 Heritage assets located within 500m of the route are shown in Table 14.2. There are no physical impacts on any of these assets. It is possible that noise and visual perception may be impacted in certain circumstances.

14.5.18 There is a high likelihood that intrusive works will uncover previously unrecognised archaeological deposits. The potential for previously unrecorded assets has not been quantified.

14.5.19 This phase of the project will conduct remote sensing, geophysical survey and walk over surveys, all the non-intrusive work that can be undertaken. It is likely that additional evaluation work will be required at a later stage of the project, once the decision to proceed to construction is taken. This may include evaluation trenching and full area assessment. The scale of this work will depend upon the results of the preceding studies.

Table 14.3 Heritage assets known within 500m of the route options

Name	Status	Source
Sodstone Manor	LBII	6540 Cadw
Sodstone House	LBII	6538 Cadw
Coach house and stables at Sodstone House	LBII	6539 Cadw
Blaen Marlais	LBII	6508 Cadw
Barn in grounds of Blaen Marlais	LBII	6509 Cadw
Blaen Ffynnonau	LBII	6506 Cadw
Stable attached to Blaen Ffynnonau	LBII	6507 Cadw
Cilrath Fach	LBII	6528 Cadw
Cowhouse at Cilrath Fach	LBII	6529 Cadw
Lofted cowhouse at Cilrath Fach	LBII	6530 Cadw
Barn at Cilrath Fach	LBII	6532 Cadw
Stable at Cilrath Fach	LBII	6531 Cadw
Redstone Cross Barrows	SAM	PE154 Cadw

14.6 Proposed Scope of Baseline Studies

14.6.1 Data gathering to be undertaken will include:

a) Acquiring Historic Environment Records (HER) information for 500m study area and designated assets within 5km radius;

b) Undertaking reviews of recorded assets and examine published local history and other sources, including published documentary, cartographic (Tithe Map and historic Ordnance Survey maps) and air photographic (Google Earth and National Monument Records air photographs) data;

c) Examining available Lidar surveys of the area and undertake geophysical survey of the project area;

d) Geophysical surveys of the extent of the project.

Assessment of an intrusive nature will be considered following results of the surveys identified above.

14.6.2 The subject matter will be broken down into two main areas. These will be identified and considered separately insofar as they are directly overlapping, but may require different mitigation techniques:

a) Archaeological remains and historic landscapes;

b) Historic buildings.

14.7 Assessment of Potential Effects

14.7.1 Impacts identified include physical impact on heritage features, damage and indirect impacts on buried archaeological features, change in visual perception and noise in specific heritage locations. The change in the setting of heritage assets will also be assessed.

14.7.2 The identified impacts on heritage assets and their settings have not been definitively established and thus it is not possible to state with any certainty at this stage what impact will remain following detailed design and mitigation. Once a detailed design is produced for the Scheme, the residual effects can be assessed in more detail.

Cumulative Effects

14.7.3 The overall cumulative impact alongside other contemporary and future developments is likely to be adverse. At this stage, any magnitude of impact has not been quantified.

14.7.4 The study to date has identified assets of cultural heritage value, primarily of built heritage assets dating from the 19th and 20th centuries, which are distributed throughout the study area. Additional assets of earlier date were recorded. Further study is required to assess the full range of heritage assets within the study area.

14.8 Mitigation Measures

14.8.1 Mitigation is expected to take the form of investigation and recording of assets or parts of assets that are directly affected by construction works, and the inclusion of landscape mitigation to protect an asset where the setting of the feature is affected by the scheme.

15 COMMUNITY AND PRIVATE ASSETS

15.1 Introduction

15.1.1 This topic will be addressed in two chapters of the proposed Environmental Statement so that there will be separation of assessments of agricultural land use from other land use and community assets.

15.1.2 The agricultural assessment will cover the loss of land and soil resources, the type of land management and farming practices currently operated and the potential impacts on these, and matters such as severance, disturbance and disruption.

15.1.3 Initial studies have shown that no community land would be taken by the Scheme. The effects on development land will be considered because there are allocations under the Pembrokeshire Local Plan for 'strategic employment' and 'housing' to the south of the Scheme in Narberth.

15.1.4 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

15.2 Relevant Guidance

National Planning Policy

15.2.1 Paragraph 3.54 of Planning Policy Wales Ed 10 (PPWE10) notes that 'Agricultural land of grades 1, 2 and 3a of the Agricultural Land Classification system (ALC) is the best and most versatile and should be conserved as a finite resource for the future'. Paragraph 3.55 goes on to advise that considerable weight should be given to protecting such land from development, and that it should be developed only if there is an overriding need and land in lower grades is not available.

15.2.2 Technical Advice Note (TAN) 6 'Planning for Sustainable Rural Communities' also advises at paragraph 6.2.1 that 'when preparing development plans and considering planning applications, planning authorities should consider the quality of agricultural land and other agricultural factors.' Section 6.2 advises on the 'other' factors to consider when assessing the effects of development on agricultural land. These include:

a) The effects on farm size and structure;

a) The effects on the efficient use of buildings, fixed equipment and capital investment; and

b) The effects on drainage, both surface water and land drainage systems.

15.2.3 National Planning Policy governing the non-agricultural development of agricultural land is set out in Planning Policy Wales (Edition 10, 2016). Paragraph 3.54 on page 38 notes that:

> *'Agricultural land of Grades 1, 2 and 3a of the Agricultural Land Classification system (ALC) is the best and most versatile and should be conserved as a finite resource for the future.*
>
> *When considering the search sequence and in developing development plan policies and development management decisions considerable weight should be given to protecting such land from development, because of its special importance. Land in Grades 1, 2 and 3a should only be developed if there is an over-riding need for the development, and either previously developed land or land in lower agricultural grades is unavailable, or available lower grade land has an environmental value recognised by a landscape, wildlife, historic or archaeological designation which outweighs the agricultural considerations. If land in grades 1, 2 and 3a does need to be developed, and there is a choice between sites of different grades, development should be directed to land of the lowest grade'.*

15.2.4 Well Being of Future Generations Act which has the vision of community facilities that contribute to '*A modern, fit for purpose, inclusive and sustainable infrastructure across Wales*'. Under the Act it is proposed that there should be three levels of provision, with the overarching principles being the tackling of poverty and inequalities along with consideration of effective co-location of services appropriately applied to each level.

15.2.5 Public bodies, including Welsh Government, must work towards delivering all 7 well-being goals. The Resilient Wales goal of maintaining and enhancing a biodiverse natural environment with healthy functioning ecosystems must be given equal prominence within all well-being objectives laid out by Welsh Government and public bodies. Future land management policies must therefore deliver for this goal as much as any other goal. Sustainable land management is crucial

to successful progress on Welsh Government indicators on the status of biodiversity and ecosystems and has a key role in helping gather the data to inform the measurements of progress.

15.2.6 Environment (Wales) Act 2016 also has relevance in achieving sustainable land management and biodiversity goals and to reducing carbon emissions by 2050.

Local Planning Policy

15.2.7 The current Pembrokeshire Local Development Plan provides for the allocation of land for new housing and employment land.

Assessment Guidance

15.2.8 The loss of land used by the community would be assessed in accordance with the methodology within the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 6, Chapter 4.

15.2.9 Assessment of the effects on Agricultural Land and Farm Businesses will be carried out in accordance with the methodology within the DMRB Volume 11, section 3, Part 6. As per the DMRB and national planning policy set out in Planning Policy WALES Edition 10, December 2018).

15.3 Study Area

15.3.1 DMRB Volume 11, Section 3, Part 8 does not specify a study area for the assessment of effects on communities and community resources but references the need to establish local travel patterns and the identification of key community facilities and their catchment areas (Highways Agency, 1993). The study area for the Scheme must, therefore, take account of the way community facilities are provided in a rural setting. For these reasons, the study area includes a 500m corridor either side of the proposed carriageway and the settlements of Narberth Clynderwen, Robeston Wathen and Llanddewi Velfrey. This may affect farmland within that corridor that is occupied by farm businesses that extend further afield, and in those cases the study area will be the whole of the potentially affected farm business.

15.4 Work Undertaken to Date

15.4.1 The Welsh Government has produced a 'Predictive Agricultural Land Classification Map' (2017). The affected land is shown on this predictive map as comprising land mostly falling into subgrade 3b with patches of Grade 4. Under the Guidance Note that accompanies this map, where the predicted land quality is in Grades 3b, 4 or 5, no ALC survey is required.

15.4.2 A preliminary survey of community facilities and land has been completed to allow land ownership plans to be developed.

15.5 Baseline Conditions

Community land and facilities

15.5.1 The proposed route will pass Blaenmarlais Care Home, a facility used by the community. In addition, it will pass residential properties and a small commercial unit. The connecting Redstone Road (B4313) provides access to land allocated under the local plan for strategic employment and housing, although the potential effects are considered to be indirect.

Agricultural Land Quality

15.5.2 Aerial images show that the land is mostly farmed, and the proposed route alignment affects areas permanent pastureland which is grazed by livestock (beef, sheep and dairy) and utilised for fodder production, although there are areas of woodland. As noted, the land quality of the study area is shown as subgrade 3b with small areas of grade 4, i.e. land that is not 'best and most versatile agricultural land'.

15.6 Proposed Scope of Baseline Studies

15.6.1 As the predictive map identifies that no land of best and most versatile quality will be affected, no field survey will be undertaken.

15.6.2 In respect of farm businesses, a review of land Registry information (to be provided by the client), together with responses to questionnaires, will be undertaken. Aerial photography will be reviewed.

15.6.3 Where necessary, the main affected agricultural owners / occupiers will be visited and interviewed in order to collect information about their agricultural use of the land. Face-to-face interviews will be held with the occupiers of the most affected units and the affected farms inspected. Where land-take is minimal or limited to field edges we will view the Site and undertake telephone interviews with the occupiers.

15.6.4 A survey of community facilities will be required.

15.7 Assessment Methodology

15.7.1 This section will identify and predict the likely effects of the proposed development on agricultural land quality, farm businesses and community assets, including commercial premises.

15.7.2 The process of EIA requires various thresholds to be set to determine the levels of significance of impact. There are no universally recognised definitions of what constitutes 'significant'; this will differ according to the perspective of the stakeholder(s). However, for the purposes of this technical assessment of agricultural resources, and to assist in its interpretation, common assessment criteria and terminology were developed for the analysis of predicted impacts.

15.7.3 For community assets the assessment will use the approach set out in Section 9.2 of this report. The assessment will consider temporary effects, i.e. those only experienced during construction and permanent effects, i.e. those that will be experienced throughout operation.

15.7.4 The assessment criteria for impacts on agricultural soil resources and businesses as set out below were agreed previously with the Regional Planning Advisor from the Technical Services Department of the Welsh Government. The criteria are based on the formulaic approach proposed in the Revised DMRB guidance.

15.7.5 Farm and land-based rural businesses, whether run by owner-occupiers, tenants, licensees or contractors, and whether affected directly or indirectly, are a key receptor. The assessment will consider the physical effects, including land loss, severance, the potential effects on the movement of livestock and machinery, field accesses, drainage and the use of farm buildings. It will also consider, taking a long-term view, the potential effects on the medium to long-term ability for the remaining holding to continue in a beneficial agricultural use.

15.7.6 The effect on occupying and neighbouring land-based businesses can vary from year to year, and even from day to day, affected by many external influences such as management wishes and decisions, market prices, illnesses and diseases, the weather and monetary exchange rates. As such it is a transient impact, so a long-term assessment will be carried out assuming a similar scale of agricultural use continues.

15.7.7 Whilst the quality and quantity of agricultural land influences the farming and other land management practices operated over it, the effect on those businesses is assessed as being of local importance, due to their transient nature. That distinction is not intended to denigrate the important role of land managers in providing food for the nation and other opportunities and services.

15.7.8 The assessment on land resources will be carried out in three stages. First the magnitude, secondly the importance / sensitivity of the receptor, and thirdly the significance of impact will be considered. These will be determined against the criteria set out in Table 15.1 below. The sensitivity of receptors will be determined against the criteria set out in Table 15.2.

Table 15.1 Magnitude of Impact Assessment Criteria for Agriculture

Impact Magnitude	**Definition**	
	Impact on Soils	**Impact on Local Agriculture**
Major	The Scheme would directly lead to the loss of over 20 hectares of "best and most versatile agricultural land" (Grades 1/2/3a).	The impact of the Scheme would render a full-time agricultural business non-viable.
Moderate	The Scheme would directly lead to the loss of between 5 and 20 hectares of "best and most versatile agricultural land" (Grades 1/2/3a).	The impact of the Scheme would require significant changes in the day to day management of a full-time agricultural business.
Minor	The Scheme would directly lead to the loss of less than 5 hectares of "best and most versatile agricultural land" (Grades 1/2/3a) or the loss of any quantity of non "best and most versatile agricultural land" (Grades 3b/4/5).	Land take would require only minor changes in the day to day management / structure of a full-time agricultural business or land take would result in the loss or a significant impact on a part-time business.
Negligible	No direct impact upon agricultural land	Land take would require only negligible changes to an agricultural business

Table 15.2 Sensitivity of Receptors

Sensitivity	Receptor/ Resource
High	Land resources are matters of potentially national importance, as identified in PPWE10. The BMV agricultural land (Grades 1, 2 and 3a) is of national importance. The effect on land resources is a combination of the quantum and quality of agricultural land affected, relative to both the national resource and the relative availability of land of that quality locally. Land resources of BMV quality should therefore be classified as being of high environmental value (sensitivity).
Medium	Land that is of poorer quality, Grades 3b, 4 and 5, is of lower sensitivity and is afforded no special protection in PPWE10. It is nevertheless a finite resource of local importance and so is regarded as of moderate sensitivity. Full-time farm businesses are of medium sensitivity, as the way that farms are operated will vary over time according to ownership, security of tenure and local and international economic factors. Farm businesses are tolerant of some change without detriment to their character.
Low	Part-time farm businesses are of low sensitivity. The way that farms are operated will vary over time according to ownership, security of tenure and local and international economic factors. Farm businesses are tolerant of some change without detriment to their character.

15.7.9 A combination of the magnitude and sensitivity will allow an assessment of the significance of the impact on agricultural assets to be made as per Table 15.3 below.

Table 15.3 Significance of Impact Criteria

Magnitude	Sensitivity		
	High	Medium	Low
Major	Major Adverse / Beneficial	Moderate Adverse / Beneficial	Minor Adverse / Beneficial
Moderate	Moderate Adverse / Beneficial	Minor Adverse / Beneficial	Minor Adverse / Beneficial
Minor	Minor Adverse / Beneficial	Minor Adverse / Beneficial	Minor Adverse / Beneficial
Negligible	Negligible	Negligible	Negligible

15.8 Assessment of Potential Effects

15.8.1 The scheme is likely to have only a neutral impact on community facilities, but an adverse effect on farm businesses because of field and farm severance.

15.9 Mitigation Measures

15.9.1 The assessment of potential effects on farm businesses will be made

early in the process. Accordingly, the impacts will be identified, and mitigation will, where possible, be built into the Scheme.

15.9.2 Mitigation of effects on community facilities and assets will be developed through the Scheme design. Refer to Chapter 13 Landscape and Visual and Chapter 17 Noise and Vibration.

16 AIR QUALITY

16.1 Introduction

16.1.1 This section of the Scoping Report details the proposed scope of the assessment for local air quality and regional pollutant emissions, during both the construction and operational phases of the Scheme.

16.1.2 This section of the Scoping Report identifies potential effects that could result from the Scheme and details the proposed scope of the assessment for local air quality and regional pollutant emissions, during the operational phase of the Scheme.

16.1.3 Emissions of construction dust and particulate matter (PM) occur as a result of construction activities such as demolition, earthworks, construction and trackout. The quantities of each depend on the scale and intensity of the construction works. Once emitted dust can be deposited and become a nuisance. Emissions from vehicle exhausts contain several pollutants, including oxides of nitrogen (NOx), carbon monoxide (CO), hydrocarbons, carbon dioxide (CO2) and particulate matter (PM). The quantities of each pollutant emitted depend on the type of vehicle, quantity and type of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed into the ambient air. Pollutant concentrations of nitrogen dioxide (NO_2) and PM in the air can be measured or modelled, and then compared with air quality standards. Local air quality would be affected as a result of the construction and operation of the Scheme, as a result of increased vehicle numbers and redistribution of vehicles across the network.

16.1.4 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

16.2 Relevant Guidance

European Air Quality Management

16.2.1 In May 2008, the Council Directive (2008/50/EC)[47] on Ambient Air Quality and Cleaner Air for Europe came into force. The Directive sets

[47] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

'limit values' and 'target values' for ambient concentrations of pollutants. The limit values defined in the Directive are legal requirements and compliance with these is reported on an annual basis by Welsh Ministers. The Directive also covers the division of the UK into zones for the purpose of compliance reporting. The Directive was transposed into national legislation in Wales by the Air Quality Standards (Wales) Regulations 2010 (WSI 2010 No. 1433).

16.2.2 In addition to limit values to protect human health, the EU has set NO_x limit values for the protection of vegetation. The annual mean limit value for NO_x for the protection of vegetation is 30µg/m^3. The limit values for the protection of vegetation apply to locations more than 20km from towns with more than 250,000 inhabitants or more than 5 km from other built-up areas, industrial installations or motorways. As stated in the EU Directive, monitoring sites need to be representative of an area of 1,000 square kilometres, the limit does not have a statutory basis in micro-scale environments such as those close to a road or other pollution source.

16.2.3 The United Nations Economic Commission for Europe (UNECE) and the World Health Organisation (WHO) have set a critical level for NO_x (30µg/m^3), for the protection of vegetation. Therefore, the statutory nature conservation agency's (Natural Resources Wales) policy is to apply the 30µg/m^3 criterion as a benchmark, on a precautionary basis, in internationally designated conservation sites and in Sites of Special Scientific Interest (SSSIs).

Environment Act 1995

16.2.4 Part IV of the Environment Act 1995[48] places a duty on Welsh Ministers for the Environment to develop, implement and maintain an air quality strategy with the aim of reducing atmospheric emissions and improving air quality. The National Air Quality Strategy (NAQS) for England, Scotland, Wales and Northern Ireland provides the framework for ensuring compliance with air quality limit values based on a combination of international, national and local measures to reduce emissions and improve air quality. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of local air quality management and declare Air Quality Management Areas (AQMAs) where necessary.

[48] Environment Act 1995, Chapter 25, Part IV Air Quality

16.2.5 The NAQS has now been superseded by the Clean Air Strategy which is discussed further in section 16.2.6 and 16.2.7.

Air Quality (Wales) Regulations 2000 and Air Quality (Wales) (Amendment) Regulations 2002

16.2.6 The Air Quality (Wales) Regulations[49] as amended in 2002[50] bring the air quality objectives into Welsh law. These are discussed further in sections 16.2.8 and 16.2.8.

Air Quality Objectives and Limit Values

16.2.7 Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment i.e. effects occur (long-term) after a prolonged period of exposure to elevated concentrations, and others have standards expressed as 24-hour, 1-hour or 15-minute average concentrations (short-term) due to the acute way in which they affect health or the natural environment i.e. after a relatively short period of exposure. Some pollutants have standards expressed in terms of both long-term and short-term concentrations. Table 16.1 sets out the EU air quality limit values and national air quality objectives for the pollutants relevant to this study (NO_2 and PM_{10}).

16.2.8 In most cases, the air quality limit values and air quality objectives have the same pollutant concentration threshold and date for compliance. The key difference is that Welsh Ministers are required under European Law to ensure compliance with the air quality limit values whereas local authorities are only obliged under national legislation to undertake best efforts to comply with the air quality objectives. To assist local authorities in demonstrating best efforts, the Environment Act 1995 requires that when carrying out their local air quality management functions, local authorities shall have regard to guidance issued by Welsh Ministers.

[49] Welsh Government (2000), Air Quality (Wales) Regulations
[50] Welsh Government (2002), Air Quality (Wales) (Amendment) Regulations

Table 16.1 UK and EU air quality standards and guidelines

Pollutant	Averaging period	Limit value/objective
Nitrogen dioxide (NO_2)	1 hour mean	200µg/m^3, not to be exceeded more than 18 times a year (99.79th percentile)
	Annual mean	40µg/m^3
Fine Particulate Matter (PM_{10})	Daily mean	50µg/m^3, not to be exceeded more than 35 times a year (90.4th percentile)
	Annual mean	40µg/m^3
Very Fine Particulate Matter ($PM_{2.5}$)	Annual mean	25µg/m^3

Well-being of Future Generations (Wales) Act 2015

16.2.9 The Well-being of Future Generations Act[51] has several well-being goals that are to be achieved through implementation of sustainable development. Changes in air quality can have an impact on the health of ecological habitats and humans, as such, the goals to create 'a resilient Wales' and 'a healthier Wales' apply.

16.2.10 National indicators have been set for Welsh Ministers to understand the progress being made to achieving the well-being goals. One of these national indicators relates to levels of NO_2 in the air. The Well-being of Future Generations Act aims to reduce pollution exposure by assessing a weighted population average to NO_2 on an annual basis.

Planning Policy Wales, Edition 10

16.2.11 The 10th edition of Planning Policy Wales[52] (PPW10) was published in December 2018. It sets out land-use and planning policy for Wales. The new planning policy incorporates principles derived from the Well-being of Future Generations (Wales) Act 2015.

16.2.12 The policy document is set out into themes, with air quality predominantly addressed in the Distinctive and Natural Places theme. Section 6.7 of PPW10, Air Quality and Soundscape, highlights the importance that air quality has in creating a positive experience of

[51] Welsh Government (2015) Well-being of Future Generations (Wales) Act
[52] Welsh Government (2018) Planning Policy Wales Edition 10 (PPW10)

place, public health, amenity and well-being. Specific reference is made to the contribution the planning system should make to achieving a healthier Wales through reducing population exposure to air pollution, while also tackling high pollution hotspots. Additionally, it states that preventing the creation of any new, or worsening of existing, air quality pollution problems is important.

UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations 2017

16.2.13 The UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations[53] sets out a number of investment initiatives and plans aimed at tackling NO_2 related air quality issues in the UK. This includes funding for Ultra Low Emissions Vehicles (ULEVs), grants for local authorities to improve air quality, funding for cleaner bus technology and cycling and walking infrastructure.

16.2.14 The plan passes the responsibility for dealing with air quality issues in the devolved nations of the UK onto their respective national governments. The Welsh Government produced a supplemental plan to the UK Clean Air Plan in 2018, which is set out in paragraph 16.2.16.

Tackling Roadside Nitrogen Dioxide Concentrations in Wales – Welsh Supplemental Air Quality Plan (2018)

16.2.15 The Welsh Supplemental Plan[54] was produced by the Welsh Government in response to the 2017 UK air quality plan. The plan sets out measures aimed at addressing air quality issues primarily along the strategic road network in Wales and local authority areas that are predicted to still be exceeding the NO_2 limit values. The measures include a number of 50mph speed limits on sections of the road network that are predicted to still be exceeding the annual mean limit value for NO_2 and working with selected local authorities (Cardiff Council and Caerphilly County Borough Council) to produce their own air quality assessments and plans to address air quality issues. The measures are designed to achieve compliance with the limit value as early as 2020.

[53] UK Government (2017), UK plan for tackling roadside nitrogen dioxide concentrations
[54] Welsh Government (2018), Tackling Roadside Nitrogen Dioxide Concentrations in Wales

Clean Air Strategy 2019

16.2.16 The Clean Air Strategy[55] addresses emissions of air quality from a number of sources, including transport and provides measures that are being taken to either create new legislation or fund new projects that will help to reduce emissions from the transport sector.

16.2.17 Measures that effect road transport include working to ensure that the sale of new conventional petrol and diesel engine cars and vans ends by 2040, the introduction of new legislation to allow manufacturers to be compelled to recall vehicles for failures in their emission control systems, research into reducing non-exhaust emission of particulate matter, and action on using cleaner modes of transport for passenger and freight transport which include air quality.

One Wales: Connecting the Nation- The Wales Transport Strategy (2008)

16.2.18 The Transport Strategy for Wales[56] recognises that transport can be a key contributor to air pollution and consequently have an impact on human health and ecological habitats. It acknowledges that in order to improve air quality emissions from transport will have to reduce.

16.2.19 The strategy sets out actions designed to make sustainable travel easier to achieve with the consequence that emissions attributed to transport will be reduced. These measures increasing an integrated transport system that supports closer working between public transport providers, supporting the development of sustainable travel towns, and supporting the creation of regional transport plans.

Pembrokeshire County Council Local Development Plan 2013-2021

16.2.20 Policies from the Pembrokeshire County Council (PCC) Local Development Plan 2013-2021[57] relevant to air quality include:

> **GN1: General Development Policy,** Point 2: developments will be permitted where they will not result in a significant detrimental impact on local air quality; and

[55] UK Government (2019), Clean Air Strategy
[56] Welsh Government (2008), One Wales: Connecting the Nation – The Wales Transport Strategy
[57] Pembrokeshire County Council (2013) Pembrokeshire County Council Local Development Plan: Planning Pembrokeshire's Future

GN3: Infrastructure and New Development: provision must be made for mitigation of potential adverse impacts on air quality.

Local Air Quality Management Policy and Technical Guidance

16.2.21 The 2016 policy guidance document from Defra, LAQM.PG(16)[58], provides additional guidance on the links between transport and air quality. LAQM.PG(16) describes how road transport contributes to local air pollution and how transport measures may bring improvements in air quality. Key transport-related government initiatives are set out, including regulatory measures and standards to reduce vehicle emissions and improve fuels, tax-based measures and the development of an integrated transport strategy.

16.2.22 LAQM.PG(16) also provides guidance on the links between air quality and the land-use planning system. The guidance advises that air quality considerations should be integrated into the planning process at the earliest stage and is intended to aid local authorities in developing action plans to deal with specific air quality problems and create strategies to improve air quality. It summarises the main ways in which the land-use planning system can help deliver compliance with the air quality objectives.

16.2.23 LAQM.TG(16)[59] provides guidance to local authorities and air quality practitioners on all levels of air quality modelling and assessment. Where relevant this guidance has been considered.

Design Manual for Roads and Bridges

16.2.24 The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1: HA207/07[60] provides guidance for the assessment of air quality from road schemes. This guidance will be used to identify the Scheme's study area.

16.2.25 It should be noted DMRB and associated IANs have not yet been adopted in Wales, however, it is considered that DMRB and these IANs reflect current best practice guidance and as there is no suitable Welsh equivalent guidance, these were used to inform the proposed method of

[58] Defra (2016) Local Air Quality Management Policy Guidance. LAQM.PG(16)
[59] Defra (2016) Local Air Quality Management Technical Guidance. LAQM.TG(16)
[60] Highways Agency, (2007) Design Manual For Roads and Bridges Volume 11, Section 3, Part 1 Air Quality

assessment where applicable.

EPUK/IAQM land-use planning and development control

16.2.26 The 2017 Land-Use Planning & Development Control guidance document[61] produced by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) provides a framework for professionals operating in the planning system to provide a means of reaching sound decisions, regarding the air quality implications of development proposals. The guidance will be used to assess the significance of the Scheme.

Dust Guidance

16.2.27 Dust is the generic term used in the British Standard document BS 6069 (Part Two)[62] to describe particulate matter in the size range 1–75 µm in diameter. Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions of the Environmental Protection Act 1990, dust nuisance is defined as a statutory nuisance.

16.2.28 There are currently no formal standards or guidelines for what constitutes dust nuisance in the UK, nor are formal dust deposition standards specified. This reflects the uncertainties in dust monitoring technology and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. In law, complaints about excessive dust deposition would have to be investigated by the local planning authority and any complaint upheld for a statutory nuisance to occur. However, dust deposition is generally managed by suitable on-site practices and mitigation rather than by the determination of statutory nuisance and/or prosecution or enforcement notice(s).

16.2.29 The IAQM has published guidance[63] on the assessment of dust from demolition and construction. This provides a risk-based qualitative approach for determining the potential for dust impacts during the construction phase of the Scheme.

[61] EPUK/IAQM, (2017) Land-Use Planning & Development Control: Planning for Air Quality
[62] British Standards Institute (1983), BS6069: Part 2 1983, ISO 4225-1994, Characterisation of air quality
[63] IAQM (2016) Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)

16.3 Study Area

16.3.1 The air quality assessment of emissions related to traffic will comprise two sub-topics, each of which will have its own study area:

Local air quality, which relates to pollutants with the potential to affect human health and ecosystems at a local level; and

Regional air quality, which relates to local pollutants dispersing over a larger area, with the potential to affect human health or ecosystems, and greenhouse gas emissions which contribute to climate change.

16.3.2 The study area for the assessment of local air quality will be defined following guidance contained in HA207/07[60]. It will comprise:

a) all receptors within 200m of the centre line of the existing road;
b) receptors within 200m of the centre line of the Scheme; and
c) receptors within 200m of any other 'affected roads'.

16.3.3 The Affected Road Network (ARN) for the local assessment will be identified by the criteria published in HA207/07, based on how the Scheme causes changes to the road network. A road is included in the ARN if one or more of the following criteria are true:

a) Road alignment will change by 5m or more;
b) Daily traffic flows will change by >= 1,000 Annual Average Daily Traffic (AADT);
c) Heavy Duty Vehicle (HDV) flows will change by >= 200 AADT;
d) Daily average speed will change by >= 10kph; and
e) Peak hour speed will change by >= 20kph.

16.3.4 For the regional assessment, the ARN will be defined as those links within the traffic reliability areas (TRA) that meet any of the criteria below for the Scheme opening year (2021) or design year (2036):

a) Daily traffic flows will change by 10% AADT or more;
b) HDV flows will change by 10% AADT or more; and
c) Daily average speed will change by 20km/hr or more.

16.4 Work Undertaken to Date

Air Quality Monitoring

16.4.1 A diffusion tube monitoring survey was undertaken in Llanddewi Velfrey for the scheme known as the A40 between Llanddewi Velfrey and Penblewin roundabout (A40 LVP). The survey was carried out between May and December 2017.

16.4.2 The results of the six month monitoring survey were annualised, following the methodology set out in LAQM.TG(16)[59], to calculate annual mean concentrations at all monitored locations. The results of the study carried out for the A40 LVP can be used to inform the baseline for the Scheme.

A40 Llanddewi Velfrey to Penblewin Roundabout Improvements

16.4.3 A local and regional air quality assessment[64] for the A40 LVP section of the A40 improvement work was carried out and published in 2019. The A40 LVP scheme is a bypass project that would move the majority of road traffic passing through Llanddewi Velfrey to the north of the village, resulting in an improvement for most receptors in the area. The impact of the A40 LVP scheme on local air quality was predicted to be beneficial with no significant impacts.

16.5 Baseline Conditions

16.5.1 Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment, these are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

Local Air Quality

16.5.2 A review of the most recent local air quality progress report produced by Pembrokeshire County Council[65] showed that the nearest automatic monitoring site to the Scheme is located approximately 5km south in Princes Gate, Narberth. The monitoring details for this automatic

[64] Welsh Government (2019) A40 Llanddewi Velfrey to Penblewin Improvements – Environmental Statement Chapter 13: Air Quality
[65] Pembrokeshire County Council (2017) 2017 Air Quality Progress Report

monitoring site are in Table 16.2 and the results are in Table 16.3.

Table 16.2 Local authority automatic monitoring details

Site name	**OS grid reference**	**Pollutants monitored**	**Relevant exposure?** ***(Y/N with distance (m) to relevant exposure)***	**Distance to kerb of nearest road** ***(N/A if not applicable)***
Narberth (Princes Gate)*	214376, 212776	NO_2, SO_2, O_3, PM_{10}	No	Approx. 140m
*Site is a rural site and is not within an AQMA.				

Table 16.3 Local authority automatic monitoring results (2016-2018)

	NO_2			**PM_{10}**		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**
Annual mean (µg m^{-3})	3.0	3.0	3.7	12.0	11.1	11.9
Max hourly mean (µg m^{-3})	61.0	51.0	39.0	50.0	61.0	96.0
Data capture (%)	93.0	97.4	98.6	95.0	94.7	97.3

16.5.3 The monitoring results from the A40 LVP monitoring survey are shown in Table 16.4 and the details are in Table 16.5.

Table 16.4 A40 LVP NO_2 diffusion tube monitoring locations

DT ID	**Site ID**	**Type**	**X**	**Y**	**Distance to Scheme (km)**
1	AURN – Princes Gate	Background	214376	212776	4.8
2	Blackmore Hill	Roadside	211430	216592	0.3
3	Penblewin Roundabout	Roadside	212055	216635	0.1
4	Maes-y-Rhos (Public footpath)	Roadside	214356	217009	2.4
5	Llanfallteg junction	Roadside	214741	216897	2.7
6	Penllan	Roadside	215562	216855	3.4
7	Willow Tree School for Dogs	Background	215100	217030	3.2

Table 16.5 A40 LVP monitoring results (2017)

DT ID	Site ID	Annualised and bias adjusted NO_2 concentrations (µg/m^3)
1	AURN – Princes Gate	2.7
2	Blackmore Hill	19.9
3	Penblewin Roundabout	20.1
4	Maes-y-Rhos (Public footpath)	7.4
5	Llanfallteg Junction	18.2
6	Penllan	18.5
7	Willow Tree School for Dogs	4.0

16.5.4 The A40 LVP monitoring shows that local air quality concentrations are well below the objectives. Even at roadside locations annual mean NO_2 concentrations is not at risk of exceeding the air quality objectives. These pollutant concentrations are considered to be representative of the Scheme area.

Background Air Quality

16.5.5 Defra publishes background pollutant mapping for every 1km x 1km grid square across the UK[66]. Background pollutant mapping has been reviewed for those grid squares in the study area and background pollutant concentrations for the baseline year of 2017 are presented in Table 16.6. This data shows that predicted background pollutant concentrations are well below the annual mean NO_2 and PM_{10} objectives (40µg/m^3).

Table 16.6 Background concentrations

OS grid square		2017 Concentrations (µg/m^3)		
X	Y	NO_x	NO_2	PM_{10}
210500	216500	4.9	3.8	9.7
211500	216500	4.9	3.9	9.7
212500	216500	5.1	5.1	9.8

16.6 Proposed Scope of Baseline Studies

16.6.1 A desk-based review of the following data sources will be undertaken to determine baseline air quality conditions in this assessment for both

[66] Defra, Background Pollutant Mapping, http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

human and ecological receptors:

a) Pembrokeshire County Council review and assessment reports and local air quality monitoring data[65];
b) The Welsh Air Quality website[67];
c) MAGIC website[68];
d) The Defra website[69]; and
e) NRW website[70].

16.6.2 The publicly available ambient monitoring data and the data from the A40 LVP monitoring survey will be enough to provide the baseline assessment for the Scheme. No further monitoring surveys are required.

16.7 Methodology for Assessment of Effects

16.7.1 The overall approach to the air quality assessment for construction and the operational phase comprises:

a) An assessment of the potential changes in air quality arising from fugitive releases of construction dust and particulate matter during the construction of the Scheme;
b) an assessment of the potential changes in air quality arising from changes in traffic emissions during the construction and operation of the Scheme; and
c) formulation of mitigation measures, where necessary, to ensure any adverse effects on air quality are minimised.

16.7.2 This assessment conforms to the standard practice of environmental impact assessment, whereby the baseline is established, and then the situation with the development in place (Do Something (DS)) is compared with the situation without it (Do Minimum (DM)).

Construction Assessment

16.7.3 The Scheme will include construction of new highway. The construction effects will be assessed using the qualitative approach described in the latest guidance by the Institute of Air Quality Management (IAQM)[63]. The guidance applies to the assessment of dust from construction/ demolition activities.

[67] Welsh air quality website: https://airquality.gov.wales/
[68] Defra Magic website: https://magic.defra.gov.uk/
[69] Defra website: https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
[70] NRW website: https://naturalresources.wales/?lang=en

16.7.4 Construction-related traffic has the potential to impact local concentrations of pollutants. The traffic volumes will be screened using criteria in DMRB to determine if construction traffic emissions should be assessed.

Operational Assessment

16.7.5 A detailed assessment using an air dispersion model (Advanced Dispersion Modelling System (ADMS)-Roads version 4.1) will be used to determine the potential effects on annual mean NO_2 and PM_{10} concentrations at selected sensitive human receptors in accordance with HA207/07[60] guidance.

16.7.6 The following sections detail the inputs and processes to be used in the assessment.

Assessment Scenarios

16.7.7 The assessment scenarios can be summarised as follows:

Baseline scenario (using 2017 traffic volumes and using 2017 emission factors);

Do-Minimum (DM) scenario (2021), which is the future year without the Scheme (using 2021 traffic volumes and using 2017 emission factors); and

Do-Something (DS) scenario (2021), which is the future year including the impact from the Scheme (using 2021 traffic volumes and using 2017 emission factors).

16.7.8 Emission rates will be calculated using the Defra Emissions Factor Toolkit (EFT) v8.0.1[71]. Impacts on air quality during operation will be modelled using 2017 vehicle emission factors and 2017 background concentrations for all the scenarios to provide a pessimistic assumption of future concentrations.

Sensitive Receptors

16.7.9 Sensitive receptors within 200m from the ARN will be identified in the study area using OS address information and Google Earth. Sensitive receptors are defined as those residential properties/ schools/hospitals that are likely to experience a change in pollutant concentrations as a

[71] Defra (2017) Emissions Factors Toolkit (EFT) v8.0.1; https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html; [Accessed: February 2019].

result of the Scheme.

Background Concentrations

16.7.10 'Background' air quality is a concept used to enable assessment of the effects of all relevant emission sources, without the need for all the sources to be considered explicitly. For the purpose of this assessment, the background air quality represents the contribution of all relevant sources of air pollutants, except those from roads specifically included in the air quality model. The predicted concentration impact due to the modelled roads is added to the background pollutant concentrations.

16.7.11 The Defra air quality website[66] includes estimated background air pollutant concentrations maps for NOx, NO_2, and PM_{10}, for each 1km x 1km square covering Wales. The background maps will be used to determine a relevant background pollutant concentration for the modelling assessment and processing of modelling results.

Dispersion Model Set-up

16.7.12 Meteorological data will be purchased for the Milford Haven met site for the baseline year; Milford Haven is the site used for the A40 LVP assessment.

16.7.13 Road sources will be input to the ADMS-Roads dispersion model to calculate total concentrations of future pollutant concentrations at receptor locations.

Model Verification

16.7.14 A comparison of modelled and measured NO_2 concentrations will be undertaken as part of the process known as model verification. Verification will be undertaken for the baseline year, using the principles laid out in section A3.223 of LAQM.TG(16)[59].

16.7.15 The objectives of the model verification are to evaluate model performance, determine if model adjustment is required, and to provide confidence in the assessment.

16.7.16 LAQM.TG(16) suggests that if modelled annual mean NO_2 concentrations are within ±25% and preferably within ±10% of the monitored concentration and there is no systematic under or over-

prediction, then model adjustment is not considered necessary to further improve modelled results.

16.7.17 Modelled results may not compare as well at some locations for the following reasons:

a) errors/uncertainties in traffic flow and speed data estimates;
b) errors in model setup (including road widths or receptor locations);
c) uncertainty in monitoring data, notably diffusion tubes, e.g. bias adjustment factors and annualisation of short-term data; and
d) uncertainty in emissions/emission factors.

16.7.18 The above factors will be investigated as part of the model verification process to minimise the uncertainties as far as practicable.

NOx to NO_2 Conversion

16.7.19 The approach for calculating the roadside conversion of NO_x to NO_2 will follow the guidance in LAQM.TG(16)[59] and the LAQM website. This approach allows the calculation of NO_2 from NO_x concentrations, taking into account the difference between ambient NO_x concentrations with and without the Scheme, the concentration of ozone and the different proportions of primary NO_2 emissions in different years. This approach is available as a spreadsheet calculator; the version released in August 2017 (v6.1) will be used in this assessment.

Regional Air Quality Assessment

16.7.20 Pollutant emissions will be calculated for the regional assessment study area based on the regional assessment screening criteria outlined in Section 16.3. Emissions will be calculated using the traffic characteristics (AADT flows, speed bands and percentage HDVs) and road length for each affected road in the study area. The emission factors from the EfT[71] will be used. Total annual emissions for both the base year (2017), DM and DS scenarios (2021) and design year (2036) will be calculated. As emission factors are not available for 2036, the traffic data for these years will be calculated assuming emission factors for the latest year available, 2030.

Significance Criteria

16.7.21 The 2017 EPUK/IAQM guidance note 'Land-Use Planning & Development Control'[61] provides an approach to determining the air quality impacts resulting from a proposed development and the overall significance of local air quality effects arising from a proposed development.

16.7.22 First, impact descriptors are determined based on the magnitude of incremental change as a proportion of the relevant assessment level, in this instance the annual mean NO_2 and PM_{10} objectives. The change is then examined in relation to the predicted total pollutant concentrations in the assessment year and its relationship with the annual mean NO_2 and PM_{10} objectives.

16.7.23 The assessment framework for determining impact descriptors at each of the assessed receptors is shown in Table 16.7.

Table 16.7 Impact descriptors

Annual average concentrations at receptor in the assessment year	**% Change in concentrations relative to annual mean NO_2 and PM_{10} objectives**			
	1	**2-5**	**6-10**	**>10**
75% or less of objective	Negligible	Negligible	Slight	Moderate
76-94% of objective	Negligible	Slight	Moderate	Moderate
95-102% of objective	Slight	Moderate	Moderate	Substantial
103-109% of objective	Moderate	Moderate	Substantial	Substantial
110% of more of objective	Moderate	Substantial	Substantial	Substantial
Note: Changes in pollutant concentrations of less than 0% i.e. <0.5% would be described as negligible				

16.7.24 The impact descriptors at each of the assessed receptors can then be used as a starting point to make a judgement on the overall significance of effect of a proposed development, however other influences would also need to be taken into account, such as:

a) The existing and future air quality in the absence of the development;

b) The extent of current and future population exposure to the impacts; and

c) The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

16.7.25 Professional judgement should be used to determine the overall significance of effects of the proposed development, however, in circumstances where the proposed development can be judged in isolation, it is likely that a 'moderate' or 'substantial' impact will give rise to a significant effect and a 'negligible' or 'slight' impact will not result in a significant effect.

16.8 Assessment of Potential Effects

16.8.1 This section sets out the elements of the Scheme which could influence local air quality. The Scheme has the potential to impact air quality during the construction and operational phases.

Construction Phase Effects

16.8.2 The construction of the new road would potentially give rise to emissions of fugitive dust and emissions from construction vehicles.

16.8.3 Emissions of dust from the construction of the Scheme will be minimised by implementing best practice mitigation measures which will be detailed in the Scheme's Construction Environmental Management Plan (CEMP). The (IAQM)guidance[72] on the assessment of dust explains that once the appropriate mitigation measures are applied, in most cases the resulting dust impacts can be reduced to negligible levels. A construction dust assessment will be carried out.

16.8.4 Assessment of emissions associated with construction traffic have been scoped out of further assessment. Emissions from construction traffic will be temporary and are considered to form a small proportion of total traffic on the existing road network, therefore, they are not considered to be significant.

Operational Phase Effects

16.8.5 The Scheme may increase traffic on the A40 as congestion would be relieved and therefore the road would be more attractive to road users. The increase in traffic has the potential to impact receptors along the ARN due to increased traffic emissions.

16.8.6 Due to the potential increase in emissions in the operational phase a

[72] IAQM (2016) Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)

detailed modelling assessment is proposed to assess local air quality. The proposed method of assessment is detailed in section 16.7.

Potential Impacts of the Northern Route

16.8.7 The northern route option moves the alignment of the road to the north of the existing A40 and therefore emissions of pollutants are further away from existing receptors as the majority of receptors are located along the existing alignment of the A40. It is expected this will lead to improvements in air quality at receptors immediately adjacent to the A40 road in the Redstone Cross area.

Potential Impacts of the Southern Route

16.8.8 The southern route option moves the alignment of the road to the south of the existing A40 and therefore emissions of pollutants further away from existing receptors as the majority of receptors are located along the existing alignment of the A40. It does move the road closer to receptors located further south on Redstone Road. This may impact air quality at these receptors.

16.9 Mitigation Measures

16.9.1 Mitigation measures for the construction phase of the Scheme will be detailed in the CEMP. If the assessment identifies significant air quality effects from the operational phase of the Scheme, where practicable, mitigation measures will be recommended for inclusion in the Scheme design.

17 NOISE AND VIBRATION

17.1 Introduction

17.1.1 This section of the Scoping Report details the proposed scope of the noise and vibration assessment for both the construction and operational phases of the Scheme. This will include desktop baseline studies and on-site studies to identify and characterise sensitive receptors and prevailing noise levels.

17.1.2 Two options are currently being considered for the Scheme:

a) Northern option

b) Southern option

17.1.3 This scoping report provides a high-level assessment of the two options. This scoping report describes the method that will be applied to the single preferred option for the Environmental Statement.

17.1.4 The construction of the Scheme has the potential to give rise to temporary increases in noise and vibration at sensitive receptors. A methodology is described to establish the likely significance of these temporary impacts.

17.1.5 The operation of the Scheme may give rise to changes in noise levels (both adverse and beneficial) due to the proposed changes to the alignment which would shift road traffic noise towards some sensitive receptors while reducing levels at others. Changes in noise levels may also be attributed to other factors in addition to the change in alignment including changes in traffic volume, percentage of heavy vehicles, speed or road surface type. The methodology for assessing the likely significance of permanent noise changes is described in this chapter.

17.1.6 If required to reduce adverse impacts and significant effects, mitigation measures would be proposed. An outline of such provisions that could be considered is provided at the end of this chapter.

17.1.7 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

17.2 Relevant Guidance

Well-being of Future Generations (Wales) Act 2015

17.2.1 The Act has Well-being Goals to achieve through implementing sustainable development. Changes in noise levels can have an impact on the health of habitat and humans, as such the goals to create 'a resilient Wales' and 'a healthier Wales' are applicable.

Planning Policy Wales Edition 10

17.2.2 Planning Policy Wales Edition 10 - December 2018 (Welsh Assembly Government, 2018), describes the planning development policies of the Welsh Assembly Government. Examples of policy and key statements relevant to highway planning and design are provided below.

17.2.3 Chapter 5 of the document relates to 'Productive & Enterprising Places'. Paragraph 5.3.4 relating to transportation infrastructure states: *'Great care must be taken to minimise the adverse impacts of new or improved transport infrastructure on the natural, historic and built environment and on local communities, including on public health resulting from community severance and airborne pollution…Routes should make the best use of existing landforms and other landscape features to reduce noise and visual effects…Where no other alternative routes or options are practicable, transport infrastructure schemes should provide mitigation measures to minimise the negative impacts and enhance the positive ones caused by their construction and operation, including reducing exposure to airborne pollution.'*

17.2.4 Chapter 6 of the document relates to 'Distinctive & Natural Places'. Paragraphs 6.7.4 to 6.7.10 includes policy text in relation to 'Framework for Addressing Air quality and Soundscape'. Paragraph 6.7.6 states: *'In proposing new development, planning authorities and developers must, therefore:*

a) Address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority area or areas where there are sensitive receptors;

b) Not create areas of poor air quality or inappropriate soundscape; and

c) Seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.'

17.2.5 Paragraphs 6.7.15 to 6.7.18 includes policy text in relation to 'Location of Commercial, Industrial and other Potentially Polluting Development'. Paragraph 6.7.15 states: '*For the purposes of this section, potentially polluting development includes…transport infrastructure. Such development should be located in areas where there is low potential for public exposure, or where the impact can be minimised.'*

17.2.6 Paragraphs 6.7.22 to 6.7.25 include policy text in relation to 'Soundscapes and Compatibility of Uses'. Paragraph 6.7.25 states: *'Planning authorities should identify areas of cultural or historic importance to be given special consideration in terms of soundscape where this may be necessary to safeguard the vibrancy of places or provide tranquil, restorative environments within busy built-up areas…'*

TAN 11 Noise

17.2.7 TAN 11 (Welsh Assembly Government, 1997) provides technical guidance on noise generating development including transportation projects.

Pembrokeshire County Council (PCC) Local Development Plan 2013-2021

17.2.8 Policies relevant to noise include:

GN1: General Development Policy, Point 2 – developments will be permitted where they will not result in an increase in noise and vibration levels; and

GN3: Infrastructure and New Development- provision must be made for mitigation of potential adverse impacts including noise intrusion.

GN.37: Protection and Enhancement of Biodiversity – policy to ensure that species and their habitats are protected from the potentially adverse effects of development, and where possible enhanced. Potentially adverse effects may include disruption to species and habitats prior to, during and/or after construction for example unacceptable noise.

17.3 Study Area

17.3.1 The study area for permanent impacts associated with operational road traffic would be determined in accordance with Design Manual for Roads and Bridges (DMRB) HD213/11. This requires the following steps:

a) Identify the start and end points of the physical works associated with the road project.

b) Identify the existing routes that are being bypassed or improved, and any proposed new routes, between the start and end points.

c) Define a boundary one kilometre from the carriageway edge of the routes identified in (b).

d) Define a boundary 600m from the carriageway edge around each of the routes identified in (b) above and also 600m from any other affected routes within the boundary defined in (c) above. The total area within these 600m boundaries is termed the 'calculation area'. An affected route is where there is the possibility of a change of 1dBLA10,18h or more in the short-term or 3dBLA10,18h or more in the long-term.

e) Identify any affected routes beyond the boundary defined in (c).

f) Define a boundary 50m from the carriageway edge of the routes identified in (e) above.

17.3.2 It is acknowledged in DMRB HD 213/11 that a reduced study area may be necessary dependent on the extents of the traffic model.

17.3.3 The study area for temporary impacts associated with construction noise and vibration would be 600m from the edge of the works. This study area would be set wider as necessary to include other temporary noise sources such as any construction compounds or haul routes associated with construction traffic.

17.4 Work Undertaken to Date

17.4.1 No site visits or surveys were undertaken in respect to the noise and vibration assessment for the A40 Penblewin to Redstone Cross Improvements scheme prior to the production of this Scoping Report.

17.4.2 Arup undertook some preliminary updating of the acoustic model for the A40 Llanddewi Velfrey project in relation to A40 Penblewin to Redstone Cross Improvements Scheme, however no assessment was undertaken as instruction was received to cease work on this section in

August 2017.

17.5 Baseline Conditions

17.5.1 An initial desktop study indicates that the study area is rural in character with the A40 likely being the major noise source. Noise levels at boundaries of the study area could be substantially lower than adjacent to the existing A40.

17.5.2 The baseline noise levels affecting sensitive receptors in the study area will be determined primarily through prediction of the Do-Minimum situation in the Baseline Year (planned opening year of the Scheme). This will be supplemented by noise surveys as described in section 17.6 to determine the prevailing noise levels.

17.6 Proposed Scope of Baseline Studies

17.6.1 The baseline studies will be a combination of a desktop study and noise survey. They will intend to be a representative of the baseline year to be used for the Environmental Statement.

Proposed desktop study

17.6.2 The proposed desktop study will include:

a) Investigation of the site using aerial imagery in GIS and OS map tiles;

b) Analysis of existing sensitive receptors using Address Base Plus (Ordnance Survey); and

c) Existing building and structures using GIS datasets.

17.6.3 The receptors which will be assessed include residential dwellings, care home, as well as hospitals, schools, community facilities, designated areas (e.g. AONB, National Park, SAC, SPA, SSSI, SAM), and public rights of way if identified in the study area.

Proposed noise surveys

17.6.4 No noise surveys were undertaken prior to the preparation of this Scoping Report. The preferred method of assessing the noise levels from a road Scheme is by prediction using quantitative digital modelling techniques with surveyed and forecasted traffic engineering

information (total flow, number of heavy vehicles and speed) rather than by measurement. However, a noise survey can assist with the understanding of prevailing noise levels. It is therefore proposed to undertake baseline noise surveys following the comparative and/or shortened measurement procedures as described in the Department of Transport/Welsh Office document "Calculation of Road Traffic Noise" (CRTN). A detailed survey plan will be developed for agreement with the Local Planning Authority.

17.6.5 The shortened measurement procedure requires that 3 x one-hour measurements are undertaken in consecutive hours between the hours of 10:00hrs and 17:00hrs on a typical weekday. A full hour measurement may be represented by a 15-minute sample measurement where the traffic flows meet certain conditions as set out in CRTN. The three-hour measurement can then be used to derive the 18-hour noise level, $L_{A10,18hr}$ as predicted by the CRTN methodology.

17.6.6 As an alternative, where it is possible to find a secure location, one noise logger may be deployed to record noise levels over a full 24-hour period and the CRTN comparative noise measurement procedure will be used at a small number of additional positions. At each 'satellite' position, a minimum of two 15-minute samples would be measured concurrently with a noise logger which is subject to noise from the same road under the same conditions.

17.7 Methodology for Assessment of Effects

17.7.1 Basic analysis of the DMRB HD213/11 threshold screening criteria will be conducted of the traffic engineering data when it is available. The 'detailed' methodology procedure as set out in DMRB HD213/11 would be adopted if threshold criteria used for traffic noise and vibration assessment are likely to be exceeded. If the threshold criteria are not likely to be exceeded, the 'simple' methodology procedure would be adopted." As well as magnitude of change predicted for the daytime, night-time changes will also be considered in this decision.

Construction Noise and Vibration

17.7.2 DMRB HD213/11 points to BS 5228 Parts 1 & 2 for the prediction and assessment of the effects of construction noise.

17.7.3 For this assessment the 'ABC' assessment method described in BS

5228 will be used to establish the threshold of potential significant effect for construction noise at residential receptors. Under this approach, the adverse impact threshold is determined at a dwelling using the existing ambient noise level, rounded to the nearest 5dB. This is then used to determine the assessment category: A, B or C, which then defines the adverse noise impact threshold, as described in Table 17.1. The predicted construction noise level is then compared to the appropriate threshold.

17.7.4 If the L_{Aeq} construction noise level exceeds the appropriate noise impact threshold level, then an adverse impact with the potential to cause a significant effect is identified.

17.7.5 Having established if there is a potentially significant effect using the ABC method, the final assessment of significance is made using professional judgement. This is evaluated by considering various other factors, as discussed under "Determining Significance of Effects" at the end of this section.

17.7.6 For non-residential receptors, significant effects would be evaluated on a receptor-by-receptor basis, using established noise impact criteria for the type of receptor and professional judgement based on the factors described under "Determining Significance of Effects" at the end of this section.

17.7.7 The threshold of vibration perception in residential environments is identified at an exposure level of 0.3mm/s peak particle velocity (PPV) in accordance with guidance in BS 5228: Part 2. Complaint is likely where levels occur above 1.0mm/s PPV at residential properties but this exposure can be tolerated if prior warning and explanation has been given to residents. Above a level of 10mm/s PPV the vibration is likely to be intolerable for any more than a very brief exposure to this level.

17.7.8 The overall significance of the effect is assessed using professional judgement by considering not only the criteria above but also other factors, as discussed at the end of this section.

Table 17.1 Threshold of potential significant effect at dwellings according to ABC method in BS 5228 Part 1

Assessment category and threshold value period	Threshold value, (dB)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Other: Weekday evenings (19:00 – 23:00) Saturdays (13:00 – 23:00) Sundays (07:00 – 23:00)	55	60	65
Category A: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are less than these values Category B: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are the same as Category A values Category C: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are higher than Category A values.			

Operational Noise and Vibration

17.7.9 DMRB HD 213/11 Revision 1 sets out threshold noise level changes of 1dB $L_{A10,18hr}$ in the short-term or 3dB $L_{A10,18hr}$ in the long term, which if likely to be exceeded, would result in a 'Detailed' assessment being undertaken. As the Scheme includes a route that would be constructed offline, there is potential for these thresholds to be exceeded, where the route passes closer to noise sensitive receptors which are currently at further from the existing route. The assessment of operational noise for the appropriate study area will be undertaken at the 'Simple' level if the thresholds are not exceeded.

17.7.10 The DMRB approach to assessing noise impact is to compare the noise levels for the Do Something scenario against noise levels for the Do Minimum scenario. The method requires that comparisons are made between the baseline noise situation in the Baseline Year[73] (before the change caused by the Scheme) and the noise level including the operation of the Scheme in both the Baseline Year and the Future Assessment Year[74].

17.7.11 DMRB HD 213/11 requires that a night-time noise assessment is carried out. The L_{night} descriptor is used to represent the noise level at dwellings between the hours of 23:00 and 07:00. Method 3 from the Transport Research Laboratory (TRL) report *'Converting the UK traffic*

[73] The year of the Scheme opening
[74] The worst-case year in the within the fifteen years after opening (generally the 15th year after opening).

noise index $L_{A10,18hr}$ to EU noise indices for noise mapping' will be used for predicting L_{night} noise levels. For the night-time noise assessment, only dwellings with a noise level over 55dB$L_{night,\ outside}$ in the long term are considered.

17.7.12 Noise predictions will be carried out according to the Calculation of Road Traffic Noise (CRTN) methodology using proprietary software and Annex 4 of HD 213/11. Traffic noise levels will be calculated across a grid of receptor positions, and contours of noise level exposure established. The calculation area will be determined as per the methodology described in Section 17.3.

17.7.13 Noise levels are calculated in terms of the $L_{A10,18h}$ index as specified in CRTN. This represents the A-weighted noise level exceeded for 10% of the time between the hours of 06:00 and 00:00 on an average weekday assessed at 1m outside a building façade of sensitive receptor. Night-time noise, will use the $L_{night,outside}$ index, the equivalent continuous sound level $L_{Aeq,8h}$ for the period 23:00 to 07:00 hours assessed outside a dwelling and is free-field, located away from the building façade.

17.7.14 The traffic flow predictions on which the noise calculations are made will be taken from the traffic impact assessment data for the different scenarios.

17.7.15 In addition to traffic flow information, the traffic noise calculations will take into account digital mapping data derived from both topographical surveys and landscaping details. Man-made features such as building infrastructure and man-made ground areas will also be modelled, as well as existing noise mitigation barriers and bunding. Positions of noise sensitive receptors will be identified. Details of earthworks, road surfaces, and other relevant information, will also be modelled.

17.7.16 There is no published UK guidance that clearly defines criteria for the assessment of significant effects arising from road traffic noise. The response of people to noise is subjective, and sensitivity to changes in traffic noise varies across the population. Given the variability of response and the potential for non-acoustic factors to influence perceptions of noise, any assessment of significance can only represent the general community response to traffic noise.

17.7.17 Chapter 3 of DMRB HD 213/11 Revision 1 notes that 'A change of

1dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3dB(A) change is considered perceptible, and such an increase should be mitigated if possible.'

17.7.18 DMRB provides categories for assessing road noise impact magnitude. These magnitude of impact descriptors are shown below in Table 17.2 (short term) and Table 17.3. (long term). The different scales reflect the different threshold criteria referred to in HD 213/11 (paragraph 3.5) for short term changes in traffic noise as opposed to the response to long term, steady state differences in traffic noise.

Table 17.2 DMRB classification of magnitude of noise impact in the short term

Noise Change [dB(A)]	Magnitude of Impact in the Short-term
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0 +	Major

Table 17.3 DMRB classification of magnitude of noise impact in the long term

Noise Change [dB(A)]	Magnitude of Impact in the Long-term
0	No change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10.0 +	Major

17.7.19 Arup has developed potential significance criteria for changes in road traffic noise at sensitive receptors based on the long-term impact tables in HD 213/11. These are given below in Table 17.4. The aim of these criteria are to clearly identify those receptors where a potential significant effect occurs. However, other factors specific to the individual receptors and the character of the noise impact are also considered in reaching a final assessment decision. Therefore, if potentially significant effects are identified, the overall assessment of significance is evaluated using professional judgement based on the additional factors as discussed under 'Determining Significance of Effects' at the end of this section.

Table 17.4 Assessment of magnitude and potential significance of impact

Change in Noise Level in the long Term (dB(A))	Initial Indicator of Significance
+5 or greater	Potentially significant increase
+3 to +4.9	
+1 to +2.9	Unlikely to be significant
+0.9 to -0.9	Not significant
-1 to -2.9	Unlikely to be significant
-3 to -4.9	Potentially significant decrease
-5 or less	

17.7.20 DMRB recommends that the effects of vibration should also be considered where appropriate. In the case of ground-borne vibration, the likelihood of perceptible vibration being caused is particularly dependent upon the smoothness of the road surface. Research has shown that vibration levels caused by heavy vehicles travelling at 110kph over a 25mm hump (i.e. a large discontinuity consistent with poorly backfilled trench) could cause perceptible vibration at up to 40m from the road. This would imply that it is unlikely that significant levels of vibration would be generated at distances greater than this. Also, with a newly laid road surface it is a requirement of new highway construction specification that the surface would be smooth and free from any discontinuities of this magnitude. Paragraph A5.26 of DMRB states: '*Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment would only be necessary in exceptional circumstances*.' No such exceptional circumstances are envisaged for the Scheme and hence no impacts or effects from ground-borne vibration are anticipated. Operational vibration is scoped out from further environmental assessment.

Determining Significance of Effects

17.7.21 All the identified sources of noise and vibration will be evaluated to determine if there would be adverse impacts and the potential to cause significant effects according to the criteria described above for Construction and Operational impacts respectively.

17.7.22 If potentially significant effects are identified, the overall assessment of significance is evaluated using professional judgement based on the factors set out in the following list. Non-residential receptors will be subject to individual consideration and significance considered either

on noise change or absolute limits suitable for the occupants or use of the buildings. A precautionary approach will be taken in this consideration.

Residential receptors

a) the magnitude of the impact and effect identified (based on overall noise level and noise change);

b) the number and grouping of adversely affected dwellings and shared open areas;

c) the level and character of the existing noise environment;

d) any unique features of the source or receiving environment in the local area;

e) combined exposure to noise and vibration;

f) duration of impact and effect (for construction a period of one month or more); and

g) the effectiveness of mitigation measures that could avoid or reduce the adverse effects.

Non-residential

a) the generic use (e.g. educational, healthcare, religious buildings or community uses) and hence relevant guidance on noise;

b) the times of use;

c) the design of the receptor (especially windows, doors and ventilation systems) and hence ability of receptor to experience changes in external noise environment without significant change in internal noise conditions);

d) the layout - whether the most sensitive parts of the building are closest to and face the Scheme or are located further from the Scheme and are on the opposite side of a building;

e) duration of impact and effect (for construction a period of one month or more); and

f) the effectiveness of mitigation measures that could avoid or reduce the adverse effects.

Consultations

17.7.23 Consultation would be undertaken with the Environmental Health Officer (EHO) at Pembrokeshire County Council in order to establish any existing noise concerns, particularly sensitive receptors in the study area and to confirm local policy, particularly in relation to construction noise.

17.8 Assessment of Potential Effects

17.8.1 Construction of the Scheme is likely to give rise to increases in noise for sensitive receptors within around 300m of the works. The degree of increase will be dependent on the level of existing ambient noise and predicted construction noise levels. Existing ambient noise sources would act to mask construction noise to some degree subject to the level and character of the existing ambient noise level. Increases would be temporary and best practicable means would be used to minimize impacts. Where necessary temporary noise barriers may be recommended to reduce noise impacts further.

17.8.2 It is unlikely that piling activities would be required as part of the construction of the Scheme making it unlikely that any significant vibration impacts would occur, however other activities could give rise to perceptible vibration impacts.

17.8.3 The operation of the Scheme has the potential to give rise to increases in noise at isolated properties closer to the Scheme, whilst there would be noise reductions at a small number of receptors where traffic diverts from the existing A40 route onto the new by-pass. Where Scheme improvements would be online, there may be noise increases or decreases at nearby receptors. Factors that could result in changes in noise level may include changes in traffic volume, percentage of heavy vehicles, speed, movement of the traffic source lines relative to nearby receptors and mitigation such as barriers/bunds and future road surfacing materials (i.e. low noise surfacing).

17.8.4 To provide an indication of how noise may affect receptors at a community level as a result of the Scheme, Table 17.4 and Table 17.6 set out the numbers of residential and non-residential addresses (considered to be potentially noise sensitive) within approximately 600m of the existing and the proposed new routes split into approximate distance bands.

Table 17.5 Number of Residential Addresses Within Approximately 600m

Scenario	Distance Band (m)					Total
	50	100	200	300	600	
Existing	8	1	2	11	35	57
Northern option	3	5	3	15	32	58
Southern option	3	2	16	15	28	64

Table 17.6 Number of Potentially Noise Sensitive Non-Residential Addresses Within Approximately 600m

Scenario	Distance Band (m)					Total
	50	100	200	300	600	
Existing	0	0	1	0	1	2
Northern option	0	0	0	1	1	2
Southern option	0	1	0	0	2	3

17.8.5 Table 17.4 indicates that in total there are 6 more residential addresses within 600m of the southern option compared to the northern option for the A40.

17.8.6 Both options bring the A40 further from the residential properties around Redstone Cross. However, for both options, some of these receptors have the potential to be adversely impacted by an increase in noise on existing 'quiet' facades facing the new road. Both options bring the A40 further from the residential properties at Blackmoor Hill, however with the southern option there is potential for these receptors to be adversely impacted by an increase in noise on existing 'quiet' facades.

17.8.7 The southern option brings the A40 closer to the residential properties on Redstone Road. The northern option brings the A40 closer to the residential properties on the northern part of the B4313. This includes bringing the A40 slightly closer to Sodston Lodge which is already in close proximity (around 10 metres) to the existing A40. Due to the close proximity of the receptor there is likely to be vibration impacts due to construction works as well as noise. Clarification should be sought as to whether this property will be vacated or occupied during construction.

17.8.8 In total, the southern option has more receptors within 300m when compared to the northern option however the northern option has more

receptors within 100m.

17.8.9 Table 17.6 indicates there is one more potentially noise sensitive non-residential addresses within 600m of the southern option compared to the northern option. The southern option brings the A40 closer to Blaenmarlais Care Home (within 100m) whereas the southern option takes the A40 further away to this receptor (within 300m) when compared to the existing A40.

17.8.10 Changes in noise level will depend on the three-dimensional landform between the new road and the properties, amongst other factors such as changes due to traffic flow, composition and speed. This will be determined by assessment for the preferred option that is being taken forward.

17.8.11 The high-level assessment indicates:

a) The southern option is likely to have an adverse impact on more residential and non-residential properties overall.

b) However, it should be noted that the northern option is closer to Sodston Lodge (single dwelling), which is already close to the existing A40.

17.9 Mitigation Measures

Construction

17.9.1 Best Practicable Means (BPM) mitigation methods will be implemented to control construction noise and vibration. There would be no target threshold for BPM as this should be adopted by the contractor for the works irrespective of whether significant effects are identified by the assessment. BPM places a duty on the contractor to minimise and mitigate impacts with reasonable measures, for example working hours, quieter processes where practicable, use of well-maintained and quieter powered mechanical equipment and methods of piling if required.

17.9.2 There would be a transition from beyond routine BPM to more focused measures (often described as additional rather than incorporated mitigation) where there is a significant effect identified through assessment. This would include maximising of intervening distances between construction activities and the closest noise-sensitive

receptors, localized screening specifically designed to get noise level below sig threshold where practicable or at least minimize where not possible to remove sig effect. Noise insulation or rehousing are other measures that might be included in the Construction Environmental Management Plan (CEMP).

17.9.3 The use of low noise emission plant and processes (as specified in BS 5228-1 Annex B - Noise sources, remedies and their effectiveness) will be used. In addition, and wherever possible, the maximising of intervening distances between construction plant sources and the closest noise-sensitive receptors will also be sought. Where it is not possible to reduce noise levels enough by the methods already described above, then further noise mitigation would be sought by implementation of carefully considered and designed screening methods (to be determined by the Main Contractor, once construction methods and constraints are clarified).

17.9.4 Where despite the implementation of BPM and more focused mitigation measures there are residual significant effects, the following may be applicable:

Temporary re-housing - where disruption from construction noise/vibration is such that occupation is not reasonably practicable.

Insulation of buildings - where such buildings are deemed eligible. Where dwellings are eligible for insulation due to operational traffic noise, the insulation work could be implemented early.

17.9.5 To control construction vibration, restrictions may be necessary on the distances at which of plant with the potential to result in high levels vibration (e.g. vibratory rollers) at sensitive receptors is used.

Operation

17.9.6 Examples of mitigation

a) Optimisation of the horizontal and vertical alignments
b) Noise barriers
c) Low noise surfaces
d) Noise insulation of eligible buildings

17.9.7 To ensure that any proposed operational mitigation is practicable and sustainable, the provision should be subject to the following tests:

a) Stakeholder engagement and consultation responses;

b) Engineering practicability;

c) Consideration of noise benefit compared to cost of the mitigation; and

d) Other environmental effects potentially caused by the mitigation (for example landscape or visual effects).

18 MATERIALS

18.1 Introduction

18.1.1 The materials chapter of the ES will consider potential impacts of the Scheme due to the use of material resources, and the generation and management of waste. The chapter will consider the materials balance, the potential need for import of material resources and potential for surplus materials. It will include assessment of potential impacts during construction and operation from the import of primary raw materials, secondary or recycled/reused materials and manufactured construction products, along with assessment of the generation and management of waste.

18.2 Relevant Guidance

18.2.1 This section has been prepared in accordance with Design Manual for Roads and Bridges (DMRB) HA 200/08 Volume 11, Section 1, Part 1 [75], in relation to the assessment of materials.

18.2.2 The material resources assessment will follow guidance set out in DMRB Interim Advice Note 153/11[76]. The above IAN has not yet been adopted in Wales. However, it is considered that the IAN reflects current best practice guidance and, as there is no suitable Welsh equivalent guidance, it has been used to inform the proposed method of assessment. It is acknowledged that references to the National Planning Policy Framework (NPPF) set out in the above IAN are not relevant in the Welsh context.

18.2.3 As defined in IAN 153/11, for the purposes of assessment, Materials are defined as comprising:

a) The use of material resources; and

b) The generation and management of waste.

Policy Context

18.2.4 The overarching policy in relation to the handling of material resources relevant to the Scheme is the EU Waste Framework Directive

[75] Design Manual for Roads and Bridges, Volume 11, Section 1, Part 1 - HA 200/08 (2008).
[76] Interim Advice Note 153/11 – Guidance on the Environmental Assessment of Material Resource (2011).

2008/98/EC[77]. This provides the legislative framework relating to the collection, transport, recovery and disposal of waste. It includes a common definition of 'waste', which is 'any substance or object which the holder discards or intends to discard', with the term 'discard' including the disposal, recovery or recycling of a substance.

18.2.5 The overall purpose of the Waste Framework Directive is to set out measures to protect the environment and human health by preventing or reducing the adverse effects of waste generation and its management, and by improving the efficiency of resource use. Member States are required by the Directive to take all the necessary measures to ensure that waste is recovered or disposed of without endangering human health or causing harm to the environment.

18.2.6 The Directive sets several high-level objectives, which have influenced national waste management policy and legislation. Article 11 of the Waste Framework Directive (amended in 2008) requires that Member States take the necessary measures to achieve 70% recycling of non-hazardous construction and demolition waste by 2020.

18.2.7 In addition to the above Directive, reference is made to the following guidance and legislation relating to material resources and wastes:

a) Interim Advice Note (IAN) 125/09(W) Supplementary Guidance for Users of DMRB Volume 11 'Environmental Assessment'[78].

b) Interim Advice Note (IAN) 153/11 Guidance on the Environmental Assessment of Material Resources.

c) DMRB Volume 11, Section 3 Part 3, Disruption Due to Construction[79]. This covers the effect on people and on the natural environment which can occur, mainly during construction works.

d) DEFRA Environmental Permitting (England and Wales) Regulations 2010.

e) DEFRA Environmental Permitting Guidance 'The Waste Framework Directive' for the Environmental Permitting (England and Wales) Regulations 2010.

f) The Waste (England and Wales) Regulations 2011. This implements revisions to the Waste Framework Directive in England and Wales.

g) The Hazardous Waste (England and Wales) Regulations 2005.

[77] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098
[78] Interim Advice Note (IAN) 125/09(W) Supplementary Guidance for Users of DMRB Volume 11 'Environmental Assessment' (2009).
[79] Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 3, Disruption Due to Construction, Highways Agency (1993).

h) Definition of Waste: Development Industry Code of Practice, Version 2 (Contaminated Land: Applications in Real Environments (CL:AIRE) 2011) 80.

National Policy

18.2.8 The relevant national policies are as follows:

18.2.9 **WRAP Cymru Delivery Plan: 2011-15**[81], titled Working Together for a World Without Waste, focuses on the most important issues: minimising resource use and diverting priority materials from landfill. The plan is divided into two themes: waste prevention and resource minimisation (including reuse) and; recycling and recovery (including preparation for reuse).

18.2.10 **Climate Change Strategy for Wales 2010**[82] – Chapter 12 "Resource efficiency and waste sector emission reduction" sets out actions to reduce emissions in the waste sector including: reducing indirect emissions associated with resource consumption by increasing reuse, recycling and composting.

18.2.11 **The Well-being of Future Generations (Wales) Act 2015**[83] – The act strengthens existing governance arrangements for improving the well-being of Wales to ensure that present needs are met without compromising the ability of future generations to meet their own needs. The act requires all public bodies to embed climate change into their decision-making. The Materials chapter particularly relates to objective 12: Manage, use and enhance Wales' natural resources to support long-term well-being.

18.2.12 **Environment (Wales) Act**[84], **Part 1: 'Sustainable management of natural resources (2015)**[85]' – This act includes three key features that aim to ensure that sustainable management of natural resources will be a core consideration in decision-making. Part 1: 'Sustainable management of natural resources' provides a modern legislation for managing Wales's natural resources to help tackle the challenges faced,

[80] Contaminated Land: Applications in Real Environments (CL:AIRE) (2011) Definition of Waste Development Industry Code of Practice
[81] WRAP Cymru Delivery Plan 2011-15 http://www.wrapcymru.org.uk/sites/files/wrap/WRAPCymruDeliveryPlan.pdf
[82] Climate Change Strategy for Wales, Welsh Government (October 2010)
[83] http://www.legislation.gov.uk/anaw/2015/2/pdfs/anaw_20150002_en.pdf
[84] http://gov.wales/topics/environmentcountryside/consmanagement/natural-resources-management/environment-bill/?lang=en
[85] http://gov.wales/docs/desh/publications/150512-sustainable-management-of-natural-resources-delivery-framework-en.pdf

and is focused on the opportunities resources provide.

18.2.13 **Planning Policy Wales (Edition 10, December 2018)**[86] sets out Welsh Government's objectives in terms of waste management. The main focus of the policy is planning of future waste management facilities. However, it states that '*waste prevention efforts at the design, construction and demolition stage should be made by developers*'. It goes on to state that 'all opportunities should be explored to incorporate re-used or recyclable materials or products into a new building or structure.'

18.2.14 **Chapter 14 of Planning Policy Wales** (Edition 9, November 2016)[87]This policy covers the short and long-term future use and safeguarding of mineral deposits.

18.2.15 **Welsh Government's Technical Advice Note 21: Waste**[88] provides advice on how the land use planning system should contribute towards sustainable waste management and resource efficiency.

Local Policy

18.2.16 Pembrokeshire County Council Local Development Plan[89], Adopted Plan (February 2013) provides policies on Sustainable development (Strategic Policy 1), safeguarding mineral resources (Strategic Policy 6) and waste (Strategic Policy 11). GN.22 Prior Extraction of the Mineral Resource[90] provides supplementary good practice guidance.

18.3 Study Area

18.3.1 The study area for assessment of materials will include the footprint of the construction works. Consideration of potential effects outside the construction works will be based on locations of potential import of material resources, vehicle movements (import/export), and waste management arrangements. External material sources and waste facilities will be as local to the Scheme as practical.

[86] https://beta.gov.wales/sites/default/files/consultations/2018-02/ppw-restructure-draft-ppw_en.pdf
[87] http://gov.wales/topics/planning/policy/ppw/?lang=en
[88] Technical Advice Note 21: Waste, Welsh Government (February 2014).
[89] https://www.pembrokeshire.gov.uk/content.asp?nav=1626,109,2045
[90] Good Practice Guidance Note – LDP policy GN.22 – prior extraction of the mineral resource.

18.4 Work Undertaken to Date

18.4.1 Much of the information needed for this chapter of the ES will be derived from the geotechnical Preliminary Sources Study Report (PSSR), proposed ground investigation information and the preliminary Scheme design. Preliminary design of the Scheme is still being developed, and therefore, the earthworks strategy has not been finalised.

18.4.2 Preliminary estimates of likely quantities of earthworks suggest that there will be a net import of fill for the southern option, and a net export for the northern option. A key aim of the design is to achieve a net earthworks balance, and to minimise material imports and exports.

18.5 Baseline Conditions

Northern Alignment

18.5.1 The Preliminary Sources Study Report (PSSR)[91] undertaken by Arup for the Northern Alignment, indicates the study area to be underlain by bedrock with a very limited area of superficial materials, likely to comprise glacial till, under a section of the route to the north of Redstone Cross. The bedrock beneath the Scheme is indicated to comprise predominantly weathered mudstones with thin bands of sandstones and limestone shale. In addition, it is anticipated that localised areas of shales, sandstones and conglomerates will be present along the Northern Alignment.

18.5.2 Groundwater levels are currently unknown across the site. The superficial deposits and the weathered bedrock may have low permeabilities and have potential to support perched groundwater above the main groundwater body.

18.5.3 The mineral resources map identifies areas of ‘other sandstone’ at the eastern and western end of the study area. The aggregate safeguarding map identifies the eastern and western ends of the site to extend into a Category 2 aggregate safeguarding area for sandstone deposits.

[91] A40 Penblewin to Redstone Cross Improvements, Preliminary Sources Study Report Northern Alignment, Arup (May 2019)

Southern Alignment

18.5.4 The Preliminary Sources Study Report (PSSR)[92] undertaken by Arup for the Southern Alignment, indicates the central section of the Southern Alignment to be underlain by superficial deposits likely to comprise glacial till. The Southern Alignment crosses several bedrock formations, these predominantly comprise weathered mudstones with thin bands of sandstones and limestone shale. In addition to extensive areas of limestone, shales, sandstones and conglomerates.

18.5.5 Groundwater levels are anticipated to be high in low lying areas. The superficial deposits and the weathered bedrock are likely to have low permeabilities and there may be perched groundwater where more permeable ground conditions lie above these.

18.5.6 The mineral resources map identifies areas of 'other sandstone' at the eastern and western ends of the study area. The aggregate safeguarding map identifies the eastern and western ends of the site to extend into a Category 2 aggregate safeguarding area for sandstone deposits.

18.6 Proposed Scope of Baseline Studies

18.6.1 The existing baseline conditions will be identified from desk-based studies and information from ground investigations. This information will be used to determine the nature of existing materials on site that would be used in the earthworks. The potential locations of primary raw materials, secondary or recycled/reused materials and manufactured construction products, along with potential surplus material disposal sites will also be considered.

18.6.2 The desk-based studies will utilise the following sources:

a) British Geological Survey 1:50,000 Sheet 228 Haverfordwest (Drift) 1976;

b) British Geological Survey 1:50,000 Sheet 228 Haverfordwest (Solid) 1976;

c) British Geological Survey 1:100,000 South West Wales Mineral Resource Map;

d) British Geological Survey 1:100,000 South West Wales Aggregate Safeguarding Map;

[92] A40 Llanddewi Velfrey to Pontblewin Redstone Cross Improvement – Preliminary Sources Study Report, Arup (December 2017)

e) A40 Llanddewi Velfrey to Penblewin, Redstone Cross Improvement Preliminary Sources Study Report, December 2017, Arup (note, this report was prepared for the southern alignment only);

f) A40 Penblewin to Redstone Cross Improvements, Preliminary Sources Study Report Northern Alignment, Arup.

g) Pembrokeshire County Council (2013) Local Development Plan up to 2021; and

h) Natural Resources Wales (NRW) Public Register – list of operational waste management facilities.

18.7 Methodology for Assessment Effects

18.7.1 In line with IAN 153/11 a Scoping Assessment identify potential impacts of the scheme might be, and as the project value is >£300,000, as a minimum a Simple Assessment will then be undertaken. Dependent on the outcome of this assessment, a Detailed Assessment may also be required in accordance with IAN 153/11.

18.7.2 The Simple Assessment will be based on data and information that is readily available, will address potential effects identified at the Scoping level, present the likely environmental effects to inform the final design, or to reach an understanding of the likely environmental effects that will identify the need for Detailed Assessment.

18.7.3 For the purposes of assessing the effects associated with materials use and waste, the Simple Assessment is a qualitative exercise which should aim to identify the following:

a) The materials required for the project and where information is available, the quantities;

b) The anticipated waste arisings from the project, and where information is available, the quantities and type (e.g., hazardous);

c) The impacts that would arise from the issues identified in an initial scoping exercise in relation to materials and waste;

d) The results of any consultation; and

e) A conclusion about whether this level of assessment is sufficient to understand the effects of the project or whether a Detailed Assessment is necessary.

18.7.4 The assessment will identify the environmental impacts and the measures to mitigate the impacts. The assessment of potential effects due to construction will be based on estimated material requirements

and will include a review in terms of material volumes, sources and movements. Vehicle movements required for delivery and export of materials will be considered. The assessment of effects due to operation will be considered based on likely maintenance requirements.

18.7.5 Should a Detailed Assessment be required in accordance with IAN 153/11, it will utilise the data gathered at the Simple Assessment level and where necessary collate additional information to quantify the materials required for the project and to forecast the quantities and types of waste that would be produced. The Detailed Assessment would be a quantitative assessment of the effects associated with material use and potential waste.

18.7.6 Consultation with NRW and the Pembrokeshire County Council Pollution Control Team will be undertaken to identify any concerns regarding material resources and waste management. NRW will be specifically consulted with respect to the Site Waste Management Plan which will be produced as part of the CEMP.

18.8 Assessment of Potential Effects

18.8.1 The Scheme has the potential to generate local effects during the construction phase. Potential effects during construction are:

a) The generation of excess materials requiring removal from site to landfill or an alternative site.

b) The requirement for the import of construction materials (including primary aggregates).

18.8.2 The Scheme has limited potential to generate an effect during the operational phase as there are no day-to-day requirements to import or export materials and the operation of the Scheme is intended to generate minimum quantities of waste. Potential material uses and waste arisings are summarised in Table 18.1.

Table 18.1 Potential wastes and material use

Project Activity	Material use and potential to generate significant impact	Potential waste arisings and potential to generate significant effects
Site clearance	N/A	Vegetation surface strip, kerbs, trees, traffic signs, lighting etc. Low volume. Limited potential for significant effects.
Earthworks	Topsoil, general fill, capping – reuse of site won material. Import of primary and secondary aggregates. Earthworks balance targeted, limited potential for significant effects.	Surplus excavated material – reuse, recycle or dispose. Low surplus volume anticipated. Limited potential for significant effects.
Installation of pavement	Import of primary or secondary / recycled materials. Potential for relatively large volumes to be required. Potential for significant effects.	Surface planings – potential to recycle / reuse.
Installation of manufactured products	Drainage, kerbs, traffic signs, lighting etc. Low volume. Limited potential for significant effects.	No significant waste generated.
Operation of the road	No significant material resources required.	No significant waste arisings.

18.9 Mitigation Measures

18.9.1 The mitigation measures developed to address the environmental impacts identified during the assessment process would be reported using a Mitigation Measures Matrix.

18.9.2 The Matrix would identify:

a) The impacts.
b) The mitigation measures.
c) A commentary on the likely effectiveness of this mitigation.
d) A description of how the measures would be implemented, measured and monitored (e.g. Contractor's design, method statements, EMP and SWMP).

19 ALL TRAVELLERS

19.1 Introduction

19.1.1 This section of the scoping report will address the effects of the Scheme on the journeys made by:

a) **Non-Motorised Users** of roads, footpaths, cycleways and bridleways (hereafter collectively referred to as WCHR routes) and

b) **Vehicle Travellers** using the public road network.

19.1.2 The assessment will not cover aspects which are included within the cost-benefit economic analysis. The assessment will be carried out following guidance in Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 8.

19.1.3 Appendix 3 includes a scheme Constraints Plan (A40PRC-ARP-EGN-M02-DR-LE-0001).

19.2 Relevant Guidance

19.2.1 Under legislation, Welsh Government has set out how WCHR routes are to be managed, protected and improved in Wales in a document entitled 'Guidance for Local Authorities on Public Rights of Way', published in October 2016 replaces several Welsh Office Circulars and Regulations.

Policy

19.2.2 The Active Travel (Wales) Act, 2013. This legislation requires '…Welsh Ministers and local authorities to take reasonable steps to enhance the provision made for, and to have regard to the needs of, walkers and cyclists; for requiring functions under the Act to be exercised so as to promote active travel journeys and secure new and improved active travel routes and related facilities; and for connected purposes'. This is supported by the proposed Active Travel Action Plan (Welsh Government, 2014a). In addition, the Transport Act 2000 (as amended by the Transport (Wales) Act 2006) is relevant.

19.2.3 WCHR routes are protected by primary legislation that includes:

a) National Parks and Access to the Countryside Act 1949
b) Countryside Act 1968
c) Highways Act 1980
d) Wildlife and Countryside Act 1981
e) Road Traffic Act 1988
f) Rights of Way Act 1990
g) Town and Country Planning Act 1990
h) Countryside and Rights of Way Act 2000
i) Natural Environment and Rural Communities Act 2006

19.2.4 Planning Policy Wales (PPW) Edition 10 (2018) sets out how the theme of 'Active and Social Places', which 'aims to ensure new development is located and designed in a way which minimises the need to travel, reduces dependency on the private car and enables sustainable access to employment, local services and community facilities. This will be achieved through integrating development with sustainable transport infrastructure and designing schemes in a way which maximises provision and use of sustainable forms of travel, including prioritising these modes over the private car.'

19.2.5 Specifically dealing with transport, PPW states that 'the planning system should enable people to access jobs and services through shorter, more efficient and sustainable journeys, by walking, cycling and public transport. By influencing the location, scale, density, mix of uses and design of new development, the planning system can improve choice in transport and secure accessibility in a way which supports sustainable development, increases physical activity, improves health and helps to tackle the causes of climate change and airborne pollution….'

19.2.6 In PPW 10 Chapter 5 'Productive and Enterprising Places' it is stated that 'planning authorities should support necessary transport infrastructure improvements, where it can be demonstrated that such measures are consistent with Welsh Government policy to encourage and increase use of sustainable transport and reduce reliance on the private car for daily journeys. Transport infrastructure should not generate significant demand for additional car movements or contribute to urban sprawl or neighbourhood severance. The planning and design of transport infrastructure must consider the needs of users of active and sustainable transport before that of the private car, taking into account the sustainable transport hierarchy'.

19.2.7 Other relevant transport policy includes Technical Advice Note (TAN) 18 (2007): Transport; One Wales: Connecting the Nation (Welsh Assembly Government, 2008) 'The Wales Transport Strategy' and the 'National Transport Plan 2010'.

19.2.8 Also relevant are Technical Advice Note (TAN) 16 (2009): Sport, Recreation and Open Space; Technical Advice Note (TAN) 18 (2007): Transport; One Wales: Connecting the Nation (Welsh Assembly Government, 2008) 'The Wales Transport Strategy' and the 'National Transport Plan 2010'.

19.2.9 The Local Development Plan sets out policy for WCHR routes under 'Leisure Routes' and 'Public Realm'. Policy GN.34 sets out the need to protect these routes.

19.2.10 The A40 is one of the key routes to and from the ferry port at Fishguard. Pembrokeshire Local Plan sets out the need to maintain landscape quality as a setting for tourism.

19.3 Study Area

19.3.1 The study area will be the extent of WCHR routes within the 500m route corridor (250m each side), although only those routes that are affected are assessed.

19.4 Work undertaken to date

19.4.1 Desk studies of routes were undertaken in Key Stage 1 and Key Stage 2. Consultations with the Planning Authority and Highway Authority have taken place for the adjacent A40 Llanddewi Velfrey to Penblewin Improvements and much of the advice are applicable to the current Redstone Cross scheme as well. Further consultations for the scheme will be carried out.

19.5 Baseline Conditions

19.5.1 There is a limited Public-Rights of Way network in the study area, but no designated cycle routes. Information for this has been obtained from the Definitive Map of Public Rights-of-Way (PRoW).

19.5.2 The pedestrian, cyclist and equestrian baseline conditions will also be

established by undertaking site visits and public rights of way condition and user surveys.

19.6 Proposed scope of Baseline studies

19.6.1 Surveys and counts of WWCHR routes are required to properly understand the relative importance of each route and the significance of impact of any changes that could result from the Scheme. These will be surveyed on both a week day and weekend day.

19.6.2 Reference to the Definitive Map will be made to ensure that all relevant Public Rights of Way are known. Non-statutory consultees will be consulted, including groups representing Equestrians, walkers and cyclists.

19.7 Assessment Methodology

19.7.1 The All Travellers topic includes an assessment of the effects on the public rights of way (footpaths, bridleways and restricted byways); cycle routes; permissive non-motorised user (WCHR) routes; public highways; public transport; overbridge and underpass crossings.

19.7.2 The assessment of effects on all travellers considers the construction and operation of the proposed new road and changes in amenity and effects on community severance and driver stress. 'Views from the Road' are also considered.

19.7.3 The following guidance documents are relevant:

DMRB Volume 11

a) Section 2, Part 5, HA 205/08 (Highways Agency et al., 2008);

b) Section 3, Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects' (Highways Agency, 1993a) in respect of the potential effects on pedestrians, cyclists and equestrians;

c) Section 3, Part 9 'Vehicle Travellers' (Highways Agency, 1993b) in respect of the potential effects on driver stress;

d) Interim Advice Note 125/09(W) Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment' (Wales Only) (Welsh Assembly Government, 2009).

19.7.4 With respect to WCHRs (pedestrians, cyclists and equestrians), the

requirements of the DMRB Volume 11, Section 3, Part 8 (Highways Agency, 1993a) are:

a) Journey length, local travel patterns: using the method for reasonably straightforward travel patterns;

b) proposed changes in journey length and duration;

c) changes in amenity on the WCHR routes, assessing changes that would arise from the Scheme compared to the Do Minimum scheme. Amenity is here defined as the relative pleasantness of the environment or journey.

d) increases or reductions in Community Severance. This will apply the method for new severance with the new road and relief of existing severance through the reduction of traffic on the detrunked road.

19.8 Assessment of Potential Effects

19.8.1 The northern route option would cut across or cause potentially adverse effects on 1 WCHR route (a bridleway). The southern route option affects no WCHR routes.

19.9 Mitigation Measures

19.9.1 Mitigation could include underpasses to provide a route under the Scheme, or crossings.

20 HEAT AND RADIATION

20.1 Introduction

20.1.1 The EIA regulations of 2017 require an assessment of the likely significant effects of the project on the environment resulting from heat and radiation. Highways England guidance[93] states that *'the consideration of heat and radiation should be addressed through scoping. It is anticipated that this is unlikely to be relevant to the scope of most highways projects.'* This Section examines whether there are likely to be any significant effects.

20.1.2 An assessment of heat and radiation should identify a:

A. **Source** of heat or radiation to be identified;

B. **Pathway** by which the heat or radiation can be transmitted;

C. **Receptor** that can be affected by the heat or radiation. A significant effect is one that would result in change in the receptor.

Source

20.1.3 Possible sources of heat or radiation for a highway could include construction activity such as the laying of hot materials such as bitumen macadam, the generation of heat from setting concrete, welding of metals, the use of abrasive materials for grinding and cutting, the running of internal combustion engines and the release of hot engine exhaust gases and the fires. These activities would mostly arise during construction, but some, would also arise from operation and maintenance of the highway. A further source is heating of surfaces and the atmosphere by solar radiation. If a source of heat and radiation is not of sufficient power, concentration or duration it will have only a minor impact on a pathway and it is in the nature of heat and radiation to dissipate so that its effects are lessened as it spreads into the environment.

Pathways

20.1.4 Transmission of heat and radiation can include convection in the

[93] Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive)

atmosphere, radiation through space and materials, heating of water or the ground. The effect of most pathways is to dissipate the energy it carries so that heat and radiation will have a lesser impact with time and distance.

Effects on receptors

20.1.5 Receptors of the impact of heat and radiation could include ground humans, terrestrial, aquatic and marine flora and fauna, surfaces, structures, materials and vehicles. The effects of heat and radiation are likely to be less significant as the energy is dissipated and most receptors will accept small to moderate fluctuations in heat without being noticeably changed. The effects of less moderate heat and radiation could include:

A. Deterioration or combustion of materials; or twisting, crumpling or cracking of materials and structures due to expansion and contraction,

B. Changing physical conditions that make habitats unsuitable for native species, or more suitable for others such as invasive species;

C. Changes to human living spaces from heat, whether generated by combustion, friction or solar gain, that make them less habitable or unhealthy.

Construction effects

20.1.6 During construction the main sources of heat is generated by the running of machinery powered by internal combustion engines burning hydrocarbon fuels. Further heat is released from materials used such as heated bitumen used in pavement construction. None of these sources are expected to create a sufficiently large and concentrated source of heat of long duration that it cannot be dissipated quickly by the atmosphere into which it will be released. The dissipated heat would have an insignificant effect on the surrounding receptors.

Operational effects

20.1.7 In traffic assessments conducted as part of this project, traffic growth on the A40 would not change as a result of the improvements. During operation of the road over the next few decades, there are changes likely in the source of energy for vehicles, with hydrocarbon fuels being

replaced by rechargeable electric vehicles in accordance with UK Government over the decades up to 2050. This would mean a gradual reduction in waste heat from burning hydrocarbons. Maintenance of the road pavement would include periodic, infrequent use of heated bitumen. Neither maintenance nor the burning of hydrocarbons are expected to create a sufficiently large and concentrated source of heat of long duration that it cannot be dissipated quickly by the atmosphere into which it will be released. The dissipated heat would have an insignificant effect on the surrounding receptors.

20.2 Conclusion

20.2.1 With no change brought about by the Scheme and no new sources of either heat or radiation being introduced it is anticipated that the generation of heat or radiation is unlikely to be relevant to this project. An assessment of the effects of heat and radiation on the environment has been scoped out.

21 CLIMATE CHANGE

21.1 Introduction

21.1.1 EIA Regulations 2017 introduced the requirement to include consideration of the impact of the proposed development on climate and the vulnerability of the project to climate change. An assessment related to climate change is composed of three elements:

a) Greenhouse gas (GHG) emissions assessment – quantifies the potential GHG emissions associated with the construction and operation of the proposed development and identifies mitigation measures to reduce these emissions.

e) Climate change resilience (CCR) assessment – evaluates the effectiveness and feasibility of adaptation measures integrated into the proposed development to avoid or reduce hazards and/or increase resilience of the proposed development to climate change impacts.

f) In-combination climate change impact (ICCI) assessment – evaluates the combined effect of the proposed development and potential climate change impacts on the receiving environment during construction and operation.

21.2 Relevant Guidance

21.2.1 The climate change assessment would be undertaken in line with the relevant legislation, policies and guidance documents, as outlined below.

Paris Agreement

21.2.2 Adopted in 2015 and entered into force in November 2016, the Paris Agreement is an international climate agreement aiming to limit global temperature increase this century to less than 2 degrees Celsius above pre-industrial levels. It additionally establishes a goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.

EIA Directive 2014/52/EU

21.2.3 The Directive 2014/52/EU states that EIAs shall identify, describe and assess the direct and indirect significant effects of climate change relevant to the project. The regulations implementing this directive

were transposed into UK legislation in May 2017.

Climate Change Act 2008

21.2.4 The Climate Change Act 2008 committed the UK to its first statutory carbon reduction target to reduce carbon emissions by at least 80% from 1990 levels by 2050. It also requires that five-yearly carbon budgets are set and not exceeded. It also established a requirement to undertake a climate change risk assessment every five years and develop a programme for adaptation action in response to the risks identified.

Well-being of Future Generations (Wales) Act 2015

21.2.5 The Well-being of Future Generations (Wales) Act 2015 requires public bodies to carry out sustainable development, which is the process of improving the economic, social, environmental and cultural well-being of Wales by actions aimed at achieving the well-being goals. The Act establishes seven well-being goals, which specifically reference acting on climate change. As such, the Act requires all public bodies to embed climate change into their decision-making.

Environment (Wales) Act 2016

21.2.6 The Environment (Wales) Act 2015 requires Welsh Ministers to meet greenhouse gas reduction targets for Wales and establishes a 2050 emission target of 80% reduction in net emissions from the baseline year (1990 or 1995 depending in the specific greenhouse gas). Progress to this target is supported by interim emissions targets set for every ten years until 2050 and carbon budgets established for five-yearly periods.

Planning (Wales) Act 2015

21.2.7 The Planning (Wales) Act 2015 emphasises that national, strategic and local planning must be carried out in accordance with the sustainable development definition and principle as per the Well-being of Future Generations (Wales) Act 2015.

Clean Growth Strategy (UK)

21.2.8 Published in October 2017, the Clean Growth Strategy outlines the UK government's proposals to decarbonising all sectors of the UK economy though the 2020s.

Climate Change Strategy for Wales

21.2.9 Published in October 2010, the Climate Change Strategy for Wales establishes a target to reduce greenhouse gas emissions by 3% per year from 2011 in areas of devolved competence, against a baseline of average emissions between 2006 and 2010. It is supported by the actions set out in the Delivery Plans for emission reduction and adaptation.

UK Climate Change Risk Assessment

21.2.10 The second UK climate change risk assessment was published in 2017, as required under the Climate Change Act 2008. It establishes the six priority risk areas for action over the following five years. It is based on the independent evidence report published by the Committee on Climate Change.

Pembrokeshire County Council Local Development Plan (2013-2021)

21.2.11 Strategic Objective A in the LDP is mitigating and responding to the challenge of climate change. It is supported by Strategic Policy 1 – Sustainable Development and General Policy GN.2 Sustainable Design, on the basis that climate change is a key long-term environmental challenge and the need to reduce emissions and use resources more efficiently is essential.

Pembrokeshire Local Flood Risk Management Strategy 2012

21.2.12 Pembrokeshire County Council has responsibility for 'local flood risks', which includes the risk of flooding from ordinary watercourses, surface runoff and groundwater. The Council have published a draft Flood Risk Management Strategy that details responsibilities, measures, objectives and assessments of flood risk.

Assessment Guidance

21.2.13 Institute of Environmental Management and Assessment (IEMA) (2015) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation is a guidance document that provides a framework for the consideration of climate change resilience and

adaptation in the EIA process, in line with Directive 2014/52/EU.

21.2.14 IEMA (2017) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance is guidance that aims to assist EIA practitioners with addressing greenhouse gas emissions assessment and mitigation. It outlines the process for undertaking the carbon assessment as it relates to the EIA stages.

PAS 2080:2016 Carbon management in infrastructure

21.2.15 PAS 2080 provides a framework on how to manage whole life carbon when delivering infrastructure assets and programmes of work. This assessment broadly follows the principles set out in PAS 2080 for the quantification of greenhouse gas emissions.

21.3 Study Area

21.3.1 For the GHG assessment of construction carbon the study area will principally take account of emissions associated with project activities and their associated transport. The study area for road user carbon, referred to as the 'Affected Road Network', will be consistent with the study area in the transport and air quality assessments.

21.3.2 For the CCR and ICCI assessments the study area will be defined based on the area of works within the project boundary and the location of affected receptors identified within other environmental factors scoped in to the assessment. This may include consideration of impacts to the infrastructure system and communities beyond the project boundary.

21.4 Work Undertaken to Date

21.4.1 The ES for the A40 Llanddewi Velfrey to Penblewin Improvement Scheme included consideration of climate change impacts. It is anticipated that the impacts for the Redstone Cross to Penblewin Scheme will be broadly similar, however no work had been undertaken to date to assess these impacts.

21.5 Baseline Conditions

Greenhouse Gas (GHG) Emissions Assessment

21.5.1 The GHG assessment assesses the impact of capital, operational and user carbon emissions resulting from the project. In this chapter carbon is used throughout this report as shorthand for emissions of all greenhouse gases, measured in units of carbon dioxide equivalent (CO_2e).

21.5.2 Capital carbon is assumed to be zero in the baseline scenario as construction of the Scheme is not undertaken. Operational carbon sources include energy consumption by existing street lighting, which will be negligible in comparison to carbon from other sources associated with the Scheme such as user vehicle tailpipe emissions.

21.5.3 For user carbon, the assessment will compare the emissions resulting from two scenarios:

Do minimum scenario (baseline) – emissions without the Scheme, projected as a future baseline in the operational phase;

Do something scenario – emissions with the Scheme.

Climate Change Resilience (CCR) and In-combination Climate Change Impact (ICCI) assessments

21.5.4 The baseline environment for the CCR and ICCI assessments includes consideration of:

a) Current climate conditions – established for a range of climate variables based on the long-term average of historical weather data for 1961 – 1990. This data is a comparator for the projected future climate conditions.

b) Future climate conditions – based on projections of different emissions scenarios and probability levels.

21.5.5 The description of the future climate baseline will be based upon climate change projection data from the United Kingdom Climate Projections 2018 (UKCP18)[94]. The UKCP18 climate change projection data is the most widely used data for the UK and are available for

[94] Met Office (2018) UK Climate Projections https://www.metoffice.gov.uk/research/collaboration/ukcp [Accessed 22 February 2019}]

different emission scenarios and time periods up to the 2080s.

21.5.6 The assessments will include consideration of future climate conditions over two timescales. The timescales will include a medium-term (2050s) and long-term projection (2080s) projection. Note that 'the 2050s' is defined by the Met Office as the period 2040-2069, decades are defined similarly for the 2080s (2070-2099).

21.5.7 Overall, the trends in climate variables for Pembrokeshire are expected to include:

a) High temperatures – Increase in mean daily temperatures in the summer and winter, increase in the number of hot days (days when daily mean temperature is >25°C) and increased insolation

c) Low temperatures – Decrease in the number of frost days (days when daily minimum temperature <0°C).

d) High precipitation – Increase in mean daily rainfall in the winter, increase in the number of days with heavy rain.

e) Low precipitation – Decrease in mean daily rainfall in the summer, increase in the annual number of dry spells.

f) Extreme weather – Increase in extreme wind events[95]. Increase in the number of lighting days, particularly in Autumn[96].

21.6 Proposed Scope of Baseline Studies

21.6.1 No additional surveys are required to calculate the effects of traffic. Traffic data for the existing road and modelled for the Scheme will be available from surveys already conducted for the Scheme. The Local Authority will be consulted for the ES to obtain further information where relevant.

21.7 Methodology for Assessment of Effects

GHG assessment

21.7.1 GHG emissions from human activities, such as burning fossil fuels and changing land uses, are causing anthropogenic climate change. The UK and Wales have legally binding GHG reduction targets through the

[95] IPCC (2014) Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, https://ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap23_FINAL.pdf [Accessed June 2018] page 1279
[96] UK Climate Projections (2010) Future changes in lightning from the UKCP09 ensemble of regional climate model projections, http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87950&filetype=pdf [Accessed June 2018]

Climate Change Act 2008 and the Environment (Wales) Act 2016. Previous GHG assessments of road schemes have shown that emissions from vehicles using the road account for the vast majority of carbon emissions over the project life.

21.7.2 The GHG emissions will be quantified using the principal steps outlined in Publicly Available Specification 2080:2016 Carbon Management in Infrastructure (PAS 2080), as shown in Figure 21.1

Figure 21.1 Principal steps of GHG emissions quantification

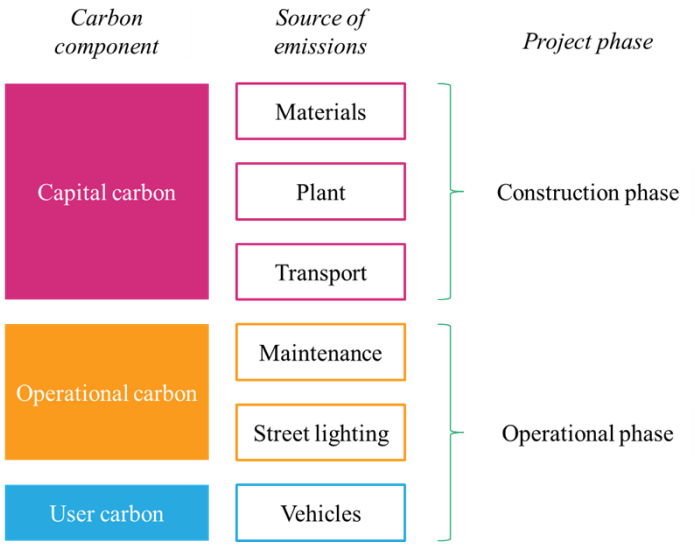


Figure 21.2 Scope of carbon assessment

21.7.3 A whole-life approach will be adopted, capturing both direct and indirect GHG emissions arising as a result of the Scheme across supply chain, construction, operation and use. End of life is not considered due to the long design life of the asset and given that emissions associated with end of life are commonly relatively small.

21.7.4 The GHG emissions from the development will be calculated by converting 'activity data' (such as energy consumption and transport kilometres travelled) into quantities of GHG emissions through the application of emissions conversion factors.

21.7.5 The emissions conversion factors used to complete the calculations are expected to include the following:

a) The Inventory of Carbon and Energy (ICE) v3.0.

b) GHG reporting: conversion factors 2019, published in June 2019 by the UK Department of Business, Energy and Industrial Strategy (BEIS)

c) Environmental Product Declarations (EPDs) – for products and materials not available in ICE v3.0

d) Energy and Emissions Projections updated in 2018 by the Department of Energy and Climate Change (DECC).

CCR assessment

21.7.6 Key issues related to adaptation to climate change include flooding risks due to changes in the amount, frequency and timing of precipitation, as well as sea level rise and storm surges. Increases in average temperatures and frequency of extreme temperature and other weather events also have the potential to impact the proposed development and other environmental receptors. These will need to be taken into consideration during the design stages; both for general layout and detailed design.

21.7.7 Issues related to climate predominantly concern the operational phase and how buildings and infrastructure were designed and developed to integrate climate change resilience. Flood risk (including from sea level rise) will be assessed within the water resources assessment of the EIA and will therefore be cross-referenced rather than duplicated in this chapter.

21.7.8 The impacts of climate change are already being experienced, particularly in terms of increased frequency and severity of extreme weather events such as storms and heatwaves. The measures set out in the CEMP will be set within the context of the current climate. Due to the short temporal phase of construction, it is anticipated that these measures would appropriately address climate change risks during the construction phase. The construction phase has therefore been scoped out of the CCR and ICCI assessments.

21.7.9 The approach and methodology for the climate change resilience assessment is as follows:

a) analysis of relevant climate change and weather data, emissions scenarios and probability levels;

b) assessment of climate hazards;

c) identification of potential risks from these climate hazards to the assets and occupants of the proposed development;

d) consideration of the resilience of the proposed development within the context of any incorporated mitigation measures, including resilience measures which are embedded within the design due to regulations and design guidelines; and

e) identification of need for any further resilience measures to protect the proposed development against the effects of climate change.

21.7.10 This assessment will be undertaken as part of design stage 3. Upon completion of the assessment, and in accordance with IEMA guidance, a Climate Change Adaptation Plan will be produced to detail receptors found to be sensitive to future climate change impacts and identify a range of mitigation measures for integration into subsequent design changes.

ICCI assessment

21.7.11 The approach and methodology for the ICCI assessment is as follows:

a) analysis of relevant climate change and weather data, emissions scenarios and probability levels;

b) consideration of potential climate change impacts for all environmental topics;

c) assessment of each environmental topic's respective significant effects and the corresponding mitigation measures identified by each topic;

d) assessment of any potential in-combination climate change impacts and effects given existing mitigation measures (i.e. mitigation measures identified by each environmental topic);

e) assessment of whether there are any significant in-combination climate change effects, based upon whether potential in-combination climate change impacts are assessed to have a high likelihood or consequence;

f) consideration of additional mitigation measures to address significant in-combination climate change effects, beyond those existing mitigation measures identified by other environmental topics; and

g) inclusion of allowances for future mitigation measures and monitoring, to ensure continued resilience of receiving environment.

21.8 Assessment of Potential Effects

GHG assessment

21.8.1 In accordance with the National Policy Statement for National Networks (NPS NN), carbon emissions associated with the scheme are compared to the national UK carbon budgets. The fourth carbon budget (2023 to 2027) allows the UK to emit 1,950 $MtCO_2^e$ during the 5-year period. A significant effect would occur where the increase in carbon emissions resulting from the proposed scheme are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets.

CCR assessment

21.8.2 The significance of the risks identified in the CCR assessment will be based on the likelihood of a hazard having an impact on the proposed development, and the consequence of the impact. The potential likelihood and consequence of impacts to the proposed development will be assessed using a qualitative five-point scale.

21.8.3 The following climate change hazards are considered in the CCR risk assessment:

a) high temperatures
b) low temperature
c) high precipitation
d) low precipitation
e) humidity
f) insolation (solar irradiation)
g) storms/lightning strikes; and
h) wind

21.8.4 The potential likelihood and consequence of climate change hazards impacts to the infrastructure and assets associated with the Scheme are scored using a qualitative five-point scale as set out in the table below.

Table 21.2 Climate Change qualitative five point scale

Likelihood	Very unlikely	Unlikely	As likely as not	Likely	Very likely
Consequence	Very low	Low	Medium	High	Very high

21.8.5 The resulting risk level is scored as one of the following in the table below.

Table 21.3 Risk Matrix

Consequence	**V. High**	3	3	4	5	5
	High	2	3	3	5	5
	Medium	2	2	3	4	4
	Low	1	1	2	3	3
	V. Low	1	1	2	2	3
		V. Unlikely	**Unlikely**	**Possible**	**Likely**	**V. Likely**
		Likelihood				

ICCI assessment

21.8.6 Following the initial assessment, topics are categorised into one of the following five categories, based on the number and significance of potential in-combination impacts as part of the initial assessment:

1. At least one potential in-combination climate change effect with high significance (to remain scoped in)
2. More than five potential in-combination climate change effects with medium significance (to remain scoped in)
3. Five or fewer potential in-combination climate change effects with medium significance (to be scoped out)
4. Potential in-combination climate change effects with low significance only (to be scoped out)
5. No potential in-combination climate change effects (to be scoped out)

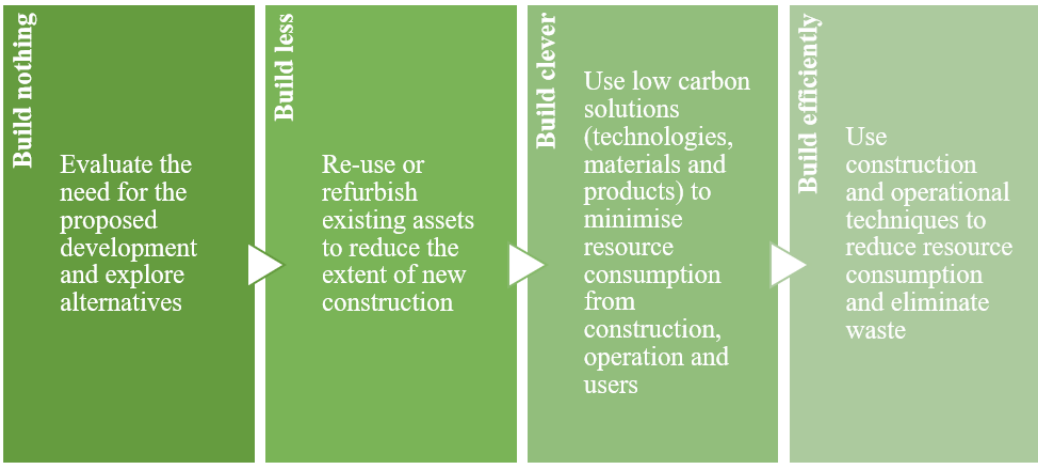
21.9 Mitigation Measures

GHG assessment

21.9.1 PAS 2080 outlines the GHG emissions reduction hierarchy shown in

Figure 21.3. This will be adopted when identifying opportunities to reduce emissions over the life of the project.

Figure 21.3 Carbon emissions reduction hierarchy[97]



21.9.2 The IEMA guide to assessing greenhouse gas (GHG) emissions and evaluating their significance[6] publishes the over-arching principle:

> *"The GHG emissions from all projects will contribute to climate change; the largest inter-related cumulative environmental effects…as such any GHG emissions or reductions from a project might be considered to be significant…"*

21.9.3 In accordance with this guidance, any carbon emissions associated with the Scheme can be deemed significant. To provide an indication of the relative scale of the emissions from the Scheme they can be compared to the carbon emissions from road transport on all purpose roads (commonly referred to as A roads) in Pembrokeshire.

21.9.4 The GHG emissions assessment will be used to identify the greatest sources of GHG emissions and opportunities to reduce them. Measures proposed to mitigate the impact of GHG emissions from the construction of the proposed development may include:

a) Reduce the quantity of materials required through efficient design;

b) Implement the principles of 'designing out waste' to reduce the embodied emissions used to manufacture materials that are subsequently wasted;

[97] Construction Leadership Council & the Green Construction Board (2016) PAS 2080:2016 Carbon management in infrastructure. BSI Limited, London, UK.https://shop.bsigroup.com/forms/PASs/PAS-2080/ [Accessed June 2018]

c) Select alternative materials that have a lower emissions intensity, e.g. recycled materials, cement substitutes; and

d) Select local material suppliers to reduce the transport distances and associated emissions from freight.

21.9.5 Measures proposed to mitigate the impact of GHG emissions from the operation of the proposed development may include:

a) Select energy efficient infrastructure, equipment and fittings in order to reduce energy demand during operation;

a) Select durable materials with low requirements for maintenance and replacement over the operational life of the development, with consideration of appropriate selection of materials based on the design life of the asset; and

b) Develop strategies to encourage the use of low carbon transport modes in line with the Active Travel Act, including active and public transport, in order to reduce user emissions.

21.9.6 The ability to influence and reduce GHG emissions is most effective during the design stage, therefore the assessment provides an opportunity to maximise this benefit.

CCR and ICCI assessments

21.9.7 Measures to improve the resilience of the development to future climate change impacts should be integrated into the design. These may include, but are not limited to[98]:

a) Designing the development to address flood risks – including locating the development to minimise risk, implementing sustainable drainage systems (SuDS) principles in drainage design, consideration of flood-tolerant construction, temporary and permanent flood defences and post-flood recovery measures.

b) Designing the development to manage water efficiently – implementing sustainable drainage systems (SuDS) principles in drainage design.

c) Selecting weather-resistant materials and fixings – including consideration of effects of extended wetting and heat in causing accelerated material degradation.

21.9.8 Myriad additional impacts exist which will be addressed fully once the

[98] Technology Strategy Board (2010) Design for Future Climate Report: Opportunities for Adaptation in the Built Environment

assessments have been completed

21.9.9 In order to avoid maladaptive outcomes that limit future adaptation options, further measures to mitigate the impacts identified in the CCR and ICCI assessments will be recommended if a significant impact is identified. For the ICCI assessment, these will be developed in conjunction with the relevant EIA topic leads.

21.10 Conclusion

21.10.1 An assessment of climate change should be carried out because of the potential adverse effects in terms of contribution of GHG emissions to climate change.

21.10.2 As outlined above, the GHG assessment will include projected embodied, operational and use phase emissions. As outlined in 21.7.3, end of life GHG emissions will be scoped out of the assessment.

21.10.3 The CCR and ICCI assessments will provide an indication of the risks to the asset from climate change and in-combination impacts on receptors due to climate change and the scheme, however it is not considered likely that there would be significant adverse effects following mitigation for either of these aspects.

21.10.4 As stated in 21.7.8, due to the short-lived nature of the construction phase of the scheme this phase will be scoped out of the assessment.

22 RISK OF MAJOR ACCIDENT OR DISASTER

22.1 Introduction

22.1.1 This assessment addresses the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project during construction and operation to risks of major accidents or disasters which are relevant to the project concerned.

22.1.2 EIA should always be proportionate and so the intention is that this chapter of the ES, if an assessment is required, would address the major risks that are relevant to the Scheme, in the context that the resilience of the A40 is of importance to the region. For example, flood risk from surface water, major road accidents resulting in road closures are relevant, while volcanic eruptions, famine and plagues of pests are not.

22.2 Relevant Guidance

22.2.1 Neither the regulations nor the EU Directive define the scope or method to be used in the assessment. However, IEMA provide useful outline guidance in an EIA Quality Mark Article[99]. The article provides useful definitions:

Major Accident: an uncontrolled occurrence in the course of the construction or operation of a development, leading to serious danger to the environment, which may be either immediate or delayed.
Examples: large-scale fire, structural collapse, explosion, or transport accident.

Disaster: an external event (i.e. not directly caused by the development) leading to serious danger to the environment, which may be either immediate or delayed.
Examples: natural sources such as coastal flooding, adverse weather, ground movement; man-made sources such as escalation of a fire from an adjacent facility, dam collapse etc.

22.2.2 UK National Risk Register 2015[100] provides a checklist of civil emergencies and the risks posed (Table 22.1). The list of risks identified

[99] https://www.iema.net/assets/uploads/EIA%20Articles/AMEC%20What%20is%20this%20MADness.pdf | Amec Foster Wheeler. 2018.
[100] National Risk Register Of Civil Emergencies 2017 edition, Cabinet Office.

in the register forms the basis for this assessment scope.

22.2.3 Emerging EIA practice excludes health and safety matters from this assessment as they are covered elsewhere by detailed legislation.

Table 22.1 Checklist of hazards

Type of hazard			**Type of hazard**	
Geophysical	Earthquake Landslide Tsumani Volcanic eruption		**Biological**	Infectious animal disease epidemic Infectious human disease epidemic Pest plague
Hydrological	Coastal Flood **Riparian/Surface water flood**		**Manmade**	Conflict, war and terrorism Cyber-attack on critical services Displaced population Disruptive industrial action Famine and food insecurity Industrial accidents Poor air quality events Public disorder Electricity failure **Transport accidents** Widespread failure of services
Climatological	Drought Extreme temperatures Wildfire			
Meteorological	**Heavy snow** Hurricane, storms and gales Severe space weather Storm surge			

22.3 Study Area

22.3.1 The study area is definable only after any potential major accident or disaster that could arise were identified as relevant to the project and which could result in '*serious danger'* to the environment. However, in each case the project is either the source of the accident or is subjected to the disaster resulting in adverse effects on the environment.

22.4 Work Undertaken to Date

22.4.1 Table 22.1 Checklist of Hazards sets out a long list of potential major accidents and disasters. A preliminary scoping exercise has highlighted those that are most relevant and are shown in bold text.

22.5 Baseline Conditions

22.5.1 Accident records for the existing A40 and information about the local

environment obtained for other assessments such as road drainage and water environment, geology and soils.

22.6 Proposed Scope of Baseline Studies

22.6.1 The existing condition will be established by a desk study of the potential hazards as set out in Table 22.1.

22.6.2 Consultation with statutory or non-statutory consultees would be required to obtain data on sources of risks and consequences. The Local Authority, Traffic Wales, emergency services and Natural Resources Wales and are important sources of data and advice.

22.6.3 No surveys are required for this assessment

22.7 Methodology for Assessment of Effects

22.7.1 The method of assessment has several stages:

Screening of relevant threats:
based on the National Risk Register of Civil Emergencies[101]) these are listed in Table 22.1.

Consideration of vulnerabilities:
how site location and adjacent land use makes the project vulnerable to the risk of accidents and disasters;

Scoping of low and high risks to the project:
using source-pathway-receptor risk matrix approach where the project becomes a pathway that increases risk as a result of the changes brought about);

Consideration of high risks:
based on risk factors, avoidance, prevention and mitigation;

Cross referencing
of identified risks to other ES chapters, as appropriate;

Examination of residual risks.

22.7.2 The aim of the EIA is to introduce mitigation measures that:

a) Reduce the likelihood of hazard;

[101] Cabinet Office 2015.

b) Reduce the magnitude of the hazard on the development if it is realised;
c) Break the pathway between the hazard and the development;
d) Increase the resilience of the development to the hazard;
e) Reduce the magnitude of the triggered effect;
f) Reduce the vulnerability of the receptor to the triggered effect;
g) Break the pathway between the development and the receptor.

22.7.3 The EIA process will evaluate the exposure and vulnerability of the development to each of the hazards on the list, identify the potential major accidents or disasters associated with each, and assess the risk of likely significant environmental effects that would be caused. Figure 22.1 shows how these potential impacts are considered. The result is that the assessment will address high risk, but low likelihood events; however, there are no defined thresholds above or below which an event is not considered.

Significance criteria

22.7.4 'Significant adverse effects' are considered to mean: 'The loss of life or permanent injury, and/or permanent or long-lasting damage to an environmental receptor[102]'.

22.8 Assessment of Potential Effects

22.8.1 Table 22.1, provided in an early section of this chapter 22, shows a checklist of hazards that is broadly based on the list provided in the UK National Risk Register 2015[103], with those that are relevant to the A40 Scheme emboldened. The potential effects of the Scheme will therefore arise from these.

[102] IEMA (2017) EIA Quality Mark Webinar: Major Accidents and Natural Disasters in EIA. 13th July 2017.
[103] National Risk Register Of Civil Emergencies 2017 edition, Cabinet Office.

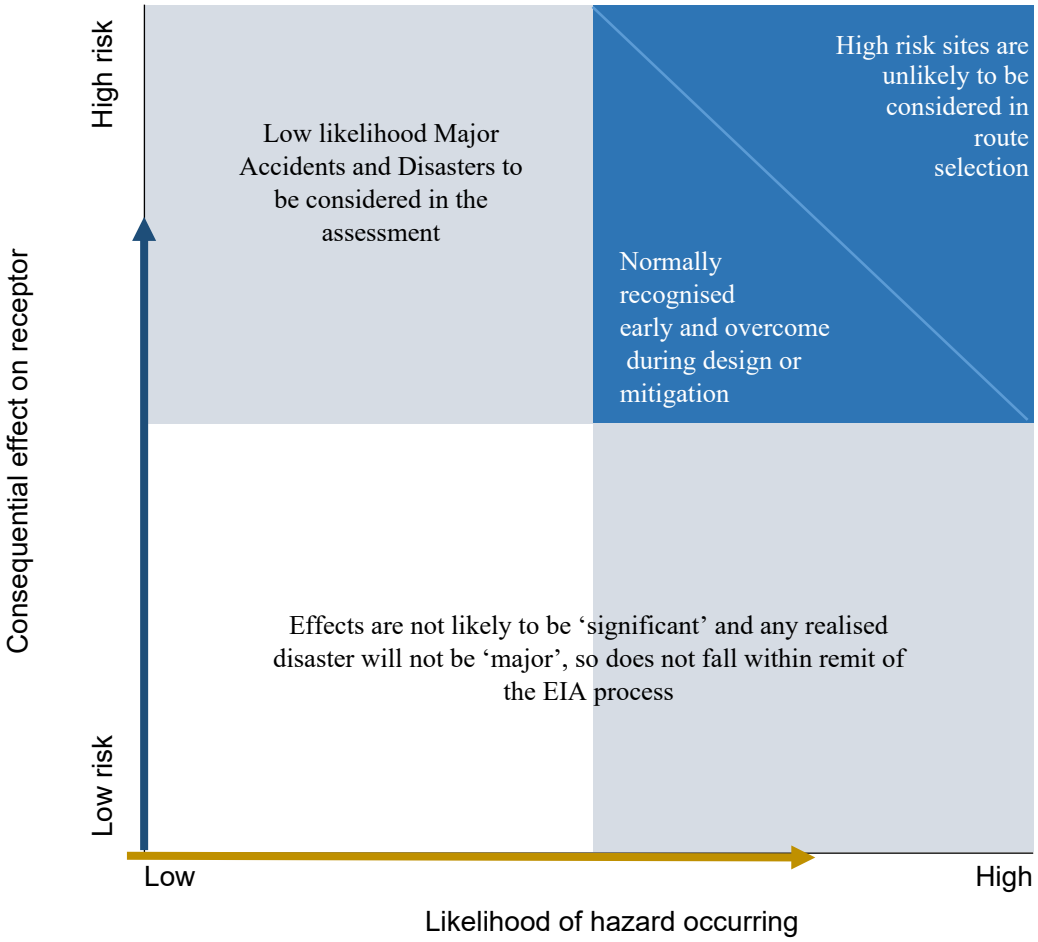


Figure 22.1 Assessment of risk of major accident and disaster

22.8.2 The potential consequences of riparian or surface water flooding will be addressed in the ES Chapter 11 - Road Drainage and Water Environment.

22.8.3 In particular, the effects of severe heavy snow, or transport accidents that could result in closure of the road are considered of greatest concern to the potentially isolated community in the villages and to the wider travelling public.

Natural events

Heavy prolonged snow cover:
A very rare occurrence which is normally cleared as part of the annual maintenance regime within a short timescale so that the roads can resume near-normal use.

Riparian or surface flooding:
The potential consequences will be addressed in the Road drainage

and Water Environment Chapter. A Flood Consequence Assessment has shown that there is a low risk of flooding to the Scheme.

Transport accidents:

Serious accidents with and without fatalities
Accidents that close the road are infrequent. When the road is closed traffic can be diverted onto other routes with little or no effect on travellers. The effect is not considered significant

Serious accidents resulting in pollution of the environment:
The Scheme would include measures to contain and limit the spread of liquid pollutants released onto the road. The emergency services are trained and equipped to deal with these events and the effect on the environment is not considered significant.

22.9 Mitigation Measures

22.9.1 Mitigation would include measures to protect the environment.

22.10 Conclusion

22.10.1 An assessment of the potential effects of Major Accidents and Disaster is not required and so has been scoped out.

23 POPULATION AND HEALTH

23.1 Introduction

23.1.1 An assessment of population and health is a means of assessing the health consequences of a proposed project at the population level and to use this information to feed back into the design to maximise the positive and minimise the negative health impacts of the proposal.

23.1.2 Health assessment is multidisciplinary and cuts across the traditional boundaries of health, public health, social sciences and environmental sciences. The most commonly used definition of 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'*.[104]

23.1.3 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'.[105]

23.1.4 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

[104] WHO European Centre for Health Policy (1999). Health impact assessment: main concepts and suggested approach. Gothenburg consensus paper. WHO Regional Office for Europe.
[105] World Health Organisation (WHO) (2007). Constitution of the World Health Organisation, Geneva, 1946.

transport) and leisure facilities influence the health of the population.

23.1.5 Of these, only the pre-determined factors are unlikely to be influenced by a development proposal. The health assessment will therefore consider all relevant health determinants other than the pre-determined factors.

Scope of this assessment

23.1.6 Due to the rural location of the Scheme and the relatively small number of human receptors in the area (whether residential, occupational or recreational), it is unlikely that the health of a whole population would be affected either positively or negatively by the scheme. In this regard, it is considered that a full health assessment can be scoped out.

23.1.7 However, there is a possibility that impacts could affect the health of individuals who either live close to, or who regularly visit the areas around the Scheme for recreational or transport reasons.

23.1.8 This assessment will therefore consider the health effects of the Scheme on a much smaller receptor base than a typical health assessment.

23.2 Relevant Guidance

23.2.1 Guidance that has been used in the preparation of this assessment includes:

a) Wales HIA Support Unit (WHIASU); HIA, A Practical Guide;

b) Ben Cave Associates, (2009); A review package for Health Impact Assessment reports of development projects;

c) Health Impact Assessment of Transport Initiatives, A Guide. NHS Health Scotland, 2008.

23.3 Study Area

23.3.1 The geographical scope of the assessment will vary between different health determinants being assessed, however generally data will be assessed from the ward level (Lampeter Velfrey and Narberth Rural) and from the wider Pembrokeshire area as relevant. This will be aligned with the geographical scope of the community and private assets assessment.

23.4 Work Undertaken to Date

23.4.1 No work has been carried out to date in relation to the Scheme; however, a population and health assessment was recently prepared for the A40 Llanddewi Velfrey to Penblewin Improvement scheme (A40LVP) and this will be used to inform this current assessment.

23.5 Baseline Conditions

23.5.1 A distinction can be made between the community profile which considers the general demographics and economic factors in the area and the health profile, which considers the health and wellbeing of those within the study area.

23.5.2 Based on the findings from the A40 LVP Improvement scheme the following information is already known about the study area:

Community profile

23.5.3 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.

23.5.4 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

23.5.5 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.

23.5.6 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.

23.5.7 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.

23.5.8 Individual health profiles of people living in properties adjacent to the Scheme are not known and it is not anticipated that this information would be sought for reasons of privacy.

23.6 Proposed Scope of Baseline Studies

23.6.1 Baseline data will be 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.

23.6.2 The baseline studies that were prepared for the A40LVP will be valuable for this assessment and will be reviewed, updated and modified to suit the Scheme assessment.

23.6.3 This gathering of baseline data will be coordinated with other workstreams within the EIA such as community and private assets assessment and the air and noise assessments.

23.7 Methodology for Assessment of Effects

Health determinants

23.7.1 Health determinants are factors that can influence the health of a community and an individual and can be wide ranging. Table 23.1 lists out the health determinants which at this stage have been identified as being relevant to the Scheme. In general, these health determinants will be relevant to all project stages, i.e. construction and operation. These may be amended following a baseline review.

Table 23.1 Health determinants identified as relevant to the A40 Redstone Cross to Penblewin Improvements

Health determinant relevant to Scheme
Access to social infrastructure (e.g. healthcare, education)
Access to open space and nature/physical activity
Air quality
Noise
Accessibility (including public transport) and active travel
Personal safety and perceptions of safety
Access to work and training
Community severance and social inclusion
Injuries and death (transport related)
Climate change

Vulnerable groups

23.7.2 The health assessment will consider health and well-being status and current health problems of all people within the study area. However, vulnerable and/or disadvantaged groups can often experience health impacts more acutely than other groups within communities. The identification of vulnerable groups will also include consideration of people with protected characteristics, as defined by the Equality Act 2010. This will allow consideration equality issues that would need to be addressed.

Linking health determinants to health impacts

23.7.3 Using available literature, including previous health studies and recent research, an evidence base will be collated to identify links between the selected determinants and health impacts.

23.7.4 Impacts may be direct or indirect and links may be causal or compounding. Key reference material is likely to include:

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:
d) Public Health Wales;
e) WHO;
f) National Institute for Health and Care Excellence (NICE);

g) Health Development Agency (HDA).

23.8 Assessment of Potential Effects

23.8.1 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, the level of exposure of the population to this change and the sensitivity of the people (receptors or population) who will experience the effect. Consideration is also given to any vulnerable groups within the population which may be particularly affected by changes to health determinants.

23.8.2 Assessment is made as to whether the effect on health determinants is:

a) Direct or indirect;

b) Positive or negative; and

c) Permanent or temporary.

23.8.3 This approach permits the assessment to provide a relative scale of effects in order to give a sense of the significance of the potential health effects.

23.8.4 The significance matrix set out in Table 23.2 considers the impact magnitude on health determinants against the geographical extent of exposure in the population at different geographical levels (National, Regional and Local) in order to identify the overall significance of an impact. It is not considered that there would be any effects that would be experienced on an international level from this project, so this geographical scope has not been included in this instance.

23.8.5 Where available, details of impact magnitude have been identified from other environmental assessments of the ES. It should also be noted that within the Local population exposure there may be a range of exposure from lots of the local population affected, to only a few within the local population affected. This is the reason for a range of significance levels for each impact magnitude within the local population exposure column. Within the assessment, clarification for which local geographical exposure is identified will be explained.

Table 23.2 Impact Significance Matrix

	Geographical extent of exposure		
Impact magnitude on health determinant	**National**	**Regional**	**Local**
Very high	Major	Major	Major
High	Major	Major	Moderate- Minor
Medium	Moderate	Moderate	Minor-Negligible
Low	Moderate	Minor	Neutral
Very low	Minor	Minor	Neutral

23.8.6 The level of significance determined above can be described in more detail based on significance criteria as set out in Table 23.3.

Table 23.3 Impact Significance Matrix Details

Significance level	Criteria
Major +++/--- (positive or negative)	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 well-being would be a major positive. Health effects are categorised as a major negative if they could lead directly to deaths, acute or chronic diseases or mental ill health. 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. They can affect either or both physical and mental health and either directly or through the wider determinants of health and well-being. They can be temporary or permanent in nature. These effects can be important local, district, regional and national considerations. Mitigation measures and detailed design work can reduce the level of negative effect though residual effects are likely to remain.
Moderate ++/-- (positive or negative)	Health effects are categorised as a moderate positive if they enhance mental well-being significantly and/or reduce exacerbations to existing illness and reduce the occurrence of acute or chronic diseases. 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. 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. The cumulative effect of a set of moderate effects can lead to a major effect. These effects can be important local, district and regional considerations.

Significance level	Criteria
	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.
Minor/Mild +/- (positive or negative)	Health effects are categorised as minor/mild either, positive or negative, if they are generally lower level quality of life or well-being impacts. Increases or reductions in noise, odour, visual amenity, etc. are examples of such effects. 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. They can be permanent or temporary in nature. These effects can be important local considerations. Mitigation measures and detailed design work can reduce the negative and enhance the positive effects such that there are only some residual effects remaining.
Neutral/No Effect~	No health effect or effects within the bounds of normal/accepted variation.

23.9 Mitigation Measures

23.9.1 Where impacts are identified in the population and health assessment, recommendations will be proposed to reduce any negative impacts and maximise any positive impacts on health outcomes from the Scheme.

23.9.2 Recommendations will be fed into the design process through on-going discussions and meetings with the design team to ensure that issues related to health influence the final design.

23.9.3 Where mitigation has been identified through other EIA topic assessments (e.g. air and noise) that will serve to improve health outcomes, this mitigation will be cross-referenced within the health assessment.

23.9.4 The responsible organisation(s) and the timing of actions required to implement any recommendations made will be identified.

24 CUMULATIVE EFFECTS

24.1 Introduction

24.1.1 Cumulative effects result from multiple actions on receptors or resources occurring in combination over time. The cumulative effects within each environmental factor, for example noise, will be addressed within the relevant topic chapters.

24.1.2 Cumulative assessments should also cover the effects arising from different schemes and developments and the impacts of more than one environmental factor on a receptor. This might include noise and visual impact in combination. This chapter addresses these two types of cumulative impact and will set out the broad methods for assessing these two types cumulative impact separately.

Type (i) **Cumulative Effects from a Single Scheme (Inter-relationships):** is the assessment of effects on receptors or receptor groups, such as local residents, users of local rights of way or services, which may be affected by different environmental effects generated by the Scheme simultaneously or concurrently. This is sometimes referred to as the 'inter-relationships' between different environmental effects. This assessment includes consideration of particular locations where several effects, for example noise, air quality and visual change, may all occur.

Type (ii) **Cumulative Effects from Different Schemes** is the assessment of effects of the Scheme together with other proposed (but not yet built) developments, where there is the potential for impacts to overlap spatially or temporally. For example, there are likely to be cumulative impacts resulting from in-combination effects from this A40 Redstone Cross to Penblewin scheme with the immediately adjacent A40 Llanddewi Velfrey to Penblewin Scheme.

24.2 Relevant Guidance

24.2.1 The EIA Directive requires the EIA to consider cumulative effects and interrelationships. Cumulative effects result from multiple actions on receptors and resources and over time and are generally additive or

interactive (synergistic) in nature. Cumulative impacts can also be considered as: *'...impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.*' (European Commission 1999).

Planning Policy Context

24.2.2 The adopted Pembrokeshire County Council Local Development Plan 2013 (PLDP) refers to the importance of cumulative effects. Other references to cumulative effects relate to a requirement for development near existing residential areas to not adversely affect 'local residential amenity, either in its own right or cumulatively with other uses'.

24.2.3 The adopted PLDP highlights the importance of ensuring that the cumulative effects of development in Monmouthshire and adjoining areas do not result in harm to internationally designated nature conservation sites. The Local Development Plan also states that development in neighbourhood centres, new retail and renewable energy schemes will be permitted provided that the development, either individually or cumulatively with other recently proposed development, does not undermine vitality, attractiveness or viability.

24.2.4 There are no specific local policies relating to cumulative effects in relation to new highway development.

24.3 Relevant Guidance for the Assessment

24.3.1 A range of guidance is available on cumulative effects assessment but at present there is no single, agreed industry standard method.

24.3.2 Relevant guidance taken into account in this assessment is as follows.

HA205/08 Principles of Environmental Assessment – Assessment and Management of Environmental Effects (Highways Agency et al., 2008).

Advice Note 17: Cumulative effects assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2015).

DMRB Guidance

24.3.3 The Design Manual for Roads and Bridges (DMRB) guidance sets out

in HA 205/08 (Highways Agency et al., 2008) states that there are two types of cumulative effects to be considered in environmental assessment. As set out in Section 21 above, these are (i) cumulative effects from a single scheme (referred to as 'inter-relationships').

Planning Inspectorate guidance

24.3.4 In light of the concise guidance provided in DMRB and the relevance of this more recent advice note to a major infrastructure scheme, this is considered to be the most applicable and up to date guidance and will be followed for this assessment. The Planning Inspectorate provide guidance on the approach to Type (ii) cumulative assessment.

24.4 Study Area

24.4.1 The study area for the cumulative and in combination effects assessment has been based on the zones of influence of the environmental effects of the Scheme. These will be presented in tables. The information within this chapter would be based on the baseline data and assessments provided in the topic chapters 8 to 17.

24.5 Consultation

24.5.1 Consultation regarding cumulative effects would include agreeing a list of other proposed developments for inclusion in the cumulative effects assessment. DMRB guidance states that in each case, other schemes to be considered in the assessment of cumulative effects should be determined in consultation with the local planning authority and other statutory bodies. A summary of the consultation with stakeholders undertaken for the cumulative effects assessment would be provided.

24.6 Assessment Criteria and Assignment of Significance

24.6.1 The assessment does not aim to assign significance levels; instead it is used to identify where there is the potential for cumulative effects. A statement is made as to whether the cumulative effect would be worse or better than the effects predicted for the Scheme alone, whether the cumulative effects have the potential to be more significant than the effects of the Scheme alone and, if so, whether this would be adverse or beneficial.

24.6.2 The key difficulties in any cumulative effects assessment relate to the level of detail available in relation to other proposed developments and the reliance that would need to be made on environmental assessments carried out by others.

24.6.3 For those applications at earlier stages of development or those for which EIA has not been undertaken, professional judgement and knowledge of the wider study area are employed to consider the receptors or resources that may be affected by the Scheme and the other development in question.

24.6.4 The above considerations, together with the lack of a definitive and agreed process for the assessment of cumulative effects, leads to difficulty in assigning a level of significance to cumulative effects. Nevertheless, the aim of the assessment is to present the findings of the EIA and to identify cumulative effects on particular receptors or groups of receptors. This is beneficial to understanding the environmental effects of the Scheme both alone and together with other proposed developments.

24.7 Baseline Conditions

24.7.1 For Type (i) cumulative effects, the baseline will be the identified through knowledge of the Scheme and by reference to the specialist assessments under each topic heading. For Type (ii) cumulative effects the baseline will be identified by consulting the Planning Authorities to obtain details of relevant developments within the study area. A screening process would be employed to identify those Major Developments that need to be taken into consideration.

24.8 Potential effects

24.8.1 This assessment considers receptors or receptor groups, such as residents, users of local rights of way or services that may be affected by different environmental effects generated from the Scheme simultaneously or concurrently. This may include, for example, locations where noise, air quality and visual change may all occur at the same time. To differentiate this assessment from the cumulative effects assessment with other proposed developments, these are referred to as ‘inter-relationships’ or ‘inter-related effects’. All these effects would be derived from the Scheme.

24.8.2 People living locally to the Scheme may be affected adversely or beneficially. The new section of trunk road would enable traffic related effects to move from a more densely populated residential area to a less populated one. Those people living near the existing A40 trunk road would see beneficial changes in relation to noise levels and air quality but a more limited visual change. The cumulative beneficial effects have the potential to be more significant than the individual effects of the Scheme.

24.8.3 Despite the lower density of dwellings near the new section of trunk road, there are new receptors that would experience an increase in noise as a result of the new section of motorway. Although air quality changes would not breach environmental standards, there would be a change in air quality near the new section of trunk road. Changes in views from some dwellings nearby would also result from the introduction of the new section of road and would also be a new effect for these receptors. The cumulative adverse effects have the potential to be more significant than the individual effects of the Scheme and would be new significant effects for those living near the new trunk road.

24.8.4 There are several types of cumulative effects likely to occur during the lifetime of the Scheme. These include cumulative effects due to loss of land agricultural land and various farm holdings; and the loss of terrestrial habitat for protected species. Most potential cumulative impacts could arise as a result of proposed housing or solar farm developments in the vicinity of the Scheme.

24.8.5 In terms of landscape effects, other proposed development would add further urbanisation to certain landscape character areas (LCAs) and, in other areas, would be in keeping with landscape character (for example, further built development in an already urbanised area) and would not result in a significant cumulative effect on landscape. Similarly, for views, the introduction of more development and vertical elements (such as wind turbines) in some areas would not present a noticeable cumulative visual effect, while in other locations, where development represents a more noticeable change from the baseline, there may be an increase in adverse visual effects on residential receptors, users of Public Rights of Way and road users.

24.8.6 Cumulative effects between the Scheme and other planned or proposed developments may occur in respect of the setting of several cultural heritage assets.

25 CONCLUSION

25.1.1 The topics listed in Table 25.1 include all those addressed in this report. Those topics scoped-in for consideration in the EIA for the Scheme are indicated with an asterisk (*).

Table 25.1 Topic Chapters

Topic Chapter	Scoped in?	To be covered in:
Geology and Soils	Y	Chapter 10 of the ES
Road Drainage and Water Environment	Y	Chapter 11 of the ES
Nature Conservation (Biodiversity)	Y	Chapter 12 of the ES
Landscape and Visual	Y	Chapter 13 of the ES
Archaeology and Cultural Heritage	Y	Chapter 14 of the ES
Community and Private Assets	Y	Chapter 15 of the ES: Non-Agricultural Chapter 15 of the ES: Agricultural
Air Quality	Y	Chapter 16 of the ES
Noise and Vibration	Y	Chapter 17 of the ES
All Travellers	Y	Chapter 19 of the ES
Materials	Y	Chapter 18 of the ES
Heat and Radiation	N	Not included in the ES
Population and Human Health	Y	Chapter 23 of the ES
Risk of Major Accident and Disaster	N	Scoped out and so not included in the ES
Climate Change	Y	Chapter 21 of the ES
Cumulative Effects	Y	Chapter 24 of the ES
Management of Environmental Effects	Y	Chapter 24 of the ES

25.2 Monitoring of mitigation

25.2.1 Based on the findings of the scoping exercise and the proposed content of the ES set out in Table 25.1, it is considered that monitoring is likely to be required for all significant pre-mitigation impacts of the scheme. All of these impacts and proposed mitigation were set out in the draft ES chapters. The objective of monitoring is to demonstrate the effectiveness of the proposed measures and to identify if any further mitigation is required to meet the mitigation objectives.

Geology and soils

25.2.2 The assessment indicates that there are potential water-related effects in construction that would require monitoring. During construction excavated materials and wastes would arise from excavation. Monitoring of materials is set out below under paragraph 25.2.14.

Road drainage and water environment

25.2.3 No significant effects are expected, but during construction there is potential for effects on groundwater (refer to paragraph 25.2.2).

Ecology

25.2.4 European Protected Species (EPS) licences are likely to be required for the project during construction. Licences would include a requirement for monitoring, in particular:

a) Use of mammal crossings (underpasses and tunnels) bats, otter, dormouse, badger
b) Replacement badger sett use
c) Use of bat boxes
d) Habitat/vegetation establishment: (refer to Paragraph 25.2.5).

Landscape and visual impact

25.2.5 The need for monitoring of landscape mitigation is based on two main requirements:

a) The achievement of the target percentage cover of grassed areas and planting within 15 years of aftercare in accordance with as set out in DMRD Volume 10, with proportionate interim targets during the 5 years of contract aftercare;
b) Achievement of the objectives of mitigation for significant effects by the Design Year, with proportionate interim targets during the 5 years of contract aftercare;

Cultural Heritage

25.2.6 None required for archaeology within the land take of the Scheme. Monitoring required for the mitigation of impacts on the settings of designated and HER sites. This mitigation will be provided under the landscape and visual impact, see paragraph 25.2.5.

Community and private assets

25.2.7 Monitoring required for the achievement of mitigation for the significant impact on Bethel Chapel, see landscape and visual impact assessment in paragraph 25.2.5.

Air Quality

25.2.8 During construction, there is potential for the mobilisation of dust due to the nature of the works to construct the Scheme. The potential effect of this dust mobilisation is soiling upon receptors within the vicinity of the works. The assessment of construction dust will determine the scale of these potential effects and will aid in identifying appropriate mitigation measures. The mitigation measures are designed so that any residual effect is not significant.

25.2.9 During operation, it is anticipated that the traffic that currently passes along the existing A40 will use the Scheme. By moving this traffic further away from receptors improvements in air quality can be expected. Where the Scheme brings traffic closer to receptors a deterioration in air quality can be expected. In both circumstances, it is anticipated that air quality would remain below the air quality standards.

Agricultural Assessment

25.2.10 Post-construction monitoring required to ensure that measures to maintain access to farms and fields meet the mitigation objectives.

Noise and Vibration

25.2.11 The prediction and assessment methodologies set out in Section 17.7 would be used to support the verification of the effectiveness of mitigation measures.

25.2.12 Welsh Government has a duty to assess noise levels following the opening of the Scheme to traffic. The purpose of this is to establish the buildings which previously did not qualify for an original offer of carrying out or making a grant in respect of carrying out noise insulation work, but which would have become eligible by virtue of increased traffic flow.

All Travellers

25.2.13 No monitoring required because no significant pre-mitigation effects are likely. Monitoring of landscape measures that provide a setting for footpaths would be carried out, see paragraph 25.2.5.

Materials

25.2.14 Procedures would be adopted by the Contractor prior to construction to control and reduce the use of materials. This would be monitored and documented in the Site Waste Management Plan (SWMP) for the Scheme which would form part of the CEMP. The SWMP would detail the estimated quantities of waste material and the opportunities for reuse, recycling, recovery or disposal.

25.2.15 Materials would be responsibly sourced (i.e. must have a certified provenance, traceability and sustainability) where possible, in order to reduce the impact on material resources.

Population and Human Health

25.2.16 No significant adverse effects are likely and so no monitoring is proposed.

Climate Change

25.2.17 No monitoring is proposed.

Appendix 1: Long list of route options plan

A1

CRUGIAU
TUMULI (BARROWS)

FFERM MAENCOCH
REDSTONE FARM

SODSTON LODGE

BWTHYNNOD MAENCOCH
REDSTONE COTTAGES

CEFNIFFORDD YR A40
A40 TRUNK ROAD

CYLCHFAN PENBLEWIN
PENBLEWIN ROUNDABOUT

A478
CRYMMACH

B4313

B4314 NARBERTH

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LEGEND

SOUTHERN ALIGNMENTS

- OPTION 1a
- OPTION 1b
- OPTION 1c
- OPTION 1d
- OPTION 1e
- OPTION 1f
- OPTION 1g

NORTHERN ALIGNMENTS

- OPTION 2a
- OPTION 2b
- OPTION 2c
- OPTION 2d

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev	Date	Description	By	Chkd	Appd	Auth
P01	09/07/19	FIRST ISSUE	DS	AC	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS · MOTT MACDONALD · ARUP · RICHARDS MOORHOUSE LLP

Drawing Title
CENTERLINES OF DESIGN OPTIONS

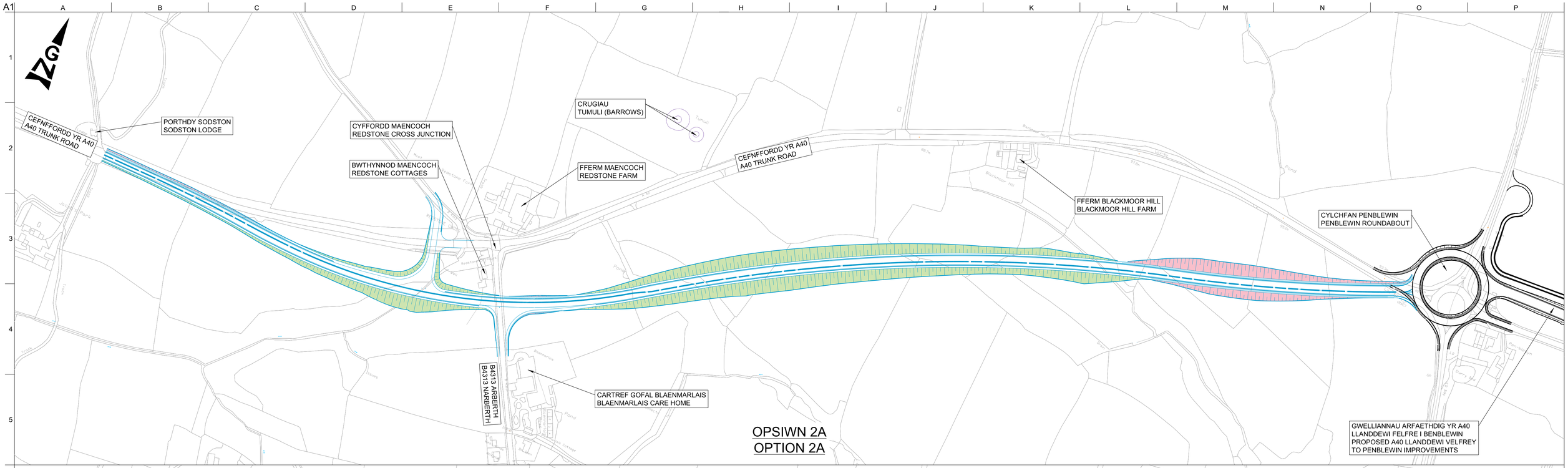
Suitability
S2 | SUITABLE FOR INFORMATION

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	DS	AC	TE	GD
	Date 09/07/19	Date 09/07/19	Date 09/07/19	Date 09/07/19

Name
A40PRC - ARP - HML - M02 - DR - D - 0013
Project | Originator | Volume | Location | Type | Role | Number

Appendix 2: Shortlist of route options plans



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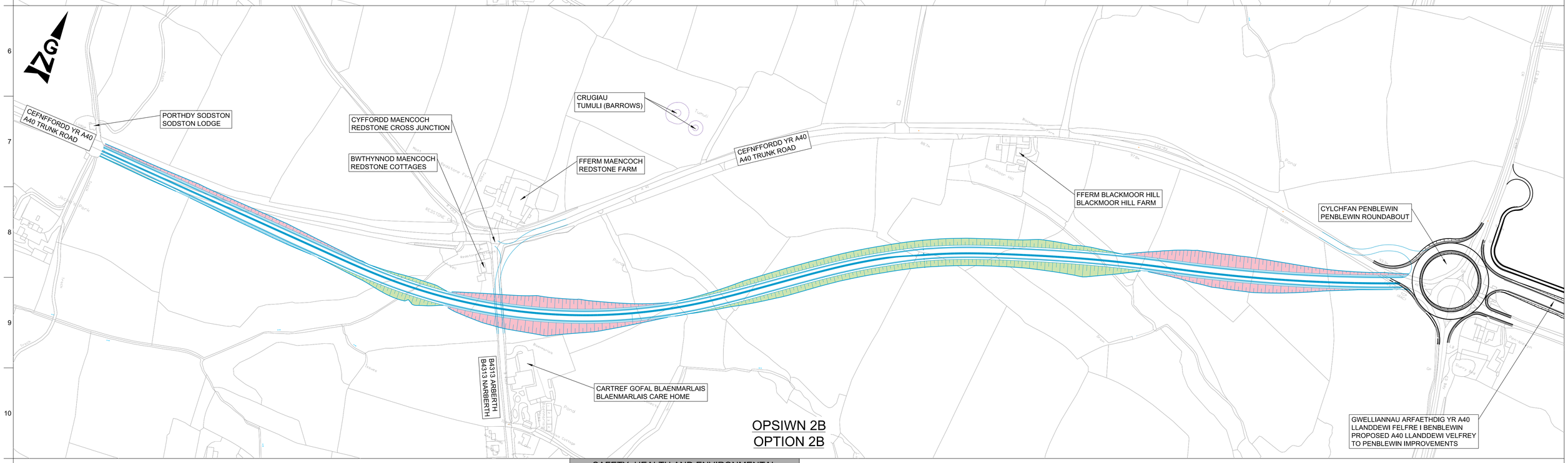

OPSIWN 2B
OPTION 2B

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Construction
(Enter "None" if applicable)

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(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

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Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS · MOTT MACDONALD · ARUP · RICHARDS PLANNING | LANDSCAPE | ENVIRONMENT

Drawing Title
FIGURE 3.3
SOUTHERN ROUTE OPTIONS
2A & 2B

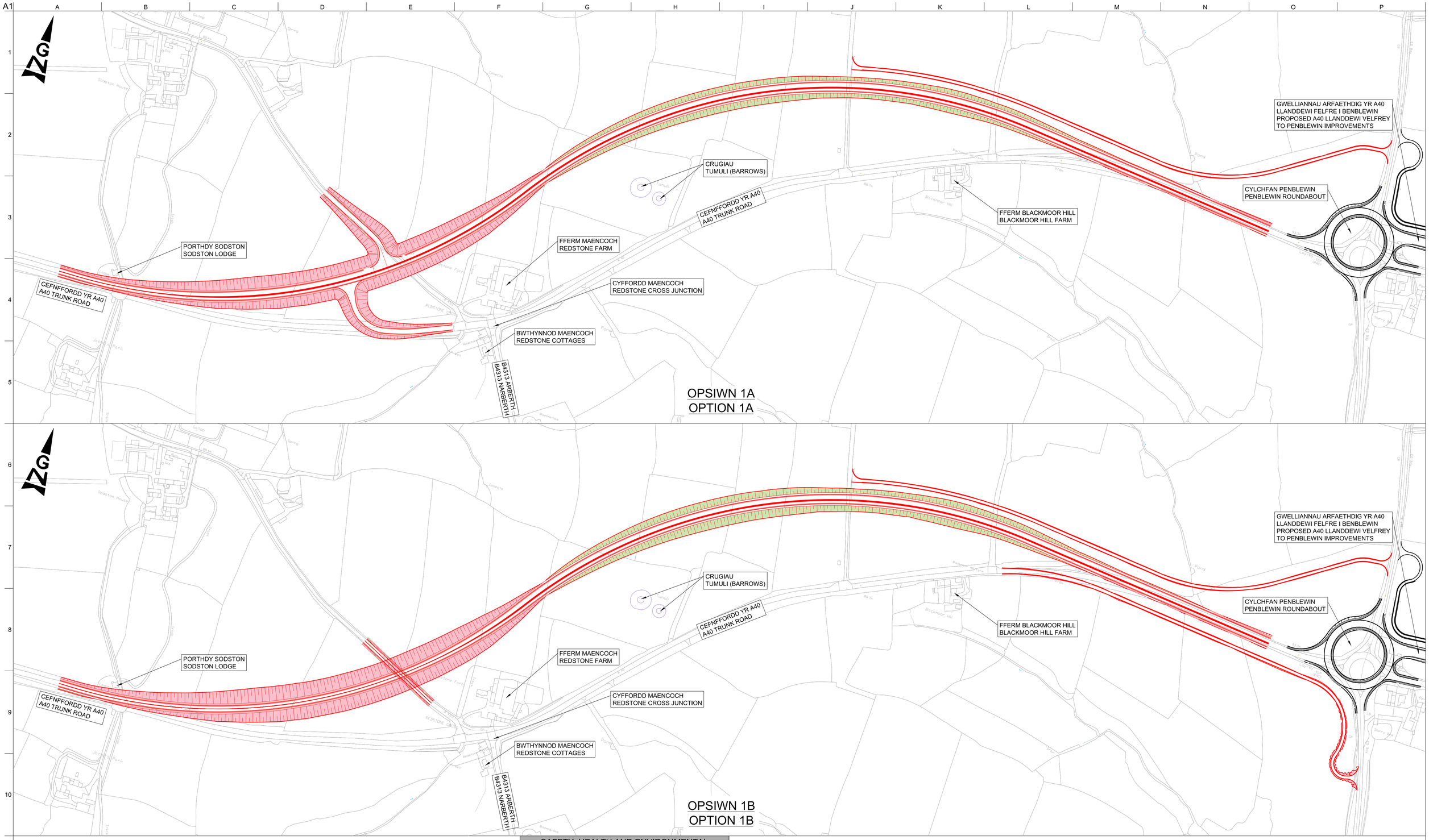
Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P01	AJ	GJ	TE	PB
	Date 24/05/19	Date 24/05/19	Date 24/05/19	Date 10/02/20

Name
A40PRC - ARP - HML - M02 - DR - D - 0011

Project	Originator	Volume	Location	Type	Role	Number



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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev	Date	Description	By	Chkd	Appd	Auth
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P01	10/02/20	---	AJ	GJ	TE	PB

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

Drawing Title
FIGURE 3.2
NORTHERN ROUTE OPTIONS
1A & 1B

Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A1 1:2500

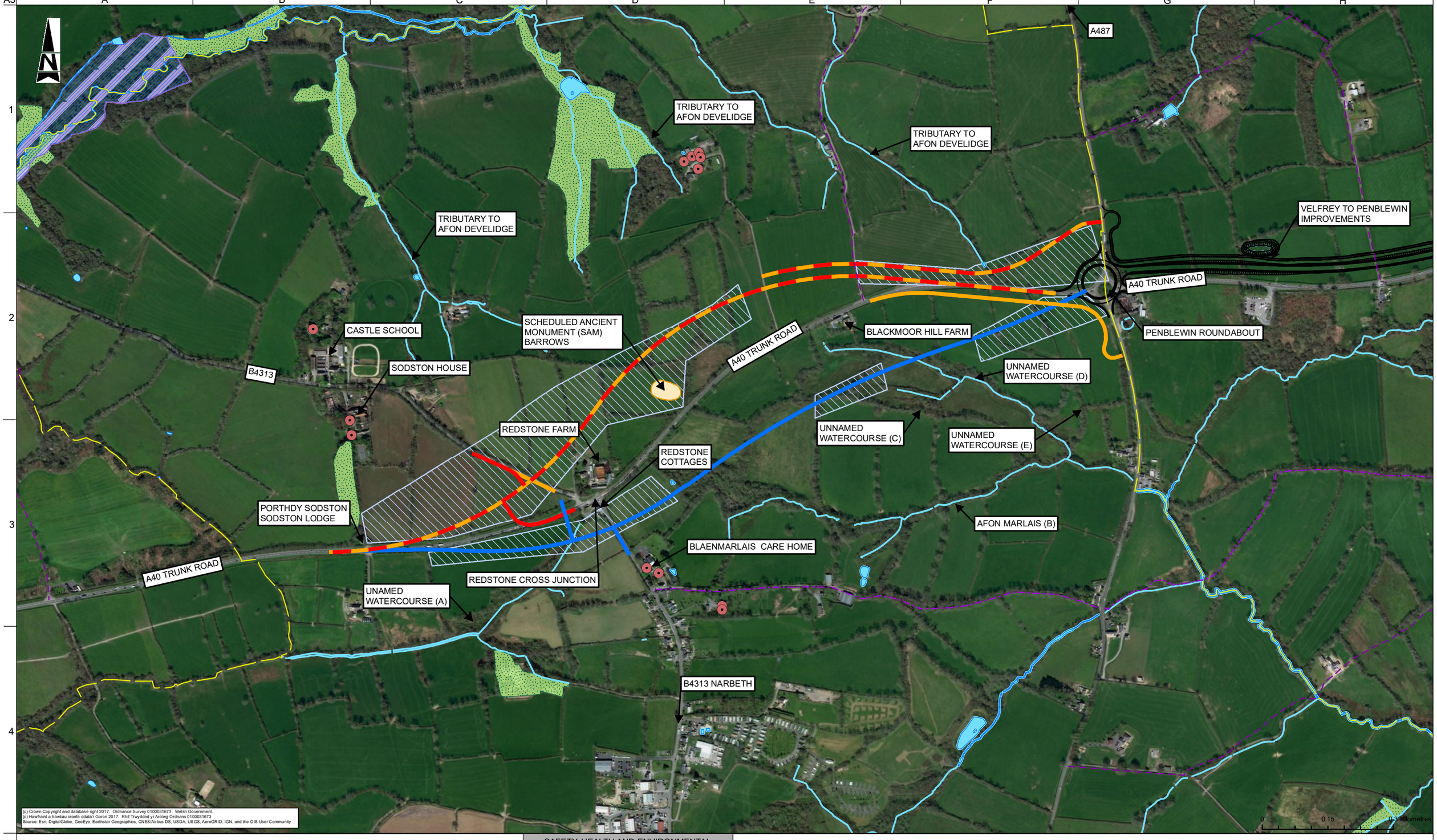
Rev	By	Chkd	Appd	Auth
P01	AJ	GJ	TE	PB
	Date 24/05/19	Date 24/05/19	Date 24/05/19	Date 10/02/20

Name
A40PRC - ARP - HML - M02 - DR - D - 0012
Project | Originator | Volume | Location | Type | Role | Number

Appendix 3: Environmental Constraints plan

A3 | A | B | C | D | E | F | G | H

1 | 2 | 3 | 4



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LEGEND

- OPTION 1A - NORHTERN ROUTE WITH STAGGERED T-JUNCTION AT REDSTONE CROSS
- OPTION 1A - NORHTERN ROUTE WITH NO JUNCTION AT REDSTONE CROSS
- OPTION 2 - SOUTHERN ROUTE WITH STAGGERED T-JUNCTION AT REDSTONE CROSS
- LISTED BUILDING
- COMMUNITY BOUNDARIES
- AREA OF LIKELY ARCHAEOLOGICAL INTEREST
- SCHEDULED ANCIENT MONUMENT
- SITES OF SPECIAL SCIENTIFIC INTEREST (SSSI)
- SPECIAL AREAS OF CONSERVATION (SAC)
- ANCIENT WOODLAND
- WATERBODIES
- RIVER

PUBLIC RIGHT OF WAY

- BRIDLEWAY
- FOOTPATH

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	05/07/19	FIRST ISSUE	KD	AC	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

Drawing Title
CONSTRAINT PLAN

Suitability
S2 | FIT FOR INFORMATION

Scale at A3
1:8,000

Rev	By	Chkd	Appd	Auth
P01	KD	AC	TE	GD
	Date 05/07/19	Date 05/07/19	Date 05/07/19	Date 05/07/19

Name
A40PRC - ARP - EGN - M02 - DR - LE - 0001

Project	Originator	Volume	Location	Type	Role	Number

Appendix 4: Heritage Assets

Table 14.1 Gazetteer of Heritage Sites

Easting	Northing	Name	Status	Ref
207038	218281	Camp 200m NE of Stoneyford Promontory Fort	SAM	PE105
207122	218453	Camp 370m NE of Stoneyford Enclosure	SAM	PE104
207258	217422	Llawhaden Village Pound	LBII	18796
207292	217452	Llawhaden Castle	SAM	PE024
207303	217465	Llawhaden Castle	LBII*	6065
207348	218189	Camp 400m NW of Holgan Promontory Fort	SAM	PE102
207463	217254	Llawhaden Bridge	SAM	PE023
207473	217251	Llawhaden Bridge and River Bank Wall	LBII*	6064
207520	217468	Church of St. Aidan	LBII	6062
207633	215536	Bush Inn Camp Promontory Fort	SAM	PE182
207933	219716	Gelly Earthwork Rath	SAM	PE184
208085	213257	Mounton Chapel	LBII	6082
208363	219511	Gelli Bridge	LBII	18799
208369	219516	Gelli Bridge (partly in Llawhaden community)	LBII	83174
208438	215925	Rock Well	LBII	18801
208450	215746	Robeston Wathen Church	LBII	6092
208510	215776	Robeston House	LBII	18800
208547	219674	Longridge Bridge (Partly in New Moat Community)	LBII	82469
208572	219733	Cleddau Railway Bridge (partly in New Moat Community)	LBII	82464
208739	212966	Molleston Camp Enclosure	SAM	PE274
208859	217683	Pen Llwyn House	LBII	6071
208863	214093	Iron Age Hillslope Enclosure in Canaston Wood	SAM	PE413
209081	217912	Bethesda Congregational Chapel	LBII	18797
209310	220316	Dovecote at Llandre-Egremont	LBII	82465
209325	220323	Llandre-Egremont Farmhouse	LBII	9398
209353	212945	The Grove	LBII	18978
209383	216824	Pont Shan	LBII	6537
209383	216827	Pont Shan	LBII	18798
209425	217114	Vaynor Gaer Ringwork	SAM	PE115
209458	220291	Llandre Entrenchment Enclosure	SAM	CM089
209702	212387	Great Molleston Farmhouse	LBII	18977
209805	217513	Vaynor	LBII*	6072
209994	215130	Milestone	LBII	6533
210209	216556	Sodstone Manor	LBII	6540

Easting	Northing	Name	Status	Ref
210293	216347	Coach House & Stables Sodstone House	LBII	6539
210297	216314	Sodstone House	LBII	6538
210836	214467	Plas Farmhouse	LBII	6476
210839	214428	Parish Church of St Andrew	LBII	6475
210861	214668	Bethesda Baptist Chapel	LBII	6485
210883	214816	Hill House (Chestnut Tree Lodge)	LBII	6500
210891	215047	No.21 Northfield Road	LBII	6505
210894	214813	The Emporium	LBII	6501
210895	214678	Gates to Bethesda Chapel	LBII	6486
210900	214643	National Westminster Bank	LBII	6484
210900	214784	No.3 High Street	LBII	6479
210901	214790	No.2 High Street	LBII	6478
210901	215062	Bloomfield Terrace	LBII	6503
210903	214635	Howell Williams Solicitor, County of Pembroke Sherriff's Office	LBII	6483
210904	214797	The Coach & Horses Inn	LBII	6477
210906	214627	Pencraig	LBII	6482
210907	215069	Bloomfield Terrace	LBII	6504
210912	214797	Animal Kitchen	LBII	6516
210926	214622	Town Hall	LBII	6481
210932	214643	The Golden Sheaf	LBII	6480
210945	214427	Milestone by entrance to New Cemetery	LBII	6474
210949	214590	Anthony Maxwell – Photographer	LBII	6494
210953	214585	Anthony Maxwell – Photographer	LBII	6493
210959	214573	No.14 Market Square	LBII	6492
210966	214616	Hugh H Morgan	LBII	6487
210972	214596	War Memorial	LBII	6495
210972	216010	Blaen Marlais	LBII	6508
210974	214546	The Former Courthouse	LBII	6558
210975	214582	Telephone Call-box by War Memorial	LBII	6496
210975	214586	Lamp Standard by War Memorial	LBII	6497
210978	214392	Narbeth Castle	LBII	6473
210981	214522	No.12 Market Square	LBII	6498
210982	214617	Megna Indian Takeaway	LBII	6488
210985	214394	Narberth Castle	SAM	PE040
210988	214620	The Old Pharmacy	LBII	87564
210997	214585	Whispers	LBII	6490

Easting	Northing	Name	Status	Ref
210997	214606	Pillar Box	LBII	6489
211000	215998	Barn in Grounds of Blaen Marlais	LBII	6509
211001	215080	Bloomfield	LBII	6502
211002	214645	Barclay's Bank	LBII	6510
211005	214511	The Rutzen Arms P.H.	LBII	6499
211006	214584	Olieme House	LBII	6491
211015	216416	Redstone Cross Round Barrows	SAM	PE154
211032	214651	Old Bank House	LBII	6511
211036	214634	G.Badham & Sons	LBII	6515
211040	214658	Staunton House	LBII	6512
211052	214632	Llwynon	LBII	6513
211057	216939	Cowhouse at Cilrath Fach	LBII	6529
211059	214634	Annexe adjoining No.61 (Llwynon)	LBII	6514
211076	216950	Lofted Cowhouse at Cilrath Fach	LBII	6530
211080	214630	Tabernacle United Reformed Church	LBII	6522
211083	214611	Schoolroom to Tabernacle United Reformed Church	LBII	6523
211090	216922	Cilrath Fach	LBII	6528
211091	216959	Stable at Cilrath Fach	LBII	6531
211095	216945	Barn at Cilrath Fach	LBII	6532
211145	215914	Stable attached to Blaen Ffynnonau	LBII	6507
211145	215923	Blaen Ffynnonau	LBII	6506
211202	213321	Allensbank	LBII	18974
211211	217923	Grondre House	LBII	82467
211334	213034	Narberth Mountain Enclosure	SAM	PE394
211454	213274	Milestone on Lane leading off A478 to Cold Blow	LBII	6527
211639	214670	Byre at Greenway Farm	LBII	6520
211640	214662	Outhouse at Greenway Farm	LBII	6521
211653	214649	Stable adjoining Greenway Farm	LBII	6519
211653	214653	Cartshed adjoining Greenway Farm	LBII	6518
211656	214662	Greenway Farm	LBII	6517
211933	214206	Coach House at Blackaldern	LBII	6525
211953	214528	Milestone	LBII	6536
211961	214204	Blackaldern	LBII	6524
212107	214395	Parish Boundary Stone	LBII	6526
212130	217010	Cae'r Maenau Fawr House		NMR 21700

Easting	Northing	Name	Status	Ref
212135	221577	Llandissilio War Memorial	LBII	82947
212184	220784	Cottage by Nant-y-Ffin Hotel	LBII	82946
212277	220593	Crugiau Round Barrows	SAM	CM309
212322	218940	Earthworks SE of Clyn-Derwen Enclosure	SAM	CM065
212755	214375	Parish Church of St Teilo	LBII	6535
212830	216320	Settlement, Henllan		NMR 309064
212833	214178	Clyn Pattel Motte & Bailey Motte	SAM	PE412
212854	214359	Parc Glas	LBII	6534
212908	214039	Crinow and Lampeter Velfrey Parish Boundary Stone	LBII	18998
213270	216820	Henllan Lodge		NMR 302516
213280	216290	Henllan House		NMR 22048
213306	216339	Henllan, Garden		NMR 265865
213405	215294	Llangwathan Castle Mound Motte	SAM	PE434
213648	216898	Ffynnon Baptist Chapel	LBII	6056
213650	216320	Henllan Enclosure		NMR 402252
213985	216102	Caerau Gaer Rath	SAM	PE176
214019	220519	Eithin-man	LBII	82466
214155	212548	Milepost at Gelli-deg	LBII	18991
214392	215870	St David's Parish Church	LBII	18982
214392	215870	St. David's Parish Church	LBII	18982
214449	216075	Llanddewi Gaer Promontory Fort	SAM	PE086
214661	218513	Barn at Glanrhyd	LBII	9731
214686	218439	Offices & Outbuildings to W of Glanrhyd House (also known as The Court House)	LBII	9730
214688	218533	Glanrhyd Farm	LBII	15630
214717	218447	Water house at rear of Glanrhyd House	LBII	82473
214721	218439	Glanrhyd House	LBII	9729
214766	216897	War Memorial	LBII	18983
215164	212357	Blaengwaith-Noah Camp Promontory Fort	SAM	PE085
215178	219469	Llanfallteg Bridge	LBII	82348
215471	214402	Telephone Call-box to SE of St Peter's Church	LBII	87566
215496	214612	Castell Ringwork	SAM	PE177
215501	214412	War Memorial	LBII	18989

Easting	Northing	Name	Status	Ref
215523	214439	Church of St Peter	LBII	6055
215539	218280	Roman Road 300m East of Bryn Farm Road	SAM	PE472
215577	212127	Milepost at Glan Rhyd	LBII	18990
215709	216121	Panteg farmhouse	LBII*	6547
215930	216980	Bethel Welsh Independent Chapel		NMR 11066
216252	217009	Old Stable Block at Gwindy	LBII	6542
216287	217020	Gwindy Farmhouse with walls and railings to garden	LBII	6541
216290	217020	Gwyndy House		NMR 22025
216635	214687	Derry Cottage	LBII	18999
216843	220428	Lan	LBII	82347
217018	216417	Waundwrgi Farmhouse	LBII	18985
217104	212372	Milepost near Lower Llantydwell	LBII	18988
217179	216929	Fron	LBII	18984
217199	217201	Pengawse Ring Cairn	SAM	PE390
217394	217762	Trewern Mansion	LBII	6546
217461	214105	Carvan Congregational Chapel	LBII	18997
217658	216889	Pengawse Medieval House Site Manor	SAM	PE389
217708	218747	St Canna's Chair Inscribed stone	SAM	PE148
217709	212314	Crug Swllt Round Barrow	SAM	PE364
217733	218714	Llangan Church Cropmark Enclosure	SAM	CM264
217769	219863	Inscribed Stone N of Parciau Farmhouse	SAM	CM069
217848	216352	Llan-Marlais Round Barrow	SAM	PE327
218185	212645	Cyffic and Lampeter Velfrey Parish Boundary Stone	LBII	18986
218186	212648	Milepost in Tavernspite village	LBII	18987
218720	218200	Blaen-lliwe, Cropmark Enclosure South Of		NMR 309346
219849	215033	Llwynybrain Cottage	LBII	24953
220040	216170	Trevaughan Bridge	LBII	9416
220134	217283	Roman Road 250m NE of Pwll-y-Hwyaid Road	SAM	CM279

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ANNEX A: Record of Determination, Welsh Assembly Government, Transport, Housing and Regeneration.
For use with Annex II relevant projects only

Name of project: A40 Penblewin to Redstone Cross Improvements	**Location** (including national grid reference): A40 Trunk Road approx. 14.4km east of Haverfordwest and 26.5km west of Carmarthen. OS Grid Reference: 214870, 216820

Qualifying criteria for Annex II relevant project: (please tick which are relevant)

Improvement element of project is >1ha	√	Project is located within 'sensitive' area		Other with potential for significant effect (e.g. adjacent to sensitive site)	√

A. Description of project:

The proposed A40 Penblewin to Redstone Cross Improvements (the "Scheme"), comprise a 1.8km length of the A40 Trunk Road between the Penblewin Roundabout and to the west of the Redstone Cross Junction. The Scheme would be a single carriageway with two-lanes provided in the westbound direction, to allow for overtaking, and one lane provided in the eastbound direction.

The Scheme would commence approximately 550m west of Redstone Cross (Ch0+000), where the existing A40 passes the entrance to Sodston Lodge and Jacobs Park. The Scheme would leave the line of the existing A40 at Sodston Lodge and draw gradually to the south. At approximately Ch.400 the road would cross a small wooded watercourse on an embankment up to 4m high. It would then begin to descend on a gentle gradient, entering a cutting up to 7m deep through the Redstone ridge Ch.500. To the north side of the Scheme would be properties at Redstone Cross and to the south the Blaenmarlais Care Home. The B4313 Redstone Road would cross the A40 on a proposed bridge at Ch0+570 and then join the detrunked A40 on the east side of Redstone Cross. The detrunked existing A40 road would be a local road extending from Redstone Cross to Penblewin roundabout.

From Ch.570 to Ch.800 the Scheme, still descending would transition from cutting to embankment and continue the gentle left-hand curve to cross a small watercourse at around Ch.860. Here the Scheme would gradually transfer from cutting to embankment to cross lower-lying land occupied by woodland. The embankment would continue eastwards, crossing a further two minor watercourses, with the Scheme entering a shallow right-hand bend which would continue to Ch. 1,450. At Ch.400 the embankment would cease, and the Scheme would continue east up to 8m deep as it commences the climb towards Penblewin roundabout at Ch.1760, which is roughly ground level.

At Penblewin, the Scheme would re-join the A40 trunk road at the enlarged roundabout previously proposed for the Llanddewi Velfrey to Penblewin Improvements scheme (which forms part of separate draft orders). The enlarged (Penblewin) roundabout would extend further north and west than the existing and would serve the A40 trunk road, the A478 trunk road and link to the Penblewin Rest Area. In addition, a sixth arm would be required for a new short link to the detrunked A40 west to Redstone Cross.

The proposed overbridge would re-join the A40 trunk road at the enlarged roundabout and would cross the proposed A40 at Ch0+560 and join Penblewin Roundabout via the detrunked A40.

B. Description of local environment, including statutory and non-statutory designations:

The setting is a rural, lowland agricultural landscape with a dispersed population and scattered small villages. The Preseli Hills lie approximately 12km to the north, and Carmarthen Bay is 10km to the south of the Scheme. A tributary in the upper reaches of the Eastern Cleddau reaches to Redstone Cross, while the closest boundary of the Pembrokeshire Coast National Park lies 4.5km away to the south-west.

The landform is undulating with convex upper slopes and relatively steep-sided small valleys formed by flashy watercourses with narrow, damp flood plains. The land consists mainly of improved or semi-improved grassland used for grazing, silage, haylage with fields divided by hedges and hedge banks with small linear belts of woodland primarily alongside the watercourses or steeper slopes.

Designated sites

There are five Special Areas of Conservation (SACs) within 10km and a further two SACs designated for bats within 30km of the site; and

- Afonydd Cleddau / Cleddau Rivers SAC (1.1km W), Annex II species, brook lamprey, river lamprey, bullhead, and European otter.
- Pembrokeshire Marine / Sir Benfro Forol SAC (4.5km W) Annex II species: river lamprey; allis shad, twaite shad, and otter.
- Yerbeston Tops SAC (7.2km SW), Annex II: species marsh fritillary butterfly.
- Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC (7.4km W), Annex II species greater horseshoe bat, lesser horseshoe bat, otter
- One Special Protection Area within 10km

The habitats along the route support populations of European Protected Species (EPS), including bats, otter, dormouse and barn owl. There is a large population of badger and numerous setts.

- There are 12 Listed Buildings within 500m of the Scheme;
- Narbeth Castle is located 1.4km to the south;
- One Scheduled Monument within 500m north of the existing A40;
- 11 Scheduled Monuments within 5km;
- One Registered Historic Park and Garden within 5km; and
- One candidate Noise Action Plan Priority Area located 28km at Llanddewi Velfrey.

C. **Details of extent of environmental impact assessment work undertaken and summary of any consultation undertaken with the statutory consultation bodies**

Landscape and Visual

The Scheme would require substantial cuttings and embankments through the agricultural landscape, which would be visible mainly from the south, but due to the presence of tall hedges, woodland, and landform, the views would be restricted to only a limited area containing a few dwellings. The most significant visual impact would occur at Redstone Cross, where the changes due to the deep cutting and the shallow embankment to the west would be visible from houses in the vicinity, Penblewin Farm, and at the two dwellings at Blackmoor Hill Farm.

Nature Conservation

The Scheme would cut through woodland, hedges and agricultural land that currently provides habitat suited to various EPS, including bats, dormouse, otters and barn owls. The Scheme could sever commuting routes and isolate populations from foraging areas. Connectivity between key habitats for protected species should be maintained. The Scheme is likely to cross several watercourses close to their source which could disrupt groundwater. These watercourse flow west into the Rivers Cleddau SAC, or east into the tributaries of the Taf. During construction, the Scheme could have an adverse effect on the SACs (River Cleddau) which lies downstream, due to waterborne silt during earthworks. Potential impacts on populations of bats, in particular, the lesser and greater horseshoe species, which are associated with SACs to the north and south, could be adversely affected by severance of flight lines. The surrounding woodland, scrub, and hedgerow is good habitat for dormouse. Populations of this species could be separated if connectivity habitat is severed. Otter are known to use local watercourses and are widespread throughout Wales and known to have a wider local presence.

Community and Private Assets: Agriculture

The route could adversely affect some agricultural properties by taking or severing land or by disrupting access routes.

All Travellers

There are no Public Rights of Way (PRoW) directly affected by the Scheme, although detrunking works on the old A40 could enhance the local Active Travel network. When completed, the Scheme would reduce community severance by improving north-south connectivity as well as safety by providing a bridge for the B4314 across the A40.

Measures to improve connectivity and access for Walkers, Cyclists and Horse Riders (WCHR) users would be enhanced by creating an Active Travel route on the detrunked A40 and a safe crossing over the new A40.

Air Quality

Construction materials would need to be brought to site by Heavy Goods Vehicles (HGVs) and there would be disruption of local traffic. Earthworks would cause noise and could generate airborne dust with adverse effects on the local population. While most local residents should also benefit from improvements in air quality and reductions in traffic noise when the new road is operational, several properties lying close to the route with potential to suffer adverse effects of traffic noise. Construction would be carried out with measures to minimise the effects of construction dust.

Archaeology and Cultural Heritage

There is a Scheduled Monument less than 100m north of the existing A40 and the Scheme would take fast-moving traffic at least 150m further away. The Scheme would be moved closer to a group of Listed Buildings at Blaenmarlais, to the south of Redstone Cross. Blaenmorlais is also a Care Home and regarded as a sensitive receptor, with potential for traffic noise to increase for residents.

Noise and Vibration

The dominant noise source is road traffic from the existing A40. A noise and vibration assessment will be undertaken to determine the significance of temporary and permanent effects of noise and vibration during the construction and operation phases. Construction would be carried out with measures to minimise the effects of construction noise.

Geology and Soils

There are two known quarries within the Scheme area, therefore there is the potential for unknown historical quarrying and infilled land to be encountered which could be a source of contamination. An

assessment of geology and soils will be undertaken, taking into account geology, geological features, mineral resources and land contamination.

Road Drainage and the Water Environment

The water environment for the Scheme consists of surface watercourses including a number of unnamed tributaries and ponds, the underlying groundwater and associated groundwater dependant features. An assessment will consider the potential effects of the Scheme upon the water environment which considered effects upon water quality, water quantity and flood risk was undertaken. Attenuation basins and pollution control devices could be provided on road drainage to mitigate potential adverse effects on flood risk and accidental spillage. Construction would be carried out with measures to minimise the effects of construction silt.

Community and Private Assets (excluding agriculture)

The local community facilities, include doctor surgeries, hospitals, aged people homes, schools, shops, post offices, places of worship, parks, play areas and other public open space and sports centres. An assessment will consider the effects on private and commercial assets, including private property and associated land take, commercial property and development land.

Population and Human Health

The Scheme may influence public health and wellbeing in the areas surrounding the Scheme. As assessment of the population and human health will examine how the Scheme will impact the local population and different social groups where possible.

Climate Change

The Scheme will both impact climate change and be impacted by it. A greenhouse gas assessment will be undertaken to assess how the Scheme will increase greenhouse gas emissions. In tandem two more assessments, a climate change resilience assessment and in-combination climate change impact assessment, will be undertaken to assess if the Scheme's design needs to be altered to accommodate a changing climate.

Heat and Radiation

Heat and radiation can arise from construction activity and operation, for example, the running of internal combustion engines and the heating of surfaces by solar radiation. None of these sources of heat and radiation are of sufficient power, concentration or duration to have a significant effect. Heat and radiation tend to readily dissipate in the environment. With no change brought about by the Scheme and no new sources of either heat or radiation being introduced, it is anticipated that the generation of heat or radiation is unlikely to be relevant to this project. An assessment of the effects of heat and radiation on the environment has been scoped out.

Consultations

An Environmental Liaison Group (ELG) has been established with representatives from Natural Resources Wales, Cadw, Pembrokeshire County Council, Welsh Government and the South Wales Trunk Road Agency. The ELG has met regularly and has commented on the choice of route, aspects of design and potential mitigation, the environmental effects, the Appropriate Assessment and the Environmental Statement. Further meetings with these organisations have been arranged to discuss specific matters within their remit. Further correspondence will be carried out as necessary with these and other relevant organisations.

D. Determination decision, statement of case in support of this decision that EIA is required:
Previous work on the Scheme has included various desk studies and reports, with a number of ecological and other environmental surveys between 2004 and 2007. A list of these reports and dates of publication are set out in Section F. The Environmental Assessment Report (EAR) of 2006, produced by PB and TACP, assesses the likely impacts of the preliminary alignment design conducted to develop a Route Option sufficiently for the WelTAG Stage 2 assessment process ('Route Selection' stage) to be completed. The associated predicted impacts are assessed on a precautionary basis. They do not take account of mitigation which would typically be incorporated in the design when potential impacts are more clearly quantified. alkover surveys and public data resources have allowed consideration of environmental constraints within the proposed alignment corridor, as required for each environmental topic. Further targeted surveys will be carried out to review the presence/ absence of protected species to inform an Environmental Assessment.

E. Determination decision, statement of case in support of this decision that EIA is required:

Under the EIA Directive 2014/52/EU, amending the 2011 Directive, the proposed works are not an Annex I development. However, the works are an Annex II relevant development because the total area of the Scheme will exceed the 1ha threshold and therefore have undergone the determination process.

It has been identified that there are several sites that are subject to Article 6 (3) of the Habitats Directive. The information contained within the EIA Screening and Scoping Report identified that the Scheme could have significant effects in relation to Natura 2000 sites (in line with Annex III of the EC Directive). The EIA Screening and Scoping Report also provides information that further supports the conclusion that there would be the potential for significant further environment impacts in relation to a number of topics, including (but not exhaustively) ecology, agriculture, air quality, and community impacts. The Scheme is, therefore, an 'EIA Development'.

File references of supporting documentation for future reference:

- Stage 1 Corridor Appraisal Report (and revision) PB 2003 and 2004
- Route Options Report (2 volumes) PB 2004
- Safety of Children, Pedestrians and Cyclists report PB 2004
- Stage 1 and Stage 2 Environmental Assessment Report (EAR) PB /TACP 2006
- Design Options Report (Vol 1 & 2) PB June 2015
- WelTAG Stage 1 and 2 Report (Arup – 2019)

I have determined, following discussions with the Welsh Government's /~~Trunk Road Agent's~~ Environmental Advisor that a statutory Environmental Impact Assessment is/~~is not~~ required for this project.

Signature Project Director: Dated: 10 June 2020

Authorisation to publish Notice of Determination:

Signature Welsh Ministers' Nominee: Digitally signed by R S S Morgan Date: 2020.06.25 15:12:37 +01'00' Dated:

Minutes

Project	**A40 Llanddewi Velfrey to Penblewin Improvements**
Subject	Environmental Liaison Group Meeting 3
File Reference	A40LVP-ARP-EGN-SWI-MI-LE-0001
Prepared by	
Attendees	(ED) WG (LW) ECAT/WG (SH) ECAT/WG (LE) – NRW (PD) – SWTRA (CL) – SWTRA (CH) SWTRA (RS) – Pembrokeshire CC (LL) – Pembrokeshire CC (HC) Arcadis (PW) – Arup (TE) Arup (AS) – RML
Apologies	
Circulation	Those present
Date	27th September 2018

Ref	Item	Action
1	**Introductions and Project Update**	
1.1	Welcome from AS.	
1.2	Due to the 8 month delay that has occurred in the progress of the project those who were attending re-introduced themselves. There were two new names, , who has replaced (Employers Agent Environmental Advisor), who was present at the previous ELG meetings. is the new representative from Cadw, who was unable to attend today.	
1.3	TE gave a high-level introduction to the scheme and a brief overview of recent events following the liquidation of Carillion. It was confirmed that the Scheme layout will be the same going forward that was previously developed.	
1.4	The revised high-level project programme was set out by TE as shown on the slides attached to this meeting minute.	
1.5	AS confirmed that the latest Screening and Scoping Report had been circulated to the ELG members on 25/09/2018. Any comments that ELG members may have on this have been requested within 3 weeks. The Scoping and Screening had previously been circulated to the ELG, but	

Ref	Item	Action
	now the Screening and Scoping has been updated to reflect the latest Regulations and Directives that have since come into force.	
2	**Scheme Environmental Objectives**	
2.1	AS presented a power point presentation, which is attached to this meeting minute. The Environmental Objectives were reviewed to refresh the ELG of the Objectives that were agreed during the first ELG.	
2.2	LW reminded attendees that any measures that exceeded the required for mitigation were to be called 'contributions in line with the Well-Being of Future Generations Act'. This is a clearer and more accurate statement than to describe these as 'enhancements'. AS to consider this further in relation to the reporting of the AEIS	**AS**
2.3	PW requested that equestrians be added to the list of beneficiaries along with cyclists and pedestrians in Objective 6.	**AS**
3	**The proposed Scheme**	
3.1	AS presented the latest iteration of the Environmental Masterplan. A number of comments /questions arose:	
3.2	Will the proposed equestrian underpass in Ffynnon Wood be lit? *There is no intention to light this because of its locality and its provision for bats as well as equestrians and pedestrians. Bats are likely to us this route to cross the A40 and lighting is known to discourage bats. It is also noted that nature of the underpass (length and headroom) there will likely be sufficient ambient light entering the underpass.*	
3.3	The proposal to graze the north slopes of the big embankment on the Llanddewi Velfrey bypass section needs careful consideration and LW requested that a plan showing the area should be forwarded to LW, SH and CL for consideration. Because it is difficult to commit to this low-cost maintenance solution at this stage, grazing is not currently mentioned in the ES. It was agreed that grassland seeded onto subsoil would be more sustainable, require less frequent grass cutting and be of greater value to biodiversity that topsoiled grassland.	AS
3.4	LL asked if an artificial otter holt could be provided in a suitable location within the scheme, possibly in Ffynnon Wood. *PW was concerned that the holt would be hard to located in a suitably quiet location but would take the idea away for consideration.*	PW
3.5	SH asked if the design allowed vehicular access to all of the balancing ponds. *This was confirmed by TE.*	
3.6	LL noted that an area of woodland around Henllan lodge had recently been felled. She asked whether this had been considered in the preparation of the EMPs. AS to review	AS
3.7	RS raised the importance of the view from the large Embankment, east of Llanfallteg Road, towards the Preseli's. AS explained that there will be a low bund (approx. 600mm) that will form a small false cutting, which will give an element of screening towards the road but will allow for the view to still be enjoyed from the road.	
3.8	The risk of bird strikes was discussed in the vicinity of the large embankment. AS confirmed that the Landscape Architect and Ecologist were working together to mitigate this risk.	

Ref	Item	Action
4.9	Scheme lighting requirements were discussed. TE confirmed that the only lighting on the Scheme is at the two roundabout junctions at either end of the Scheme. The lighting provision is planned to be minimised in order to minimise impact (this requires a departure from standard). The provision will be similar to the lighting provision on the A40 Robertston Wathern to Slebech Park Scheme.	
4.10	The length and size of culverts and underpasses at the Eastern end of the Scheme (Llanddewi Velfrey bypass) were discussed. This length of the scheme crosses a series of small steep-sided wooded valleys with watercourses. Culverts here will carry watercourses, serve as dedicated mammal underpasses for bats, dormice and other species. A farm underpass at Pentroyddyn-fach will also carry a watercourse in a channel, a footpath and provide a crossing for bats. An underpass in the embankment to the east of Pentroyddyn-fawr will serve a public footpath and provide a bat and badger crossing.	
4.11	CL requested that SWTRA see the Land Referencing plans so that the proposed land take and easements can be seen. TE to organise a copy.	TE
5	**Report on surveys**	
5.1	Since the last ELG meeting in August 2017 the programme of environmental surveys has been completed	
5.2	The last of the bat surveys was completed showing no change from the established pattern of bat activity.	
5.3	Badger surveys have also been completed. It was confirmed that one set will require stopping up and a replacement set required.	
5.4	The archaeology geophysical survey of the scheme extent has identified a range of possible sites and these have been added into the Gazetteer of sites being considered.	
6	**The Environmental Impact Assessment**	
6.1	There have been some important changes to the EU Directives on EIA. LW provided an outline of these changes.	
6.2	EU Directive 2014/52/EU published in the EU Journal on the 16th May 2017. The UK published Statutory Instrument 2017 No.1070 on the 5th December 2017 entitled 'The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways, and Transport) Regulations 2017.	
6.3	The 2008 revision of Design manual for Roads and Bridges (DMRB) has been withdrawn by Highways England. Volume 11, which addressed EIA has been replaced by new documents. Topic guidance will be published. There are some Wales-only annexes to the new DMRB known as Procedures and Guidance documents (PAG). The new DMRB will be slimmer and more contractual.	
6.4	CL asked about the Green Corridor Initiative. LW explained that this was announced in July 2018 by the Minster and is part of the Natural Resource Policy to improve corridors. The corridors in Wales include A55, A470, A487 etc. The purpose is to improve the corridors into and through Wales with 'gateways' at Fishguard, Holyhead, along the English Border and in Milford Haven. There is a five-year programme of improvements to cover species, economics, social and environmental topics.	

Ref	Item	Action
6.5	The programme to publication of the Scheme ES was discussed. The plan is to have the ES published early December 2018. LW expressed concern that the Screening and Scoping Report might need further work to meet the requirements of the new EU Directive.	
6.6	LW requested that the AIES Screening should be reviewed in the light of new case law. He set these out as: People Over Wind; Sweetman; Grace. PW explained he had taken these into account within the AIES and SIAA.	
6.7	LW raised the matter of a Sustainable Development Report which would be open for public scrutiny regarding the contribution of the Scheme to meeting Well-Being Goals.	

Minutes

Project	**A40 Penblewin to Redstone Cross Improvements**
Subject	Environmental Liaison Group (ELG) Meeting 1
File Reference	A40PRC-ARP-EAC-M02-MI-LE-0001
Prepared by	
Attendees	(MD) WG (SH) ECAT/WG (PD) – SWTRA (CL) – SWTRA (EH) SWTRA (RS) – Pembrokeshire CC (TT) – Pembrokeshire CC - CADW (KM) – Dyfed Archaeological Trust (DAT) (HC) Arcadis (CJ) – Arup (DM) - RML (TE) Arup (AS) – RML
Apologies	
Circulation	Those present and apologies
Date	18 May 2019

Ref	Item	Action
	The following abbreviations have been used within these meeting minutes: A40LVP – A40 Llanddewi Velfrey to Penblewin Improvments A40PRC – A40 Penblewin to Redstone Cross Improvements	
1	**Introductions and Project Update**	
1.1	Welcome from AS and a round of introductions was undertaken. New members to the ELG included: (Pembrokeshire CC), to replace who has left PCC. (CADW)	
1.2	The focus of the ELG was around a presentation given by AS, which is appended to the back of these minutes. The following minutes is a record of the discussion and actions that were had around the presentation	

Ref	Item	Action
1.3	An update was given on the A40LVP. It was noted that draft Orders are planned to be published in July.	
2	**Scheme Environmental Objectives**	
2.1	AS presented the Scheme Environmental Objectives and potential enhancements, which have been developed based upon those from the A40LVP. Discussion was had around these objectives and the following points raised.	
2.2	SH raised that there was no mention of Equestrians. AS to update Enhancement number 3 to include Equestrian users.	**AS**
2.3	CL said that we should ensure what we do meets the requirements of the Environment (Wales)Act Section 6. CL flagged that the team need to take 'Net Gain' into consideration.	
2.4	PD suggested that a gateway feature should be considered, potentially at Penblewin Roundabout. "Green Corridors" should be considered. AS requested that any agreed strategy for Green Corridor gateways should be set out so that suitable measures could be designed as part of the KS3 or as a requirement of the future D&B contractor's role.	**AS** **SWTRA**
2.5	SH said that Climate Change should form part of the Objectives. AS to consider further. Post meeting note: AS added a draft objective for consideration: *'Address the potential climate change effects of the Scheme on flood risk'*	**AS** **All**
2.6	HC outlined the need for including something on Population and Human Health within the objectives. Post meeting note: AS added a draft objective for consideration: *'Provide safer opportunities for active travel to promote healthy lifestyles'.*	**AS** **All**
2.7	TE outlined that there are scheme problems and objectives identified through the WelTAG Appraisal. AS to consider how the environmental objectives sit within the Scheme Objectives. The environmental objectives will be revisited in future ELG meetings to ensure that they remain relevant to the scheme. [Post meeting note - Scheme Problems and Objectives noted below for Information.] **Problems** Consultation with key stakeholders, including the Local Authority, Welsh Government Departments and the Regional Transport Planner has identified the following problems: a) The A40 mainline and Redstone Cross Junction are substandard and where overtaking provision does exist it is currently not spread along the length of the A40 such as there are long lengths in each direction with no safe overtaking opportunities. b) Limited overtaking opportunities lead to poor journey time reliability and driver frustration. c) The existing Redstone Cross Junction layout is perceived to have a low safety record.	**AS**

Ref	Item	Action
	d) Occasional convoys of heavy goods vehicles from the ferry ports and slow-moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities. e) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities. f) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road. g) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents. h) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections. **Scheme Objectives** A number of transport planning objectives have been developed iteratively during previous development work and engagement on the A40 project, aiming to address one or more of the identified problems. During the early stages of Key Stage 3 the problems and objectives were refreshed during a focused workshop event with key stakeholders to take into account the WelTAG 2017 guidance and Wellbeing of Future Generations (Wales) Act wellbeing goals. The scheme objectives are: **O1** To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations. **O2** To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock. **O3** To reduce community severance and provide health and amenity benefits. **O4** To improve the Redstone Cross Junction safety and reduce the number and severity of A40 mainline collisions. **O5** To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles. **O6** To deliver a scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs. **O7** Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon. **O8** Give due consideration to the impact of transport on the environment and provide enhancement when practicable.	

Ref	Item	Action
2.8	TE gave an overview of the short list of options that are currently being considered.	
3	**Report on Surveys**	
	Archaeology	
3.1	gave a short overview of the Archaeology findings of the A40LVP and gave a brief description of the interpretation of the Geophysical Surveys.	
3.2	continued to give an overview of the geophysical surveys being undertaken on the A40PRC. He explained that both the northern and southern route corridors had been surveyed. The northern corridor has significantly more archaeological interest, from what can be interpreted from the Geophysical survey, with possible barrows and a henge monument. This all forms part of the setting for the Scheduled Ancient Monument (SAM) located north east of Redstone Cross.	
3.3	It was noted that field NG7 was missing from the interpretation. DM to look into why this field was not included on the interpretation.	**DM**
3.4	It was noted that a standing stone is present within NG6. The origins of this standing stone are unknown. It could be a modern artefact (placed within the last few hundred years).	
3.5	RS noted that there is a Roman Road 1km to the north of the Scheme. He questioned the possibility of Roman remains.	
3.6	DM said that the ground on the southern corridor was a lot wetter, with areas of peat, especially in field NG6. These areas could not be properly surveyed, but have the potential to be of archaeological interest.	
3.7	queried whether the barrows on the north could be a barrow cemetery. The high level of activity shown from the geophysical survey suggests that the area (including the SAM) would be of high national importance. All of the findings would form part of the setting of the SAM	
3.8	If the northern corridor was preferred, it would be challenging to mitigate. A preservation by recording approach would need to be taken.	
3.9	The setting of the SAM would be greatly affected. Barrows are usually sited in locations where they are inter-visible with other barrows. If the proposed route is on embankment, then this will interfere with these sightlines.	
	Ecology and Biodiversity	
3.10	CJ provided a summary of the Ecology Surveys that are being undertaken along with initial findings.	
3.11	<u>Northern Corridor</u> Extended Phase 1 Survey has been undertaken - predominantly fields of improved grassland with hedges. Some of the hedges are mature and may be sufficiently diverse to be Important Hedgerows under the Hedgerows Regulations Act; Botanical survey (NVC & Hedgerow Regulation Assessment) – in progress. Protected species surveys: • Bat Building Visual Inspections – 1 x Low potential building; • Bat Building Emergence and Dawn Survey – in progress;	

Ref	Item	Action
	• Bat Trees (GLTA results) – 0 x High potential, 4 x Moderate potential, 35 Low potential; • Bat Tree Climbing inspections – in progress; • Bat Static detector surveys (6 x detectors) – in progress; • Bat walked activity transect surveys – in progress; • Dormouse surveys (approx. 400 nest tubes) – in progress, no presence confirmed so far; • Riparian mammal surveys within 500m of centreline – in progress, no presence confirmed so far; • Breeding bird transects – in progress; • Barn owls – surveys yet to commence. • Badgers – a lot of badger activity, a vey large main sett to north of the scheme, but few setts on the alignment itself; • Amphibians – no ponds in survey area. • Reptiles – surveys to commence in coming weeks.	
3.12	<u>Southern Corridor</u> Phase 1 Survey – the scheme passes through two areas of semi-natural broadleaved woodland which follow the valleys of small watercourses. These areas include wet woodland with alder and willow and are bordered by areas of marshy grassland, particularly to the south of the alignment. The scheme also crosses some mature hedgerows, some of which may be classed as important, and some improved grassland fields used for cattle grazing; Botanical survey (NVC & Hedgerow Regulation Assessment) – in progress; Protected species surveys: • Bat Building Visual Inspections – 1 x Confirmed (Blackmoor Hill Farm), 1 x High potential (cottage south of Redstone Cross), 2 x Moderate potential (2 x buildings at Redstone Farm), 4 x Low potential. • Bat Building Emergence and Dawn Survey – in progress; • Bat Trees (GLTA results) – 2 x High potential, 2 x Moderate potential, >50 Low potential • Bat Tree Climbing inspections – in progress; • Bat Static detector surveys (6 x detectors) – in progress; • Bat walked activity transect surveys – in progress; • Dormouse surveys (approx. 400 nest tubes) – in progress, no presence confirmed so far; • Riparian mammal surveys within 500m of centreline – in progress, possible otter spraint identified; • Breeding bird transects – in progress; • Barn owls – surveys yet to commence. • Badgers – a main sett just to south of alignment within the banks of the stream. At least two outliers will need to be excluded; • Amphibians – no ponds in survey area. • Reptiles – surveys to commence in coming weeks.	
3.13	TT said that there is a new Barbastelle project being undertaken in Canaston Woods, which is to the east of the Scheme, to research the	

Ref	Item	Action
	importance of connectivity/linkages and to try and determine if the bats are part of a greater population.	
3.14	TT asked if the botanical surveys included Lower Plants?	**CJ**
3.15	TT raised the question of whether marsh fritillaries and brown hairstreaks might be found in the area of the southern route. There could be a metapopulation of Marsh fritillaries using the wet grasslands.	**CJ**
3.15	TT said that the next six weeks are critical for surveys, especially for Bat movements. It is worth having the outcomes of these surveys to feed into any route decision making.	
4	**Other Environmental Considerations**	
4.1	AS discussed, the route alignments and their impacts on Hydrology. The southern corridor would likely have a greater impact on Hydrology as there are several watercourses that are intercepted at the top of their catchment. The northern corridor may have an impact due to sections of the route being in cutting. This may intercept groundwater. All the watercourses heading east and are part of the Taf catchment. One at the west end heads towards the Eastern Cleddau.	
4.2	AS explained that Welsh government have an embargo on planting Ash within new schemes and asked if RS could update the meeting on Ash Die-back in Pembs. TT and RS outlined the ongoing challenges with Ash dieback. There is a Dyfed Strategy for the effects of the disease. Due to the high proportion/number of Ash trees on the road network, the ongoing outbreak is likely to have an impact on the landscape. Sapling trees are more prone to the disease and being smaller are below the canopies of trees already succumbing. Trees die quickly. Tree Council have published a Toolkit. The embargo on the planting of ash will affect the landscape design and other species will be selected, in accord with the Llanddewi Velfrey Scheme.	
4.3	The Environmental Objectives were revisited at the end of the meeting to see if the ELG had any further comments. AS to action. Objectives to be reviewed at the next ELG. It was discussed that the wording of the Objectives needs further consideration and tightening up. For example, “adverse impact on biodiversity”.	**AS**
4.4	TE to include WelTAG/Scheme Objectives in the meeting minutes (See post meeting note in section 2 of these minutes).	**TE**
5	**AOB**	
5.1	RS highlighted the importance of the A40PRC not impacting upon the deliverability of any further improvement west to Caneston Bridge. MD confirmed that the schemes are being developed independently and are mutually exclusive. The delivery of the schemes and procurement strategy are being considered, this may include both schemes being constructed together as one scheme.	
5.2	RS queried the option for online improvements. TE explained that this included within the design options considered but was ruled out as an	

Ref	Item	Action
	option. TE explained the reasons why. RS emphasised the need to robustly rule this option out.	TE
5.3	At the previous ELG, CL requested that SWTRA see the Land Referencing plans so that the proposed land take and easements can be seen. TE to organise a copy.	TE
5.4	HC noted that the scheme needs to consider the WFGA.	

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Minutes

Project	**A40 Penblewin to Redstone Cross Improvements**
Subject	Environmental Liaison Group (ELG) Meeting 2
File Reference	A40PRC-ARP-EAC-M02-MI-LE-0002
Prepared by	Andrew Sumner & Tom Edwards
Attendees	(SH) – ECAT/WG – NRW (PD) – SWTRA (CL) – SWTRA (RS) – Pembrokeshire CC – Pembrokeshire CC – CADW – Arcadis – Arup – Arup – RML

Apologies

Circulation	Those present and apologies
Date	3 October 2019

Ref	Item	Action
	The following abbreviations have been used within these meeting minutes: A40LVP – A40 Llanddewi Velfrey to Penblewin Improvements A40PRC – A40 Penblewin to Redstone Cross Improvements	
1	**Introductions**	
1.1	Welcome from AS and a round of introductions was undertaken. (Pembrokeshire CC) is new to the ELG. She has replaced who has left PCC (stood in at previous ELG)	
1.2	The focus of the ELG was around a presentation given by AS, which is appended to the back of these minutes. The following minutes are a record of the discussion and actions that were had around the presentation.	

Ref	Item	Action
2	**A40 Llanddewi Velfrey to Penblewin Improvements (A40LVP)**	
2.1	TE provided an update on the A40LVP. Recent key milestones that have been achieved along with future milestones are: **Achieved:** 31 July 2019 — Draft Orders and ES Published 20 September 2019 — End of Objection Period **Upcoming:** Early 2020 — Potential Public Inquiry Summer 2020 — Welsh Ministers decision to make the Orders Winter 2020 — Appoint D&B Contractor (subject to Welsh Ministers decision) Early 2021 — Commence Construction on Site Winter 2022 — A40 Improvements open	
2.2	TE outlined the main ongoing activities are. These include pre-construction ecology surveys, responding to objections to the draft Orders and Early preparation for a potential Public Local Inquiry (PLI). At date of meeting, the Scheme has received 29 objections from a mix of statutory and non-statutory bodies. A large proportion of the objections are in relation to matters of detail, such as Private Means of Access, Accommodation Works and Side Roads. RS asked whether minor details such as gate/fencing provision would be enough to trigger a PLI. TE confirmed that these comments are treated as objections as they usually raised by landowners, and therefore deemed to statutory objections. TE stressed that the intention is to resolve the concerns raised and remove the objection ahead of any PLI to remove the.	
2.3	TE explained that a Ground Investigation (GI) is on site now. This is to provide further information and to fill gaps in areas that GI was previously restricted.	
2.4	PW gave an overview of the recent Ecology Surveys undertaken on A40LVP Scheme. A summary of this is provided below:	
2.5	**Bat Roosts (Buildings)** – Update visual inspections and dusk emergence / dawn re-entry surveys of known roosts almost complete. 11 buildings with known roosts re-surveyed. 10 of these buildings so far are still roosts, with a couple more surveys to do in next couple of weeks.	
2.6	**Bat Roosts (Trees)** – Update surveys of 39 trees with moderate / high potential / confirmed roosts, plus 150 extra trees with roost potential confirmed during a new GLTA. 138 trees were climbed - 19 were left unclimbed due to access restrictions. Dusk emergence / dawn re-entry surveys carried out on 16 trees prioritised because they were in the scheme footprint. Confirmed roosts in 4 trees. Land access restrictions have limited some of the survey effort in a handful of locations.	

Ref	Item	Action
2.7	**Bats Statics** – data collection and sound analysis in progress until end of October / November. Analysis of April data has shown occasional passes of GHS and barbastelle.	
2.8	**Dormouse** – Evidence of Dormouse confirmed during September surveys (no evidence prior to this survey). October and November checks left to be undertaken. Some land access restrictions have been encountered during June and August.	
2.9	**Riparian mammals** – first round of surveys (June) found no signs of water vole, some old otter spraints and potential lay-up sites and a potential holt recorded. Second round of surveys are currently underway.	
2.10	**GCN** – No further evidence found in 2019.	
2.11	**Badgers** - Badger surveys have been undertaken and are complete. Similar outcomes to previous surveys.	
3	**A40 Penblewin to Redstone Cross Improvements (A40PRC)**	
3.1	AS provided a brief overview of the project to refresh the ELG of the Scheme. AS gave an overview of the project programme. February 2019 — Commencement of project July 2019 — Issue of Draft EIA Screening and Scoping reports to ELG Early 2020 — Issue of Draft Environmental Statement to ELG Spring 2020 — Publication of Draft Orders and Environmental Statement Mid 2020 — Public Inquiry Early 2021 — Possible commencement of construction Late 2022 — Completion of construction CN outlined that the Welsh Governments intention is to develop the A40LVP and A40PRC schemes separately through Key Stages 3 and 4, but then deliver them as one project through construction. This gives flexibility in delivery and minimises risk if either of the Schemes were to receive significant challenge through the Statutory Process.	
3.2	At the previous meeting, the ELG challenged the route selection process. TE presented the online option that has been further developed to show the impacts of a full standard, compliant Scheme. There would be significant impact to property, local land/property access issues (potentially requiring sideroads running parallel to the mainline) and challenging construction issues due to level difference between existing and proposed. TE outlined that a WelTAG Stage 1 and 2 study has been undertaken and "Option 2B" has been recommended as the preferred option. This is the route that is being progressed.	
3.3	TE outlined that a Public Consultation has recently ended. TE outlined the main findings and outcomes from the Consultation. These were: • Many respondence support option 2B (as shown from previous Exhibitions)	

Ref	Item	Action
	• Key concerns relating to impact on traffic in Narberth • Many requested consideration of Redstone Cross access to the West • Concern on impact on residential and Care home • Suggestions include incorporating active travel provision along the existing A40, providing more cycle, walking and horse-riding routes These points raised are being investigated further by the project team.	
3.4	TE said that the intention is to publish a preferred route at the end of November.	
3.5	AS presented and described the developing preferred route option (Option 2B) – See presentation. AS/TE explained that a new junction has been introduced to the West of the Redstone Cross overbridge to provide enhanced access to vehicles wanting to travel to and from the West from Narberth. This junction would negate the need for vehicles travelling to the north of Narberth (the Redstone Cross area) to "double back" by using the Penblewin Roundabout and the existing A40 (to be detrunked).	
3.6	PW gave an overview of the recent Ecology Surveys undertaken on A40PRC Scheme. Both the North and Southern corridors have been surveyed to date. A summary of this is provided below:	
3.7	**NVC** – Surveys undertaken and complete. All the woodlands along the southern route are considered lowland mixed deciduous woodlands listed as Habitat of Principle Importance under the Environment (Wales) Act 2016. None of the grasslands were considered Habitats of Principle Importance.	
3.8	**Hedgerows –** Surveys undertaken and complete. 43 of 68 hedgerows surveyed qualified as 'Important'. Now dormice have been confirmed, all hedgerows now qualify as important.	
3.9	**Dormouse –** Presence confirmed on both North and South options - nests found on both. October and November checks still to be completed.	
3.10	**Bat Roosts (Buildings) –** BLE maternity roost, common pipistrelle and soprano pipistrelle day roosts in Redstone Farm, soprano pipistrelle and Pipistrellus day roosts in The Old Farm House Redstone Cross, soprano pipistrelle maternity roost and common pipistrelle day roost in Blackmore Hill Farm. **Bat Roosts (Trees) -** 53 trees were climbed, and 9 trees maintained their high/moderate suitability – 3 trees had high suitability and 6 moderate suitability. No droppings were found in any of the trees. All trees except one were in the southern route option. Emergence surveys were/are being conducted on 7 trees (of the remaining 2 trees (of the 9), one had no access and one is outside of 50m) no bats have been seen emerging from any of the trees so far.	

Ref	Item	Action
	Bats: Transects – surveys and sound analysis in progress until end of October. Mostly soprano pipistrelle, common pipistrelle and noctule. More activity on southern option than northern option. **Bats: Statics** – data collection and sound analysis in progress until end of October / November	
3.11	**Riparian mammals –** first round of surveys (June) found no signs of water vole, but some old otter spraints and potential lay-up sites. Second round of surveys currently underway.	
3.12	**GCN –** Surveys complete – GCN are not present.	
3.13	**Breeding birds –** surveys completed, common breeding bird assemblages - waiting for report from subconsultant.	
3.14	**Barn owls –** surveys completed, no potential roost sites found within study area. PW noted that although the surveys indicated no roosts, the surveys did find evidence of a Barn owl fatality on the A40 during one of their surveys. PD asked if this had been reported to the Wildlife Trust. PW will check with the team to ensure it is reported (If it hasn't been already).	**PW**
3.15	**Reptiles –** In progress, five checks completed so far, two to go. No reptiles found. PW suggested that there is suitable habitat for grass snake, but none have been found yet.	
3.16	**Badgers -** Badger survey completed. Several badger setts found across the study area.	
3.17	PW outlined the main impact of the proposed route is on the wet-woodland in several locations. He outlined that mitigation being considered for this is reuse of the affected soils, elsewhere on the Scheme. AS/PW currently working on the mitigation strategy for the Scheme, including locations of proposed culverts and underpasses.	**AS/PW**
3.18	CL asked for an update from the last ELG meeting on the Biodiversity/Archaeology discussions. AS outlined that further geophysical surveys have been undertaken since the last ELG, including in the areas of the Barrows Schedule Ancient Monument (SAM) and also in the location of the proposed Western junction (as described in 3.5 of these minutes). There are no new findings from these surveys, which provides further justification for the southern route having the least impact when compared to northern routes.	
3.19	AS gave a high-level overview of the developing draft Environmental Master Plan (EMP). (see attached presentation)	
3.20	A discussion was had on the detail of attenuation ponds. PD made the point that careful consideration is needed between planting in these areas and maintenance/access requirements.	

Ref	Item	Action
	RS questioned whether the ponds will be/need to be permanently wet. PW said that there is no need to provide wet ponds as mitigation for the Scheme, as the Scheme does not impact on this kind of habitat. PW questioned whether the most eastern ponds location could be reviewed due to its impact upon existing habitat. TE said he would review with the project team. RS raised the water quality within attenuation ponds and its impact upon planting. CL said from SWTRAs point of view it has been an issue. RS said that if there is the opportunity to increase biodiversity then it should be considered further. TE outlined that there are H&S considerations required of ponds, which can impact on their details, including fencing. This assessment includes consideration of the surrounding population (including vulnerable groups – schools/care homes etc) AS to consider all the above points in the development of the EMP	**TE** **AS**
3.21	LM raised the impact of the Scheme on the SAM, in particular the side road that ties the existing A40 into the amended Penblewin Roundabout. Impact on setting can include longer views, light, noise and even smells. CADW has guidance on landscape and settings, which should be considered. AS confirmed that he has access to this and that he would circulate to the project team. AS suggested that David Maynard discuss the points above further with LM. AS to arrange. AS explained that the alignment of the side road has been developed to try and reduce the impact upon the potential archaeology identified during the geophysical surveys. LM said that the impact of this will be dependent on the vertical alignment of the side road route- on embankment potentially burying (but preserving) the archaeology, but impact on the setting; in cutting where some archaeology maybe lost but could have less impact on the setting. LM mentioned that some of the legislation is out of date within the Screening and Scoping. AS will check this.	**AS** **AS** **AS**
5	**AOB**	
5.1	AS reminded the ELG that the Screening and Scoping Report for the A40PRC Scheme has been issued for comment. He encouraged all comments to be made as soon as possible so that they can be addressed. CL confirmed that SWTRA would not be providing comment. LE confirmed that the Report is with the NRW specialists. Comments will be provided in due course.	**All**

Ref	Item	Action
5.2	LM asked whether there is any opportunity to improve/enhance the setting of the SAM. A few ideas that were discussed were: Active Travel Routes are being considered as part of the de-trunking proposals/strategy. Opportunity to use these routes to draw attention/raise awareness to the SAMs through signing. Location of stopping points for traffic along the road. Existing layby is located close to the Penblewin Roundabout and will be on the section to be de-trunked. Currently this is not a safe or attractive opportunity for people to walk along the verge to the location of the barrows in the adjacent field. Is there any opportunity to improve? AS to consider further and feedback to the project team.	**AS**
5.3	CL queried how the Scheme will address the Green Corridors guidance/initiative. AS outlined his initial/developing thoughts on how the Scheme may address this: • Use of topsoil for planting areas – no topsoil for species rich grasslands to keep fertility low. • Woodland soils that are affected by the Scheme to be reused. • Carbon Sequestration (Carbon Sink) – planting and grass seeding to mitigate Carbon impacts. • Use of stands of Black Poplar in wet woodland areas. AS to consider further in the development of the EMP. CL said that it is important to balance the cost/maintenance against the biodiversity benefits of the measures taken forward.	**AS**
5.4	The next ELG will be early in 2020, following the Christmas break. The date will be considered closer to the time and invites sent out by AS.	**AS**

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