



A496 Llanbedr Access Improvement

VOLUME 1: ENVIRONMENTAL STATEMENT



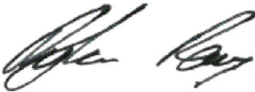
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Chapter 1.0: Introduction

This chapter identifies the project that has been the subject of the Environmental Impact Assessment, as summarised in this Environmental Statement. It also defines the legal basis for the Environmental Statement, explains its purpose and outlines its scope and content.

1.1 Identifying the Project

1.1.1 Gwynedd Council propose to improve a 1.5km section of the primary route for traffic between Barmouth and Porthmadog/ Blaenau Ffestiniog. The Proposed Improvement aims to improve access to Llanbedr Airfield, which is a designated Welsh Government Enterprise Zone (Snowdonia). In addition the Llanbedr area is a destination in itself for both tourism and employment activity. The main issues associated with local transport movements in and around Llanbedr involve congestion and safety concerns associated with traffic travelling along the A496 through the centre of Llanbedr and seasonal holiday traffic accessing Mochras (Shell Island campsite) via the Mochras Road junction in the centre of the village. The Proposed Improvement is titled the A496 Llanbedr Access Improvement (hereafter referred to as 'the Proposed Improvement').

1.1.2 The A496 Llanbedr Access Improvement (see Figure 1, Volume 1a) is located 11.5 km north of Barmouth on the Cambrian coast. The Proposed Improvement re-positions a 1.5 km section of the A496, moving it from the village centre to the western outskirts of Llanbedr. The land to which the planning application is made is generally in private ownership. Land adjoining the improved route mainly includes fields of improved grassland pasture used for grazing livestock. The existing A496 route provides access to existing properties in Llanbedr village. There is one bus stop along the existing alignment of the A496 and a railway station (an unmanned halt) on the Cambrian Coastline located approximately 750 metres to the west of the village and close to the proposed route

1.1.3 The Proposed Improvement lies approximately 208m west of the Meirionydd Oakwoods and bat site, which is part of a Special Area of Conservation (SAC) , approximately 290m east of the Pen Llyn a'r Sarnau SAC and approximately 1170m east of the Morfa Harlech a Morfa Dyffryn SAC.

1.1.4 The A496 was estimated to have, in 2015, an Annual Average Daily Traffic (AADT) of approximately 3,000 vehicles two ways, including heavy vehicles.

1.1.5 The project has been appraised using the Welsh Transport Appraisal Guidance (WelTAG) process which has identified that the initial aims of the A496 Llanbedr Access Improvement were to:

1. Improve access to Llanbedr Airfield and other sites of economic activity lying west of Llanbedr
2. Improve congestion and traffic problems within the village of Llanbedr
3. Improve journey times and reliability along the A496
4. To achieve aims 1, 2 and 3 above whilst minimising adverse effects on the environment

1.1.6 As an outcome of the WelTAG process the following Transport Planning Objectives (TPO's) were established to define solutions with which to address the transport problems identified in the study area (ranked in order of local public perception):

1. Reduce traffic congestion at the Mochras Road/A496 junction.
2. Reduce the negative impact of traffic on the community of Llanbedr.
3. Improve transport connectivity to and from Llanbedr Airfield.
4. Improve the efficiency and reliability of all transport to and from Llanbedr Airfield.

5. Improve the actual and perceived safety of travel for all travellers within Llanbedr and along Mochras Road.
6. Improve freight transport access to and from Llanbedr Airfield.
7. Improve travel opportunities for pedestrians and cyclists within Llanbedr and along Mochras Road.
8. Minimise the impact of transport improvements on local environmental and heritage features.
9. Be resilient to local effects of climate change, particularly future increases in flood events.

The proposed design aims to tackle those objectives in the ranked order shown above.

1.1.7 The Proposed Improvement encompasses the following design measures:

- Construction of a new road approximately 1.5 km long consisting of a single 7.3m wide carriageway.
- The alignment of the road has been designed to use the local topography and to reduce the need for import and export of material as much as practically possible.
- The horizontal alignment provides a curving alignment from the existing A496 just south of the sewage treatment works at the northern end of the Proposed Improvement, across fields and part of the floodplain of the Afon Artro to cross the river and Mochras Road on a new bridge.
- South of the river the Proposed Improvement follows a gently curving horizontal alignment initially through a cutting, to tie into the existing A496 just south of Llanbedr.
- Three junctions are proposed, one each to the north and south of Llanbedr, providing links into the village from these directions along the existing road (which would be reclassified), and one junction to Mochras Road allowing access to/from the airfield and Shell Island to the west and to the village centre to the east.
- No provisions for non-motorised users (NMUs) are expected along the main bypass alignment of the Proposed Improvement. All existing local provisions for NMU would be maintained as part of the Proposed Improvement, and measures instigated to improve connectivity between current facilities. Where the Proposed Improvement crosses the line of existing NMU routes, PRoW No 1 (Llanbedr) would be diverted through an underpass immediately to the north of its current location.

1.2 The Legal Basis for the Environmental Statement

1.2.1 This Environmental Statement (ES) has been prepared by YGC and their sub-consultants on behalf of Gwynedd Council to accompany an application for planning permission for the Proposed Improvement. It is issued in accordance with EC Directive 2011/92/EU¹ (as amended) as amended by Directive 2014/52/EU relating to the impact of certain public and private projects on the environment and is transposed into UK law by the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2016 .

1.2.2 The proposals are considered to fall under the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2016 as a 'relevant project' listed in Schedule 2(10) *i.e.* due to their size (over 1 hectare) and location within a sensitive site (Snowdonia National Park).

¹ This has since been revised by EC Directive 2014/52/EU, but the changes do not need to be transposed into UK law until Spring 2017.

- 1.2.3 The Proposed Improvement lies within the Snowdonia National Park and the Snowdonia National Park Authority (SNPA) are the local planning authority. Therefore a formal screening opinion was requested from SNPA to determine whether a statutory Environmental Impact Assessment (EIA) was required. The screening process is necessary to identify and specify whether the proposals are likely to have a significant effect on the receiving environment and will therefore require EIA. This process was completed in July 2015 when SNPA confirmed that the Proposed Improvement was likely to have significant environmental effects and that an EIA should be completed.
- 1.2.4 SNPA requested that a planning application should be submitted for the Proposed Improvement and this ES is submitted as part of that application.

Assessment of Implications on European Sites

- 1.2.5 The Proposed Improvement would involve work within 85m of the Meirionnydd Oakwood's and bat site Special Area of Conservation (SAC), within 290m of the Pen Llyn a'r Sarnau SAC and within 1170m of the Morfa Harlech a Morfa Dyffryn SAC. (see Figure 5.4.1, Volume 1a). Regulation 61 of The Conservation of Habitats and Species Regulations 2010 (as amended) states that:

*“A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which—
(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects), and
(b) is not directly connected with or necessary to the management of that site,
must make an appropriate assessment of the implications for that site in view of that site's conservation objectives”.*

- 1.2.6 Therefore, an Assessment of Implications on European Sites (AIES) would be undertaken by the relevant competent authority (SNPA) of the potential impacts on these sites associated with the construction and operation of the Proposed Improvement. The Statement to Inform an Appropriate Assessment (SIAA) to facilitate the AIES decision-making process will be provided to the competent authority (SNPA) in conjunction with the planning application for the Proposed Improvement. The SIAA is contained in Volume 2, Technical Appendix G.

1.3 The Purpose of the Environmental Statement

- 1.3.1 This ES identifies, describes and assesses the potential environmental impacts that may arise as a result of the Proposed Improvement, and outlines measures to avoid, reduce and, if possible, remedy the major adverse effects. The ES also outlines potential enhancement measures that have been identified as part of the EIA process. It provides relevant information regarding the design of the Proposed Improvement to enable the relevant planning authority to take into consideration any representations before deciding whether or not to proceed with the project, with or without modifications. It also provides an outline of the main alternatives and the reasons why these have not been presented as the Proposed Improvement.

1.4 The Scope and Content of the Environmental Statement

- 1.4.1 This ES has been prepared in accordance with the guidance provided by the Design Manual for Roads and Bridges (DMRB) Volume 11: Environmental Assessment, Sections 1 - 3 and Interim Advice Note 125/09(W)² adopting standard initial assessment methods, except where specified otherwise.
- 1.4.2 The EIA process and this ES have been co-ordinated by YGC, who also produced the chapters relating to Nature Conservation, Geology and Soils, Materials, Effects on All Travellers, Community and Private Assets and Road Drainage and the Water Environment. The following contributors have provided specialist support:
- ADAS: Agricultural Assessment (Community and Private Assets)
 - Arcadis: Air Quality, Noise and Vibration, Landscape
 - Brython Archaeology : Cultural Heritage
- 1.4.3 This ES comprises the following documents:
- Non-Technical Summary: a brief summary of the main findings of the ES in a non-technical language.
 - Volume 1: The Environmental Statement (this document) - a comprehensive and concise document drawing together all relevant information about the predicted environmental impacts of the Proposed Improvement.
 - Volume 1a: Plans and figures to which this ES refers.
 - Volume 2: Detailed Technical Appendices of specific assessment topics described in this ES.
- 1.4.4 In accordance with HD48/08 *Reporting of Environmental Impact Assessments*³ this ES contains the following sections:
- **The Proposed Improvement (Chapter 2.0):** Describing the background to the Proposed Improvement, justifying its need and highlighting its objectives. Other relevant information includes a summary of the existing site conditions, land use and land take information, a description of the Proposed Improvement and general details about the construction, operation and long term management of the project.
 - **Alternatives Considered (Chapter 3.0):** Explaining which alternatives were considered before reaching the final decision on the chosen design.
 - **Environmental Assessment Methods and Consultations (Chapter 4.0):** Stating and justifying the methods and predictive techniques used in the assessment process, the scoping techniques applied and the consultations carried out.
 - **Topic Analysis (Chapter 5.0):** Considering each environmental topic as outlined in the DMRB (Volume 11, Section 3) and IAN 125/09(W), this section establishes the baseline and regulatory/policy framework for each topic and uses the information gathered to identify the likely impacts. Mitigation measures are proposed and a summary of residual significant effects for each topic after mitigation is provided.
 - **Cumulative Effects (Chapter 6.0):** Assessing the likelihood of further effects as a result of a combination of the Proposed Improvement with other proposed projects/plans and incremental effects within the project itself. Cumulative effects are considered with regard to the guidance provided in HA205/08 and HD48/08.
 - **Environmental Management (Chapter 7.0):** Outlining how the proposed mitigation measures and the principles of sustainable development and good practice will be delivered during the construction phase of the Proposed Improvement.

² Interim Advice Note 125/09(W): Supplementary Guidance for Users of DMRB Volume 11 'Environmental Assessment' (Wales only), Welsh Assembly Government, July 2010.

³ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 6, HD48/08, Highways Agency, August 2008.

- **Conclusions (Chapter 8.0):** A summary of the main effects and mitigation measures resulting from the Proposed Improvement.

Consideration of EIA Directive 2014/52/EU

1.4.5 Although, as previously stated, this ES has been written in accordance with EIA Directive 2011/92/EU, elements of Directive 2014/52/EU have been taken in to consideration in some chapters. Annex IV Directive 2014/52/EU states what information should be included in the Environmental Impact Assessment report (*i.e.* ES), and includes the following areas which differ from Directive 2011/92/EU:

Heat and radiation

1.4.6 Given the nature and scale of the Proposed Improvement, there are not anticipated to be any significant effects from heat or radiation and these have not been included in this assessment.

Material assets

1.4.7 Annex IV of the EIA Directive includes reference to 'material assets'. The phrase 'material assets' has a broad scope, which may include assets of human or natural origin, valued for socio-economic/community or heritage reasons. Material assets are in practice considered across a range of topic areas within this ES, in particular Chapter 5.2: Cultural Heritage and Chapter 5.8: Community and Private Assets.

Effects of the Proposed Improvement on climate

1.4.8 Atmospheric emissions associated with the use of the Proposed Improvement during construction and operation are assessed within Chapter 5.1 (Air Quality) of the ES.

Human health

1.4.9 Although no overall assessment of the Proposed Improvement on human health has been undertaken, the thresholds on which the assessment of the impact of noise is based, is largely concerned with how noise can affect human health (see Chapter 5.7: Noise and Vibration). The assessment of air quality explained in Chapter 5.1: Air Quality also highlights how the Proposed Improvement will impact human health.

1.4.10 One of the main aims of the Proposed Improvement is to improve safety standards for the users of this section of the existing A496, which will be achieved by removing congestion from Llanbedr village. Improving pedestrian and cycling routes to provide alternative, healthier forms of travel is also included within the Proposed Improvement and these aspects are explained in more detail in Chapter 5.8: Effects on All Travellers.

Vulnerability of the Proposed Improvement to climate change

1.4.11 Climate change has been considered during the Proposed Improvement design process. The design has taken into account, for example, future flood risk and resilience to extreme weather events. In the case of flooding, this is considered in Chapter 5.10: Road Drainage and the Water Environment.

Chapter 2.0: The Proposed Improvement

This chapter explains the justification for the Proposed Improvement and describes its key elements. Relevant policies, plans and strategies are summarised and the construction and operational aspects are outlined.

2.1 Background to the Proposed Improvement

2.1.1. The development of strategically located Enterprise Zones throughout Wales is a Welsh Government-led initiative to encourage new business opportunities and foster economic growth⁴. There are currently seven Enterprise Zones within/proposed for Wales, with each one targeting a specific business sector. The Snowdonia Enterprise Zone is located in Gwynedd, north-west Wales and consists of two sites; the former nuclear power station at Trawsfynydd and the former military airfield at Llanbedr. The airfield site is being developed under the business name of the Snowdonia Aerospace Centre.

2.1.2 YGC were commissioned by Gwynedd Council to investigate options for improving transport access associated with the Snowdonia Aerospace Centre located on the Llanbedr airfield via a WelTAG study, which resulted in the identification of wider objectives to improve the local transport network⁵.

2.1.3 Following the completion of the WelTAG Planning and Appraisal (Stage 1)⁶, a preferred option was identified. The preferred option would pass to the west of Llanbedr (between the current A496 and the Cambrian railway line) crossing over Mochras Road and the Afon Artro on a bridge, allowing the Mochras Road link into the village to remain open to all traffic, and would tie into the existing A496 to the north and south of Llanbedr. (See drawing number 511/GA/200A). This option has been developed further and now forms the Proposed Improvement

2.1.4 Prior to the WelTAG study various other studies were completed regarding transport issues in and around Llanbedr. These were considered during the WelTAG Planning stage⁷ and are summarised here as they provide a useful background context for the project's history.

Llanbedr local transport issues

2.1.5 The A496 has a wide user group due to being the primary connection between Barmouth to the south and Porthmadog/Blaenau Ffestiniog to the north. Villages along this route between these points include, Llanaber, Tal y Bont, Dyffryn Ardudwy, Llanbedr, Llanfair, Harlech and Talsarnau

2.1.6 The main issues associated with local transport movements in and around Llanbedr that have been identified in the past involve congestion and safety concerns associated with traffic travelling along the A496 through the centre of Llanbedr and seasonal holiday traffic accessing Mochras (Shell Island) via Mochras Road and its junction with the A496 which is in the centre of the village.

2.1.7 Current driver stress within the study area is largely caused by congestion along the A496 and Mochras Road when traffic volumes are highest during summer months. The narrow bridge in combination with two busy junctions either side of the bridge and parked cars along Mochras Road, cause significant amount of congestion, particularly during peak tourist season. This situation is

⁴ Enterprise Zones, Welsh Government, 2012

⁵ Welsh Transport Planning and Appraisal Guidance (WelTAG), Issue 6, Version 7.1, Welsh Assembly Government, June 2008.

⁶ Snowdonia Enterprise Zone: Llanbedr Access Improvements WelTAG Planning and Appraisal report, YGC 2014

⁷ Snowdonia Enterprise Zone: Llanbedr Access Improvements WelTAG Planning stage report, YGC 2014

exacerbated by larger vehicles wishing to enter or exit Mochras Road, as these vehicles are likely to face difficulty manoeuvring due to the tight radii currently provided.

- 2.1.8 Also, parked cars on the A496, to the south of the bridge and junction limit visibility to the right (south) for vehicles emerging from Mochras Road, forcing drivers to move over the give way line for better line of sight. The view north, over the bridge when exiting Mochras Road is poor, due to the height of the parapet wall on the bridge and the angle at which the A496 approaches the junction (reflex angle).
- 2.1.9 There are commercial and residential properties on both sides of the A496 within the study area with frontage, driveways and entrances emerging directly onto the road. People/pedestrians and/or vehicles emerging from these properties/driveways or entrances are likely to emerge without any prior notice to travellers. Road side footways within the study area are intermittent and narrow and do mean that pedestrians are forced to step onto the road at some sections. When pedestrians are using the road, vehicular travellers may have to stop in order to allow oncoming traffic to pass before they can pull out to the opposite lane to negotiate around the pedestrians on the road. This is likely to cause some congestion, increase journey times and also increase driver discomfort as there is an inherent increase in risk of collision between both pedestrians and oncoming vehicles.
- 2.1.10 A previous solution to address these issues was a 7.3m wide single carriageway bypass taking traffic to the west of Llanbedr between the village and the railway line, which was proposed by Gwynedd County Council and presented to the public in October 1992. However, no further development took place regarding this proposal and Gwynedd Council had confirmed that the proposals were no longer feasible due to financial and transport policy constraints⁸.
- 2.1.11 To address local transport issues in the absence of a bypass, a list of potential smaller-scale improvements was suggested by the Llanbedr Community Council⁹, including improved off-street parking and traffic management¹⁰.

Snowdonia Aerospace Centre (formerly Llanbedr Aviation Centre)

- 2.1.12 Since the project is focused on identifying transport solutions driven by providing improved access for Llanbedr airfield, any transport solutions identified and taken forward must consider the future development aspirations for Llanbedr airfield.
- 2.1.13 The Snowdonia Aerospace Centre, located at the airfield, forms part of the Welsh Government's designated Snowdonia Enterprise Zone (SEZ). The Llanbedr site of the SEZ is described by the Welsh Government as *"Three runways - of 2.3km, 1.4km and 1.3km - take off into the Zone's 7,100km² of segregated airspace, stretching over Cardigan Bay. A world-class facility for developing and testing of RPAS, it has been shortlisted as one of six preferred locations for the UK Spaceport."* and describes the segregated airspace as *"unique in the UK and the first of its kind in Europe, it allows simultaneous access by both civil and military operators"*¹¹.
- 2.1.14 previous reports in connection with the Enterprise Zone have highlighted that poor HGV access to the site is a constraint and improvements to the local road network are required.

⁸ Letter from Gwynedd Council (Transportation and Street Care) to Llanbedr Community Council, 25th November 2010

⁹ Letter from Gwynedd Council (Transportation and Street Care) to Llanbedr Community Council, 8th March 2010

¹⁰ *Ibid.* footnote 6.

¹¹ <https://businesswales.gov.wales/enterprisezones/zones/snowdonia/about-snowdonia-enterprise-zone>

2.2 Justification in relation to relevant policies and plans and the project objectives

- 2.2.1 There are a number of policies and plans which can be seen as relevant to this Proposed Improvement and there are potentially positive and negative aspects arising from the Proposed Improvement in relation to those policies and plans. For example the Proposed Improvement appears to provide a lot of the outcomes of The Wales Transport Strategy¹² in terms of Social, Economic and some Environmental aims such as reducing the impact of transport on greenhouse gas emissions and adapting to the impacts of climate change but also creates potential conflicts with others e.g. The Eryri Local Development Plan¹³ and the SNPA's purpose of conserving and enhancing the natural beauty, wildlife and cultural heritage of the National Park whilst reconciling this with its duty to foster the economic and social well-being of local communities.
- 2.2.2 The A496 is an important transport route in North Wales forming a coastal link between the towns of Barmouth and Porthmadog/Blaenau Ffestiniog and linking into the trunk road network at Dolgellau, Penrhyndeudraeth and Maentwrog. It also serves numerous settlements along the coast, providing a route for commercial, tourist and local traffic.
- 2.2.3 As an outcome of the WelTAG process the following Transport Planning Objectives (TPO's), ranked in order of local public perception, were established.
1. Reduce traffic congestion at the Mochras Road/A496 junction.
 2. Reduce the negative impact of traffic on the community of Llanbedr.
 3. Improve transport connectivity to and from Llanbedr Airfield.
 4. Improve the efficiency and reliability of all transport to and from Llanbedr Airfield.
 5. Improve the actual and perceived safety of travel for all travellers within Llanbedr and along Mochras Road.
 6. Improve freight transport access to and from Llanbedr Airfield.
 7. Improve travel opportunities for pedestrians and cyclists within Llanbedr and along Mochras Road.
 8. Minimise the impact of transport improvements on local environmental and heritage features.
 9. Be resilient to local effects of climate change, particularly future increases in flood events.
- 2.2.4 The development of the airfield site is one of the aims of the Snowdonia Enterprise Zone and improving access to the site is seen as key to its development. It is generally recognised that improved access/infrastructure will make the site more attractive to potential businesses and will help to retain existing businesses.
- 2.2.5 The Llanbedr Access Improvements (hereafter referred to as the Proposed Improvement) would re-position a 1.5 km section of the A496, moving it from the village centre to the western outskirts of Llanbedr and removing most of the through traffic from the village centre. The Proposed Improvement would therefore provide an enhanced transport route for through traffic and respond to the needs of the existing road users by removing the bottlenecks of the narrow bridge over the Afon Artro and the numerous junctions and accesses onto the existing A496 whilst also improving access towards Llanbedr airfield.

¹² One Wales: Connecting the Nation – The Wales Transport Strategy 2008

¹³ Eryri Local Development Plan 2007 – 2022 – Written Statement – Adopted Version 2011

- 2.2.6 The Proposed Improvement is an 'off-line' improvement and alternative 'route options' and alternative means of meeting the objectives have been considered and are outlined in Chapter 3.0.
- 2.2.7 It has been suggested that the effective bypassing of the village as part of the Proposed Improvement may lead to some reduction in trade for some businesses e.g. passing trade from the existing A496, but it has also been suggested that it may make these and other village businesses more attractive due to the reduction in traffic levels, particularly HGVs.
- 2.2.8 The economic impact of the Proposed Improvement is detailed in the Economic Impact Assessment ¹⁴ and the main conclusions are that the Proposed Improvement implemented on its own will have a neutral economic impact on the village. However the Assessment also found that the Proposed Improvement would have a positive impact on the village and elsewhere, if the proposed developments for the airfield site go ahead.

The Existing Road

- 2.2.9 The existing A496 (1.53km in length) passes through the centre of the village where there is speed limit of 30mph, crossing the River Artro on a narrow masonry arch bridge. The section of the existing A496 to be improved commences close to the sewage treatment works approximately 0.75 km. north of Llanbedr. The existing alignment follows a roughly north-south route passing through the village centre and consists of a single carriageway with no verges or hard strips and is often bounded by low masonry walls at the road edge.
- 2.2.10 There is virtually no footway for the entire length of the existing A496 and virtually no kerbs. Various farm and domestic accesses all link directly onto the A496 and in the village many houses front directly onto it. None of the accesses have merge/diverge tapers and most have restricted visibility.
- 2.2.11 Available flood mapping suggests that flooding of the existing A496 south of the bridge over the Afon Artro isn't a problem but that north of the bridge approximately 2/3 of the road is designated as Flood Zone 3¹⁵. Improvements to the existing road are therefore required to alleviate existing flooding problems and ensure future resilience to flooding.
- 2.2.12 Highway drainage on the existing road is relatively informal the majority of it being either over the edge drainage, informal channel and gully or channel and gully.

Current and Predicted Traffic Flow

- 2.2.13 The two-way traffic flow for 2015 had an Annual Average Daily Traffic figure (AADT 24hr) of 2935 vehicles. Predictions for the anticipated opening year of 2020 and the design year of 2035 (without the Proposed Improvement occurring) at central growth rates are shown in Table 2.2.1.

¹⁴ An Economic Impact Assessment for the A496 Llanbedr Access Improvement and Snowdonia Aerospace Centre, Wavehill, January 2017

¹⁵ <http://lle.gov.wales/catalogue/item/Flood3/?lang=en>

Table 2.2.1: Existing and predicted two-way traffic flow figures (AADT 24hr)

	Existing A496	Proposed A496	Existing Mochras Road (east of proposed tie-in)	Proposed Mochras Road (west of proposed tie-in)
Existing traffic flows (2015)	2935	-	673	-
Opening Year 2020 (at central growth)	310	2909	710	71
Design Year 2035 (at central growth)	379	3144	882	77

- i. Notes:
- ii. AADT figure for 2015 is based on junction counts and automatic traffic counters located on the A496 at the North and South of Llanbedr as well as on the road heading down to Mochras. The traffic flow figures provided are based on 12 hour and 24 hour surveys in August and October 2015 and January 2016 and 12 months automatic traffic counter records.
- iii. 2020 was assumed as the year of opening of the Proposed Improvement at the time of calculation.
- iv. Traffic growth is based on National Road Traffic Forecasts (NTRF).
- v. Do Minimum and Do Something flows are the same, the section of existing highway is being improved offline to current standards of DMRB.

2.2.14 Llanbedr is situated in a rural area with no existing viable alternative local route. Therefore, the majority of vehicles travelling along the existing section of the A496 are forced to pass through the centre of Llanbedr with seasonal holiday traffic accessing Shell Island/Mochras and airfield traffic using the junction of the A496 with Mochras Road in the centre of the village leading to congestion.

2.2.15 With the Proposed Improvement the majority of through traffic would be diverted away from the village centre along the new route and the majority of the SEZ and Shell Island traffic would also be diverted away from the village centre, using the direct access onto the A496 instead. The facility to access the village from the west along Mochras Road would however be maintained via the bridge under the proposed new A496.

2.2.16 No increase in traffic flow, above that which would occur naturally is expected as a result of the Proposed Improvement. Increased traffic flow from the development of the Snowdonia Aerospace Centre at Llanbedr airfield is expected and has been included in the traffic figures used.

Accidents

2.2.17 Accident statistics between 2010 and 2015 are summarised in Table 2.2.2. These are accidents involving personal injury that have been recorded by the North Wales Police. There are likely to have been further accidents, involving vehicle damage only, which are unrecorded.

Table 2.2.2: Personal Injury Statistics: 2010 – 2015 (Source: IRIS)

Year	Fatal	Serious	Slight
2011	0	0	1
2012	0	0	0
2013	0	0	1
2014	0	0	0
2015	0	0	1
Total 2010-15	0	0	3

This section of the A496 has an accident rate of 0.38 Personal Injury Accidents (PIA) per million vehicle kilometres (MVK) for the period 2011 – 2015. This is lower than the national average rate of

0.671 (2015) for an older section of carriageway without hardstrips given in the COBA Manual (DMRB: Volume 13).

2.3 Description of the Proposed Improvement

Design Standards adopted for the Proposed Improvement

2.3.1 The Proposed Improvement has been designed in general accordance with the Design Manual for Roads and Bridges (DMRB). The DMRB is a comprehensive manual which incorporates current Standards and Advice Notes relating to Trunk Roads. The design speed of 100kph (60mph), which is the normal design speed for this type of road, would match that of the adjacent sections.

Design of the Proposed Improvement (see Figures 2.2 to 2.7, Volume 1a)

2.3.2 The Proposed Improvement involves the construction of a new road approximately 1.5 km long consisting of a single 7.3m wide carriageway with 1.0m wide hard strips each side and a minimum 2.5m wide verge beyond. The preferred route provides an off-line improvement allowing the existing A496 to function as normal during the construction period.

2.3.3 The alignment of the road has been designed to use the local topography and to reduce the need for import and export of material as much as practically possible. The road improvement includes a cutting to the south of the river Artro the excavated material from which will be used in the creation of embankments that are required to the north of the river.

2.3.4 The horizontal alignment provides a curving alignment from the existing A496 just south of the sewage treatment works at the northern end of the Proposed Improvement, across fields and part of the floodplain of the Afon Artro to cross the river and Mochras Road at an approximate right angle on a new bridge.

2.3.5 South of the river the Proposed Improvement follows a gently curving horizontal alignment to tie into the existing A496 just south of Llanbedr.

2.3.6 With regards the vertical alignment, the existing road at the northern end of the Proposed Improvement lies at a level of approximately 3 metres Above Ordnance Datum (AOD) whilst at the southern tie-in the existing road is at a level of approximately 40m AOD. The route therefore has to increase in level from north to south by approximately 37 metres.

2.3.7 For the northern section of the route, the road will rise on a relatively low embankment initially, which will increase in level to cross the Afon Artro and Mochras Road (existing level 4.6 mAOD) via a new bridge. South of Mochras Road the proposed route will enter a cutting up to approximately 10 metres deep (on its western side) and proceed to climb uphill on a very gently curving horizontal alignment to tie into the existing A496 just south of Llanbedr.

2.3.8 Three junctions are proposed, one each to the north and south of Llanbedr, providing links into the village from these directions along the existing road (which would be reclassified), and one junction to Mochras Road allowing access to/from the airfield and Shell Island to the west and to the village centre to the east.

2.3.9 The most northerly junction will be a conventional "T" junction with no right turning provision, as the number of vehicles making this manoeuvre should be minimal given the two junctions allowing access from the south and west.

2.3.10 The central junction will provide the turning for both northbound and southbound traffic from the new A496 towards the west i.e. to the airfield and the Shell Island campsite. A right hand turning

lane will be provided at this junction, with a ghost island i.e. a separate lane created using road markings designed to allow through traffic to proceed unhindered.

- 2.3.11 Llanbedr village centre can also be accessed from this central junction via Mochras Road which will pass under the new A496. As the majority of traffic from/to the Enterprise Zone and Shell Island is expected to use the new A496, traffic levels along the section of Mochras Road between this junction and the village centre will be substantially reduced.
- 2.3.12 Consideration has been given to providing a roundabout at this location but is not justified due to the relatively low traffic levels and the environmental impact of a roundabout, particularly the requirement for additional land take and street lighting.
- 2.3.13 The southernmost junction will include a right hand turning lane for northbound traffic turning into the village, again with a ghost island. This junction can also be used by southbound vehicles wishing to turn into the village.
- 2.3.14 No provisions for non-motorised users (NMUs) are expected along the main bypass alignment of the Proposed Improvement. All existing local provisions for NMU would be maintained as part of the Proposed Improvement, and measures investigated to improve connectivity between current facilities. Where the Proposed Improvement crosses the line of existing NMU routes, PRoW No 1 (Llanbedr) would be diverted through an underpass immediately to the north of its current location.
- 2.3.15 Provisions for pedestrians would be provided along the re-aligned section of Mochras Road up to the railway crossing and there will be opportunities for improving pedestrian provision along the existing length of Mochras Road due to the lower traffic volumes along this. All county roads, property / farm and field access adjoining the proposed new A496 will be enhanced with visibility and / or junction layouts improved.

Structures

Bridges, Culverts, Livestock Under Passes and Walls.

- 2.3.16 There will be two bridges constructed as part of the Proposed Improvement. One bridge will span a watercourse to the north of the Afon Artro and the other spans the Afon Artro as well as Mochras Road. The design of the main bridge spanning the Afon Artro and Mochras Road is shown on drawing number 5111/S03/01 and the design of the structure of the watercourse to the north of the Afon Artro crossing is shown on drawing number 5111/S02/01.
- 2.3.17 A 2.3m² culvert will be installed as an agricultural underpass to accommodate PRoW No 1 (Llanbedr) and to allow movement for livestock north of the Afon Artro shown, shown on drawing number 5111/S03/01.
- 2.3.18 A 2.6m² culvert south of the river will allow movement for livestock and facilitate the movement of bats (see Chapter Nature Conservation 5.4) shown on drawing number 5111/S04/01.
- 2.3.19 A 2.2m² box culvert for ecology mitigation is provided at Watercourse 3 at the northern end of the Proposed Improvement (see Chapter Nature Conservation 5.4) shown on drawing number 5111/S05/01.
- 2.3.20 Stone containment walls will provide protection and mitigation for visual impact over the embankments and the proposed bridges. There would be a small number of associated road signs and other minor items.

Verges

2.3.21 The eastern and western verge would be a minimum of 2.5m wide and grassed with a filter drain on one side dependent upon the super elevation for that section.

Kerbs

2.3.22 Kerbs will only be provided at the over-bridges and at junctions and in connection with new footways along Mochras Road.

Drainage

2.3.23 The Proposed Improvement's drainage has been designed for a 1 in 5 year return period plus 30% for climate change.

2.3.24 Surface water drainage will be provided incorporating a mixture of methods including piping, attenuation/balancing ponds, vegetated drainage (grassed channels), filter drains and gullies. The mixture of drainage methods will allow for flood and pollution risk to be reduced. Land to be acquired for proposed attenuation works is shown on drawing number 5111/GA/200A.

2.3.25 These in turn would discharge into existing watercourses be it the Afon Artro or its tributaries, as at present, either through new outfalls, through modifications to existing headwalls, or through direct connections into existing culverts. The volume of water discharging into the watercourses would be restricted to be equal or less than the green-field runoff discharge using attenuation/ balancing ponds and hydro brakes or similar apparatus.

2.3.26 There is a differentiation between the design of the highway drainage and the design of the culverts that carry watercourses under the highway. The highway drainage is for a 1 in 5 year storm event (plus 30% to allow for climate change), but the cross culverts are designed to cater for a 1 in 100 year storm event (plus 30% to allow for climate change), both in accordance with current DMRB guidance.

2.3.27 In addition to the surface water drainage, the addition of culverts crossing underneath the road structure will provide compensatory floodplain storage area. Where the road crosses through the active floodplain, 900 diameter pipes will be incorporated with 2m spacing to allow for the natural flow of water into and from the tidal and fluvial floodplain. This will ensure that there is no adverse effect from loss of floodplain area due to the construction of the road structure.

2.3.28 The agricultural underpasses would be drained in such a manner that does not discharge directly into watercourses *i.e.* filtered through/over adjacent ground or designed to drain away from such features.

Lighting, Signs and Roadside Features

2.3.29 There is currently lighting along the A496 within the village boundaries and along Mochras Road as far as the railway halt/crossing.

2.3.30 The Proposed Improvement lies within the Snowdonia Dark Skies Reserve, an internationally recognised designation and the Proposed Improvement lighting design must take this into account. The lighting along Mochras road as far as Llanbedr Halt will be maintained and only this will be lit but the existing lighting will be replaced with new equipment designed to reduce light spill, glare etc.

2.3.31 The new lighting along Mochras Road will be classified as Environmental Zone E1, Glare Class G6 and will be fully shielded. It is also recommended that the colour temperature of any new lighting is within the range 3,000K to 4,000K, that LED lighting is used and that the lighting is dimmable, allowing the output to be reduced between certain hours. There is a commitment in Chapter 5.4 that the river corridor lighting level will be less than 1 lux. Dependent on the detailed lighting design it is

likely that maximum lighting column heights of 6 metres will be used and the likely spacing of these will be in the range 25 – 30 metres. Dependent on the outcome of future Road safety Audits it may be possible to reduce the lighting requirements further by e.g. providing lighting covering the footway only.

2.3.32 The main carriageway of the new A496 and all the new road junctions will be unlit. No illuminated road signs are required.

2.3.33 For traffic using the A496 directional road signs indicating the village centre and its facilities would be required for the northern and southern junctions and directional signs both sides of the central junction i.e. the turning for Llanbedr airfield and Shell Island. Directional signs facing the minor roads at each junction with the new A496 will also be required. Give way signs will be required at all junctions. The locations and anticipated type of directional signs is shown on drawing number 5111/RM/200.

Statutory Undertakers

2.3.34 The Proposed Improvement would affect apparatus owned by BT, Power Systems (Electricity), and Dŵr Cymru (Water). The exact extent of this work is subject to the results of ongoing consultation and site surveys by the relevant third parties. However, it is currently anticipated that the apparatus would be diverted within the Proposed Improvement footprint during the construction phase. In some locations power lines will be repositioned underground to improve the visual impact on sensitive Proposed Improvement receptors.

2.4 Land use setting and land take

2.4.1 The Proposed Improvement is situated in a rural area mainly comprising improved agricultural grazing land with associated farms. There also small areas of mixed woodland and a small number of private non-agricultural dwellings within the study area. The area is situated within the Snowdonia National Park and Landscape of Outstanding Historic Interest. Site of Special Scientific Interest (SSSI) is situated at its closest 175m from the most northerly point and 321m from southerly point of the Proposed Improvement. Special Areas of Conservation (SAC) and are situated 217m from most northerly and 173 southerly point of the Proposed Improvement.

2.4.2 The Proposed Improvement would result in the permanent loss of approximately 6 hectares of arable land (5.25 ha of Grade 4 farmland (poor quality), 0.75 ha of Grade 5 farmland (very poor quality). The farmland affected is predominantly improved grassland for grazing. Additionally 0.325ha of non-agricultural private land would be lost permanently.

2.4.3 See Chapters 5.4 (Nature Conservation) and 5.9 (Community and Private Assets) for further details on land take impacts due to the Proposed Improvement.

2.5 Construction, Operation and Long Term Management

Buildability

2.5.1 Subject to the proposals satisfying the statutory approvals process, the commitments made within this ES and in response to any objections/representations would be incorporated into an Environmental Commitments Register (ECR), which would form part of the contract documents. A project team consisting of a principal contractor and designer would then be appointed to complete the detailed design and construction of the Proposed Improvement. The detailed design stage would involve, for example, finalising the landscape and drainage proposals based on the principles established within this ES, obtaining statutory environmental permits/consents and ongoing liaison with the statutory environmental bodies. It is envisaged that part of the duties placed upon the

appointed project team would be to establish and maintain a Construction Environmental Management Plan (CEMP) to manage and record the delivery of the commitments made within this ES and recorded in the ECR, and any subsequent commitments made during the detailed design phase (see Chapter 7.0 for further details).

- 2.5.2 It is anticipated that construction work would commence in Autumn 2019 and be completed and will take 12 months to complete.
- 2.5.3 During the construction period, approximately 9.29 ha of private land would be required in total. Any agricultural land and associated boundary features taken on a temporary basis during the construction period would be reinstated on completion.
- 2.5.4 During the construction period local residents would suffer temporary adverse impacts from construction noise and vibration arising from excavation, earth-moving activities, and compaction of materials and surfacing works as stated in Chapter 5.7 Noise and Vibration. These impacts would be limited in duration and associated with the Proposed Improvement close to particular properties.
- 2.5.5 The land required for construction of the Proposed Improvement is to be acquired by agreement, if possible, but may have to be acquired by compulsory purchase. The compulsory purchase order, if required and if confirmed, would include all permanent and temporary land acquisition required for construction of the Proposed Improvement.
- 2.5.6 Any agricultural land and associated boundary features taken on a temporary basis during the construction period would be reinstated on completion.
- 2.5.7 As the majority of the works are off-line the existing A496 would be kept open for most if not all of the time. The construction of the bridge over Mochras Road may require some short duration closures along that road e.g. for the placing of bridge beams, however as there is no viable alternative access these will have to be kept to a minimum and of very short duration or an alternative access provided.

Movement of Land Owners and Local Residents

- 2.5.8 In accordance with the DMRB, Volume 11, residential properties have been assessed to ascertain whether their occupants would experience nuisance or disruption during the construction period (see Chapter 5.7: Noise and Vibration).
- 2.5.9 During this period, all vehicular and pedestrian movements to and from properties would be through the contractor's site or through the traffic management measures implemented by the contractor. Access to the roadside properties and businesses below would be maintained throughout the contract period:
- Uned 5-6, Bydwynn, LL45 2LP (Business)
 - Uned 7, Bydwynn, LL45 2LP (Business)
 - Gweithdy, Bydwyn, LL45 2LP (Business)
 - Llwyn y Pin, Llanbedr, LL45 2LP
 - Fflat A, Hafod y Bryn, LL45 2LP
 - Fflat B, Hafod y Bryn, LL45 2LP
 - Fflat C, Hafod y Bryn, LL45 2LP
 - Hafod y bryn lodge, LL45 2LP
 - Tal Artro, LL45 2DZ

Contractor's obligations

2.5.10 Construction impacts would be avoided or minimised by imposing conditions on the Contractor and the working methods via the Contract Documents. The control of working practices would be important in limiting the short term impacts of the Proposed Improvement on the environment. The Contractor would be required to prepare method statements, as inputs to the Construction Environmental Management Plan (CEMP) during the construction stages (see Chapter 7 for further information about Environmental Management Plans in relation to the Proposed Improvement).

2.5.11 The method statements would be continuously reviewed and updated as required, and would describe the measures and procedures to be taken during the works to meet sustainable construction objectives including:

- Conserving resources: minimising waste and its disposal by recycling materials on site, using recycled products, improving disposal routes for waste and protecting non-renewable resources and minimising the use of primary or non-renewable resources and energy use.
- Protecting and conserving landscape and wildlife: avoiding damage or disturbance to biodiversity, landscape, cultural, water and other resources which are of local, national or international importance.
- Use of recycled materials: avoiding the use of timber, aggregates, peat or other materials that are produced from non-renewable or vulnerable sources and optimising the use of recycled materials.
- Avoiding pollution to water, air and land.
- Climate change: management of the construction period to minimise emissions of greenhouse gases.
- Monitoring and auditing sustainable construction and environmental measures and procedures through the CEMP to ensure effective delivery and to take remedial action or other timely interventions to secure the sustainable development and environmental commitments specified for the Proposed Improvement.

2.5.12 All haul routes, storage areas, working compounds and other temporary construction facilities that are still to be finalised would be determined with consideration of the sensitive environment at the site and any affected land would be reinstated following agreement with the landowner and statutory consultees where relevant. No such facilities are to be located within the designated protected sites. Any construction facility located adjacent to a protected site would be operated in accordance with environmental best practice and in full consultation with NRW/SNPA /Cadw to avoid adverse effects on the site and its qualifying features.

2.5.13 Compliance with these controls would be managed through the development and implementation of the Contractor's Environmental Management System (EMS). The Contractor would also be required to register the project with the Considerate Constructor's Proposed Improvement

Contractor's compound

2.5.14 The construction of the Proposed Improvement would require land for the Contractor and Engineer to site their compound. Due to the nature of the construction contractual arrangements the location of this will be decided by the successful Contractor and will be based on a number of factors. Likely sites are land adjoining the proposed new road or other locations offering suitable facilities. The Contractor may need to seek and gain planning permission and fulfil further environmental assessment and consultation with the overseeing organisation and statutory consultees.

Stockpiles

2.5.15 Stockpiles would be kept clear of existing trees and watercourses. The location of stockpiles in relation to watercourses would take account of any possible pollution and flooding risk during periods of spate.

Fencing and reinstatement of storage areas

2.5.16 All temporary storage areas would be reinstated to their existing ground profiles and surface finishes and boundary treatments reinstated unless otherwise agreed with the landowner and the LPA.

Imported and Exported Materials (see Chapter 5.6: Materials)

2.5.17 Imported material is expected to include road construction aggregates together with reinforcement steel, concrete, cement, pipes and fencing materials. It is estimated that approximately 70,000 m³ of additional fill material would be required by the work. It is anticipated that the majority of imported fill used on the project will comprise secondary aggregates from local sources. Surplus unsuitable material would be transported by road vehicles to a licensed disposal site. All acceptable waste material would be disposed of at a suitable location away from the site.

2.6 Long-term Management and Maintenance

2.6.1 The construction contract defects period would generally be for one year and the landscape and ecology aftercare period would generally be for a one to three year period following the completion of the Proposed Improvement. This would be confirmed at the detailed design stage.

2.6.2 On completion of the work it is envisaged that standard highway operation and maintenance procedures would be carried out during the lifetime of the Proposed Improvement on a suitably regular basis, as required by Gwynedd Council. The anticipated design life of the Proposed Improvement would be 120 years for the bridge and earthworks. Typical maintenance activities during this period would be likely to include, but are not limited to:

- winter maintenance, such as de-icing/gritting;
- line painting and resurfacing;
- dealing with traffic accidents and repairs to damage;
- maintenance of the highway drainage network;
- management and maintenance of roadside grass areas and roadside vegetation trimming to comply with the environmental objectives, and;
- management of nature conservation (habitat and protected species) measures including new bat roost structure.

2.6.3 A 5 year soft landscaping contract would address Landscape and Nature Conservation commitments including :

- Treatment of invasive species and injurious weeds
- Habitat mitigation areas i.e. lowland meadow, rush pasture
- Woodland planting areas
- Hedgerows

2.7 Legislation, Policies and Plans Overview

2.7.1 The following legislation, policies and plans are considered to be of most relevance to the context of the Proposed Improvement at a national, regional and local scale. Legislation, policies and plans specific to environmental aspects of the Proposed Improvement are discussed in the relevant environmental topic chapters of this ES (Chapters 5.1 to 5.10). Due to the relatively restricted and mainly online nature of the work involved, the Proposed Improvement largely facilitates the strategies and policies established in national, regional and local planning frameworks. Account has been taken of the environmentally sensitive nature of the area, and the standards of design and the proposed mitigation measures are in accordance with the policies for conserving these values. Mitigation measures have been proposed to take account of any potential impacts, with the aim being to improve this section of the A486 without compromising the environment.

Legislation

Environment (Wales) Act, March 2016

- 2.7.2 This Act creates the legislation needed to plan and manage Wales' natural resources in a more sustainable and joined-up way. The overarching aims of the Act are to put in place legislation that will enable Wales' resources to be managed in a more proactive, sustainable and joined-up manner and to establish the legislative framework necessary to tackle climate change. The Act supports the Welsh Government's wider work to help secure Wales' long term well-being, so that it benefits from a prosperous economy, a healthy and resilient environment and vibrant, cohesive communities.
- 2.7.3 Part 2 of the Act addresses climate change and provides the Welsh Ministers with powers to put in place statutory emission reduction targets, including at least an 80% reduction in emissions by 2050 and carbon budgeting to support their delivery. This is vital within the context of the Welsh Government's existing UK and EU obligations and sets a clear pathway for decarbonisation; it also provides certainty and clarity for business and investment.
- 2.7.4 The Act provides public authorities with a re-shaped requirement to seek to maintain and enhance biodiversity. The impacts of the Proposed Improvement on biodiversity within the Proposed Improvement's footprint have been identified and assessed as part of the EIA process and reported in this ES (see Chapter 5.4), along with mitigation measures to avoid or reduce such impacts (*e.g.* replanting hedgerows and trees) and enhancement measures to support biodiversity (*e.g.* improved access underneath the carriageway).

Historic Environment (Wales) Act, 2016

- 2.7.5 This Act makes important changes to the two main UK laws that provide the legislative framework for the protection and management of the historic environment: the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990. The Act:
- gives more effective protection to listed buildings and scheduled ancient monuments;
 - improves the sustainable management of the historic environment; and,
 - introduces greater transparency and accountability into decisions taken on the historic environment.
- 2.7.6 The majority of the Act's measures will require further secondary legislation or other preparations before they are brought into effect later in 2016 or 2017. The Act will also form the core of an integrated suite of legislation, policy, advice and guidance. Together, these will give Wales flexible and effective systems for the sustainable management of the Welsh historic environment, reflecting current conservation principles and practice.
- 2.7.7 The Proposed Improvement has the potential to adversely affect heritage features including listed buildings, archaeological remains and Landscapes of Outstanding Historical Importance. The Proposed Improvement falls within the Snowdonia National Park and the Arduwy Landscape of Outstanding Historic Significance. These have been considered and assessed as part of the EIA and ASIDOHL assessment and reported in chapter 5.2 of this ES. Mitigation measures include appropriate recording of heritage features and field boundaries in advance of destruction, mitigation planting to reduce visual impact and interpretation provided at Meini Hirion Standing Stones.

The Well-being of Future Generations Act, 2015

- 2.7.8 This 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:

- identifies goals to improve the well-being of Wales;
- introduces national indicators, that will measure the difference being made to the well-being of Wales;
- establishes a Future Generations Commissioner for Wales to act as an advocate for future generations, and;
- puts local service boards and well-being plans on a statutory basis and simplifies requirements for integrated community planning.

2.7.9 The Act requires public bodies to act *“in accordance with the sustainable development principle”*, which means that the body must act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs. The Act defines sustainable development 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”*.

The following five ways of working are identified in the Act, which public bodies need to consider to demonstrate that they have applied the sustainable development principle:

- Long Term: The importance of balancing short-term needs with the need to safeguard the ability to also meet long-term needs.
- Prevention: How acting to prevent problems occurring or getting worse may help public bodies meet their objectives.
- Integration: Considering how the public body’s well-being objectives may impact upon each of the well-being goals, on their other objectives, or on the objectives of other public bodies.
- Collaboration: Acting in collaboration with any other person (or different parts of the body itself) that could help the body to meet its well-being objectives.
- Involvement: The importance of involving people with an interest in achieving the well-being goals, and ensuring that those people reflect the diversity of the area which the body serves.

2.7.10 Seven ‘well-being’ goals are identified in the Act and provide a shared vision for public bodies in Wales to work towards. The Proposed Improvement’s objectives would contribute to achieving some of these goals and long-term sustainable development in Wales by:

- improving the standards of a strategically important highway to ensure that it provides efficient future connectivity between communities and economic hubs (goal: a Wales of cohesive communities);
- improving pedestrian and cycling access connections to provide alternative, healthier forms of travel (goal: a healthier Wales);
- enhancing biodiversity and future connectivity for wildlife at the locality (goal: a resilient Wales), and;
- considering the aims of sustainable development within the design, construction and operation of the Proposed Improvement (goal: a globally responsible Wales).
- the Proposed Improvement would also contribute to supporting an economy which generates wealth and provides employment opportunities through making the transport network and associated international links, more reliable and safer (goal: a prosperous Wales).

Planning (Wales) Act, 2015

2.7.11 This Act sets out a series of legislative changes to deliver reform of the planning system in Wales to ensure that it is fair, resilient and enables development. The act addresses 5 key objectives:

- a modernised framework for the delivery of planning services – the act introduces powers to allow planning applications to be made directly to Welsh Ministers in limited circumstances;
- strengthening the plan led approach – the act introduces a legal basis for the preparation of a National Development Framework and Strategic Development Plans

- improved resilience – the act will allow the Welsh Ministers to direct local planning authorities to work together and for local planning authorities to be merged;
- frontloading and improving the development management system – the act will introduce a statutory pre application procedure for defined categories of planning application, and;
- enabling effective enforcement and appeals – the act enables changes to enforcement procedures to secure prompt, meaningful action against breaches of planning control and increase the transparency and efficiency of the appeal system.

The Act, particularly the Sustainable Development aspect, is of relevance to the Proposed Improvement due to its links with the Well-being of Future Generations Act and the Environment (Wales) Act.

Active Travel (Wales) Act 2013

Active Travel (Wales) Act 2013 – Design Guidance (Welsh Government, 2014)

2.7.12 This Act is intended to enable more people to walk and cycle and generally travel by non-motorised transport. The Act requires local authorities to continuously improve facilities and routes for pedestrians and cyclists and to prepare maps identifying current and potential future routes for their use. The Act also requires new road Proposed Improvements to consider the needs of pedestrians and cyclists at the design stage and is therefore directly relevant to the Proposed Improvement. A Non-Motorised Users Supplementary Report¹⁶ has considered the needs of pedestrians and cyclists. While no provision for pedestrians and cyclists along the new A496 carriageway is proposed, opportunities have been identified to improve the existing footpath for pedestrians along Mochras Road. The Proposed Improvement would significantly improve conditions for all travellers through Llanbedr due to the reduction in traffic levels within the village providing safer provisions for sustainable modes of transport such as walking and cycling. The grade separation between the two roads i.e. the A496 and Mochras Road is designed so traffic would cross at different levels rather than the same level providing segregation between local traffic, pedestrians, cyclists and horse riders. The existing footpath for pedestrians along Mochras Road will also be improved. The Proposed Improvement design includes provision of a pedestrian underpass for a local footpath crossing the new road.

2.7.13 The Act also gives Welsh Ministers the power to issue guidance on the location, nature and condition that routes must meet before they can be considered as active travel routes. The accompanying Design Guidance is therefore to be used by everyone involved in the planning, design, approval, construction and maintenance of active travel networks and infrastructure and is of particular relevance to professional staff working for those responsible for creating, modifying and managing the built environment.

Policies and Plans Overview

2.7.14 The following policies and plans are considered to be of most relevance to the Proposed Improvement at a national, regional and local scale. Account has been taken of the environmentally sensitive nature of the area, and the standards of design and the proposed mitigation measures are in accordance with the policies for conserving these values. Mitigation measures have been proposed to either avoid or minimise any significant environmental impacts. Details of additional, topic-specific policies and plans that are relevant to the Proposed Improvement are provided within the Regulatory/Policy Framework sections of each individual topic chapter within this ES (see Chapter 5.0).

¹⁶ A496 Llanbedr Access Improvement, Non Motorised Users Supplementary Report, YGC December 2016

National (Wales level) Policies and Plans

Taking Wales Forward 2016 – 2020 (Welsh Government, 2016)

2.7.15 Taking Wales Forward sets out the Welsh Government's programme to drive improvement in the Welsh economy and public services, delivering a Wales which is prosperous and secure, healthy and active, ambitious and learning, united and connected. The document outlines the Welsh Government's key priorities for delivering the improvements, which are to be delivered in line with the Welsh Government's Well-being Objectives.

Planning Policy Wales (Edition 9) (Welsh Government, 2016)

2.7.16 The PPW documents provide guidance on a wide range of topics in the form of 21 Technical Advice Notes (TANs). While these documents chiefly apply to local planning authorities in preparing their local development plans, it is considered good practice to apply their principles to Welsh Government projects. Therefore, because the Proposed Improvement could result in varying degrees of impact upon the natural and built environment consideration has been given at the design stage to limit such impacts to a minimum. Chapter 5.0 of this ES identifies the impacts for each environmental topic and describes the proposed mitigation measures to avoid or reduce their magnitude. The relevant Technical Advice Notes (TANs) have been identified in the individual environmental assessment topic chapters of this ES.

National Transport Finance Plan (Welsh Government, 2015)

2.7.17 The NTFP sets out the Welsh Government's investment plans for the transport and services that it is responsible for and how it proposes to deliver the outcomes set out in the Wales Transport Strategy from 2015. The purpose of the NTFP is to:

- provide the timescale for financing the Proposed Improvements undertaken by the Welsh Government;
- provide the timescale for delivering these Proposed Improvements;
- detail the estimated expenditure required to deliver the Proposed Improvements, and;
- identify the likely source of financing to allow delivery to take place.

The Proposed Improvement is referred to in the NTFP (Annex A: Delivery Schedule - Proposed Improvement reference: IT3, **Improving Public transport links to key sites and services: Review opportunities already identified by others to improve access between and to/from Enterprise Zones and Local Growth Zones**) to be delivered from 2015 to 2020 and beyond.

Welsh Government Active Travel Action Plan (Welsh Government, February 2016)

2.7.18 The Active Travel Action Plan complements the Active Travel (Wales) Act 2013 and sets out a vision for active travel and how it relates to wider aims. It describes how to:

- work with others to achieve changes required
- embed active travel across different portfolios
- monitor progress against these actions
- monitor the rates of active travel across Wales

The Proposed Improvement has been designed to take account of the need to provide and increase opportunities for active travel and opportunities have been identified to improve the existing footpath for pedestrians along Mochras Road.

The Wales Infrastructure Investment Plan (Welsh Government, 2012)

The Wales Infrastructure Investment Plan Annual Report 2015 and Project Pipeline (Welsh Government, 2015)

2.7.19 The Wales Infrastructure Investment Plan (WIIP) provides the context for national government infrastructure investment, ensuring that it delivers maximum benefits to Wales and sets out the Welsh Government's strategic investment priorities, provides a detailed account of investment plans and sets out the key elements of a new approach to infrastructure investment.

- 2.7.20 The WIIP is designed to prioritise, scope and coordinate delivery of major infrastructure investments, whilst making a significant contribution to the long term economic, social and environmental well-being of people and communities in Wales.
- 2.7.21 The plan presents a set of strategic investment priorities which will support delivery of future infrastructure investment and guide the investment of approximately £15 billion over the next decade. There are seven investment priorities, which reinforce the Programme for Government (Welsh Government's plan of action), one of which includes developing Enterprise Zones and the infrastructure which enables them to function.
- 2.7.22 The plan explains that it is the Welsh Government's intention for the Enterprise Zones to contribute to growth in the local economy and provide a catalyst for economic growth elsewhere in Wales, beyond the boundaries of the zones themselves. The Welsh Government aim to work with partners to ensure that the infrastructure needs identified for the Enterprise Zones are met and where specific transport requirements are identified, appropriate funding will be directed to deliver the necessary enhancements for the zones.
- 2.7.23 The WIIP 2015 Annual Report provides an update on progress against the delivery of the WIIP. The delivery of initiatives for the seven Welsh Enterprise Zones is also included within the June 2015 version of the Project Pipeline (Annex 1.1; Economic Development). The pipeline list includes Welsh Government (WG) programmes and projects where total Proposed Improvement value exceeds £15m and, if not already started, are due to begin within the next three years.
- 2.7.24 The Proposed Improvement directly aims to improve access to Llanbedr Airfield, which is a designated Welsh Government Enterprise Zone (Snowdonia). The Snowdonia Enterprise Zone consists of two sites including the former military airfield at Llanbedr being developed under the business name of the Snowdonia Aerospace Centre. Previous studies identified the constraints and optimum proposals associated with developing the Snowdonia Aerospace Centre whereby HGV access is described as being essential and is expected to require improvements to the local road network. It is generally recognised that improved access/infrastructure will make the site more attractive to potential businesses and will help to retain existing businesses.

One Wales: One Planet – the Sustainable Development Proposed Improvement of the Welsh Assembly Government (Welsh Assembly Government, May 2009)

- 2.7.25 The Government of Wales Act 2006 (Section 79) requires the Welsh Ministers to set out how they propose, in the exercise of their functions, to promote sustainable development. Therefore, this document sets out the Welsh Government's vision and commitments for achieving sustainable development within Wales, and within a UK, EU and International context, stating that: *"sustainable development (the process that leads to Wales becoming a sustainable nation) will be the central organising principle of the Welsh Assembly Government, and we will encourage and enable others to embrace sustainable development as their central organising principle."*
- 2.7.26 The Proposed Improvement will contribute to sustainable development in Wales by improving a section of a road link of strategic economic importance for future use. Environmental impacts have been considered at the design stage and have either been avoided or minimised accordingly.

One Wales: Connecting the Nation – The Wales Transport Strategy (Welsh Assembly Government, April 2008)

- 2.7.27 The Wales Transport Strategy is a key tool in developing an effective transport strategy for Wales. The document outlines how transport policy approach is more responsive in its delivery of the Welsh Government's wider policy agenda, and attempts to be flexible to reflect different regional circumstances.

2.7.28 Prepared in accordance with The Transport (Wales) Act 2006, the stated goal of the Wales Transport Strategy is to promote sustainable transport networks that safeguard the environment while strengthening Wales' economic and social life. The WTS identifies a series of high-level outcomes and sets out the steps to their delivery, including:

- achieving a more effective and efficient transport system;
- achieving greater use of the more sustainable and healthy forms of travel;
- minimising demands on the transport system, and;
- reducing the impact of transport on greenhouse gas emissions.

2.7.29 The WTS seeks to achieve various social, economic and environmental outcomes through sustainable transport development and replaces The Transport Framework for Wales (Welsh Assembly Government, 2001). The following five key areas have been identified as requiring substantial progress:

- 1) Reducing greenhouse gas emissions and other environmental impacts;
- 2) Integrating local transport;
- 3) Improving access between key settlements and sites;
- 4) Enhancing international connectivity, and;
- 5) Increasing safety and security.

2.7.30 Social outcomes of particular relevance to the Proposed Improvement include: *“improving the actual and perceived safety of travel”* and *“encouraging healthy lifestyles”* as well as improving access to key facilities and public services. Improving people's perceptions of safety for using sustainable transport modes and ensuring the safety of all travellers are important aspects of the Strategy, which contributes to meeting the aims of the Road Safety Strategy for Wales (Welsh Assembly Government, January 2003). The Proposed Improvement would facilitate these social outcomes by significantly improving conditions for all travellers through Llanbedr due to the reduction in traffic levels within the village providing safer provisions for sustainable modes of transport such as walking and cycling. The existing footpath for pedestrians along Mochras Road will also be improved.

2.7.31 Economic outcomes of the Strategy, supported by the Proposed Improvement, include:

- *“improving the efficient, reliable and sustainable movement of people [and] freight.”* The Proposed Improvement would facilitate these economic outcomes by improving transport connectivity and efficiency for both people and freight travelling along the A496 between Barmouth/ Dolgellau in the south and Penrhynaedraeth/ Maentwrog in the North. Previous studies identified the constraints and optimum proposals associated with developing the Snowdonia Aerospace Centre whereby HGV access is currently a site constraint which would be improved but the Proposed Improvement.
- *“Improving access to employment opportunities”*. It is generally recognised that improved access/infrastructure will make Snowdonia Enterprise Zone at Llanbedr Airfield more attractive to potential businesses and will help to retain existing businesses.
- *“An efficient and effective transport system helps increase the number of people wanting to live, work and spend leisure time in Wales, which in turn builds strong and vibrant local economies.”* The Proposed Improvement would remove the congestion of seasonal traffic accessing Shall Island campsite (the largest campsite in Europe) and would improve driver stress of local residents and tourists travelling along this A496 section of the Cambrian coast.

2.7.32 Environmental outcomes relevant to the Proposed Improvement include *“improving the positive impact of transport on the local environment, heritage and biodiversity”*. The Strategy aims to reduce the environmental impacts of transport by *“taking action to reduce the effects of transport on noise, severance, air and water pollution and biodiversity.”* The Proposed Improvement would hinder the outcomes relating to local environment, heritage and biodiversity in the short term (during and immediately following construction) due to the initial habitat loss and habitat/species

disturbance. However, by minimising adverse impacts and identifying enhancement opportunities, the proposed design and mitigation measures would help to facilitate and enhance these in the long term.

Wales Spatial Plan – People, Places, Futures (Welsh Government, 2004 - updated 2008)

2.7.33 The broad 20 year vision and role, purpose and principles of the Wales Spatial Plan are:

- making sure that decisions are taken with regard to their impact beyond sectoral or administrative boundaries and that the core values of sustainable development govern everything the Welsh Government do;
- setting the context for local and community planning;
- influencing where the Welsh Government spend money through understanding the roles of and interactions between places, and;
- providing a clear evidence base for the public, private and third (voluntary) sectors to develop policy and action.

2.7.34 The Wales Spatial Plan aims to deliver sustainable development through its area strategies in the context of the Welsh Government's Sustainable Development Proposed Improvement. It identifies 6 sub-regions in Wales without defining hard boundaries, reflecting the different linkages involved in daily activities.

2.7.35 The Proposed Improvement is located within the Central Wales Spatial Plan Area Strategy. The agreed priorities for the area include:

- Building on important key centres in the area, whilst improving linkages and spreading benefit and growth to the wider hinterlands and rural communities outside of these areas.
- Responding to the needs of our rural communities and hinterlands by enabling growth and development, and enhancing sustainability of local communities.
- Supporting the existing rural economic sectors to provide a sustainable basis for the future of the Area's land-based economy and reinforce confidence in a rural future.
- Broadening the economic base, building on the Area's higher education infrastructure and introducing new sustainable economic opportunities.
- Realising the full potential of the Area's diverse environment and its unique cultural identity to build higher value sustainable tourism and enhance the role in responding to climate change.
- Maximising internal and external accessibility, building cross border collaborations, increasing access to services and enhancing overall economic growth.

2.7.36 The Proposed Improvement would contribute to the Wales Spatial Plan by ensuring that this section of the A496 provides for free and safe flow of traffic in the future for the development of Llanbedr Airfield (and hence this section of the Snowdonia Enterprise Zone) in addition to the local and seasonal traffic that already rely on the infrastructure.

Walking and Cycling Action Plan for Wales 2009-2013 (Welsh Government, 2008)

2.7.37 With its mission statement "*To encourage more people to walk and cycle more safely and more often*" this Plan sets out the Welsh Government's aim to maximise the opportunities afforded by walking and cycling and to reduce car use, particularly for short journeys. In addition it identifies that the provision of walking and cycling facilities is an important element in creating equal opportunities.

The core objectives of the Plan are to:

- improve the health and well-being of the population through increased physical activity;
- improve the local environment for walkers and cyclists;
- encourage sustainable travel as a practical step in combating climate change;
- increase levels of walking and cycling through promotion of facilities, and;

- ensure that walking and cycling are prioritised in cross-cutting policies, guidance and funding.

2.7.38 The provision of walking and cycling facilities has therefore been considered as part of the Proposed Improvement, in accordance with the core objectives of this Plan.

TAN 18 - Transport (Welsh Assembly Government, 2007)

2.7.39 This Technical Advice Note describes how to integrate land use and transport planning and explains how transport impacts should be assessed and mitigated. It is therefore of direct relevance to the Proposed Improvement and its design. Of particular relevance to the Proposed Improvement, TAN18 provides advice on:

- design of development
- walking and cycling
- planning for transport infrastructure
- assessing impacts and managing implementation.

Regional (North-west Wales) Policies and Plans

2.7.40 Regional Transport Plan – Trafnidiaeth Canolbarth Cymru (TraCC), September 2009 (RTP, TraCC)

This Local Transport Plan has been jointly prepared by the three Local Authorities for mid Wales, namely Powys, Ceredigion and Gwynedd (Meirionnydd) and has been overseen by TraCC as a Joint Committee of the local authorities for transport. The three local authorities are working together to facilitate economic development, ensure access for all to services and opportunities, sustain and improve the quality of community life, and make an active contribution to the management of carbon and the quality of the environment by delivering in partnership an integrated and affordable transport system in the region.

2.7.41 The four main regions in Wales are each represented by one of four regional transport consortia which have been created through partnerships between neighbouring local authorities. The consortia develop and implement the Regional Transport Plans (RTPs). Trafnidiaeth Canolbarth Cymru (TraCC) is the mid Wales regional transport partnership representing Powys, Ceredigion and the Meirionnydd district of southern Gwynedd, and hence covers the study area of this ES.

2.7.42 The Welsh Government requires TraCC to submit a Regional Transport Plan (RTP), which contains a Vision, regional transport priorities and policies to address identified problems following an analysis of the transport movement problems in mid Wales *i.e.* passenger and freight, road and rail.

2.7.43 The Mid Wales RTP was published by TraCC in September 2009 and is a bidding document which the Welsh Government uses to assign funding to projects across Wales. The bid covers the five years between 2010/11 to 2014/15. The RTP aims to deliver safe, sustainable and efficient transport networks to support economic and social activities in Mid Wales; it emphasises reducing the reliance on the private car and reversing the increase in highway congestion. Of the ten RTP priorities, the following are considered most relevant to the Proposed Improvement:

- RTP Priority 3: Improve safety and security for all transport users;
- RTP Priority 4: Improve travel accessibility to services, jobs and facilities for all sectors of society;
- RTP Priority 6: Provide, promote and improve sustainable forms of travel;
- RTP Priority 7: Maintain and improve the existing transport infrastructure (road and rail).

2.7.44 A change in the Welsh Government's funding stream now means that transport improvement grants are allocated directly to local authorities instead of the Regional Transport Consortia. Thus, there will no longer be a requirement on Regional Transport Consortia to oversee projects being funded or to co-ordinate activities arising from funding provided. It is therefore likely that the Mid Wales

Regional Transport Plan (along with the other Welsh Regional Transport Plans) will cease to exist when the two tier structure of the National Transport Plan, supported by the forthcoming Local Transport Plans, comes into existence.

5.8.45 The Plan covers a detailed programme from 2015-2020 and a framework for Proposed Improvements until 2030. Llanbedr Airfield Access improvement Proposed Improvement is identified in the LTP as a Higher Level Intervention Proposed Improvement to improve accessibility to employment and services that is of National significance.

Mid Wales Joint Local Transport Plan 2015 – 2020; Final Document (January 2015, Hyder Consulting)

2.7.46 Recently there has been considerable change regarding the transport planning framework in Wales. Local Transport Plans (LTPs), produced by Local Transport Authorities, now form one component of a two tier structure of transport planning, alongside the National Transport Plan. The LTPs allow Local Transport Authorities to update Proposed Improvements or priorities identified in their adopted Regional Transport Plans (RTPs) to accommodate changes since their publication and to address the findings and contents of studies and plans developed over each five year period.

2.7.47 The LTPs will link with the relevant sections of the current Regional Transport Plans (RTPs) and consider what has changed in the intervening period since the publication of the RTPs. For example, an increasing emphasis on the need to address issues related to economic growth has since been identified.

2.7.48 A draft Mid Wales JLTP was jointly produced by the three Mid Wales Local Authorities of Ceredigion County Council, Gwynedd Council, and Powys County Council. This was then subject to a period of consultation from 24th November 2014 to 5th January 2015 before a final version was submitted to Welsh Government by 31st January 2015.

2.7.49 The Mid Wales JLTP describes the key transport issues relevant to the local authority and sets specific priorities for the local authority to deliver from 2015 to 2020, and medium and longer term aspirations up to 2030. The JLTP is a statutory document that sits alongside the Local Development Plans and other policies and plans of each of the Local Authorities.

2.7.50 The JLTP outcomes sought, interventions and Proposed Improvements set out in the document seek to remove barriers to economic growth by improving connections to employment and strategic links to national markets, providing affordable and accessible transport to jobs and services and seeking to address the issues faced in rural communities with improvements to the County road network and walking and cycling connections, together with infrastructure to support public and community transport. The Snowdonia Enterprise Zone is identified within the JLTP as being one of the key economic growth drivers in the region. The Gwynedd coastal route of the A496 is also identified as a key linkage within the transport network.

2.7.51 The JLTP sets out the priority Proposed Improvements that the local authorities intend to invest in. The Welsh Government state that the LTPs' focus should be on targeting investment in transport that will:

- Support economic growth and safeguard jobs across Wales, but with a particular focus on the City Regions, Enterprise Zones and local growth zones;
- Reduce economic inactivity by delivering safe and affordable access to employment sites across Wales;
- Maximise the contribution that effective and affordable transport services can make to tackling poverty and target investment to support improvements in accessibility for the most disadvantaged communities, and;

- Encourage safer, healthier and sustainable travel.

2.7.52 The JLTP outcomes form a summary of what the Local Authorities want to achieve over the next five years and to 2030, from which to develop the interventions and Proposed Improvements to deliver the outcomes. The JLTP outcomes are:

- Access to Key Destinations and Markets:** Economic growth in the region will have been supported, through an improvement in the efficiency, reliability, resilience, and connectivity of movement, including freight, within Mid Wales and to and from other key destinations and markets.
- Access to Employment and Services:** Social equality and employability will have been promoted through inclusive, integrated and affordable access to employment and key health, education and social services and facilities, with a focus on tackling access to the Enterprise Zone and Local Growth Zones and those areas particularly deprived in terms of access to services.
- Improving Health and Well-being by Increasing Walking and Cycling:** Levels of cycling and walking for both necessary active travel and recreation, by residents and visitors, will have been increased.
- Improved Safety and Security:** The actual and perceived safety and security of travel by all modes will have been improved.
- Benefits and Minimised Impacts on the Environment:** The potential for transport improvements to reduce carbon emissions and improve the local and global natural and built environment will have been maximised and negative impacts minimised, including adaptation to the effects of climate change.

2.7.53 A series of Higher level Interventions have also been proposed to be delivered between 2015 and 2020. Of these the Llanbedr Airfield Access improvements are linked with *'Improving Accessibility to Employment and Services': Proposed Improvements to provide improved access to the EZ, growth zones, employment sites and town centres and sustain access to health services as well as education, community, shopping and other services. May include car share sites, bus services, active travel measures as well as road improvements.*

2.7.54 Furthermore, Table 6.2 of the JLTP describes the intervention (considered to be of national significance) as follows: *"to provide a new multi-user access road to connect the Llanbedr Airfield site to the A496. This will improve access to the Snowdonia Enterprise Zone and the connections to the others in the triangle of EZs (Anglesey and Deeside)".*

The North West and Mid Wales Integrated Transport Network Technical Report (AECOM, 2014)

2.7.55 This report provides the evidence base that is required to inform the development of the Local Transport Plans and the regional elements of the National Transport Plan from 2015. In addition, the evidence base will be used to inform the Regional Priorities workstream of the North Wales Ministerial Transport Taskforce, which is due to report by the end of 2014.

2.7.56 The study considers the current level of accessibility and economic activity alongside proposed developments in the region and also presents the issues facing the transport network and its users within the region. All modes of transport are considered, particularly active travel (*e.g.* cycling, walking) following the Active Travel (Wales) Act.

2.7.57 The report notes that in mid Wales, the Snowdonia Enterprise Zone is one of the selected projects likely to influence the transport network due to increased demand on services. The report recommends improve public transport and walking/cycling connectivity to the Llanbedr site *i.e.* the provision of new/revised services from adjacent residential communities (*e.g.* Pwllheli, Porthmadog and Dolgellau) to serve the Snowdonia Enterprise Zone.

Mid Wales Regional Highways Strategy and Prioritised Programme for Investment (Hyder Consulting, 2012)

2.7.58 TraCC's Regional Highways Strategy sets out priorities and objectives to be delivered over a five year investment programme (2012 – 2017) in accordance with the Regional Transport Plan, focusing on:

- Improving and managing highway network infrastructure;
- Promoting road safety;
- Reducing and managing freight movements, and;
- Monitoring and evaluation.

2.7.59 The strategy is intended to provide a framework for investment for all highways in the TraCC region in order to ensure that priorities are based on need and potential benefits rather than on respective responsibilities.

2.7.60 The 'Prioritised Programme for Highways Investment 2012' accompanies the strategy and comprises a five year programme of Proposed Improvements, prioritised using the evaluation framework from the strategy together with priorities for the region which may be delivered by the Welsh Government.

2.7.61 Transportation improvements in Llanbedr are not specifically identified as part of the strategy or listed in the 'Prioritised Programme for Highways Investment'. However, Proposed Improvement G5: A496 Blaenau Ffestiniog to Dolgellau highway improvements (including Proposed Improvement G7 A496 Maentwrog to Tan y Grisiau improvements) is outlined as a County-led highways Proposed Improvement prioritised for the undertaking of initial or further development work in the form of a WelTAG study.

2.7.62 The development of Llanbedr Airfield as part of the Snowdonia Enterprise Zone has close links to the A496 Maentwrog to Tan y Grisiau improvements (associated with the development of the Trawsfynydd component of the Snowdonia Enterprise Zone), and improvements to the A496 between Blaenau Ffestiniog and Dolgellau will further benefit connectivity between the Snowdonia Enterprise Zone and the A470, allowing onward access to the north Wales corridor, north-east Wales and England.

TraCC Walking and Cycling Strategy (Hyder Consulting, 2012)

2.7.63 This strategy aims to provide a strategic framework for prioritised investment in cycling and walking throughout the TraCC region. The strategy's 'Prioritised Programme for Investment 2012' comprises a five year programme of Proposed Improvements, which have been prioritised using an evaluation framework based on the strategy.

2.7.64 The main aim of the strategy is to invest in walking and cycling projects and initiatives in order to:

- Improve the health and wellbeing of mid Wales residents;
- Reduce car use and carbon and other environmental impacts of travel;
- Improve accessibility to and between key settlements, public transport interchanges, employment, education, and services and facilities;
- Encourage economic development through enhancing tourism, leisure and recreation infrastructure, and;
- Influence travel decisions of present and future transport users through land use planning and travel behaviour initiatives.

2.7.65 In order to deliver these objectives various strategy elements have been proposed involving prioritised investment in cycling and walking infrastructure, providing facilities for these groups, providing health and safety training and promoting sustainable travel choices.

- 2.7.66 The A496 through Llanbedr is located on the Lon Las Cymru (Route 8), part of the National Cycle Network. Another cycleway, which runs from Llanbedr village to Mochras (Shell Island), is identified via the Sustrans Interactive Map as being partly 'on-road' and partly 'traffic free'.
- 2.7.67 The strategy identifies and evaluates a multi-user path Proposed Improvement (number 2) from Llanbedr village to the railway halt, which upgrades the existing multi-user path in this location, but the Proposed Improvement was not taken forward to the five year Prioritised Programme for Investment. However, the Snowdonia Enterprise Zone concept had not been developed when this evaluation took place. It is likely that development of an enterprise zone in Llanbedr, like most similar developments involving new employment opportunities, would require the addition of a multi-user path providing connectivity of this area to the railway halt and bus stop at Llanbedr (west of the village). One of the requirements for prioritised investment in new Proposed Improvements under this strategy is that they lead towards a 'significant employment centre within a 2km walk or 5km cycle'; this will be directly relevant to the development of the Llanbedr site and associated access provisions.
- 2.7.68 The Proposed Improvement would significantly improve conditions for all travellers through Llanbedr due to the reduction in traffic levels within the village providing safer provisions for sustainable modes of transport such as walking and cycling. The grade separation between the two roads i.e. the A496 and Mochras Road is designed so traffic would cross at different levels rather than the same level providing segregation between local traffic, pedestrians, cyclists and horseriders. The existing footpath for pedestrians along Mochras Road will also be improved. The Proposed Improvement design includes provision of a pedestrian underpass for a local footpath crossing the new road.

Regional Bus and Community Transport Network Strategy (TraCC, 2014)

- 2.7.69 This strategy will influence the investment decisions by the public sector in the bus and community transport network in mid Wales from the financial year 2014-15 onwards. The strategy will provide the on-going framework for decisions and will also enable TraCC to respond to changes in funding, as well as the local authority provision and co-ordination of bus and community transport services and operators.
- 2.7.70 The Strategy identifies that the reduction in available funding to support bus services is a significant issue facing the whole of Wales and particularly for the TraCC region. The Strategy also acknowledges that there is a need to recognise that a standard bus operating on an infrequent timetable is not necessarily the best means in the region of enabling people to gain access to employment, education and other essential services.
- 2.7.71 The following Outcomes have been established for the strategy:
- Outcome 1 – Key services and facilities are accessible by bus and community transport services;
 - Outcome 2 – Services are affordable and cost effective;
 - Outcome 3 – Networks are integrated;
 - Outcome 4 – Services are of high quality, and;
 - Outcome 5 – Potential passengers are aware of how and when services are provided.

Local (Unitary Authority) Policies and Plans

Eryri Local Development Plan (2007 – 2022) (Snowdonia National Park Authority, 2011)

- 2.7.72 As the Proposed Improvement is situated within the Snowdonia National Park, local planning policy is directed by the Eryri Local Development Plan (LDP). The Eryri LDP provides a development strategy for sustainable development and conservation needs for the Snowdonia National Park until 2022. It is concerned mostly with the use and development of land, but will also have effects on the

local economy. It has therefore been considered within this ES as a material planning document for influencing development within the Snowdonia National Park.

2.7.73 Of particular relevance to development proposals within the Snowdonia National Park, the LDP states:

“There are certain broad requirements which all development should meet if it is to be acceptable within the National Park. Proposals must be acceptable in terms of their impact on the landscape, natural environment and cultural heritage, quality and design, sustainable use of resources, amenity, highway safety, flood risk and infrastructure.” New development in an environmentally sensitive area has the potential to contradict the aims of the LDP. However, the potential significant environmental impacts associated with the Proposed Improvement have been identified and assessed as part of the EIA process and are documented, along with the proposed mitigation measures to avoid or reduce them, within this ES. LDP policies regarding specific environmental receptors have been identified and discussed in the corresponding ES chapters.

2.7.74 Protecting, enhancing and maintaining the natural, cultural and historic environment are a key purpose of the Snowdonia National Park and the LDP supports this. Potential significant adverse impacts upon the natural environment have therefore been considered as part of the Proposed Improvement and either avoided or minimised where possible.

2.7.75 Strategic Policy Ch (Social and physical infrastructure in new developments) states:

“New development will be expected to make a contribution (on site wherever possible) to social and physical infrastructure within the National Park”. Within this Policy, transport and key physical infrastructure are recognised as two of the key aims to which contributions may be sought and which the Proposed Improvement aims to provide.

2.7.76 Paragraph 1.49 of the LDP relates to the rural economy and identifies *“a reduction in major employers, such as the defence research establishment at Llanbedr”*. It acknowledges that *“there is a need to build on the strengths and diversify the rural economy to develop alternative, higher paid employment opportunities which relates to the National Park ‘Special Qualities.’”*

2.7.77 The LDP’s Development Policy 1: General Development Principles (1) gives consideration to appropriate access to development meeting highway standards without harming the character of the locality or neighbouring amenity. Other principles identified within this policy include the need to avoid traffic generation that will result in volumes or vehicle types that harm the landscape or amenities of the National Park.

2.7.78 More specifically, Strategic Policy L: Accessibility and Transport (L) states a commitment to improving access to local facilities and reducing the need to travel, especially by private car. Changes to the highway network must not damage or cause detrimental effects to Public Rights of Way, listed buildings or historic monuments or cause adverse effects to environmental designations. Where possible, improvements to the network are expected to feature provisions for segregated pedestrian and cycling uses. The Proposed Improvement has been designed in consideration of this policy and would not result in the loss of listed buildings or historic monuments. Where Public Rights of Way would be severed, alternative provisions are proposed along with enhancements for non-motorised travellers.

2.7.79 The Eryri LDP’s Inset Map 33 (which covers Llanbedr) does not indicate any new housing allocations during the plan period (2007 – 2022) or any other development proposals that could act in combination with the Proposed Improvement to place increased pressure on the existing transport network.

2.7.80 'Promoting Accessibility and Inclusion' is another key theme of the LDP supported by the Proposed Improvement. Strategic Policy LI (Accessibility and Transport) states:

"The National Park Authority is committed to improving access to local facilities and reduce [sic] the need to travel especially by private car. Within the National Park walking and cycling, improved access to public transport and provision of facilities will be encouraged where possible and where appropriate".

Snowdonia National Park Management Plan 2010 - 2015 (Snowdonia National Park Authority, 2010)

2.7.81 The Snowdonia National Park Management Plan (NPMP) provides the long term vision and strategic direction for the national park and a framework and action plan for all those organisations that are working to secure the national park purposes. While it is not a land use planning document it is considered with the Eryri Local Development Plan as a material document for planning decisions.

2.7.82 The NPMP is a wide-ranging plan for the management of all aspects of the Snowdonia National Park; this includes the different landscapes (natural and man-made), human activities and the plant and animal environments found within the Park, and the vibrant Welsh culture of the area. The NPMP sets out the guiding principles, vision, long term aims and policies for managing all of these different aspects of the National Park. It also contains a set of integrated action plans to help achieve aims from year to year.

Gwynedd Unitary Development Plan, 2001 – 2016 (Gwynedd Council, 2009)

2.7.83 Until the adoption of the Anglesey and Gwynedd Joint Local Development Plan (JLDP) the Gwynedd Unitary Development Plan (UDP) is the currently-adopted Development Plan for the Gwynedd Local Planning Authority Area. While the Proposed Improvement is not subject to a formal planning application it constitutes a large highway improvement within the UDP area and must consider the principles of sustainable development at the local level. Relevant UDP policies have therefore been considered and are discussed in the relevant topic chapters of this ES (see Chapters 5.1 – 5.10).

2.7.84 The main objectives of the UDP are:

- Effective protection of the environment;
- Careful use of natural resources;
- Ensuring social progress which reflects the needs of all, and;
- Promote appropriate economic growth and growth in employment.

2.7.85 The UDP includes several Strategic Policies to guide sustainable development within the plan area. Those considered to be most relevant to the Proposed Improvement are as follows:

- **Taking a Precautionary Approach - Strategic Policy 1**
"Development proposals that would have an adverse or uncertain impact on the environment, the economy or cultural character (including the Welsh language) of the Plan area will be refused unless it can be conclusively shown by an appropriate impact assessment that this can be negated or mitigated in a manner acceptable to the Planning Authority".
Potential adverse environmental impacts have been identified and assessed during the design of the Proposed Improvement and steps proposed to either avoid or minimise these.
- **The Natural Environment - Strategic Policy 2**
"The area's natural environment and its landscape character, and views in and out of the Snowdonia National Park and the Anglesey and Llŷn Areas of Outstanding Natural Beauty, will be safeguarded, maintained or improved by refusing development proposals that significantly harm them."

Adverse impacts on landscape, biodiversity and communities have been identified and assessed during the design of the Proposed Improvement and steps proposed to either avoid or minimise these.

- **Built and Historic Environment - Strategic Policy 3**
"The area's built and historic environment will be protected from development that would significantly harm it and new developments in historic areas will be expected to conform to particularly high design standards which will maintain or improve their landscape character."
Potential impacts on the area's built and historic environment have been identified and assessed at the design stage and then either avoided or minimised.
- **Design Standards -Strategic Policy 4**
"Development will be expected to be of a good design in order to ensure that it makes a positive contribution, wherever possible, to the landscape, built environment and sustainable development."
The Proposed Improvement has been designed to a high standard taking into account the potential impacts on the receiving landscape and the need for development to be sustainable.
- **Developments which create risk – Strategic Policy 5**
"Developments that are inconsistent with the need to safeguard floodplains or minimising flood risk and developments that create a risk of unacceptable damage to health, property or the environment will be refused".
The proposed Proposed Improvement will be resilient to local effects of climate change, particularly future increases in flood events.
- **Transport - Strategic Policy 12**
"Transport Proposed Improvements that form part of the strategic and integrated transport network identified in the Key Diagram, extend the choice of travel modes, facilitate access for local people and show clear benefits as regards network safety and efficiency, will be approved, provided they do not lead to an unacceptable increase in the need to travel and that they do not significantly harm the environment or the amenities of local residents".
The Proposed Improvement will reduce traffic congestion at the Mochras Road/ A496 junction, improving the actual and perceived safety of travel for all travellers within Llanbedr. This will reduce the negative impact of traffic on the community in Llanbedr. The reduction in traffic levels, particularly HG's through the village will improve opportunities for pedestrians and cyclists within Llanbedr and along Mochras Road.

Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 – deposit plan (Isle of Anglesey County Council and Gwynedd Council, 2015)

2.7.86 The JLDP aims to guide sustainable development over a 15 year period (2011 – 2026) within the Anglesey and Gwynedd Local Planning Authority areas and will eventually replace the UDP. While the JLDP has not yet been formally adopted a deposit draft has been prepared and this has been considered as a material planning policy document within this ES. The JLDP is currently at the Independent Examination stage and is currently anticipated to be formally adopted in spring 2017.

2.7.87 As with the Gwynedd UDP, it is important that the Proposed Improvement considers the sustainable development objectives contained within the JLDP. Those considered to be of most relevance are:

SO3: *"Improve and maintain safe, efficient, high quality, modern and integrated transport networks to employment, services and education/ training facilities particularly by foot, bicycle and public transport, thus reducing where possible the number of journeys in private cars".*

The Proposed Improvement is expected to facilitate this by improving cyclist/pedestrian provision between Llanbedr village to Snowdonia Enterprise Zone at Llanbedr Airfield, through improving

safety by reducing congestion, particularly HGV's in the village centre and improving the footpath provision at Mochras Road.

SO16: *“Protect, enhance and manage the natural and heritage assets of the Plan area, including its natural resources, wildlife habitats, and its landscape character and historic environment”*.

The potential adverse environmental effects associated with the Proposed Improvement have been identified as part of the EIA process and either avoided via iterative design measures or minimised by proposed mitigation measures.

Summary

- 2.7.88 This chapter has established the national, regional and local policy and planning context for potential transport infrastructure improvements associated with the study area. Many of these documents highlight the importance of providing or improving transport infrastructure to encourage economic growth within Wales. The documents also underline the importance of promoting sustainable modes of travel in order to reduce the environmental impact of transport, increase the efficiency of existing transport infrastructure and improve the health of the Welsh nation.
- 2.7.89 This chapter also identifies the hierarchical nature of transport planning in Wales, and illustrates how national policies, such as the National Transport Plan, Wales Transport Strategy and the Walking and Cycling Action Plan for Wales link closely and influence the content of the Regional Transport Plans, which in turn have formed the basis for the emerging Local Transport Plans. The National and Local Transport Plans strongly feature references to Enterprise Zones and subsequent developments to transport infrastructure which are likely to be required to allow such areas to function effectively. Both the LTP and NTP refer to Enterprise Zones as an area of strategic importance and economic growth.

Chapter 3.0: Alternatives Considered

This chapter provides a brief summary of the alternatives that have been considered and the reasons for selecting the chosen option.

3.1 Identifying options

- 3.1.1 There have been plans in connection with a proposed bypass of Llanbedr and a protected route for this was established in 1953. In 1992 a public consultation event was held to discuss the protected route but for various reasons no further progress was made.
- 3.1.2 More recently, with the establishment of the Snowdonia Enterprise Zone (Snowdonia EZ) in 2012, the need for improved access links that part of the Enterprise Zone (EZ) located at Llanbedr airfield was recognised as vital to help retain and attract new businesses offering a more diverse range of employment opportunities.
- 3.1.3 This led to a broader consideration of access problems, in the local area resulting in the WelTAG Planning and Appraisal (Stage 1) study to investigate options for improving transport access associated with the proposed Llanbedr Aviation Centre and Enterprise Park element of the Snowdonia Enterprise Zone, completed by YGC in 2015. Following the identification of Problems, Opportunities and Constraints and the establishment of Transport Planning Objectives (TPO's) as part of the WelTAG study, potential solutions (alternative options) were defined that could be implemented to meet the study objectives. Potential solutions were identified by a combination of:
1. Consideration of public feedback from a participation event held in Llanbedr on 5th June 2014.
 2. A workshop between project team members which involved using the identified problems, opportunities and constraints to identify potential solutions and then checking that these would be in synergy with the TPO's.
- 3.1.4 Each solution was classified within one of the following three general approaches:
1. Local improvements in Llanbedr;
 2. Improvements to the wider highway transport network around Llanbedr, and;
 3. New solutions involving alternative transport modes to highways.
- 3.1.5 In addition, a Do Minimum/Nothing scenario was considered *i.e.* retaining the existing situation with associated maintenance completed as and when required.
- 3.1.6 Following the identification of initial solutions each was broadly appraised against the study objectives in order to aid their refinement and provide transparency in the decision-making process. Those solutions remaining after the initial screening were then sifted against the Wales Transport Strategy outcomes and for their likely degree of public acceptability, construction and operational feasibility and financial affordability. The initial solutions and the outcomes of the sifting exercise are summarised in Table 3.1.

Table 3.1: Summary of WelTAG Planning stage solutions before and after sifting

Initial Planning stage solutions	Options remaining after sifting
<ol style="list-style-type: none"> 1. Provide designated car parking facilities within Llanbedr and link with suitable pedestrian access. 2. Improve the A496/Mochras Road junction; this could require demolishing adjacent buildings and replacing the listed Pont Llanbedr. 3. Culvert the Afon Artro from the A496/Mochras Road junction west opposite the residential properties and realign Mochras Road northwards to improve access. 4. Remove the south-western corner parapet constraint from Pont Llanbedr to improve HGV access on to Mochras Road from the north. 5. Provide a cantilever structure from the A496/Mochras Road junction west over the Afon Artro to carry traffic along Mochras Road to/from the A496. 6. Provide traffic calming measures through Llanbedr village and along the A496 junction approach on Mochras Road <i>e.g.</i> double yellow lines, flashing speed restriction reminder signs, right of way islands and removal of overhanging roadside vegetation. 7. Provide a traffic light system in Llanbedr village centre to control traffic at the A496/Mochras Road junction. 8. Bypass Llanbedr to the west (between the A496 and railway line) with the section of Mochras Road between the new bypass and A496 remaining open to all traffic. 9. Bypass Llanbedr to the west (between the A496 and railway line) with the section of Mochras Road between the new bypass and A496 closed except for access and foot/cycle traffic. 10. Bypass Llanbedr to the west of the railway line. 11. Provide a one-way bypass to the west of Llanbedr for southbound or northbound traffic only (traffic travelling in the other direction would continue to use the A496 through Llanbedr). 12. Bypass Llanbedr to the east of the A496. 13. Provide a new link road to the north (west of Llanbedr) connecting Mochras Road and the A496. 14. Provide a new link road to the south (west of Llanbedr) connecting Mochras Road and the A496. 15. Improve Mochras Road to meet current standards between Llanbedr and Llanbedr Airfield. 16. Provide passing bays for HGV's along Mochras 	<ol style="list-style-type: none"> 1. Bypass Llanbedr to the west (between the A496 and railway line) with the section of Mochras Road between the new bypass and A496 remaining open to all traffic. 2. Bypass Llanbedr to the west (between the A496 and railway line) with the section of Mochras Road between the new bypass and A496 closed except for access and foot/cycle traffic. 3. Provide a new link road to the north (west of Llanbedr) connecting Mochras Road and the A496. 4. Provide a new link road to the south (west of Llanbedr) connecting Mochras Road and the A496. 5. Provide designated car parking facilities within Llanbedr and link with suitable pedestrian access (in combination with Solution 1, 2, 3, 4 or 5). 6. Provide traffic calming measures through Llanbedr village and along the A496 junction approach on Mochras Road <i>e.g.</i> double yellow lines, flashing speed restriction reminder signs, right of way islands and removal of overhanging roadside vegetation (in combination with Solution 1, 2, 3, 4 or 5). 7. Do Minimum/Nothing and retain the existing situation.

<p>Road between Llanbedr and Llanbedr Airfield.</p> <ol style="list-style-type: none"> 17. Develop the existing emergency access to Llanbedr Airfield from the south to accommodate HGV's. 18. Move the Mochras Road/A496 junction to the north. 19. Move the Mochras Road/A496 junction to the south. 20. Develop the Llanbedr railway halt into a rail transport hub with freight facilities, including rail access into Llanbedr airfield. 21. Provide a sea-based transport/freight hub where the surfaced section of Mochras Road terminates and becomes a tidal causeway. 22. Use Llanbedr Airfield as a hub for air freight transport. 23. Do Minimum/Nothing and retain the existing situation. 	
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3.1.7 Following a public participation event in Llanbedr on 2nd October 2014 the previously sifted options were further refined for appraisal based on the feedback received. Since the option to provide a bypass west of Llanbedr was ranked most popular, two additional possible bypass routes were also defined and appraised. The option involving bypassing Llanbedr and closing Mochras Road to through traffic was omitted following the feedback since it did not compare as favourably with an alternative option, which involved keeping Mochras Road open to through traffic. The options to provide improved car parking facilities and traffic calming measures in Llanbedr were proposed to be implemented in-combination with the other options as they would not satisfy many of the study objectives individually.

3.1.8 Following appraisal against the study objectives, the refined options that were appraised against the Welsh Impact Areas of economic, environmental and societal factors were:

- **Option 1:** Provide two new link roads connecting Mochras Road with the A496 north and south of Llanbedr.
- **Option 2:** Bypass Llanbedr to the west (between the A496 and the railway line) with the section of Mochras Road between the A496 junction and new bypass tie in remaining open to all traffic.
- **Option 3:** Bypass Llanbedr following the previous route announced in 1992.
- **Option 4:** Bypass Llanbedr from the A496 lay-by on the southern approach to Llanbedr then follow the route of the railway line and access track north to Mochras Road.
- **Option 5:** Improved car parking facilities and double yellow lines within Llanbedr (implemented in-combination with Options 1 – 4).
- **Option 6:** Do nothing and continue to maintain the current situation.

3.2 Selecting the preferred option

3.2.1 Table 3.2 summarises the conclusions of the WelTAG Appraisal (Stage 1) process, following which Option 2 was selected as the preferred option.

Table 3.2: Summary of WelTAG appraisal process

Option	Summary of conclusion
<p>Option 1: Provide two new link roads connecting Mochras Road with the A496 north and south of Llanbedr.</p>	<ul style="list-style-type: none"> • Would meet many of the TPO's e.g. improving access to Llanbedr airfield. • Would not completely address some of the TPO's e.g. reducing traffic congestion at the Mochras Road/A496 junction and reducing the negative impact of traffic on Llanbedr. • Maintaining the A496 through Llanbedr as the main route for traffic would allay concerns about a potential reduction in passing trade associated with a bypass option. • Would result in a negative net present value for money, meaning it is not cost effective compared to Options 2 to 4. • Large landscape and land use impact, especially as a result of an extensive cutting for the southern link road.
<p>Option 2: Bypass Llanbedr to the west (between the A496 and the railway line) with the section of Mochras Road between the A496 junction and new bypass tie in remaining open to all traffic.</p>	<ul style="list-style-type: none"> • Expected to provide the largest contribution to achieving the TPO's. • Provides continued local access along Mochras Road to and from Llanbedr. • Estimated to be the cheapest to construct. • Concerns raised by local business owners about the potential adverse effects of a bypass option. • Large landscape and land use impact.
<p>Option 3: Bypass Llanbedr following the previous route announced in 1992.</p>	<ul style="list-style-type: none"> • Least impact on surrounding land use and landscape. • Would not be possible to provide local access along Mochras Road east of the bypass without a high likelihood of residential properties being lost. • Large adverse impact on a Scheduled Ancient Monument and woodland protected by a Tree Preservation Order. • Estimated to be the most expensive to construct. • Concerns raised by local business owners about the potential adverse effects of a bypass option.
<p>Option 4: Bypass Llanbedr from the A496 lay-by on the southern approach to Llanbedr then follow the route of the railway line and access track north to Mochras Road.</p>	<ul style="list-style-type: none"> • Highest positive net present value and benefit: cost ratio. • High probability that properties close to the railway crossing would be lost, or severely affected. • Likely to require the most departures from highway standards (particularly through the southern section). • Would need to traverse an area of wet ground adjacent to the live Cambrian railway line. Close proximity to the railway line also presents significant construction feasibility and safety risks. • Concerns raised by local business owners about the potential adverse effects of a bypass option. • Large landscape and land use impact.
<p>Option 5: Improved car parking facilities and double yellow lines within Llanbedr (implemented in-combination with</p>	<ul style="list-style-type: none"> • Would not address most of the TPO's and would therefore not be implemented on its own. • In combination with Option 1, 2, 3 or 4 could

Options 1 – 4).	contribute to improving Llanbedr village centre by removing obstructions from on-street parking and providing improved car parking facilities.
Option 6: Do nothing and continue to maintain the current situation.	<ul style="list-style-type: none"> • Would not result in most of the TPO's being achieved, particularly improved access for Llanbedr airfield.

3.2.2 Option 2 was considered to be the optimal route that offers the largest contribution to achieving the study objectives while avoiding the disadvantages associated with Options 1, 3 and 4. Option 5 was also recommended to be considered in further detail, in combination with Option 2.

Design stage alternatives

3.2.3 The design process for this planning application has adopted the preferred route and then sought to arrive at the best design solution given the selected route.

3.2.4 In arriving at the proposed A496 Llanbedr Access Improvement the physical, social and economic context informed the design principles for the road improvement. Consultation comments have also influenced the design outcome

3.2.5 Consideration has been given during the design stage of the proposals to avoid or minimise significant adverse environmental impacts as part of an iterative design approach. Design measures that have been incorporated within the proposals to avoid or minimise significant adverse environmental effects include:

3.2.6 Issues raised during landowner consultations have been considered as the design has developed. The following changes have been made to the current design to address some of these:

- The design of the access at Plas y Bryn farm
- A drainage attenuation pond has been relocated from the western side of the works to the eastern side of the proposed alignment.

Proposed northern link from near Pensarn Station running parallel to the existing railway line.

3.2.7 This option was considered at an early stage but discounted for the following reasons:

- a. The need for a long, approximately 100 metre, minimum span bridge across the Afon Artro due to the skew angle of the road across the river. This distance is measured between the top of the flood protection embankments at an angle parallel to the railway embankment. Such a span is at the limit for the design of a single span structure and would require a relatively large /thick deck section which would be visually intrusive. The alternative would be a multi-span structure with piers located within the flood banks of the Afon Artro which would create problems in terms of restriction of flow, interference with flow patterns with the existing rail bridge, scour etc.
- b. The effect of constructing a new embankment across what are likely to be soft soils in close proximity to the railway embankment and the risk of that affecting the railway e.g. potential for heave. The depth of superficial soils and the likelihood that such soils will be very soft or soft increases with distance from the existing road so the potential for heave arising from construction of a new embankment is a major risk. The close proximity of the railway and possibility of this being affected by heave together with potential objections from Network Rail and the increased costs to manage this risk and construct an embankment over soft soils makes this alternative much less favourable when compared to other alternatives.
- c. The increased length of road/embankment construction needed i.e. approximately 0.90 km from just south of Pensarn to a point near Mochras Road versus 0.6 km for the preferred route from the A496

near the sewage treatment works to just east of the car park on Mochras Road resulting in an increase of approximately 50% in terms of land take, materials etc. make this alternative less sustainable when compared to the preferred route.

Roundabout to Mochras Road

- 3.2.8 The current design includes a central junction which will provide the turning for both northbound and southbound traffic from the new A496 towards the west i.e. to the airfield and the Shell Island campsite. A right hand turning lane will be provided at this junction, with a ghost island i.e. a separate lane created using road markings designed to allow through traffic to proceed unhindered. Llanbedr village centre can also be accessed from this central junction via Mochras Road which will pass under the new A496.
- 3.2.9 Consideration has been given to providing a roundabout at this location but is not justified due to the relatively low traffic levels and the environmental impact of a roundabout, particularly the requirement for additional land take and street lighting and the effect on bat flight paths and landscape impact.

Chapter 4.0: Environmental Impact Assessment Methods

This chapter summarises the screening and scoping that was completed in order to determine the assessment methods and topics to be included within the Environmental Impact Assessment. The types of surveys and predictive techniques used to inform the ES and the generic significance criteria are also explained. Note that topic-specific survey and assessment methods are explained in further detail in each relevant topic chapter, where applicable (see Chapter 5.0).

4.1 Screening and Scoping

- 4.1.1 Following consultation with the Snowdonia National Park Authority it was confirmed that the proposals fell under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (subsequently updated to Town and Country Planning Environmental Impact Assessment Wales Regulations 2016) as an infrastructure project listed in Schedule 2(10) *i.e.* a 'relevant project' due to its size (over 1ha) and location within a sensitive site (Snowdonia National Park).
- 4.1.2 Therefore, in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 the SNPA were formally requested to provide a screening opinion on the need for EIA for the Proposed Improvement as well as a scoping opinion for the content of an ES.
- 4.1.3 In their screening response (received on 7th July 2015), the SNPA confirmed that an EIA would be required and that this should include the topics which are listed in Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) Regulations, 1999, as amended.
- 4.1.4 Following the screening opinion and prior to commencing with the statutory Environmental Impact Assessment (EIA) an initial scoping exercise was completed to identify the key issues to be addressed by the EIA and to outline the methods that would be applied to establish and assess the significant environmental impacts associated with the proposals. Scoping is an iterative, ongoing exercise that can contribute to EIA as further information about the project design and receptors becomes available. At the outset scoping provides a useful opportunity to identify the key issues to be considered within the EIA and to allow other stakeholders to comment at an early stage on the EIA process for a project.
- 4.1.5 A Scoping Report to present and summarise the findings of the initial scoping study was prepared by YGC in accordance with the DMRB, Volume 11, Section 2, Part 4¹⁷ and Part 6¹⁸ guidance and submitted to the SNPA on 30th July 2015.
- 4.1.6 It was proposed that the assessment for each of the DMRB environmental topics considered within the EIA would be based on the guidance provided within the Design Manual for Roads and Bridges, Volume 11 unless specified otherwise. The following generic guidance has therefore been used to inform the approach taken with the EIA method, assessment of environmental effects (including assigning value, assessing magnitude of change/impact and assigning significance of effect) and reporting of the EIA process:

¹⁷ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 4, HA204/08: Scoping of Environmental Impact Assessments (Highways Agency, 2008).

¹⁸ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 6, HD48/08: Reporting of Environmental Impact Assessments (Highways Agency, 2008).

- DMRB, Volume 11, Section 1, Part 1: HA200/08 ‘Aims and Objectives of Environmental Impact Assessment’ (Highways Agency, 2009);
- DMRB, Volume 11, Section 2, Part 1: HA201/08 ‘General Principles and Guidance of Environmental Impact Assessment’ (Highways Agency, 2008);
- DMRB, Volume 11, Section 2, Part 2: HA202/08 ‘Environmental Impact Assessment’ (Highways Agency, 2008);
- DMRB, Volume 11, Section 2, Part 3: HD47/08 ‘Screening of Projects for Environmental Impact Assessment’ (Highways Agency, 2008);
- DMRB, Volume 11, Section 2, Part 4: HA204/08 ‘Scoping of Environmental Impact Assessments’ (Highways Agency, 2008);
- DMRB, Volume 11, Section 2, Part 5: HA205/08 ‘Assessment and Management of Environmental Impact Assessment’ (Highways Agency, 2008);
- DMRB, Volume 11, Section 2, Part 6: HD48/08 ‘Reporting of Environmental Impact Assessment’ (Highways Agency, 2008), and;
- Interim Advice Note 125/09(W): ‘Supplementary guidance for users of DMRB Volume 11 Environmental Assessment (Welsh Government, 2010).

4.1.7 The environmental design of the project has been completed in accordance with the DMRB, Volume 10 guidance, unless specified otherwise.

4.1.8 Topic-specific guidance provided within the DMRB, Volume 11, Section 3 has been used for the individual environmental topic assessments. Where alternative topic-specific guidance is available that is more current than the DMRB guidance and widely accepted as best practice this has also been used and explained in the relevant topic sections of Chapter 5.0.

4.1.9 In their Scoping Opinion the SNPA requested that the EIA includes the items listed in Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. Table 5.1 shows how the Schedule 4 topics correlate with the DMRB guidance that the EIA has been based on.

Table 5.1: Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2016 Schedule 4 requirements and correlation with DMRB, Volume 11 ES contents

Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2016, Schedule 4 requirement	Relevant DMRB Volume 11 ES chapter
Part 1	
A description of the physical characteristics of the whole development and the land-use requirements during the construction and operational phases	Chapter 2.0: The Project
A description of the main characteristics of the production processes, for instance, nature and quantity of the materials used.	Chapter 2.0: The Project Chapter 5.6: Materials
An estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed development.	<ul style="list-style-type: none"> • Water - Chapter 5.10: Road Drainage and the Water Environment • Air – Chapter 5.1: Air Quality • Soil – Chapter 5.5: Geology and Soils • Noise/Vibration – Chapter 5.7: Noise and Vibration • Light – Chapter 5.3: Landscape • Heat/radiation – Not considered applicable to the proposals since they are not associated with the generation of heat or radiation.

<p>An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for his choice, taking into account the environmental effects.</p>	<p>Chapter 3.0: Alternatives Considered</p>
<p>A description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.</p>	<ul style="list-style-type: none"> • Population – Chapter 5.9: Community and Private Assets, Chapter 5.8: Effects on All Travellers; • Fauna/flora – Chapter 5.4: Nature Conservation • Soil - Chapter 5.5: Geology and Soils; • Water - Chapter 5.10: Road Drainage and the Water Environment; • Air - Chapter 5.1: Air Quality; • Climatic factors - Chapter 5.1: Air Quality, Chapter 5.10: Road Drainage and the Water Environment; • Material assets - Chapter 5.9: Community and Private Assets; • Architectural/archaeological heritage – Chapter 5.2: Cultural Heritage; • Landscape – Chapter 5.3: Landscape; • Inter-relationship between the above factors – Chapter 6.0: Cumulative Effects
<p>A description of the likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development, resulting from: (a) the existence of the development; (b) the use of natural resources; (c) the emission of pollutants, the creation of nuisances and the elimination of waste; (d) and the description by the applicant of the forecasting methods used to assess the effects on the environment.</p>	<p>a) Chapters 5.1 – 5.10, Chapter 8.0: Conclusions b) Chapter 5.6: Materials c) Chapters 5.1, 5.6, 5.7 & 5.10 d) Chapter 4.0: Environmental Impact Assessment Methods</p>
<p>A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.</p>	<p>Mitigation measures sections of Chapters 5.1 – 5.10 Chapter 8.0: Conclusions</p>
<p>A non-technical summary of the information provided under paragraphs 1 to 5 of this Part.</p>	<p>Non-technical Summary (available as a bilingual, separate document)</p>
<p>An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the applicant in compiling the required information.</p>	<p>Limitations/assumptions sections of Chapters 5.1 – 5.10.</p>
<p>Additional Part 2 requirements not already addressed above</p>	
<p>A description of the development comprising information on the site, design and size of the development.</p>	<p>Chapter 1.0: Introduction Chapter 2.0: The Project</p>
<p>The data required to identify and assess the main effects which the development is likely to have on the environment.</p>	<p>Method sections of Chapters 5.1 – 5.10 Technical Reports</p>

Summary of Consultation

- 4.1.10 Consultation has previously occurred with the statutory environmental bodies throughout the WelTAG process. The SEB's involved in the consultation include:
- Cadw;
 - Natural Resources Wales (NRW), and;
 - Snowdonia National Park Authority (SNPA).
- 4.1.11 The feedback received contributed to informing the WelTAG appraisal process of the options described in Chapter 3.0 and the scope of assessments associated with the EIA process.
- 4.1.12 NRW and SNPA were invited to comment on the scope of the proposed ecological surveys for 2015 and 2016 and also on the information obtained from surveys completed previously during the WelTAG study in 2014. The feedback received has been used to inform the ecological surveys that have been completed and contributed to a clearer understanding of the baseline conditions.
- 4.1.13 Cadw and SNPA were invited to comment on the implication of the Proposed Improvement on the setting of the SAM standing stones to the northern edge of Llanbedr, along with a review of potential mitigation measures, both as part of the Proposed Improvement and in the form of off-site works.
- 4.1.14 Three Environmental Liaison Group (ELG) meetings consisting of representatives of the three SEB's listed above and project team members were established in November 2015, March 2016 and December 2016. Regular meetings were held with the ELG, which helped to inform a proactive, iterative design approach to addressing key concerns during the design process.

4.2 Surveys, predictive techniques, method and constraints

- 4.2.1 Based on the results of the scoping exercise and previous data it was decided to carry out field surveys for the following environmental assessment topics: Cultural Heritage; Landscape; Nature Conservation and Road Drainage and the Water Environment.
- 4.2.2 For the other topics it was considered that desk studies were the most appropriate method of obtaining and/or updating the available baseline information. These included: Air Quality; Geology and Soils; Materials; Noise and Vibration; Effects on All Travellers and Community and Private Assets.
- 4.2.3 The methods outlined in the DMRB, Volume 11, Section 3; Environmental Assessment Techniques (August 2008) were followed where relevant for each topic, unless where stated otherwise in the relative topic chapter (see Chapter 5.0). Since the method of evaluation and assessment for each topic varies, a description of each adopted method is provided within each relevant chapter. Any constraints or limitations to carrying out each assessment are also outlined within each relevant topic chapter (see Chapter 5.0).
- 4.2.4 Professional judgement has been used in the interpretation of the results obtained in relation to the potential impacts, mitigation and significance of any residual impacts. Where insufficient information is available relating to the circumstances of an impact, the approach has been to identify risks on the basis of the precautionary principle.

4.2.5 When considering the magnitude and extent of likely impacts and significant effects associated with the Proposed Improvement the following factors, from HA 204/08¹⁹, were considered where relevant:

- the characteristics of the project in terms of its size and activities, use of natural and man-made resources, production of waste, risk and consequence of pollution incidents, and risk of accidents;
- the importance of the receiving environment, *i.e.*, of international, national, regional, county or local importance, or sensitivity or value;
- the likely scale of the change following mitigation *e.g.*, the land area, number of people affected and degree of change from the existing situation;
- the duration of any potential significant effects, whether permanent or temporary, and positive or negative, as a result of direct, indirect, secondary, cumulative, short, medium and long term effects;
- the study area, particularly in considering the boundaries for cumulative effects, and also the spatial boundary of the valued receptor/resource with potential to be affected directly or indirectly;
- the time period within which significant effects may arise, and;
- consideration of past, present and reasonably foreseeable actions and trends that are having or will have a major influence on a valued receptor/resource.

4.3 Significance criteria

4.3.1 The level of significance that an impact generates can be difficult to judge objectively. In order to reach robust and objective conclusions regarding the significance of environmental effects associated with the Proposed Improvement the following criteria (see Tables 4.2 to 4.5), taken from HA 205/08²⁰ were therefore used to assist in assigning environmental value (or sensitivity), the magnitude of impacts and the level of significance of effects, unless where specified otherwise in Chapter 5.0.

4.3.2 Typical descriptors for assigning the value (or sensitivity) of environmental attributes are shown in Table 4.2. However, the value categories and typical descriptors can vary depending on individual topics and, if applicable, this is explained in the relevant topic chapters (see Chapter 5.0).

Table 4.2: Environmental Value (or Sensitivity) and Typical Descriptors

Value (sensitivity)	Typical descriptors
<i>Very High</i>	Very high importance and rarity, international scale and limited potential for substitution.
<i>High</i>	High importance and rarity, national scale, and limited potential for substitution.
<i>Medium</i>	High or medium importance and rarity, regional scale, limited potential for substitution.
<i>Low (or Lower)</i>	Low or medium importance and rarity, local scale.
<i>Negligible</i>	Very low importance and rarity, local scale.

¹⁹ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 4, HA 204/08: 'Scoping of Environmental Impact Assessments', Highways Agency, August 2008.

²⁰ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5, HA 205/08: 'Assessment and Management of Environmental Effects', Highways Agency, August 2008.

4.3.3 The typical descriptors and criteria for defining the magnitude of an impact (degree of change from the baseline) are shown in Table 4.3.

Table 4.3: Magnitude of Impact and Typical Descriptors

Magnitude of impact	Typical criteria descriptors
<i>Major</i>	<i>Adverse:</i> Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	<i>Beneficial:</i> Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
<i>Moderate</i>	<i>Adverse:</i> Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	<i>Beneficial:</i> Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
<i>Minor</i>	<i>Adverse:</i> Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	<i>Beneficial:</i> Minor benefit to, or addition of, one (maybe more) key characteristics, some beneficial impact on attribute or a reduced risk of negative impact occurring.
<i>Negligible</i>	<i>Adverse:</i> Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	<i>Beneficial:</i> Very minor benefit to or positive addition of one or more characteristics, features or elements.
<i>No change</i>	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

4.3.4 The five significance categories used within this ES (unless where specified otherwise) and their descriptors are summarised in Table 4.4.

Table 4.4: Descriptors of the Significance of Effect categories

Significance category	Typical descriptors of effect
<i>Very large</i>	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
<i>Large</i>	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
<i>Moderate</i>	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor.
<i>Negligible</i>	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
<i>Neutral</i>	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

4.3.5 The significance of an effect (adverse or beneficial) is assigned by combining the value (or sensitivity) of an environmental attribute with the magnitude of impact (degree of change) affecting it as a result of a project. The potential outcomes of significance, assigned before and after the consideration of design and mitigation measures, are shown in Table 4.5.

Table 4.5: Arriving at the Significance of Effect categories

		Magnitude of Impact (Degree of Change)				
		<i>No Change</i>	<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Environmental Value (Sensitivity)	<i>Very High</i>	Neutral	Slight	Moderate or large	Large or very large	Very large
	<i>High</i>	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	<i>Medium</i>	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	<i>Low</i>	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	<i>Negligible</i>	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

4.4 Mitigation and Enhancement

4.4.1 Proposed mitigation and enhancement measures are detailed within each topic chapter where relevant (see Chapter 5.0). The mitigation measures taken into account when assigning significance of effect are those considered to be essential measures that have been agreed. Where uncertainty exists as to whether mitigation measures could be delivered this is made clear in the relevant topic chapters and such desirable measures are not considered in the assignment of significance.

4.4.2 Proposals for monitoring and managing essential mitigation measures are specified in the relevant topic chapters.

4.4.3 In accordance with HA 205/08²¹ the significance of the likely environmental effects for the construction and operation phases is assigned both before and after the consideration of the effectiveness of the design and committed mitigation measures. This allows for the case or reason for, and the effectiveness of, mitigation to be described.

4.4.4 A summary of all proposed mitigation measures is provided within Chapter 8.

²¹ The Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5: HA 205/08, August 2008.

Chapter 5.0: Environmental Impact Assessment

Chapter 5.1 Air Quality

The Air Quality Assessment (Arcadis 2017) can be found in Volume 2, Technical Appendix E which provides the full model data.

Introduction

- 5.1.1 This chapter has been produced to consider the air quality implications of the Proposed Improvement. Due to the nature of the Proposed Improvement, there is the potential for air quality to affect local sensitive receptors during the construction and operational phases. These may include fugitive dust emissions associated with construction works and road traffic exhaust emissions from vehicles using the Proposed Improvement during operation.
- 5.1.2 An air quality assessment was therefore required in order to determine baseline conditions and consider potential impacts as a result of the development.

Methodology

- 5.1.3 The Proposed Improvement has the potential to cause air quality impacts during the construction and operational phases. These have been assessed in accordance with the approach outlined below and subsequent methodology:
- Consideration of best practice / guidance;
 - Professional judgement;
 - Consideration of the baseline information obtained, the proposed development details and issues raised through consultation with interested parties;
 - Prediction of potential effects based on baseline information and the proposed development details;
 - Identification of effects which, in particular, could be considered to be potentially significant in terms of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2016 (as amended) (hereinafter referred to as “the EIA Regulations”);
 - Quantification of potential effects;
 - Identification of appropriate mitigation measures; and
 - Prediction of residual effects based on baseline information, the proposed improvement details and mitigation measures.

Obtaining Baseline Information

- 5.1.4 A desk study was undertaken to obtain information relating to baseline air quality conditions in the vicinity of the proposed improvement. Desk study information has been sourced from the following documents:
- Gwynedd Council Air Quality Updating and Screening Assessment 2009;
 - Gwynedd Council Air Quality Progress Report 2011;
 - Department for Environment, Food and Rural Affairs (Defra) LAQM UK AIR website (<http://uk-air.defra.gov.uk>); and
 - MAGIC website (<http://magic.defra.gov.uk/website/magic>).
- 5.1.5 A review of Ordnance Survey mapping and aerial photography available via Google Earth was also undertaken in order to identify sensitive receptor locations around the Scheme.

Construction Phase Assessment

- 5.1.6 There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the Institute of Air Quality Management's (IAQM) '*Guidance on the Assessment of Dust from Demolition and Construction*'²².
- 5.1.7 Activities on the proposed construction site have been divided into four types to reflect their different potential impacts. These are:
- Demolition;
 - Earthworks;
 - Construction; and
 - Trackout of mud and debris onto the highway.
- 5.1.8 The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:
- Annoyance due to dust soiling;
 - Harm to ecological receptors; and
 - The risk of health effects due to a significant increase in exposure to PM₁₀.
- 5.1.9 The assessment steps are detailed below.

Step 1

- 5.1.10 Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 350m of the boundary or 50m from the construction vehicle route (up to 500m from the construction site entrance for large sites, 200m from medium sites and 50m from small sites), then the assessment proceeds to Step 2. Additionally, should ecological receptors be identified within 50m of the Scheme or 50m from the construction vehicle route (up to 500m from the construction site entrance for large sites, 200m from medium sites and 50m from small sites), then the assessment also proceeds to Step 2.
- 5.1.11 Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Step 2

- 5.1.12 Step 2 assesses the risk of potential dust impacts. A project is allocated a risk category based on two factors:
- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and
 - The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).
- 5.1.13 The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.
- 5.1.14 Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 5-1-1.

²² Institute of Air Quality Management (2016), *Guidance on the Assessment of Dust from Demolition and Construction* version 1.1

Table 5-1-1 – Construction Dust - Magnitude of Emission²²

Magnitude	Activity	Criteria
Large	Demolition	Total building volume greater than 50,000m ³ Potentially dusty construction material (e.g. concrete) On-site crushing and screening Demolition activities greater than 20m above ground level
	Earthworks	Total site area greater than 10,000m ² Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) More than 10 heavy earth moving vehicles active at any one time Formation of bunds greater than 8m in height More than 100,000 tonnes of material moved
	Construction	Total building volume greater than 100,000m ³ On site concrete batching Sandblasting
	Trackout	More than 50 Heavy Duty Vehicle (HDV) trips per day Potentially dusty surface material (e.g. high clay content) Unpaved road length greater than 100m
Medium	Demolition	Total building volume 20,000m ³ to 50,000m ³ Potentially dusty construction material Demolition activities 10m to 20m above ground level
	Earthworks	Total site area 2,500m ² to 10,000m ² Moderately dusty soil type (e.g. silt) 5 to 10 heavy earth moving vehicles active at any one time Formation of bunds 4m to 8m in height Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	Total building volume 25,000m ³ to 100,000m ³ Potentially dusty construction material (e.g. concrete) On site concrete batching
	Trackout	10 to 50 HDV trips per day Moderately dusty surface material (e.g. high clay content) Unpaved road length 50m to 100m

Magnitude	Activity	Criteria
Small	Demolition	Total building volume under 20,000m ³ Construction material with low potential for dust release (e.g. metal cladding or timber) Demolition activities less than 10m above ground level. Demolition activities during wetter months
	Earthworks	Total site area less than 2,500m ² Soil type with large grain size (e.g. sand) Less than 5 heavy earth moving vehicles active at any one time Formation of bunds less than 4m in height Total material moved less than 20,000 tonnes Earthworks during wetter months
	Construction	Total building volume less than 25,000m ³ Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	Less than 10 HDV trips per day Surface material with low potential for dust release Unpaved road length less than 50m

5.1.15 Step 2B defines the sensitivity of the area around the development to potential dust impacts. The influencing factors are shown in Table 5-1-2.

Table 5-1-2 – Construction Dust - Examples of Factors Defining Sensitivity of an Area²²

Receptor Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	Users expect of high levels of amenity High aesthetic or value property People expected to be present continuously for extended periods of time Locations where members of the public are exposed over a time period relevant to the objective for PM ₁₀ . e.g. residential properties, hospitals, schools and residential care homes	Internationally or nationally designated site e.g. Special Area of Conservation
Medium	Users would expect to enjoy a reasonable level of amenity Aesthetics or value of their property could be diminished by soiling People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks	Nationally designated site e.g. Sites of Special Scientific Interest

Receptor Sensitivity	Examples	
	Human Receptors	Ecological Receptors
	and places of work	
Low	<p>Enjoyment of amenity would not reasonably be expected</p> <p>Property would not be expected to be diminished in appearance</p> <p>Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads</p>	Locally designated site e.g. Local Nature Reserve

5.1.16 Guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts:

- Any history of dust-generating activities in the area;
- The likelihood of concurrent dust-generating activity on nearby sites;
- Any pre-existing screening between the source and receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

5.1.17 These factors have been considered during the undertaking of the assessment.

5.1.18 The criteria for determining the sensitivity of the area to dust soiling effects on people and property is summarised in Table 5-1-3.

Table 5-1-3– Construction Dust - Sensitivity of the Area to Dust Soiling Effects on People and Property²²

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Note – only the highest level of sensitivity needs to be considered

5.1.19 Table 5-1-4 outlines the criteria for determining the sensitivity of the area to human health impacts.

Table 5-1-4– criteria for determining the sensitivity of the area to human health impacts.

Receptor Sensitivity	Annual Mean PM ₁₀ Conc.	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m ³	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m ³	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m ³	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	Less than 24µg/m ³	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	Greater than 32µg/m ³	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32µg/m ³	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m ³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m ³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	1 or more	Low	Low	Low	Low	Low

Note – only the highest level of sensitivity needs to be considered

5.1.20 Table 5-1- 5 outlines the criteria for determining the sensitivity of the area to ecological impacts.

Table 5-1-5– Construction Dust - Sensitivity of the Area to Ecological Impacts²²

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

5.1.21 Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts.

5.1.22 Table 5-1- 6 outlines the risk category from demolition activities.

Table 5-1-6 – Construction Dust - Dust Risk Category from Demolition Activities²²

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

5.1.23 Table 5-1-7 outlines the risk category from earthworks and construction activities.

Table 5-1-7– Construction Dust - Dust Risk Category from Earthworks and Construction Activities²²

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

5.1.24 Table 5-1-8 outlines the risk category from trackout activities.

Table 5-1-8 – Construction Dust - Dust Risk Category from Trackout Activities²²

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Step 3

5.1.25 Step 3 requires the identification of site-specific mitigation measures within the guidance to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with negligible risk, mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

Step 4

5.1.26 Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be not significant. This has been described as negligible within this report to provide continuity between assessment terminologies.

Operational Phase Assessment

Road Traffic Vehicle Exhaust Emissions

5.1.27 The study area in relation to the Proposed Improvement is defined by the changes in traffic flows on the local road network. For the purposes of the air quality assessment, the operational impacts have been confined to the impacts at worse case sensitive receptors, which are likely to experience the highest pollutant concentrations and changes as a result of the changes in traffic flows predicted by the traffic model for each option. The criteria defined in Paragraph 3.12 to 3.16 of the Design Manual for Roads and Bridges (DMRB) HA207/07²³ have been used to identify the affected road network and is presented below;

- Road alignment will change by 5 metres or more; or
- Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speeds will change by 10 kilometre/hour or more; or
- Peak hour speed will change by 20 kilometre/hour or more.

5.1.28 If a road link meets any of the criteria above, it is defined as an 'affected road'. The affected road network (ARN) is a composite network of all the affected road links.

5.1.29 Following analysis of the traffic data, it was determined that an assessment was required as the criteria outlined above were exceeded.

5.1.30 Potential impacts have been defined by predicting pollutant concentrations at sensitive locations for the following scenarios:

- Base year (2015);
- Opening year Do-Minimum (2020) (predicted traffic flows in the anticipated year opening should the project not proceed); and
- Opening year Do-Something (2020) (predicted traffic flows in the anticipated year of opening should the project be completed).

²³ Highways Agency (2007) HA207/07 Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1.

- 5.1.31 Receptors that are potentially sensitive to changes in air quality are defined in DMRB HA207/07²³³ as housing, schools, hospitals and designated species or habitats within a designated ecological site, located within 200m of the ARN (as defined above). It should be noted that the air quality assessment methodology in accordance with DMRB does not assign a value or sensitivity to a receptor. It should also be noted that due to the small road network provided, all roads within the traffic model were considered in the air quality modelling for the purpose of this assessment. The traffic data used for the assessment are presented in Volume 2 Air Quality Assessment, Appendix A – Figure A.1 – Total Road Network included in the Traffic Data, and Table A.1 – Road Descriptions.
- 5.1.32 The exposure to NO₂ and PM₁₀ for existing worst-case sensitive receptors, identified using the criteria outlined above, has been modelled using the Atmospheric Dispersion Modelling System (ADMS) Roads. The model uses detailed information regarding traffic flows on the local road network together with meteorological data to predict pollutant concentrations at specific locations selected by the user. A detailed description of the road traffic air quality modelling undertaken is outlined in Volume 2 Air Quality Assessment, Appendix A – Table A.2 – Traffic Data.
- 5.1.33 In accordance with the criteria, a total of 14 sensitive receptors (residential properties) were selected at sites located within 200 metres of the Proposed Improvement’s associated road network to represent worst-case locations, along with one ecological receptor.
- 5.1.34 The locations of the sensitive receptors (residential properties) are detailed in Table 5-1-9

Table 5-1-9 - Sensitive Receptor Locations

Receptor ID	Receptor Description	National Grid Reference (NGR)	
		X	Y
R1	Residential –A496 North of Llanbedr	258370	327213
R2	Residential – A496 Sarn Hir	258469	326917
R3	Residential – A496 Pont	258529	326839
R4	Residential – Ffordd Pentre Gwynfryn	258607	326904
R5	Residential – A496 Tegfryn	258533	326792
R6	Residential – Ffordd Mochras	258523	326794
R7	Residential – A496 Tegfryn	258536	326768
R8	Residential – A496 Tegfryn	258497	326713
R9	Residential – A496 Tegfryn	258519	326723
R10	Residential – A496 South of Llanbedr	258473	326522
R11	Residential – A496 South of Llanbedr	258311	326397
R12	Residential – Plas y Bryn	258127	326608
R13	Residential – Ffordd Mochras	258213	326854
R14	Residential – Ffordd Mochras	257979	326772

- 5.1.35 A designated ecological site (Coedydd Derw a Safleoedd Ystumod Meirion / Meirionnydd Oakwoods and Bat Sites, a designated Special Area of Conservation (SAC)), was identified within 200m of the ARN. Ecological receptor locations have been modelled as a transect up to 200m perpendicular to the A496 within the SAC.

- 5.1.36 As per guidance provided in Annex 3 of the LAQM.TG (16) document³⁰, modelled pollutant concentrations have been verified against the local authority air quality monitoring results. The verification process is outlined in Appendix A – Model Input.
- 5.1.37 Modelled road-traffic oxides of nitrogen (NO_x) have been converted to NO₂ using Version 5.1 of the NO_x to NO₂ calculator²⁴. The calculator takes into account the difference between vehicular and background NO_x, the concentration of ozone (O₃) (to oxidise Nitrogen Oxide (NO) to NO₂), and the different proportions of primary (directly emitted) NO₂ in different years.

Long Term Trend Analysis

- 5.1.38 A report produced on behalf of Defra²⁵, considered NO₂ monitoring data from across the UK and suggests that reductions in concentrations have slowed in recent years; therefore, it is now agreed among many air quality professionals that future predictions of NO₂ concentrations may be underestimated. Defra updated the air quality tools in 2016 (including the new emission factor toolkit, background maps and NO_x / NO₂ converter) which aimed to close this “gap” between forecast and monitored NO₂ trends. However, it is considered that future NO₂ levels based on these updated tools are still likely to be underestimated. Therefore, a long-term trend (LTT) gap analysis has been carried out for NO₂, in accordance with ‘Interim Advice Note (IAN) 170/12v3 Updated air quality advice on the assessment of future NO_x and NO₂ projections for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality’²⁶
- 5.1.39 This LTT NO₂ gap analysis has been based on adjustment of 2020 NO₂ modelled concentrations for both the Do-Minimum and Do-Something scenarios using 2015 modelled baseline NO₂ concentrations and an alternative projection factor (based on a projected Base Year, which is the Base Year traffic data with opening year emissions and backgrounds) as outlined in IAN 170/12v3²⁶. Highways England (HE) has provided a gap analysis tool to assist with the calculation which has been used in the assessment²⁷.

Significance

- 5.1.40 To determine whether a road scheme gives rise to significant air quality impact, the advice in IAN 174/13²⁸ has been considered. The advice provides a means of evaluating the significance of local air quality effects in line with the requirement of the Environmental Impact Assessment (EIA) Directive.
- 5.1.41 The results from the air quality modelling at receptors are used to inform the overall significance of the scheme; the larger the change in concentrations, the more certainty there is that there will be an impact as a result of the scheme. Only receptors which exceed the AQS objective (annual mean of 40µg/m³ for NO₂) in either the Do-Minimum or Do-Something scenarios are used to inform significance. Where the differences in concentrations are less than 1% of the air quality threshold (e.g. less than 0.4µg/m³ for annual average NO₂), then the change at these receptors is considered to be imperceptible, and they are scoped out of the judgement on significance.
- 5.1.42 It must be noted that to determine the significance of a scheme, all receptors which exceed the AQS objective should be modelled. However, this assessment has only considered a selection of worst-case receptors, and the updated DMRB air quality model has been used to predict concentrations. This assessment has therefore provided an indication of whether any of the

²⁴ Defra (2016) NO_x to NO₂ Calculator Version 5.1, <http://laqm.defra.gov.uk/>

²⁵ Defra (2011) Trends in NO_x and NO₂ emissions and ambient measurements in the UK

²⁶ Highways Agency (2013) IAN 170/12v3 Updated air quality advice on the assessment of future NO_x and NO₂ projections for users of DMRB Volume 11, Section 3, Part 1, Air Quality

²⁷ Highways England (2012), Highways Agency Long Term Gap Analysis Calculator (IAN 170/12 HA LTCalc)

²⁸ Highways Agency (2013) IAN 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07)

options could lead to a significant impact based on the advice in IAN 174/13²⁸. The guidelines to inform the judgement in significance are presented in Table 5-1-10.

Table 5-1-10- Guidelines to Inform Significance²⁸

Magnitude of Change in Annual Average NO ₂ or PM ₁₀ (µg/m ³)	Total Number of Receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

- 5.1.43 Where the number of receptors fall below the guideline bands to inform significance, the Proposed Improvement is deemed not to have a significant impact e.g. 20 small worsenings would not be classed as significant. If the number of receptors affected is greater than the upper guideline bands (60 for small, 30 for medium and 10 for large), then the Proposed Improvement would be considered to have a significant impact on air quality. Projects which affect receptors within the guideline bands require justification to determine whether the Proposed Improvement is significant.
- 5.1.44 It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts during operation. There are no similar significance criteria for the assessment of construction impacts.
- 5.1.45 For ecological receptors, IAN 174/13²⁸ and the DMRB guidance are used to determine whether the Project is likely to have a significant impact. DMRB HA 207/07²³. Annex F outlines the approach for the air quality assessment of ecologically designated site.
- 5.1.46 Table 5-1-10 details the magnitude categories that should be applied to changes in annual average NO₂. These categories should also be used to describe the magnitude of change in annual average NO_x at designated sites (i.e. a large increase in NO_x would be >4 µg/m³, a medium increase would be >2 to 4 µg/m³ etc.).
- 5.1.47 Section 2.6 of IAN 174/13²⁸ states that, where NO_x concentrations are found to below 30 µg/m³ (the AQS objective for the protection of ecosystems and vegetation), significant effects are not anticipated. If the objective of 30 µg/m³ is exceeded in any of the opening year modelled scenarios, significant effects may occur, and further consideration should be given to the magnitude of change. The exception to this is where changes are less than or equal to 0.4 µg/m³ (in NO_x). In such circumstances, the effects are considered to be imperceptible and unlikely to be significant. Where changes are greater than 0.4 µg/m³, the information, along with changes in nutrient nitrogen deposition, should be provided to the scheme ecologist to determine the significance of effects based on their professional judgement.

Regional Air Quality Assessment

- 5.1.48 The regional assessment is a requirement of DMRB and is undertaken to determine the change in emissions as a result of the Proposed Improvement. The assessment of the contribution of the Proposed Improvement to regional air quality is based on the total annual emission of pollutants over the road network. The pollutants considered are:
- NO_x;

- PM₁₀; and
- Carbon Dioxide (CO₂).

5.1.49 The regional impacts have been calculated using all the links built into the air quality model for the Base Year, Do Minimum and Do Something scenarios.

5.1.50 The Emissions Factor Toolkit (EFT) (v6.0.2) has been used in the regional assessment calculations and uses the traffic characteristics (flows, average vehicle speeds and percentage HDVs for each period) and road length for each affected road in the study area. Total annual emissions for the Base Year, Do Minimum and Do Something scenarios have been calculated.

Baseline Information

Regional/Policy Framework

5.1.51 This assessment has been undertaken in accordance with the following current legislation, national, regional and local plans and policies.

UK Legislation

5.1.52 Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was published in July 2007²⁹. The AQS sets out objectives that are maximum ambient pollutant concentrations not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale.

5.1.53 The regulations referred to in the AQS have been supplemented by the Air Quality Regulations (2010), which came into force on 11th June 2010 and transpose the European Union (EU) Air Quality Directive (2008/50/EC) into UK law. Air Quality Limit Values (AQLVs) were published in these regulations for seven pollutants, in addition to Target Values for an additional five pollutants. These are generally in line with the AQS objectives, although the requirements for the determination of compliance vary. Table 5-1-11 presents the AQS objectives for pollutants considered within this assessment.

Table 5-1-11 – AQS Objectives

Pollutant	Air Quality Strategy Objective	
	Concentration (µg/m ³)	Averaging Period
Nitrogen Dioxide (NO ₂)	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
Particulate matter less than 10 microns in diameter (PM ₁₀)	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year

²⁹ Defra (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

5.1.54 Table 5-1-12 summarises the advice provided in Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16))³⁰ on where the AQS objectives for pollutants considered within this report apply.

Table 5-1-12 – Examples of Where the AQS Objectives Apply

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
Annual Mean	<p>All locations where members of the public might be regularly exposed</p> <p>Building façades of residential properties, schools, hospitals, care homes etc.</p>	<p>Building façades of offices or other places of work where members of the public do not have regular access</p> <p>Hotels, unless people live there as their permanent residence</p> <p>Gardens of residential properties</p> <p>Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term</p>
24-hour Mean	<p>All locations where the annual mean objective would apply, together with hotels and gardens of residential properties</p>	<p>Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term</p>
1-hour Mean	<p>All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets)</p> <p>Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where reasonably be expected to spend one hour or more</p> <p>Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer</p>	<p>Kerbside sites where the public would not be expected to have regular access</p>

5.1.55 It is a requirement of the Environment Act (1995) that Local Authorities (LAs) review current and future air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). Any areas of relevant exposure where the AQS objectives are not, or unlikely to be, achieved should be identified.

5.1.56 Where it is anticipated that an AQS objective will not be met, it is a requirement that an Air Quality Management Area (AQMA) be declared. Where an AQMA is declared, the LA is obliged to produce an Action Plan in pursuit of the achievement of the AQS objectives.

³⁰ Defra (2016), Local Air Quality Management Technical Guidance (TG16)

Dust

5.1.57 The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2010), such as construction sites, is that provided in Section 79 of Part III of the Environmental Protection Act (1990)³¹. The Act defines nuisance as:

"any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance."

5.1.58 Enforcement of the Act, in regard to nuisance, is currently under the jurisdiction of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). Enforcement can insist that there be no dust beyond the boundary of the works. The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practice measures.

Planning Policy Wales

5.1.59 Planning Policy Wales 8th Edition (2016)³² sets out the Welsh Government's core policies and principles with respect to land use planning, including air quality and odour. Chapter 13 - Minimising and Managing Environmental Risks and Pollution states that:

"The potential for pollution affecting the use of land will be a material consideration in deciding whether to grant planning permission. Material considerations in determining applications for potentially polluting development are likely to include:

- *Location, taking into account such considerations as the reasons for selecting the chosen site itself;*
- *Impact on health and amenity;*
- *The risk and impact of potential pollution from the development insofar as this might have an effect on the use of other land and the surrounding environment (the environmental regulatory regime may well have an interest in these issues, particularly if the development would impact on an Air Quality Management Area or a Special Area of Conservation (SAC));*
- *Prevention of nuisance;*
- *Impact on the road and other transport networks; and*
- *The need, where relevant, and feasibility of restoring the land (and water resources) to standards sufficient for an appropriate after use. (Powers under the Pollution Prevention and Control Act 1999 require an operator to return a site to a satisfactory state on surrender of an Integrated Pollution Prevention and Control Permit)."*

5.1.60 The implications of Chapter 13 of the Planning Policy Wales have been considered throughout this assessment.

Local Planning Policy

Snowdonia National Park Authority

5.1.61 The Snowdonia National Park Authority (SNPA) is the Local Planning Authority for the National Park area, which encompasses Llanbedr. As such, SNPA has a statutory obligation to prepare a

³¹ Environmental Protection Act (1990) Part III, Statutory Nuisances and Clean Air

³² Welsh Government (2016), Planning Policy Wales 8th Edition

Development Plan and determine planning applications under the provisions of the Town and Country Planning Act 2004.

- 5.1.62 SNPA adopted the Eryri Local Development Plan³³ in July 2011. The Eryri Local Development Plan guides decisions on planning applications on all future development and land use planning within the National Park. Review of the Eryri Local Development Plan has identified the following policy relevant to air quality and this assessment:

“Development Policy 1: General Development Principles (1)

To conserve and enhance the ‘Special Qualities and purposes of the National Park development will only be permitted where all the following apply:

[...]

Development Policy 6: Sustainable Design and Materials.

[...]

xi. The development will not have an unacceptable adverse impact, through increased resource use, discharges or emissions, on public health, surface and ground water (quality, quantity or ecology), air quality, soil and the best and most versatile agricultural land.

xii. The development is compatible with, and does not cause significant harm, to the environment, neighbouring residential amenity or the amenity of the Park by way of noise, dust, vibration, odour, light pollution, hazardous materials or waste productions

[...]”

- 5.1.63 The implications of this policy have been considered throughout the assessment.

Baseline

- 5.1.64 The following section outlines the baseline information obtained through desk studies and consultation.

Local Air Quality Management

- 5.1.65 As required by the Environment Act (1995), GC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has concluded that all pollutants considered within the AQS are below the relevant AQS objectives within the area and such no AQMAs have been declared to date.

Air Quality Monitoring

- 5.1.66 Monitoring of pollutant concentrations is undertaken by GC using NO₂ diffusion tubes. Consultation with GC has indicated that the closest NO₂ monitoring site was located on Pont Llanbedr (A496) near Llanbedr Bridge in the centre of the village (NGR: 258532, 326803) approximately 350m east of the Proposed Improvement, as displayed in Figure 5.1.13. However, monitoring at this location ceased in 2011 due to historic low readings. The data capture for 2010 was insufficient to report due to theft / vandalism, however results available from Welsh Air³⁴ for 2009 measured an annual average NO₂ concentration of 8.5 µg/m³, well below the AQS objective. The closest current diffusion tube location is approximately 15km north-east of the Proposed

³³ Snowdonia National Park Authority (2011), Eryri Local Development Plan 2007 – 2022 Adopted Version

³⁴ Welsh Air Website (2016), <http://www.welshairquality.co.uk/>

Improvement. Due to the distance between the sites, pollutant concentrations are unlikely to be similar and this source of data has not been considered further.

Background Pollutant Concentrations

5.1.67 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by Defra for the entire of the UK to assist LAs in their Review and Assessment of air quality. The location of the Proposed Improvement covers three grid squares (NGR: (258500, 326500), (257500, 326500) and (258500, 327500)). Data for these locations were downloaded from the Defra website³⁵ for the purpose of this assessment and the average of the three grid squares is summarised in Table 5-1-13.

Table 5-1-13 - Background Pollutant Concentration Predictions

Pollutant	Average Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)	
	2015	2020
NO ₂	4.3	3.5
NO _x	5.6	4.5
PM ₁₀	10.0	9.6

5.1.68 As indicated in Table 5-1-13, background concentrations in the vicinity of the Proposed Improvement are predicted to be below the relevant AQS objectives.

Baseline Modelled Pollutant Concentrations

5.1.69 Table 5-1-14 details the annual mean NO₂ and PM₁₀ concentrations at each receptor, predicted by the ADMS-roads air quality model for the Baseline scenario (2015).

Table 5-1-14 - Modelled Pollutant Concentrations for Baseline

Receptor	Modelled Annual Mean Pollutant Concentration for Baseline Scenario (2015)	
	NO ₂ ($\mu\text{g}/\text{m}^3$)	PM ₁₀ ($\mu\text{g}/\text{m}^3$)
R1	6.6	10.1
R2	9.4	10.9
R3	9.8	10.8
R4	5.6	10.4
R5	9.9	10.9
R6	8.5	10.7
R7	7.8	10.8
R8	7.8	10.6
R9	9.3	10.8
R10	6.5	10.5

³⁵ Defra (2016) 2013-based Background Maps, <http://laqm.defra.gov.uk/>

Receptor	Modelled Annual Mean Pollutant Concentration for Baseline Scenario (2015)	
	NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)
R11	6.9	10.5
R12	4.8	10.3
R13	5.1	10.3
R14	4.6	10.0

5.1.70 As indicated in Table 5-1-14, predicted annual NO₂ and PM₁₀ concentrations are well below the AQS objectives at all receptor locations.

Magnitude of Impacts and Significance of Effects

Construction Phase Assessment

Step 1

- 5.1.71 The undertaking of activities such as demolition, excavation, ground works, cutting, construction and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from highway surfaces.
- 5.1.72 It is worth noting that at this stage the exact location, dimensions and total area which will be used for construction site compounds has not been agreed at the time of this assessment. As such the need for construction site compounds has not been assessed for impacts on air quality. It should be noted that the appointed works contractor would need to seek and gain planning permission for the siting of construction compounds, which would encompass further environmental assessment and consultation with statutory consultees.
- 5.1.73 The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.
- 5.1.74 The desk-study undertaken to inform the baseline has identified a number of sensitive receptors within 350m of the application boundary. As such, a detailed assessment of potential dust impacts was required.
- 5.1.75 There are three ecological receptors sensitive to dust within 50m of the site or trackout boundary;
- Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites – a designated SAC,
 - Morfa Dyffryn – a designated Site of Special Scientific Interest (SSSI), and
 - Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau – a designated SAC.

As such, ecological impacts have been assessed further.

Step 2A

Demolition

5.1.76 Demolition activities will include the removal of a builder's yard. The total volume to be demolished is predicted to be less than 20,000m³ and demolition activities are scheduled to occur less than 10m above ground. As such, in accordance with the criteria outlined in

5.1.77

5.1.78 Table 5-1-1, the magnitude of potential dust emissions from demolition is classified as **small**.

Earthworks

5.1.79 Earthworks will include cut and fill operations. Whilst the soil type is currently unknown at this stage, the total area covered by the Proposed Improvement is estimated to be greater than 10,000m². As such, in accordance with the criteria outlined in

5.1.80

5.1.81 Table 5-1-1, the magnitude of potential dust emissions from earthworks is classified as **large**.

Construction

5.1.82 The total volume of construction is predicted to be between 25,000 – 100,000m³ with the use of potentially dusty construction materials. It is considered unlikely that on site concrete batching will be required. As such, in accordance with the criteria outlined in Table 5-1-1, the magnitude of potential dust emissions from construction is classified as **medium**.

Trackout

5.1.83 There is currently no information available on the number of HDV movements per day, however, unpaved haul road lengths are likely to be greater than 100m in length. As such, in accordance with the criteria outlined in

5.1.84

5.1.85 Table 5-1-15, the magnitude of potential dust emissions from trackout is classified as **large**.

5.1.86 The dust emission magnitude for the project is summarised in Table 5-1-15.

Table 5-1-15 – Dust Emission Magnitude Summary

Activity	Dust emission magnitude
Demolition	Small
Earthworks	Large
Construction	Medium
Trackout	Large

Step 2B

5.1.87 Receptors sensitive to potential dust impacts during demolition, earthworks and construction were approximated from a desktop study of the area up to 350m from the site boundary for human receptors and up to 50m for ecological receptors. These are summarised in Table 5-1-16.

Table 5-1-16 – Demolition, Earthworks and Construction Dust Sensitive Receptors

Distance from Sites (m)	Approximate Number of Human Receptors*	Approximate Number of Ecological Receptors
-------------------------	--	--

Less than 20	1 – 10	0
20 – 50	1 – 10	0
50 – 100	10 – 100	-
100 – 200	10 – 100	-
200 – 350	10 – 100	-

***Number of residential properties approximated using professional judgement in the absence of further information at this stage**

- 5.1.88 There are no ecological receptors within 50m of the site boundary. As such, these have not been considered further for demolition, earthworks and construction activities.
- 5.1.89 Receptors sensitive to potential dust impacts during trackout were approximated from a desktop study of the area up to 50m from the road network within 500m of the site accesses based on the magnitude of potential dust release. These are summarised in Table 5-1-17.

Table 5-1-17 – Trackout Dust Sensitive Receptors

Distance from Trackout Study Area (m)	Approximate Number of Human Receptors*	Approximate Number of Ecological Receptors
Less than 20	10 - 100	0
20 – 50	10 - 100	3

***Number of residential properties approximated using professional judgement in the absence of further information at this stage**

- 5.1.90 In order to determine the sensitivity of the receiving environment, the background concentration for PM₁₀ was obtained from the Defra website³⁵ and identified as being 9.97µg/m³ for 2015 (Table 5-1-13). Therefore, in accordance with Table 5-1-14, health impacts should be determined based on the criteria within the less than 24µg/m³ category.
- 5.1.91 Based on the criteria shown in Table 5-1-2, the sensitivity of the receiving environment to potential dust impacts is considered to be high for both human receptors and ecological receptors. It should be noted that in accordance with the IAQM guidance²², the highest level of sensitivity should be recorded. It is not necessary to work through the whole of

5.1.92 Table 5-1-once it is clear that the highest level of sensitivity has been determined.

5.1.93 The sensitivity of the receiving environment to specific dust impacts is summarised in Table 5-1-18.

Table 5-1-18 – Summary of the Sensitivity of the Area

Potential effect	Sensitivity of the surrounding area			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium	Medium	Medium	High
Human health	Low	Low	Low	Low
Ecological	n/a	n/a	n/a	Medium

Step 2C

5.1.94 The risk of effects in the absence of environmental measures was then defined based upon the interaction between the magnitude of emission and the highest level of area sensitivity (determined in Steps 2A and 2B, respectively) for each construction activity. The risk of dust effects was determined, as presented in Table 5-1-19.

Table 5-1- 19 – Summary of the Risk of Dust Effects

Potential Effect	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Low Risk	Medium Risk	Medium Risk	High Risk
Human health	Negligible	Low Risk	Low Risk	Low Risk
Ecological	n/a	n/a	n/a	Medium Risk

5.1.95 As indicated in Table 5-1-19, the potential risk of dust soiling is **high** for trackout, **medium** for earthworks and construction activities, and **low** for demolition. The potential risk of human health impacts is **low** for earthworks, trackout and construction activities, and **negligible** for demolition. The potential risk of dust impacts to ecological sites is **medium** for trackout activities. The assessment has therefore indicated that the maximum risk of dust effects is **high**.

5.1.96 It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase.

Operation Phase Assessment

Local Air Quality Assessment

5.1.97 Table 5-1-20 details the annual mean NO₂ concentrations at each receptor, predicted by the ADMS-roads air quality model and Long Term Trend adjusted for the Do Minimum scenario and the Do Something scenario, and reflects the difference between the annual NO₂ concentrations for the Do Minimum and Do Something scenario.

Table 5-1-20 - Predicted Annual Mean NO₂ Concentrations (µg/m³) for 2020

Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		Change in NO ₂ concentration (µg/m ³)
	Do Minimum (2020)	Do Something (2020)	
R1	5.4	4.4	-1.0
R2	7.8	5.1	-2.7
R3	8.1	4.9	-3.2
R4	4.6	4.4	-0.2
R5	8.2	4.8	-3.4
R6	7.0	4.8	-2.2
R7	8.1	4.8	-3.3
R8	6.4	4.7	-1.7

Receptor	Predicted Annual Mean NO ₂ Concentration (µg/m ³)		Change in NO ₂ concentration (µg/m ³)
	Do Minimum (2020)	Do Something (2020)	
R9	7.7	4.6	-3.1
R10	5.3	5.2	-0.1
R11	5.6	4.4	-1.2
R12	3.8	4.2	0.4
R13	4.1	4.0	-0.1
R14	3.7	3.7	0.0

5.1.98 As indicated in Table 5-1-20, predicted annual NO₂ concentrations are well below the AQS objective at all receptor locations for both the Do Minimum and Do Something scenario. The majority of receptors show an improvement of annual NO₂ concentrations with the Proposed Improvement as concentrations are predicted to be lower in the Do Something scenario compared to the Do Minimum scenario at all sensitive receptor locations, with the exception of R12 where a slightly higher annual NO₂ concentration is predicted with the Project and R14 where no change is predicted.

5.1.99 Table 5-1-21 details the annual mean PM₁₀ concentrations at each receptor, predicted by the ADMS-roads air quality model for the Do Minimum scenario and the Do Something scenario, and reflects the difference between the annual PM₁₀ concentrations for the Do Minimum and Do Something scenario.

Table 5-1-21 - Predicted Annual Mean PM₁₀ Concentrations (µg/m³) for 2020

Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		Change in PM ₁₀ concentration (µg/m ³)
	Do Minimum (2020)	Do Something (2020)	
R1	9.6	9.4	-0.2
R2	10.4	9.9	-0.5
R3	10.4	9.9	-0.5
R4	9.9	9.9	0.0
R5	10.4	9.9	-0.5
R6	10.2	9.9	-0.3
R7	10.4	9.9	-0.5
R8	10.2	9.9	-0.3
R9	10.3	9.9	-0.4
R10	10.0	10.0	0.0
R11	10.1	9.9	-0.2
R12	9.8	9.9	0.1
R13	9.9	9.9	0.0

Receptor	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)		Change in PM ₁₀ concentration (µg/m ³)
	Do Minimum (2020)	Do Something (2020)	
R14	9.6	9.6	0.0

5.1.100 As indicated in Table 5-1-21, predicted annual PM₁₀ concentrations are well below the AQs objective at all receptor locations for both the Do Minimum and Do Something scenario. The majority of receptors show an improvement of annual PM₁₀ concentrations with the Proposed Improvement as concentrations are predicted to be lower in the Do Something scenario compared to the Do Minimum scenario at all sensitive receptor locations, with the exception of R12 where a slightly higher annual PM₁₀ concentration is predicted and R4, R10, R13 and R14 where no change is predicted.

5.1.101 Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC is the only ecologically designated site sensitive to nitrogen deposition located within 200m of ARN. The nearest point of the SAC to the affected road network, along with 10m interval locations as a transect up to 200m, has been modelled with regard to likely Scheme air quality impacts. There are no roads which are closer to the SAC than the affected link (A496), so it can be assumed with some confidence that the nearest point of the SAC to this link will have the highest concentration. Table 5-1-22 summarises the impact of the Proposed Improvement at the nearest point of Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC.

Table 5-1-22- Impact of the Project to Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC

Closest Affected Road	Distance to nearest affected link (metres)	Do Minimum Scenario Annual Mean NOx (µg/m ³)	Do Something Scenario Annual Mean NOx (µg/m ³)	Change in Annual Mean NOx (µg/m ³)
A496	37.5	5.4	4.7	-0.7

5.1.102 Guidance detailed in DMRB HA207/07²³ and Highways England IAN 174/13²⁸ was followed to calculate the annual mean NOx concentrations at the SAC. It was found that the change in NOx is greater than 0.4 µg/m³, however, concentrations are predicted to be well below the ecological objective of 30 µg/m³. Therefore, in accordance with the guidance, where NOx concentrations are assessed to be below their objective then significant effects are not anticipated. As the assessment does not indicate a potentially significant effect due to changes in NOx concentrations, then it is not required to calculate changes in nutrient nitrogen deposition. Additionally, it should be noted that NOx concentrations are predicted to improve at this location due to a reduction in traffic along the nearest road link to the SAC.

Regional Air Quality Assessment

5.1.103 DMRB requires a regional assessment to be undertaken for the opening year (2020). The regional assessment is based on the change in emissions over the modelled road network. The results are not used to inform the evaluation of significance, as the change in total emissions is not directly related to a change in concentrations at receptors.

5.1.104 Table 5-1-23 shows the estimated total NOx, PM₁₀ and CO₂ emissions from all roads that are in the regional assessment. The Do Minimum and Do Something scenario emissions in the opening year (2020) and emissions in the Base Year (2015) have been calculated.

Table 5-1-23 - Annual NO_x and PM₁₀ Emissions (T/year) and CO₂ Emissions (in kilo tonnes/year) for Total Modelled Road Network

Pollutant	Base Year (2015)	Do Minimum (2020)	Do Something (2020)	Change in Emissions in Opening Year	Percentage Change in Opening Year
NO _x (T/yr)	999	589	580	-9	-1.5%
PM ₁₀ (T/yr)	70	63	57	-6	-9.5%
CO ₂ (kT/yr)	370	365	352	-13	-3.6%

5.1.105 A reduction in annual NO_x, PM₁₀ and CO₂ emissions occurs between 2015 and 2020, both with and without the Proposed Improvement. This is due to improvements in vehicle emissions technology, stricter emissions standards, and projected vehicle fleet information encompassing the introduction of newer vehicles over time.

Mitigation and Residual Effects

Construction Phase

Step 3

5.1.106 The IAQM Guidance on the assessment of dust from demolition and construction²² provides potential mitigation measures to reduce impacts as a result of fugitive dust emissions during the construction phase. These have been adapted for the Proposed Improvement based on the risk of dust affects (Table 5-1-19) and are summarised in Table 5-1-24. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan (CEMP), if required by the LA.

Table 5-1- 24 - Dust and Air Emissions Mitigation Measures²²

Mitigation Measure	Highly Recommended (H) / Desirable (D)
Communications	
1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	H
2. 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.	H
3. Display the head or regional office contact information.	H
Dust Management	
4. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.	H

Mitigation Measure	Highly Recommended (H) / Desirable (D)
Site Management	
5. 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.	H
6. Make the complaints log available to the local authority when asked.	H
7. Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	H
8. Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.	H
Monitoring	
9. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.	H
10. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.	H
11. 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 or windy conditions.	H
12. Agree dust deposition, dust flux, or real-time PM ₁₀ continuous monitoring locations with the Local Authority. Where possible, commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	H
Preparing and maintaining the site	
13. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H

Mitigation Measure	Highly Recommended (H) / Desirable (D)
14. Erect solid screens or barriers around dusty activities or the site boundary so that are at least as high as any stockpiles on site.	H
15. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	H
16. Avoid site runoff of water or mud.	H
17. Keep site fencing, barriers and scaffolding clean using wet methods.	H
18. Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site, cover as described below.	H
19. Cover, seed or fence stockpiles to prevent wind whipping.	H
Operating vehicle/machinery and sustainable travel	
20. Ensure all vehicles switch off engines when stationary - no idling vehicles.	H
21. Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	H
22. Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required, these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the Local Authority, where appropriate).	H
23. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	H
24. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	H
Operations	
25. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	H
26. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	H
27. Use enclosed chutes and conveyors and covered skips.	H

Mitigation Measure	Highly Recommended (H) / Desirable (D)
28. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	H
29. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
Waste Management	
30. Avoid bonfires and burning of waste materials.	H
Demolition	
31. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	D
32. Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H
33. Avoid explosive blasting, using appropriate manual or mechanical alternatives.	H
34. Bag and remove any biological debris or damp down such material before demolition.	H
Earthworks	
35. Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	D
36. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	D
37. Only remove the cover in small areas during work and not all at once.	D
Construction	
38. Avoid scabbling (roughening of concrete surfaces) if possible.	D
39. 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.	H

Mitigation Measure	Highly Recommended (H) / Desirable (D)
40. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	D
41. For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	D
Trackout	
42. Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	H
43. Avoid dry sweeping of large areas.	H
44. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
45. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
46. Record all inspections of haul routes and any subsequent action in a site log book.	H
47. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	H
48. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
49. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H
50. Access gates to be located at least 10m from receptors where possible.	H

Mitigation of Impacts and Significance of Effects (after mitigation)

Step 4

Construction Phase

5.1.107 Assuming the relevant mitigation measures outlined in Table 5-1- are implemented, the residual effect from all dust generating activities is predicted to be negligible, in accordance with the IAQM guidance²².

Operational Phase

5.1.108 The predicted concentrations for annual mean NO₂ and PM₁₀ were below the AQS objective at all modelled receptors. In accordance with the advice outlined in IAN 174/13²⁸ only receptors which exceed the AQS objective are used to inform significance. As such, the Proposed Improvement is deemed not to have a significant impact on air quality and mitigation measures are not required.

Conclusions

5.1.109 The Proposed Improvement has the potential to cause air quality impacts at nearby sensitive locations. These include fugitive dust emissions from construction works and road traffic exhaust emissions from vehicles using the road during operation. An air quality assessment has therefore been undertaken in order to quantify potential impacts associated with the Proposed Improvement.

5.1.110 During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction, and trackout activities was predicted to be negligible.

5.1.111 Dispersion modelling was undertaken in order to predict local air quality impacts as a result of road vehicle exhaust emissions associated with traffic using the Proposed Improvement during the operational phase. Results were subsequently verified using monitoring results obtained from GC.

5.1.112 The results of the dispersion modelling assessment indicated that NO₂ and PM₁₀ concentrations were below the relevant AQS objectives for both the Do Minimum and Do Something scenarios. As such, all receptor results have been scoped out of the judgment on significance due to no exceedances of the AQS objectives as outlined in Table 5-1-12 and in accordance with IAN 174/13²⁸.

5.1.113 Dispersion modelling of NO_x was undertaken at the Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC. Concentrations were predicted to be well below the ecological objective and therefore, significant effects are not anticipated and no further assessment is required.

5.1.114 A regional assessment was completed to determine the change in emissions over the modelled road network for the 2015 baseline and the 2020 Do Minimum and Do Something scenarios. Emissions of NO_x, PM₁₀ and CO₂ all reduced from 2015 to 2020. In addition, a reduction was predicted with the Project in place.

5.1.115 Based on the assessment results, the impacts of the Proposed Improvement are largely beneficial on air quality at receptors and the impacts are not considered to be significant.

5.2 Cultural Heritage

Technical Appendix A provides Cultural Heritage Supporting documents including

- **Desk Based Assessment**
- **ASIDOHL 2**
- **Geophysical**
- **Evaluation Trenching**
- **WSI Mitigation**
- **Watching Brief Report**

Introduction

- 5.2.1 This chapter summarises the effects of the Proposed Improvement on Cultural Heritage and Archaeology. The scope of the assessment has encompassed standing monuments, buried archaeology and areas of heritage value including historic landscapes, parks and gardens and Conservation Areas.
- 5.2.2 Development can result in adverse effects to known and undiscovered archaeological remains and can negatively affect the setting of sensitive features including Scheduled Ancient Monuments (SAMs), Listed Buildings and Conservation Areas.
- 5.2.3 The aim of this chapter is to outline the cultural heritage and archaeological features that are present within the study area, identify potential impacts that could occur to them as a result of the Proposed Improvement, explain mitigation measures proposed to avoid or reduce such effects and summarise any residual effects remaining.

Methodology

Desk Based Assessment

- 5.2.4 The assessment conforms to the methodology specified in the *Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2. Cultural Heritage*.
- 5.2.5 In order to identify all heritage assets which could be impacted by the proposed improvements, a full Desk Based Assessment has been completed (Volume 2, Technical Appendix A1). The assessment considered all assets within a 500m buffer of the proposed route, and all high value assets within 2km.
- 5.2.6 To identify all known heritage assets a number of sources were consulted. These included:
- Gwynedd Historic Environment Record
 - National Monuments Record, curated by the Royal Commission on Ancient and Historical Monuments of Wales (RCAHMW)
 - Aerial photographs held by the Central Register for Aerial Photography in Wales
 - Records and cartographic material held by the Gwynedd Archive Service
 - Records held by the National Library of Wales, Aberystwyth
 - Natural Resources Wales LiDAR data
 - Published and unpublished 'grey' literature

LiDAR

- 5.2.7 LiDAR (Light Detection and Ranging) data were consulted to assess for the presence of features which were not visible in aerial photographs or those which may be missed during the walkover. These data were consulted prior to undertaking the walkover so that identified features could also be assessed on the ground.
- 5.2.8 The data were obtained in ASCII format and registered within GIS with historic and current map data as well as point data for sites recorded on the HER (Historic Environment Register). Light was simulated from various angles and identified features were transcribed onto a separate GIS layer. Once identified, features were compared against historic mapping to ascertain possible date and function.

Map Regression

- 5.2.9 In order to assess the development of the area during the post-medieval and modern period a number of cartographic sources and accompanying material were consulted. These included the 1st, 2nd and 3rd editions of the 6" Ordnance Survey County Series maps, Tithe maps for Llanfair, Llanenddwyn and Llanbedr and Cae Nest estate plans held in the National Library of Wales, Aberystwyth.

Tithe Maps and Schedules

- 5.2.10 Tithe maps and schedules were consulted to gain better understanding of changes in field patterns and gather possible clues of former use which may be preserved in field names.

Historic Landscape assessment

- 5.2.11 The entire scheme falls within the boundary of the Arduwy Landscape of Outstanding Historical Interest (HLW (Gw) 2), as set out in the ICOMOS/Cadw/Countryside Council for Wales Register of Landscapes of Outstanding Historic Interest in Wales (Cadw/ICOMOS, 1998; North Arllechwedd HLW (Gw) 2, No. 20).
- 5.2.12 Detailed guidance on the use of the Register is provided in the Guide to Good Practice on Using the Register of Landscapes of Historic Interest in Wales in the Planning and Development Process, revised (2nd) edition, Cadw, 2007 ("Guide to Good Practice").
- 5.2.13 The Proposed Scheme involves a transport improvement scheme, which therefore requires an Assessment of the Significance of the Impact of Development on Historic Landscape Areas on the Register of Landscapes of Historic Interest in Wales (commonly referred to as an ASIDOHL2). An ASIDOHL2 report has been completed for this scheme and is available as a separate document (Volume 2, Technical Appendix A2). The historic landscape has also been considered as a cultural heritage sub-topic within this assessment.

Stakeholders and Consultation

- 5.2.14 The stakeholders identified for heritage were:

- Cadw
- Snowdonia National Park Archaeologist

Both responded following the production of the initial DBA with the following comments:

- The impact of noise on the tranquillity of the Meini Hirion Standing Stones should be taken into consideration.
- Supplemental panting in hedgerows in the vicinity of the Meini Hirion Standing Stones should be considered as appropriate mitigation against visual impact.
- Enhanced interpretation should be considered as appropriate mitigation against the overall effects of the scheme on the Meini Hirion Standing Stones.

The Snowdonia Park Archaeologist also specifically requested:

- That views from the Grade I Listed church at Llandanwg were considered in the ASIDOHL.

Field Evaluation and Mitigation

- 5.2.15 To supplement the information gained through the DBA a walkover survey of the route was undertaken, further field evaluation has also been undertaken to evaluate the archaeological potential of the route.
- 5.2.16 During Ground Investigation works an archaeological watching brief was undertaken. The information gained during these works was used to inform the evaluation, and ultimately the proposed mitigation programme.
- 5.2.17 As the value of some of the identified features was *Unknown, therefore* evaluation was required to determine significance. The methods employed for evaluation were:
- Geophysical Survey
 - Targeted Evaluation Trenching

Walkover Survey

- 5.2.18 A walkover survey was undertaken by an archaeologist on the 27th of August 2015. Weather conditions were dry and sunny with good visibility. The entire route was walked but two areas were not accessible; the first was at Maes Artro within a portion of land within the buffer zone but outside the development footprint (SH58262668) for which landowner permission had not been obtained, the second was a wood within the footprint which was overgrown (PRN 60961).
- 5.2.19 The route was initially walked from the southern limit to Afon Artro, taking in the proposed junctions for Llanbedr and Mochras, then re-walked from north to south. The northern portion of the route was walked from the lay-by at SH58322739 to the sewerage treatment works at SH58142761, along the eastern side of Sarn Hir, before walking south to Afon Artro, taking a detour to Meini Hirion. From Afon Artro the route was walked again from south to north. A total of 30 new features were identified during the walkover, all are included in the combined results (Volume 2, Technical Appendix A1 ;Desk Based Assessment).

Geophysical Survey

- 5.2.20 The entire route easement was subject to a geophysical magnetometer survey to help identify buried archaeology (Volume 2, Technical Appendix A3; Geophysical Assessment). The survey revealed anomalies which were consistent with a former field system, including boundaries and possible evidence of ridge and furrow ploughing.

Evaluation Trenching

- 5.2.21 In order to test the results of the geophysical survey and the general potential of discovering buried archaeology along the route, a programme of archaeological evaluation trenching was designed (Volume 2, Technical Appendix A3; Evaluation Trenching).
- 5.2.22 A total of 26 trenches were excavated to investigate anomalies identified in the geophysical survey and desk based assessment, and areas which appeared to be void of archaeology. In addition to anomalies along the route, two trenches were excavated to evaluate the circular feature identified outside the proposed easement.
- 5.2.23 The trenching revealed that although evidence of the circular feature could be seen as two low banks, it was not a significant archaeological site. The trenching identified former field banks and drainage features associated with relict field systems seen on both the geophysical survey and LiDAR data, however a date could not be ascertained.
- 5.2.24 A possible cremation was identified to the north of the trackway to Plas y Bryn. The feature consisted of a small pit containing burnt bone and a small amount of charcoal, no artefacts were

identified in association with the deposit. It is possible that the feature is associated with prehistoric funerary activity in the area, as no dateable artefacts were discovered radiocarbon dating will be required to provide more information. It is possible that if radiocarbon dating shows that the feature is recent and of little archaeological value the proposed mitigation for the feature and surrounding area may change.

Watching Brief (GI Works)

- 5.2.25 The comprehensive watching brief was undertaken on six GI pits along the proposed route of the improvements (see Vol 2 AppendixA, A6 Watching Brief). No archaeological features were identified but it was during the watching brief that the extent and potential of the estuarine deposits to the north of Afon Artro were realised.

Assessing Value and Potential Impact

Assigning value (importance) to features

- 5.2.26 The value awarded to the various features was assigned using the criteria provided in the DMRB, Volume 11, Section 3, Part 2, Chapter 5, Sections 5.25 - 5.44 (2007), which range on a six-point scale of Very High, High, Medium, Low, Negligible and Unknown for the three cultural heritage sub-topics of archaeological remains, historic buildings and historic landscape. The assessment of value was based on the criteria given in DMRB Volume 11, Section 3, Part 2, as shown in Table 5.2.1.

Table 5.2.1: Criteria for assessing value of heritage assets

Value	Definition
Very High (<i>International</i>)	<ul style="list-style-type: none"> World Heritage Sites (<i>including nominated sites</i>) Assets acknowledged of having international importance Assets that can contribute significantly to acknowledged international research objectives ASIDOHL Category A
High (<i>National</i>)	<ul style="list-style-type: none"> Scheduled Ancient Monuments (SAM) (<i>including proposed sites</i>) Grade I and Grade II* Listed Buildings (<i>including proposed sites</i>) Unscheduled sites which are of schedulable importance or quality Unlisted buildings and some Grade II Listed Buildings which are of a standard or importance to warrant listing at Grade I or Grade II* Historic Landscapes of outstanding interest (<i>including designated and undesignated</i>) ASIDOHL Category A
Medium (<i>Regional</i>)	<ul style="list-style-type: none"> Grade II Listed Buildings (<i>including proposed sites</i>) Archaeological sites which are not schedulable but are of regional importance Buildings which fulfil the criteria for listing at Grade II Designated special historic landscapes or those worthy of designation ASIDOHL Category B
Low (<i>Local</i>)	<ul style="list-style-type: none"> Components of the historic environment which help define local distinctiveness and character (<i>including features such as walls, gateposts, tracks etc.</i>) 'Locally Listed' buildings Historic (unlisted) buildings of modest quality or historic association Historic landscapes of local interest

	ASIDOHL Category C
Negligible	<ul style="list-style-type: none"> • Sites of minor importance • Sites which have been so badly damaged that not enough remains to justify their inclusion in a higher category • Buildings of no architectural or historical note or buildings of an intrusive character • Landscapes with little or no significant historic interest
	ASIDOHL Category D
Unknown	<ul style="list-style-type: none"> • Sites or features whose character, importance or location is undetermined • Includes unevaluated buried archaeology • Sites in this category will be allocated a value category from Very High to Negligible following evaluation
	ASIDOHL Category U

5.2.27 The value of an archaeological asset refers to both the physical remains and information inherent in the site. If a site is excavated in advance of destruction the physical remains will be destroyed but the information will have been retained. This is termed “Preservation of Archaeological Remains by Record” in Planning and the Historic Environment: Archaeology (Welsh Office Circular 60/96). It should be noted that even though this is seen as a valid mitigation measure, preservation *in situ* is the preferred option.

Assigning magnitude of impact

5.2.28 The magnitude of impact (change) was assigned on a five-point scale of Major, Moderate, Minor, Negligible, and No Change using the criteria provided in HA208/07.

Assigning significance of effect

5.2.29 The significance of the effect is considered in terms of the magnitude of the impact arising from the proposed improvement in relation to the value or sensitivity of the receptor. This is determined using the matrix shown in Table 5.2.2, as derived from HA208/07.

Mitigation

5.2.30 The information gained through the fieldwork has been utilised to form the tailored mitigation strategy which is outlined in Section 5.2.79- 5.2.97 and set out in detail in Vol 2 AppendixA, A5 WSI.

5.2.31 The most appropriate methods of mitigation for each identified asset will be implemented to minimise adverse impact, where direct impact is unavoidable the mitigation will aim to gather the maximum amount of information.

Table 5.2.2: Matrix used to assign significance of effect for Cultural Heritage assets (source: HA208/07)

Archaeological Importance	Very High	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Moderate or large	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	Moderate or slight
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight
		No Change	Negligible	Minor	Moderate	Major
		Magnitude of Impact				

Baseline Information

Policy Context

5.2.32 The following plans, policies and legislation are considered relevant to the Cultural Heritage assessment.

- Ancient Monuments and Archaeological Areas Act 1979;
- Planning (Listed Buildings and Conservation Areas) Act 1990;
- Circular 60/96 Planning and the Historic Environment: Archaeology (Welsh Office, 1996);
- Circular 61/96 Planning and the Historic Environment: Historic Buildings and Conservation Areas (Welsh Office, 1996), and;
- Eryri Local Development Plan (adopted version, 2007 - 2022) – Chapter 4: Protecting and Enhancing the Cultural and Historic Environment.

Archaeological and Historical context

5.2.33 This section provides an overview of the historical background to the study area and is relevant to all three cultural heritage sub-topics. Please refer to Technical Report A (Cultural Heritage) for further details.

5.2.34 The area surrounding the proposed scheme, especially the uplands of Arddudwy, is regarded as one of the most important and best preserved archaeological landscapes in Wales, if not Europe. Peat deposits along the shoreline also provide a wealth of information on the environmental history of the changing landscape and the impact which human activity had upon it. The proposed scheme is located in the coastal plain which would have been a threshold between these contrasting environments and as such is likely to have seen a constant human presence since the end of the last Ice Age, the evidence for which has been largely masked by continuing agricultural and domestic activity.

Palaeolithic (500,000BC – 10,000BC)

5.2.35 No sites of Palaeolithic date are recorded in the vicinity of the proposed scheme, the nearest sites dating from this period are found on the Great Orme in Llandudno approximately 60km to the north-east.

Mesolithic (10,000BC – 4,000BC)

- 5.2.36 No sites of Mesolithic date are recorded in the immediate vicinity of the proposed scheme, although it is almost certain that hunter-gatherer communities would have been present in the vicinity during this period.
- 5.2.37 A flint scraper (PRN 28970) of probable Mesolithic date was found during the replacement of a raw water main to the west of Gerddi Bluog, approximately 5km to the north-west (Cooke *et al.* 2010). The majority of other sites on the HER are also findspots of stone tools, a number of which are from coastal locations or within former estuary landscapes such as a shell midden at Garreg Hylldrem Rock shelter (PRN 55789), Llanfrothen some 16.8km to the north-west.
- 5.2.38 Mesolithic artefacts have also been discovered in intertidal peats and underlying clay at Ynys-Las, Borth, which is located 34km to the south (Poucher 2009). Red Deer antler and Aurochs bone recovered from the deposits show that the area would have been a rich hunting ground. The submerged landscape represented by these peat deposits are known to have stretched up the coast at least as far as Llanbedr, and as such were almost certainly utilised in the same way by hunter-gatherer communities during the Mesolithic.

Neolithic (4,000BC – 2,300BC)

- 5.2.39 The study area contains a single recorded asset which dates from the Neolithic; an incised stone (PRN 4782) which is now housed at St. Peter's Church, Llanbedr. The stone is a sub-rounded boulder of granite onto which a single spiral motif has been 'pecked'. The stone clearly does not originate from its current location and is known to have been moved a number of times in the recent past. It is said that the stone was found in hut circles above Llanbedr, believed to have been near Hendre Waelod in Cwm Nantcol, approximately 3.5km to the east of its current location (Smith 2001). The motif is similar to those associated with the Neolithic tombs of the Boyne Valley in County Meath, Ireland. On Anglesey similar motifs can also be found at Barclodiad y Gawres, Lanfaelog, a passage tomb which reflects those found in the Boyne Valley and indicates communication between both areas during the Neolithic. It is likely that the stone originated in a similar tomb which is currently unknown and probably destroyed in antiquity.
- 5.2.40 A number of Neolithic chambered tombs survive in the wider area surrounding the proposed scheme. All of the local examples appear to have been within elongated cairns, evidence of which can still be seen at a number of the sites. The closest example is found 1.2km from the northern end of the proposed scheme at Gwern Einion (PRN 1057), a second possible example is recorded 1.3km from the southern end of the proposed scheme at Uwchlaw'r Coed (PRN 1058), although its interpretation has been questioned (Smith 2001). Various other cairns have been identified further afield in the surrounding area.
- 5.2.41 It is clear that well established communities were active in the area during the Neolithic period but no evidence of settlement has been found to date. A number of small scrapers of possible Neolithic date were discovered during works associated with the construction of a new water treatment works and associated raw water main at Rhiw Goch over 4km to the north-east, but none were associated with datable features (Cooke *et al.* 2010). Two polished stone axes found in Barmouth (PRN 4172) and Friog (PRN 4880) are clearly Neolithic in date but are some distance from the current study area.

Bronze Age (2,300BC – 700BC)

- 5.2.42 Three assets dating to the Bronze Age are located within the study area. The first are the Meini Hirion standing stones (PRN 1059) which are a designated Scheduled Ancient Monument (ME 056). The monument consists of two standing stones; the larger is a rectangular column 3.3m high, the other is a thin slab which stand less than 2m high. The antiquity of the smaller slab has been consistently questioned but there is no doubt that the larger is a prehistoric monument. The

stones are located on low lying land and may have originally been on a low protrusion surrounded by marsh prior to the canalisation of the Artro and drainage of surrounding land (Smith 2001). It is also believed that the standing stones mark the start of a Bronze Age trackway, leading to Moel Goedog, Bryn Cader Faner and over the hills to Trawsfynydd, which is traceable by following other standing stones and was still the main road until the beginning of the 19th century (Lynch 1995).

- 5.2.43 Fragments of a cinerary urn (PRN 4783) are recorded as being discovered at Pensarn, approximately 450m from the northern end of the scheme, although the exact location of the discovery is not known. It is believed that the find location may have been Pensarn farm and as such a watching brief was implemented during the installation of a rising main between Llanbedr and Llandanwg. The watching brief did not encounter any features associated with the urn and the precise location of the original discovery remains unknown (Berks *et al.* 2005).
- 5.2.44 A bronze un-looped palstave blade (PRN 4792) is recorded as being discovered during the Second World War when excavating a deep cable trench near Llanbedr (Bowen & Gresham 1967). The exact location of the discovery is not known but it is likely to have been in the vicinity of RAF Llanbedr - cable laying at this time was probably associated with increased activity at the airfield.
- 5.2.45 Recorded sites within the wider landscape also demonstrate that the area was well occupied during the Bronze Age. As with the Neolithic many of the recorded assets dating to this period are funerary in nature. The uplands of Ardudwy are peppered with burial cairns dating to the Bronze Age, notable examples are found at Hengwm to the south and Moel Goedog to the north. It is also likely that many of the hut groups in the area may have their origins in the Bronze Age but the limited amount of recent excavation is yet to conclusively prove the theory.
- 5.2.46 Burnt mounds, the majority of which can be firmly dated to the Bronze Age, are features which have been interpreted in many ways from brewing sites to cooking sites and saunas, are also present in the vicinity of the proposed scheme. The closest is recorded at Ystumgwern (PRN 14583), 1.7km south-west of the southern end of the proposed scheme. These features, which consist of a mound of heat-fractured stones which is usually accompanied by a trough for water, are probably the most common Bronze Age features encountered in north-west Wales yet their use is poorly understood and frequently debated. What can be said with certainty about the features is that they were used to boil water (and possibly other liquids) by repeatedly placing stones which were heated in a hearth into a container with the liquid to be heated; the process results in the stones fracturing and becoming unusable at which point they are discarded and over time form the mound.

Iron Age (700BC – 43AD)

- 5.2.47 No sites within the study area which are recorded on the Gwynedd HER are specifically noted as being Iron Age in date. The nearest hut circles recorded within the wider area are Bron y Foel (PRN 14579), Pen y Bryn (PRN 14580), Uwch Glan (PRN 926), Uwchlaw'r Coed (PRN 14578) and a possible example at Coed Llety Walter (PRN 16238). Investigation of hut circles in the area, including at Hengwm (PRN 33549) have shown that many of these are likely to date from the Iron Age.
- 5.2.48 A number of hillforts and enclosures are also recorded within the wider landscape which are typically Iron Age. These include Pen Dinas (PRN 1106), Craig y Dinas (1107), Bryllysg (PRN 1070), Clogwyn Arllef (PRN 1061) and Moel Goedog (PRN 1000). Many of the upland field systems in the area are likely to date from the Iron Age, some of which are directly associated with hillforts and settlements.
- 5.2.49 Funerary rituals from this period are not fully understood and no monuments associated with burials or cremations are known.

Romano British (43AD – 450AD)

- 5.2.50 The only feature of this period recorded on the Gwynedd HER is a proposed route for the Roman Road between Dolgellau and Harlech (PRN 17825), this is however widely disputed and no firm evidence has ever been found (Hopewell 2005 & *pers. comm.*).
- 5.2.51 It is also likely that many of the hut circles and settlements attributed to the Iron Age would have remained occupied during this period. Without a major Roman military influence it is likely that for many, life would have continued largely unchanged with the exception of increased access to imported goods and limited Roman influence.
- 5.2.52 The nearest Roman fort would have been Tomen y Mur (PRN 5080), 17km to the north-east at Trawsfynydd. A Roman bathhouse (PRN 16876) which is likely to have been associated with a mansion or villa was located at Llidiart Ysppyty, Tremadog, 14km to the north on the route from Tomen y Mur to Segontium, Caernarfon.
- 5.2.53 A hoard of five bronze Roman vessels dating to the first century AD and a large amount of Roman coins were discovered on Ynys Gwrtheyrn farm around 1848 (PRN 4956). In recent years a number of Roman finds, including a silver denarius of Hadrian (2nd century AD), have been reported to the Portable Antiquities Scheme from the shore around Dyffryn Ardudwy (Flook 2011 *pers. comm.*).

Early Medieval & Medieval (450AD – 1547AD)

- 5.2.54 No sites of Early Medieval date are recorded within the study area, three sites of Medieval (1066AD – 1547AD) are recorded.
- 5.2.55 The Early Medieval is represented in the wider landscape by a number of features. As was the case during the Romano British period it is likely that a number of the hut circle settlements and defended sites established during the Iron Age remained in use during the Early Medieval.
- 5.2.56 Although the current church building at Llandanwg (PRN 6949, LB Grade I ID 4790) is Medieval, with elements dating to the 13th and 15th centuries with later alterations during the 17th and 19th centuries, it appears to have been established during the Early Medieval period. A number of incised stones and grave markers (PRN 4780, 24793, 4077 & 24794) which have been found, both incorporated into the fabric of the building and in the graveyard, suggest that the church has much earlier origins which may stretch back to 3rd to 6th century, although it is unclear whether some of the stones were moved to the church at a later date.
- 5.2.57 It is documented that a Llywelyn ap Gruffydd had a wooden hall or Llys at Ystumgwern, possibly Ael y Bryn (PRN 4013), 2.5km south of the proposed scheme, which was set up in Harlech Castle, presumably as a symbol of conquest (Davidson *et al.* 2005). It is also suggested that the place name of Faeldre (PRN 3409) is a corruption of Faerdref or Mardref, and could indicate the location of the Llys.
- 5.2.58 The first Medieval site recorded within the study area is the Grade II* listed parish church of St. Peter's in Llanbedr (ID 4782, PRN 6943). The earliest surviving elements of the current building are likely to date to the 15th and 16th centuries, however it is said that the dedication goes back to at least the 13th century (Davidson & Hopewell 2004).
- 5.2.59 The second is Ffynnon Delau (PRN 4784), a Medieval holy well which was said to have been located in a field known as Llwyn y Ffynnon Delau on Pandy Farm. Although the well has now been closed it was located around 420m west of the northern end of the proposed scheme.
- 5.2.60 The third recorded site is a general number for the Medieval Township of Llanbedr (PRN 9829). The most obvious and well known Medieval site in the area is Harlech Castle (PRN 2908) which lies

approximately 4km north of the proposed scheme. The castle is a Scheduled Ancient Monument (ME 044), Grade I Listed Building (ID 25500), and forms part of the Castles and Town Walls of Edward I in Gwynedd World Heritage Site. The castle was designed by Master James of St George and built between 1283 and 1289 as part of the conquest of Edward I following the death of Llywelyn ap Gruffydd in 1282 (Davidson 2010). Although no evidence has been found some believe that the site was the location of an early Llys as the site is first mentioned, and is clearly significant, in the tales of the Mabinogion. Although an English borough was established at the same time as the castle, no evidence remains of any walls or regular pattern of burgage plots within the town (*Ibid*).

5.2.61 In the area immediately surrounding the scheme it is likely that the majority of the hut circle settlements had been abandoned by the Medieval period, however a similar pattern of scattered rural dwellings can be seen reflected in the distribution of long huts in the uplands. Areas of ridge and furrow ploughing, typically Medieval in date, throughout the area are a sign of the agricultural economy at this time.

Post Medieval & Modern (1547AD – Present)

5.2.62 A number of Post-Medieval and Modern sites are recorded within the study area. During the Civil War the families of the area sided with the Royalists, the castle was garrisoned but fell in 1647 following a short siege. Orders were given to demolish the castle but they were never executed, leaving it fall into disrepair until the 18th century (Kenney 2009).

5.2.63 Pont Llanbedr (PRN 1582), which is a Scheduled Ancient Monument (ME 026) and Grade II Listed Building (ID 4783), dates to the Civil War period and includes a date stone of 1642. The bridge was largely reconstructed around 1850, Dolgellau archives also hold documents relating to repair works to the bridge in 1827 which were undertaken by Evan Williams and for which he is paid £7, 10s (ZQS/H1828/10). Leading from the bridge to the north towards Harlech is the straight embankment and road of Sarn Hir, also the A496 (PRN 25045) and likewise dates to the mid-17th century. The bridge is still the main crossing point of Afon Artro on the A496. Also associated with the route is an 18th century milestone for Harlech and Barmouth which is located at the southern end of Llanbedr village and is Grade II listed (ID 82006).

5.2.64 The majority of the buildings within the village of Llanbedr date to the 19th and 20th centuries. Two examples are Listed Buildings, the 19th century Wenallt Stores building (ID 82016) and early 20th century Moriah Calvinist chapel (ID 18963).

5.2.65 Two houses, Cae Nest and Hafod y Bryn, and associated estates were dominant in Llanbedr during the 19th century although much of the land was owned by The Honourable Edward Mostyn Lloyd Mostyn of the nearby, larger, Cors y Gedol estate. The proposed scheme will occupy land owned by all three estates during the 19th century.

5.2.66 Cae Nest was the seat of the influential Poole family; the current house is a miniature mansion and associated outbuildings dating to the mid-19th century which occupies the site of an earlier house. Hafod y Bryn was built by Samuel Pope Esq. QC, who had interests in mining in the area. As well as the main house the estate included a lodge and Hafod y Bryn home farm, which includes a Grade II Listed octagonal dairy (PRN 11882, ID 5202). The scheme will cross land which formed part of a landscaped park which includes two woods or 'plantations', one of which lies directly on the proposed route.

5.2.67 The Cambrian Coast Railway which passes to the west of the proposed scheme was opened in 1867 and was part of the railway which was intended to connect Aberystwyth and Porthdinllaen on the north coast of the Llyn Peninsula, which William Madocks had hoped would become the main port

for Ireland. The final section of the line was never constructed and the line was terminated in Pwllheli.

- 5.2.68 There are a number of Post Medieval sites to the north of the proposed scheme associated with Pensarn Railway Station (PRN 25049). The majority of the Railway station buildings were destroyed in 1987; however the roads giving access to Pensarn railway station are marked on the 1st ed 6th 1839-1840 OS map (PRN 59765). Pensarn Railway Bridge (PRN 7266) is a wooden pile, single-tracked railway bridge and is one of thirteen timber bridges on the former Cambrian system to Aberystwyth and to Pwllheli, which are among the last few surviving in Europe and the USA. The bridge was completed in 1867 and was likely designed by Henry Coneybeare, the Cambrian's engineer.
- 5.2.69 Approximately 230m to the south-east of the southern end of the scheme a First World War prisoner of war camp is recorded (PRN 7880). Very little information is recorded on the HER and there are no associated features at the recorded location, there are however features which could be associated with such a camp visible at Tyddyn-Du, west of the recorded location. The area to the west of the proposed scheme is dominated by Llanbedr Airfield, originally established as RAF Llanbedr (PRN 7267). The airfield became operational in 1941 and was controlled by RAF Valley as a base for fighter squadrons defending the Irish Sea. The long runway was constructed in 1955, possibly to accommodate V-force bombers which were part of the UK's strategic nuclear strike force.
- 5.2.70 Further features associated with the airfield and its defences are also present in the area. To the west of the scheme two pillboxes (PRN 59744 & PRN 59745) associated with the Second World War defences are recorded, and a later Royal Observation Corps subterranean monitoring post (PRN 58519) associated with the nuclear threat posed during the Cold War is located to the south-east. In recent years the area has become popular with tourists resulting in the establishment of a number of static caravan sites along the coast. Although not necessarily aesthetically pleasing or significant in their design these are by now undoubtedly part of the historic narrative of the area.

Baseline data

- 5.2.71 A total of 76 historical features have been identified within the study area for this assessment. Of these, a total of 45 have been identified as being potentially affected by the proposed scheme (see Figures 5.2.1 – 5.2.4, Volume 1a) and included within the assessment. These comprise:
- *Three heritage assets of High value;*
 - *Nine heritage assets of Medium value;*
 - *Fourteen heritage assets of Low value;*
 - *Nine heritage asset of Negligible value;*
 - *Ten heritage assets of Unknown value.*

Statutory sites

- 5.2.72 There are no World Heritage Sites, Conservation Areas or registered Historic Parks or Gardens within the study area (within 500m of the proposed scheme). However, there are two Scheduled Ancient Monuments within the study area (Llanbedr Standing Stones and Pont Llanbedr) (see Figure 5.2.2, Volume 1a).
- 5.2.73 Due to the scale and location of the proposed development it was deemed appropriate to consider Scheduled Ancient Monuments and Grade I Listed Buildings in a wider buffer of 2km. These assets will not be directly impacted by the proposed scheme but there is a possibility of some degree of visual impact. As well as the two Scheduled Ancient Monuments included in the main 500m buffer study area, a further five are located within 2km of the proposed scheme:
- Hut Circle West of Pen-y-Bryn (PRN 1184, NGR SH59852645);
 - Alleged Hospital Chapel, Site of, Llanbedr (PRN 4781, NGR SH59402748);

- Gwern Einion Burial Chamber (PRN 1057 NGR SH58732861);
- Defended Settlement, Clogwyn Arllef (PRN 1061 NGR SH59562867), and;
- Standing Stone/Possible Burial Chamber SW of Hengaeau (PRN 1060 NGR SH58442902).

Listed Buildings

5.2.74 There are six listed buildings within the study area (within 500m of the proposed scheme); one is Grade II*-listed (Llanbedr parish church) while the others are Grade II-listed. The only Grade I Listed Building is in the wider buffer area (within 2km); the Medieval Sant Tanwg’s church at Llandanwg (see Figures 5.2.3 – 5.3.4, Volume 1a).

Historic Landscapes

5.2.75 The entire proposed scheme falls within the boundary of the Arduwy Landscape of Outstanding Historical Interest (HLW (Gw) 2). As such the proposed development has been subject to an ASIDOHL2 to systematically assess the impact on the affected Historic Character Areas affected (see Figure 5.2.1, Volume 1a).

5.2.76 The proposed scheme will have a direct physical impact upon three Historic Character Areas, the Arduwy Lower Slopes (PRN 18248) to the south and the Arduwy Coastal Strip (PRN 18247) to the north, and Llanbedr (PRN 18251). In brief, the key historic landscape characteristics are noted as being pasture, woods and farmsteads for the Arduwy Lower Slopes and cut drainage features, farmsteads and dry stone walls for the Arduwy Coastal Strip. Llanbedr is recorded as a 19th and 20th century ribbon settlement, the direct impact on this area would be minimal.

Magnitude of Impacts and Significance of Effects (before mitigation)

5.2.77 The following assets have been identified as being impacted by the proposed scheme and as such recommendations have been suggested for further assessment and proposed mitigation. Identified features which will not be impacted have been omitted from this section.

5.2.78 Table 5.2.3 summarises the value of the archaeological features identified along with the predicted magnitude of impact and significance of effect prior to mitigation.

Table 5.2.3: Value, Magnitude of Impact and Significance of Effect for Archaeological Remains before Mitigation

Asset Name, PRN number and grid reference	Archaeological Value	Magnitude of impact	Significance of effect	Further Assessment Required (Completed)
Trackway to Hen Efail PRN 60945 NGR SH58352620	Negligible	Minor	Slight adverse	None
Embanked Field Boundary PRN 60946 NGR SH58282629	Medium	Minor	Slight adverse	None
Bridle Path PRN 60947 NGR SH58283630	Medium	Minor	Slight adverse	None
Trackway to Llyn y Pin and Ael y Bryn PRN 60948 NGR SH58322630	Negligible	Negligible	Neutral	None

Driveway to Hafod y Bryn PRN 60949 NGR SH58302638	Low	Moderate	Slight adverse	None
Hafod y Bryn Lodge PRN 60950 NGR SH58312639	Medium	Moderate	Moderate adverse	None
Cross Roads PRN 60975 NGR SH58292639	Unknown	Unknown	Unknown	None
Modern Builder's Yard/Storage Facility PRN 60951 NGR SH58272639	Negligible	Negligible	Neutral	None
Disused Entrance to Modern Yard PRN 60952 NGR SH58302643	Negligible	Negligible	Neutral	None
Field Bank/Terrace PRN 60953 NGR SH58272644	Unknown	Major	Unknown	Geophysical survey and targeted evaluation trenching
Trackway to Plas y Bryn PRN 60954 NGR SH58352648	Low	Moderate	Slight adverse	None
Enclosure and Field System, Plas y Bryn PRN 24767 NGR SH5822026520	Unknown	Major	Unknown	Geophysical survey and targeted evaluation trenching
Plas y Bryn Farm, Llanbedr PRN 11882 NGR SH58042653	Medium	Moderate	Moderate adverse	Brief assessment of potential visual impact
Footpath PRN 60976 NGR SH58272654	Negligible	Minor	Slight adverse	None
Estate Gate and Fencing PRN 60955 NGR SH58282656	Low	Major	Slight adverse	None
Estate Planted Wood PRN 60956 NGR SH58192660	Low	Minor	Slight adverse	Basic record of species by ecologist
Possible Field Clearance PRN 60957 NGR SH58222661	Unknown	Unknown	Unknown	Geophysical survey
Possible Field Clearance PRN 60958 NGR SH58182662	Unknown	Unknown	Unknown	Geophysical survey
Summer House PRN 60977 NGR SH58092668	Low	Negligible	Slight adverse	Geophysical survey
Circular Earthwork	Unknown	Unknown	Unknown	Geophysical

PRN 60959 NGR SH58152668				survey, targeted evaluation trenching
Field Boundary Earthwork PRN 60960 NGR SH58192668	Unknown	Major	Unknown	Geophysical survey, targeted evaluation trenching
Small Enclosure PRN 60965 NGR SH58092675	Negligible	Negligible	Neutral	None
Estate Planted Wood PRN 60961 NGR SH58192676	Low	Major	Moderate adverse	Basic record of species by ecologist
Field Boundary Earthwork PRN 60962 NGR SH58172678	Unknown	Minor	Unknown	Geophysical survey, targeted evaluation trenching
Cottage at Level Crossing PRN 60963 NGR SH57942680	Low	Minor	Slight adverse	None
Cambrian Coast Mainline PRN 60964 NGR SH57932681	Low	Minor	Slight adverse	None
Milestone PRN 60980 NGR SH58512670	Medium	No change	Neutral	None
Moriah Calvinist Chapel PRN 60979 NGR SH58542673	Medium	No change	Neutral	None
Bridge, Pont Llanbedr PRN 1582 NGR SH58542683	High	No change	Neutral	None
Wenallt Stores PRN 60978 NGR SH58512685	Medium	No change	Neutral	None
Modern Houses on Mochras Road PRN 60966 NGR SH58222683	Negligible	Moderate	Slight adverse	None
Pillbox, East of Talwryn-bach PRN 59744 NGR SH5808126834	Medium	Moderate	Moderate adverse	None
Footpath North-west of Mochras Road PRN 60967 NGR SH58072694	Negligible	Moderate	Slight adverse	None
Mochras Road PRN 60968 NGR SH58172695	Low	Moderate	Slight adverse	None
Brick Building PRN 60969	Low	No change	Minor adverse	None

NGR SH58262695				
Llanbedr Parish Church PRN 6943 NGR SH58492698	High	No change	Neutral	Basic record of possible visual impact
Meini Hirion Standing Stones, Llanbedr PRN 1059 NGR SH58332700	High	Major	Very large adverse	Visual and Noise impact assessment
Earthworks PRN 60970 NGR SH58182700	Unknown	Major	Unknown	Geophysical survey, targeted evaluation trenching
Boundary Ditch PRN 60971 NGR SH58212717	Negligible	Minor	Slight adverse	None
Embankment, Afon Artro PRN 59767 NGR SH58222719	Low	Moderate	Slight adverse	None
Stone Built Bridge PRN 60972 NGR SH58262733	Low	Major	Moderate adverse	None
Field Bank Earthwork PRN 60973 NGR SH58272734	Unknown	Major	Unknown	Geophysical survey, targeted evaluation trenching
Stone Built Bridge and Culvert PRN 60974 NGR SH58572755	Low	Moderate	Slight adverse	None
Road, Y Sarn Hir, Pensarn PRN 25045 NGR SH58182757	Medium	Major	Moderate adverse	None
General Field Boundaries considered to form part of the historic landscape	Low	Moderate	Slight adverse	None
Unknown Archaeology along the length of the proposed scheme	Unknown	Unknown	Unknown	Geophysical survey, evaluation trenching

Proposed Mitigation Measures

5.2.79 The detailed methodology for mitigation during construction is detailed in Vol 2 AppendixA, A5 WSI. Designed mitigation methods will also reduce impact upon heritage assets, these are detailed in Chapters 5.3 Landscape and Visual Impact and 5.7 Noise and Vibration. Basic categories of archaeological mitigation measures which will be used are as follows:

None

5.2.80 There will be no impact from the scheme therefore there is no need for mitigation measures.

Detailed Recording

5.2.81 This involves creating a detailed record of the feature prior to the commencement of work on site. The record generally consists of detailed photographs, measured survey, field drawing and written description. This may be supplemented by additional techniques such as photogrammetry. Depending on the nature of the feature and impact this may also include archaeological excavation.

Basic Recording

5.2.82 This involves creating a written description supplemented with photographs prior to works commencing.

Watching Brief

5.2.83 This involves maintaining an archaeological presence during invasive works in the vicinity of an identified feature or area of archaeological potential. This may be supplementary to detailed or basic recording prior to the commencement of works, or further work may be implemented once archaeological features are identified during the course of a watching brief.

5.2.84 The level of watching brief may be dependent on the likelihood of encountering archaeology or on the importance of a previously identified feature. The levels of watching brief are:

- Comprehensive – present during all groundworks
- Intensive – present during sensitive groundworks
- Intermittent – recording following groundworks
- Partial – as and when seems appropriate

5.2.85 This methodology would be employed in all areas of the scheme except for the defined area around the trackway to Plas y Bryn which will be subject to Strip, Map and Record. The watching brief would monitor all invasive works on an intensive basis, if certain areas were deemed to have lower archaeological potential the level of watching brief could be reduced upon agreement with the SNPA archaeologist.

Strip, Map and Record

5.2.86 Strip, Map and Record is a method of mitigation used in areas of high archaeological potential. The method requires that all soils are removed under constant archaeological direction until either (a) the archaeological horizon or (b) the natural glacial subsoil or bedrock is reached. All identified archaeological features are investigated, mapped and recorded.

5.2.87 Typically 50% of each discrete feature and 10% of each linear feature would be investigated to determine function and date. Where necessary further investigation may take place. Where complicated features are identified, a new methodology may need to be formalised and agreed to ensure that appropriate methods are employed during the excavation.

5.2.88 This method will be employed in the area surrounding the possible cremation found in Trench 5 during the evaluation trenching.

Palaeoenvironmental Sampling

5.2.89 During an archaeological watching brief on Ground Investigation pits to the north of Afon Artro it became evident that deep estuarine deposits were present. These contained a significant amount of preserved organic material which could provide a wealth of information about the environmental development of the area over thousands of years.

5.2.90 In order to ensure that the information held in these deposits is recovered prior to disturbance by the scheme, it is proposed that cores are collected and palaeoenvironmental analysis undertaken. Depending on the quality of the material it should be possible to gain an understanding of the development of the estuary through plant and insect remains and the development of the wider

landscape through pollen analysis. Radiocarbon dating would also be used as part of the analysis to determine when changes in the landscape occurred.

- 5.2.91 Bulk soil samples will also be collected from suitable deposits during the investigation and excavation of features. These will be processed by wet sieving to recover charred plant remains which can be analysed and utilised for radiocarbon dating.

Avoidance

- 5.2.92 Where possible it is always desirable to avoid unnecessary impact to heritage assets. Avoidance is the preferred option for all designated assets and potentially significant archaeology.

Reinstatement or Relocation

- 5.2.93 Features that should be reinstated or relocated with archaeological advice.

Planting and Seeding

- 5.2.94 In order to reduce the visual impact upon some of the designated heritage assets planting has been proposed as mitigation to shield views and limit noise from the proposed scheme.

- 5.2.95 Supplemental tree and shrub planting would be employed in the existing field boundaries to the west, and on the flood embankment to the north, of the Meini Hirion standing stones. This will provide screening from the route which will reduce the visual impact. The visual impact will reduce as the new planting becomes established, by year 15 the visual impact will be substantially reduced. The verges of the embanked northern section of the scheme would also be seeded to reduce the visual impact.

Interpretation

- 5.2.96 Opportunities for increased interpretation will be explored at the Meini Hirion standing stones. Improved access and interpretation would increase knowledge and appreciation of the site. The details of this stage of mitigation would be discussed and finalised following completion of other aspects of mitigation, especially the palaeoenvironmental sampling, as the results may feed into the final interpretation of the site. Improved access would be accommodated by creating a public right of way to the site, it also expected that conditions for pedestrians would improve in Llanbedr allowing safer access along the current road.

Analysis and Reporting

- 5.2.97 A full programme of post-excavation analysis and reporting would be implemented at the end of the fieldwork programme. If appropriate the results of fieldwork may also be released to the popular press to keep the public informed of discoveries made during mitigation.

Magnitude of Impacts and Significance of Effects (after mitigation)

- 5.2.98 Due to the nature of the impact on many of the archaeological features (*i.e.* direct impact resulting in destruction of the feature during the construction phase) many of the mitigation measures would not reduce the overall magnitude of impact and significance of effect. Nevertheless the mitigation measures would provide an opportunity to record such features before they are lost to the scheme.

- 5.2.99 Table 5.2.4 summarises the residual effects remaining for historical features after the proposed mitigation measures and further assessment have been applied. Where planting is proposed as mitigation for assets which are indirectly impacted, the Significance of Effect is based on the conditions at year 15.

Table 5.2.4: Value, Magnitude of Impact and Significance of Effect for Heritage Assets (not including Historic Landscapes) after Mitigation

Asset Name, PRN number and grid reference	Magnitude of impact	Significance of effect	Proposed Mitigation	Magnitude of impact	Significance of effect
	Before Mitigation			After Mitigation	
Trackway to Hen Efail PRN 60945 NGR SH58352620	Minor (Direct)	Slight adverse	Basic record	Negligible (Direct)	Neutral
Embanked Field Boundary PRN 60946 NGR SH58282629	Minor (Direct)	Slight adverse	Detailed record and intensive watching brief	Negligible (Direct)	Slight adverse
Bridle Path PRN 60947 NGR SH58283630	Minor (Direct)	Slight adverse	Detailed record and intensive watching brief	Negligible (Direct)	Slight adverse
Trackway to Llyn y Pin and Ael y Bryn PRN 60948 NGR SH58322630	Negligible (Direct)	Neutral	Basic record, partial watching brief	Negligible (Direct)	Neutral
Driveway to Hafod y Bryn PRN 60949 NGR SH58302638	Moderate (Direct)	Slight adverse	Basic record, partial watching brief, reinstatement of estate gate posts if moved or re-arranged.	Minor (Direct)	Neutral
Hafod y Bryn Lodge PRN 60950 NGR SH58312639	Moderate (Direct/Indirect)	Moderate adverse	Basic record, partial watching brief, reinstatement of estate gate posts if moved or re-arranged.	Minor (Direct/Indirect)	Slight adverse
Cross Roads PRN 60975 NGR SH58292639	Unknown (Direct)	Unknown	Intensive watching brief to record any surviving features.	Minor (Direct)	Neutral – Slight adverse
Modern Builder's Yard/Storage Facility PRN 60951 NGR SH58272639	Negligible (Indirect)	Neutral	Basic record	Neutral (Indirect)	Neutral
Disused Entrance to Modern Yard PRN 60952 NGR	Negligible (Direct)	Neutral	Basic record	Neutral (Direct)	Neutral

SH58302643					
Field Bank/Terrace PRN 60953 NGR SH58272644	Major (Direct)	Moderate adverse	Intensive watching brief	Moderate (Direct)	Minor adverse
Trackway to Plas y Bryn PRN 60954 NGR SH58352648	Moderate (Direct)	Slight adverse	Original estate gateposts and configuration to be recorded and re-instated at new entrance to Plas y Bryn, intensive watching brief during removal of gateposts and intermittent watching brief during works in vicinity of trackway.	Minor (Direct)	Slight adverse
Enclosure and Field System, Plas y Bryn PRN 24767 NGR SH5822026520	Major (Direct)	Moderate adverse	Intensive watching brief	Moderate (Direct)	Slight adverse
Plas y Bryn Farm, Llanbedr PRN 11882 NGR SH58042653	Moderate (Indirect)	Moderate adverse	Basic record, planting to reduce visual impact	Minor (Indirect)	Slight adverse
Footpath PRN 60976 NGR SH58272654	Minor (Direct)	Slight adverse	Intermittent watching brief	Negligible (Direct)	Neutral
Estate Gate and Fencing PRN 60955 NGR SH58282656	Major (Direct)	Slight adverse	Basic record, relocation/re-use of gate posts and gate if repairable	Negligible (Direct)	Neutral
Estate Planted Wood PRN 60956 NGR SH58192660	Minor (Indirect)	Slight adverse	Avoidance	Minor (Indirect)	Slight adverse
Possible Field Clearance PRN 60957 NGR SH58222661	Major (Direct)	Slight adverse	Basic record, Intensive watching brief	Negligible (Direct)	Neutral
Possible Field Clearance PRN 60958 NGR SH58182662	No Change (Indirect)	Neutral	Avoidance	No Change (Indirect)	Neutral

Summer House PRN 60977 NGR SH58092668	Negligible (Indirect)	Slight adverse	Avoidance	Negligible (Indirect)	Slight adverse
Circular Earthwork PRN 60959 NGR SH58152668	Minor (Indirect)	Slight adverse	Avoidance	Minor (Indirect)	Slight adverse
Field Boundary Earthwork PRN 60960 NGR SH58192668	Major (Direct)	Moderate adverse	Basic record, Intensive watching brief	Moderate (Direct)	Slight adverse
Small Enclosure PRN 60965 NGR SH58092675	Negligible (Indirect)	Neutral	None	Negligible (Indirect)	Neutral
Estate Planted Wood PRN 60961 NGR SH58192676	Major (Direct)	Moderate adverse	Detailed record	Minor (Direct)	Slight adverse
Field Boundary Earthwork PRN 60962 NGR SH58172678	Minor (Direct)	Slight adverse	Basic record, Intensive watching brief	Negligible (Direct)	Neutral
Cottage at Level Crossing PRN 60963 NGR SH57942680	Minor (Indirect)	Slight adverse	Basic record	Minor (Indirect)	Neutral
Cambrian Coast Mainline PRN 60964 NGR SH57932681	Minor (Indirect)	Slight adverse	Basic record	Minor (Indirect)	Neutral
Milestone PRN 60980 NGR SH58512670	No change	Neutral	None	Minor (Indirect)	Slight beneficial (due to reduced risk of damage by reduced traffic)
Moriah Calvinist Chapel	No change	Neutral	None	Minor (Indirect)	Slight beneficial (due to reduced

PRN 60979 NGR SH58542673					road traffic)
Bridge, Pont Llanbedr PRN 1582 NGR SH58542683	No change	Neutral	None	Minor (Indirect)	Moderate beneficial (due to reduced risk of damage by reduced traffic)
Wenallt Stores PRN 60978 NGR SH58512685	No change	Neutral	None	Minor (Indirect)	Slight adverse (due to potential reduced passing trade)
Modern Houses on Mochras Road PRN 60966 NGR SH58222683	Moderate (Indirect)	Slight adverse	Basic record	Minor (Indirect)	Slight adverse
Pillbox, East of Talwryn-bach PRN 59744 NGR SH5808126834	Moderate (Indirect)	Moderate adverse	Basic record and a record to be made of the views from the pillbox prior to the development.	Minor (Indirect)	Slight adverse
Footpath North-west of Mochras Road PRN 60967 NGR SH58072694	Moderate (Direct)	Slight adverse	Basic record and reinstatement/relocation	Negligible (Direct)	Neutral
Mochras Road PRN 60968 NGR SH58172695	Moderate (Direct)	Slight adverse	Basic record and intensive watching brief	Minor (Direct)	Slight adverse
Brick Building PRN 60969 NGR SH58262695	No change	Minor adverse	Basic record, avoidance	Negligible (Indirect)	Neutral
Llanbedr Parish Church PRN 6943 NGR SH58492698	No change	Neutral	None	No change	Neutral
Meini Hirion Standing Stones, Llanbedr PRN 1059	Major (Indirect)	Very large adverse	Avoidance, supplemental planting in surrounding hedgerows, improved access. Possible interpretation to be	Moderate (Indirect)	Moderate adverse

NGR SH58332700			confirmed.		
Earthworks PRN 60970 NGR SH58182700	Major (Direct)	Slight adverse	Intensive watching brief	Moderate (Direct)	Neutral
Boundary Ditch PRN 60971 NGR SH58212717	Minor (Direct)	Slight adverse	Basic recording and intermittent watching brief	Negligible (Direct)	Neutral
Embankment, Afon Artro PRN 59767 NGR SH58222719	Moderate (Direct)	Slight adverse	Basic record and intensive watching brief	Minor (Direct)	Neutral
Stone Built Bridge PRN 60972 NGR SH58262733	Major (Direct)	Moderate adverse	Detailed record and intensive watching brief	Minor (Direct)	Neutral
Field Bank Earthwork PRN 60973 NGR SH58272734	Major (Direct)	Moderate adverse	Intensive watching brief	Minor (Direct)	Neutral
Stone Built Bridge and Culvert PRN 60974 NGR SH58572755	Moderate (Indirect)	Slight adverse	Detailed record and avoidance, if directly impacted an intensive watching brief to be implemented.	Minor (Indirect)	Neutral
Road, Y Sarn Hir, Pensarn PRN 25045 NGR SH58182757	Major (Direct)	Moderate adverse	Detailed recording and intensive watching brief	Minor (Direct)	Slight adverse
General Field Boundaries considered to form part of the historic landscape	Moderate (Direct)	Slight adverse	Basic record, intermittent watching brief and reinstatement	Minor (Direct)	Neutral
Unknown Archaeology along the length of the proposed scheme	Unknown (Direct)	Unknown	Intensive watching brief	Minor (Direct)	Slight adverse
Possible Cremation to the north of	Major (Direct)	Large adverse	Strip, Map and Record/Excavation	Minor (Direct)	Slight adverse

trackway to Plas y Bryn					
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5.2.100 The main asset which would be impacted by the scheme is the Meini Hirion standing stones SAM, the impact to which would be Moderate Adverse (indirect) following implementation of the proposed mitigation. As part of the assessment the standing stones were subject to a tranquillity assessment as well as visual impact assessment. This determined that the noise levels at the site would reduce by 3.5dB once the scheme was operational, at year 15 there would be a 3.1dB reduction. There would undoubtedly be a visual impact, especially during construction and in the first years of operation until the new screen planting becomes established, visual clutter would be reduced with the relocation of overhead power lines. The magnitude of the visual impact in year one would be Moderate Adverse, by year 15, with the established screen planting this would be reduced to Slight Adverse during the summer.

5.2.101 As previously mentioned, the adverse effects on the site would be further mitigated by improved access and interpretation which would be discussed once the results of the palaeoenvironmental sampling and other archaeological mitigation were available.

Historic Landscapes

5.2.102 The assessment of impact on Historic Landscape Character Areas (HLCA) has been considered in detail in the ASIDOHL, specific viewpoints can be seen in Figure 5.2.5 and accompanying plates. Table 5.2.5 summarises the results of the assessment:

Table 5.2.5: Value, Magnitude of Impact and Significance of Effect for Historic Landscape Character Areas before Mitigation

Historic Landscape Character Area	Value	Direct Physical Impact	Indirect Impact	Reduction in Value of HLCA	Significance of Effect
Llandanwg (04)	Medium	None	Very Low	Very Low	Slight
RAE Llanbedr (11)	High	None	Low	Low	Moderate
Coastal plain behind RAE Llanbedr (14)	High	Medium	Medium	Low	Fairly Severe
Fieldscape, mid-hill slopes around Cae'r Meddyg (15)	Medium	Medium	Medium	Low	Fairly Severe
Llanbedr (18)	Medium	Very Low	Low	Very Low	Slight
Llanfair (23)	Low	None	Very Low	Very Low	Slight

5.2.103 The ASIDOHL process does not take into consideration the possible beneficial impacts a development may have on historic landscapes. In this case it is likely that, although there may be increased management needs, it is likely that there would be benefits to HLCA 11, RAE Llanbedr. Although the process determined that the significance of the effect upon HLCA 14 & 15, within which the scheme would be located, would be Fairly Severe, the same process has determined that the reduction in value of both HLCA is Low.

5.2.104 Table 5.2.6 summarises the residual effects remaining for Historic Landscape Character Areas after the proposed mitigation/enhancement measures and further assessments have been applied. Where planting is proposed to reduce visual impact on assets, the Significance of Effect is based on the conditions at Year 15. Assessment of the impacts using DMRB guidance shows that following

implementation of the proposed enhancements included in the design the significance of the impact is greatly reduced once planting becomes established.

5.2.105 Designed mitigation measures which contributed significantly to the enhancement of the Historic Landscape Character Areas are detailed in Chapters 5.3 Landscape and Visual Impact, and 5.7 Noise and Vibration.

Table 5.2.6: Significance of Effect for Historic Landscape Character Areas after consideration of enhancement measures introduced to the design (operation) (DMRB Guidance)

Historic Landscape Character Area	Value	Magnitude of Impact	Enhancement measures in design	Magnitude of Impact	Significance of Effect
Llandanwg (04)	High	Negligible	<ul style="list-style-type: none"> • Utilisation of cutting to reduce visual intrusion • Seeding and planting on embankments • Hedgerow planting • Native woodland planting • Replacement of overhead lines with underground services • Covered attenuation ponds • Low noise surface on carriageway • Utilisation of local stone in walling, including some dry-stone walls • Access provisions to reduce severance 	Negligible	Neutral/Slight adverse
RAE Llanbedr (11)	High	Negligible		Negligible	Neutral/Slight adverse
Coastal plain behind RAE Llanbedr (14)	High	Moderate		Minor	Moderate/Slight adverse
Fieldscape, mid-hill slopes around Cae'r Meddyg (15)	High	Moderate		Minor	Moderate/Slight adverse
Llanbedr (18)	High	Negligible		Negligible	Neutral/ Slight beneficial
Llanfair (23)	High	Negligible		No Change	Neutral

Summary

5.2.106 The proposed scheme would be located within the Arudwy Landscape of Outstanding Historic Interest, an area which is rich in heritage assets dating from the Mesolithic through to modern times. The design of the scheme has been successful in reducing visual impact and given its location in relatively low lying land, views to the scheme would be fairly restricted. The ASIDOHL has shown that there would be impact to the HLCA within which the scheme is located, and RAE Llanbedr to which would have increased management needs once the scheme was operational. Although the results of the assessment seem fairly severe, no consideration is given to the beneficial impacts the scheme could have on the heritage assets within the areas. Assessment of the impacts using DMRB guidance shows that following implementation of the proposed enhancements included in the

design the significance of the impact is greatly reduced once planting becomes established. The greatest impact would be to HLCA 14 and 15 where the significance of the impact would be Moderate/Slight Adverse.

- 5.2.105 The assessment identified all recorded heritage assets within 500m of the proposed route and all Scheduled Ancient Monuments and Grade I Listed Buildings within a wider 2km area surrounding the proposed scheme. The assessment also identified new heritage assets through fieldwork and consultation of available resources including historic maps, archived documents, LiDAR data and aerial photographs. No high value assets would be directly impacted by the scheme.
- 5.2.106 Subsequent evaluation has demonstrated that the likelihood of encountering significant archaeological deposits along the route would be low to medium. The evaluation trenching assessed features identified on the geophysical survey and areas which appeared to be void of archaeology, although thorough it is possible that significant archaeology could remain unidentified within the footprint of the scheme. The archaeological potential of the relict field system identified during the assessment has been shown to be fairly low, however a watching brief should be maintained to ensure that as much information as possible is gained to minimise adverse impact.
- 5.2.107 The main area of interest and archaeological potential along the proposed route is in the area around the possible cremation which was identified to the north of the trackway to Plas y Bryn, and the estuarine deposits which were found to the north of Afon Artro. Both of these areas would be subject to additional mitigation.
- 5.2.108 Assessment of the impact of the proposed development has highlighted potential adverse visual impact to the setting of Meini Hirion Standing Stones which are a Scheduled Ancient Monument. The visual impact would reduce as the new screen planting becomes established and would be substantially reduced by year 15 of operation, the removal of existing power lines will also reduce the impact. The traffic noise levels would be reduced at the site as soon as the scheme was operational and would remain reduced while the scheme was operational. Improved access and interpretation at the site would increase public knowledge and appreciation, which would work to ameliorate some of the adverse impact.
- 5.2.109 The assessment has also identified potential beneficial impacts to Listed Buildings and Scheduled Ancient Monuments on the current A496 in Llanbedr due to a potential reduction in traffic.
- 5.2.110 The assessment has been completed to meet the requirements of all relevant policies, including those relating to SAMs and historic landscapes. The scheme accords to both national and regional policies for heritage.

5.3 Landscape and Visual Impact

The Landscape and Visual Impact Assessment (Arcadis 2017) is found in Volume 2, Air Quality Technical Appendix B which includes :

- *Appendix A- LVIA Figure*
- *Appendix B- Environmental Lighting Zones by character/ urban areas*
- *Appendix C- Regulatory / Policy Framework*
- *Appendix D-Listed Buildings and Monuments*
- *Appendix E – Visual Effects Schedule*

References are provided at the end of this chapter, page 126

Introduction

- 5.3.1 This assessment has been produced to consider the landscape and visual implications of the proposed A496 Llanbedr Access Improvement. The assessment considers how the Proposed Improvement will affect the resources identified in the study area in terms of landscape character and visual amenity.
- 5.3.2 Landscape is defined in the European Landscape Convention as ‘...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors’ (Council of Europe, 2000) (Ref 1). The assessment considers how the Proposed Improvement will alter the character of the landscape, as well as the views of the landscape afforded to people - visual amenity considerations. These two separate but related issues form the basis of landscape and visual impact assessment ("LVIA").
- 5.3.3 In the north, the Proposed Improvement would cut across the low lying, flat valley floor and floodplain of the Afon Artro on embankment. This section includes two new culverts located at chainages CH1100 and CH1220. The embankment increases in height to the south to cross the River Artro and Mochras Road to the west of Llanbedr. South of the Afon Artro the Proposed Improvement would continue to rise as it cuts through a local ridgeline, before crossing a locally undulating landscape on an embankment to connect with the existing highway to the south of Llanbedr. The proposed highway infrastructure would include three new culverts, a bridge over the Afon Artro / Mochras Road, a small bridge over an existing water inlet channel, drainage, lighting improvements to the Mochras Road, signs, utilities diversions and new stone walls.
- 5.3.4 This report takes account of the value and nature (sensitivity) of the landscape and views from visual receptors such as residential properties and users of Public Rights of Way ("PRoW"), from which there would be views to the Proposed Improvement, and considers the degree of change predicted to occur on the landscape and views. Whilst heritage features have a bearing on landscape value, the effects in relation to their setting have been assessed separately (see Chapter 5.2 and ASIDOHL assessment). Similarly, whilst the landscape performs an ecological function, ecological effects are considered through a separate assessment (see Chapter 5.4 Nature Conservation).
- 5.3.5 This report sets out the methodology used to undertake the assessment, and summarises the regulatory and policy framework relating to landscape and visual amenity. Following this, an overview of the baseline for the Proposed Improvement is provided. This is followed by a discussion of the predicted change to the baseline, the mitigation to avoid or reduce the changes, and the residual effects of the Proposed Improvement. The residual effects identified include those arising during the construction phase, in Opening Year (Winter) and Design Year

(Summer, 15 years following completion). Finally, a summary table of the main findings is provided.

- 5.3.6 This report will also consider the effects of artificial lighting included with the Proposed Improvement on the night time landscape.

Methodology

General Approach

- 5.3.7 The landscape and visual assessment for the Proposed Improvement has been undertaken in accordance with the following best practice guidance;
- Highways Agency (2008) HA 205/08: DMRB Volume 11, Section 2, Part 5: Assessment and Management of Environmental Effects (*Ref 2*);
 - Highways Agency (2010) Interim Advice Note (“IAN”) 135/10: ‘Landscape and Visual Effects Assessment’ (*Ref 8-2*). (IAN 135/10 supersedes Volume 11, Section 3, Part 5 of the DMRB (*Ref 3*));
 - Landscape Institute (2011) Advice Note 01/11 ‘Photography and Photomontage in Landscape and Visual Impact Assessment’ (*Ref 5*);
 - Landscape Institute and Institute of Environmental Management and Assessment (2013) ‘Guidelines for Landscape and Visual Impact Assessment’: Third Edition. (GLVIA) (*Ref 4*); and
 - Institute of Lighting Professionals (2005) ‘Guidance Notes on the Reduction of Obtrusive Light’ (*Ref 12*).

Study Area

- 5.3.8 The overarching Study Area extends to a 2km radius from the centre line of the Proposed Improvement (refer to Figure 5.3.1). Beyond this distance the Proposed Improvement would not be readily perceptible within the wider landscape.
- 5.3.9 To refine the assessment, a Zone of Visual Influence (ZVI) has been generated as shown on the Visual Effects Drawing (VED), Figure 5.3.1. The ZVI broadly defines the approximate area within which the Proposed Improvement would be visible, and has then been verified by site surveys to take into account landform and land cover (e.g. vegetation and buildings).
- 5.3.10 The study area for the Proposed Improvement falls entirely within the nationally designated Snowdonia National Park. At a local level the Snowdonia National Park Authority in their document SPG 07: Landscapes and seascapes of Eryri (*Ref 13*) maintains that the Proposed Improvement falls within the landscape character areas (LCA) of Morfa Dyffryn and Cefnwlod Arfordir Ardudwy. The analysis of the Proposed Improvement in the context of Landscape Character is based on a review of the Snowdonia National Park Authority (EYRI) Landscape Character Assessment and the LCA’s which fall within the ZVI. These are identified below and defined on Vol 1a Figure 5.3.7.

Baseline Evaluation

- 5.3.11 Desk based studies have been undertaken to identify relevant policy and landscape character information. The way in which policies relating to landscape and visual amenity are addressed at this stage is explained in Volume 2, Technical Appendix B .

The following documents have been reviewed as part of the desk study:

- National Policy Statement for National Networks (2014), Department for Transport (*Ref 11*);
- Welsh Government Planning Policy Wales (Edition 8) 2016 (*Ref 8*);
- Adopted and emerging local development plans, comprising:

- Snowdonia National Park Authority planning policies (Ref 07)
- LandMAP (Ref 10) , and:
- Local landscape character assessments, comprising:
- Snowdonia National Park Landscape Character Assessments (Ref 13)

5.3.12 A detailed landscape survey of the local LCAs was carried out in March 2016. Separate site surveys were undertaken during winter and summer to establish the likely visual influence of the Proposed Improvement, identify visual receptor groups and describe the existing views experienced by receptors.

5.3.13 Representative Viewpoints have been identified and agreed with the Snowdonia National Park (see Table 5-3-1 which details the consultation undertaken). These viewpoints give an indication of the range of existing views available. Viewpoint photographs were taken in accordance with the Landscape Institute’s Advice Note 01/11.(Ref 5) Photographs were then stitched together to generate a 90 degree view angle in the direction of the Proposed Improvement. This is the full extent of view that will be experienced by the viewer at the selected viewpoint, when facing in that direction. The photographs for the viewpoints A to G are shown on Vol 1a Figures 5.3.8 – 5.3.14.

Table 5-3-1: Summary of Consultation

Consultee	Date of Consultation	Consultation Response	Project Response
Iwan Evans (Head of Policy & Strategic Plans); Snowdonia National Park Authority	15 th January 2016	Snowdonia National Park Authority agreed with the viewpoints and requested one additional viewpoint from Shell Island, as a popular area with tourists	Additional viewpoint requested added into assessment.
John Roberts (Archaeologist); Snowdonia National Park Authority, Ian Halfpenny; Cadw, Iwan Parry (Consultant Archaeologist); Brython Archaeology	23 rd March 2016	The implication of the Proposed Improvement on the setting of the SAM standing stones to the northern edge of Llanbedr were discussed on site, along with a review of potential mitigation measures, both as part of the Proposed Improvement and in the form of off-site works.	Mitigation options to be considered include; Reinforcement planting to hedgerows adjacent to SAM Relocation of existing overhead power lines underground as part of the highway works Mitigation planting to embankment alongside the Afon Artro Diversion of the existing PRow from the A496 west to pass the SAM then pass under the proposed new overbridge road before following the river to meet the existing alignment to the north Interpretation signage for the SAM

Design and mitigation

5.3.14 Design of the Proposed Improvement has been undertaken by YGC on behalf of Gwynedd Council. The Proposed Improvement has been designed, so far as possible, to minimise landscape and visual effects. The retention of existing features and vegetation has been considered as part of the iterative design process and location-specific mitigation (such as tree and shrub planting to replace existing vegetation lost, new stone walls and stone cladding to the new structures to help integrate the new road) has been proposed in order to minimise the adverse effects of the Proposed Improvement on the landscape and on visual amenity. The proposed mitigation measures for landscape and ecology are identified on the Environmental Masterplan prepared by Gwynedd Council, and are embedded within the Proposed Improvement design and the Contract Documents and specification.

Assessing impacts

5.3.15 The magnitude of impact has been defined in accordance with the criteria provided in IAN 135/10. Significance of effect is derived as a product of magnitude of impact and sensitivity of the receptor in each case. Where a range of significance is possible, professional judgment has been applied to determine which is most appropriate, on a case by case basis.

5.3.16 In this report, residual effects during the winter of the Opening Year and the summer of the Design Year (15 years following completion) on all visual receptors have been assessed. These are reported within the Visual Effects Schedule (“VES”) in Appendix E and shown on the Visual Effects Drawing (VED), Figure 5.3.15 – 5.3.16. This report provides a summary of the findings, reporting in slightly more detail in respect of moderate effects and above.

Landscape Sensitivity

5.3.17 The sensitivity of the landscape and townscape resource have been considered in relation to both the Snowdonia National Park Authorities landscape characterisation work and Natural Resources Wales (NRW) online landscape assessment and decision making tool LANDMAP (An All-Wales GIS data set) and are then determined using the examples shown in Table 5-3-2 in relation to the quality of their features and elements and designations associated with the area.

Table 5-3-2: Landscape and Townscape Sensitivity (based on DMRB IAN135/10 Annex 1 Table 2)

Sensitivity	Typical Descriptors and Examples
High	<p>Resource which by nature of its character would be unable to accommodate change of the type proposed. Typically these would be:</p> <ul style="list-style-type: none"> • Of high quality with distinctive elements and features making a positive contribution to character and sense of place; • Likely to be designated, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale; • Areas of special recognised value through use, perception or historic and cultural associations; and • Likely to contain features and elements that are rare and could not be replaced.
Moderate	<p>Resource which by nature of its character would be able to partly accommodate change of the type proposed. Typically these would be:</p> <ul style="list-style-type: none"> • Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place; • Locally designated, or their value may be expressed through non-statutory local publications; • Containing some features of value through use, perception or historic and cultural associations; and • Likely to contain some features and elements that could not be

	replaced.
Low	<p>Resource which by nature of its character would be able to accommodate change of the type proposed. Typically these would be:</p> <ul style="list-style-type: none"> • Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place; • Not designated; • Containing few, if any, features of value through use, perception or historic and cultural associations; and • Likely to contain few, if any, features and elements that could not be replaced.

Visual Sensitivity

5.3.18 Visual impacts are likely to occur within the ZVI. In particular, these impacts would be most affected where there are residential properties and publicly accessible areas from where there are views to the Proposed Improvement. Publicly accessible locations include open access land and Public Rights of Way (PRoW).

Table 5-3-3: Visual Sensitivity and Typical Descriptors (based on DMRB IAN135/10 Annex 2 Table 1)

Sensitivity	Typical Criteria
High	<ul style="list-style-type: none"> • Residential Properties • Users of Public Rights of Way or other recreational trails (e.g. Regional Trails, footpaths, bridleways etc.) • Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land etc.)
Moderate	<ul style="list-style-type: none"> • Outdoor workers • Users of scenic roads, railways or waterways or users of designated tourist routes • Schools and other institutional buildings, and their outdoor areas
Low	<ul style="list-style-type: none"> • Indoor workers • Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes • Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities)

Factors in the Assessment of Scale (magnitude) of Impacts

5.3.19 For the purposes of the appraisal, the scale of impact on the landscape and townscape resources are determined using the point scale shown in Table 5-3-4.

Table 5-3-4: Magnitude and Nature of Impact and Typical Descriptors (based on DMRB IAN135/10 Annex 1, Table 1)

Magnitude of Impact	Typical Criteria Descriptors
Major Beneficial	Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features.
Moderate Beneficial	Partial or noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features.

Minor Beneficial	Slight improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
No Change	No noticeable loss, damage or alteration to character or features or elements.
Negligible Adverse	Barely noticeable loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Minor Adverse	Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Moderate Adverse	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Major Adverse	Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.

5.3.20 For the purposes of this assessment, the scale of impact on the visual receptors are determined using the scale and indicative criteria shown Table 5-3-5. Please note the nature of the magnitude of impact would be either negative or positive depending on the extent to which the Proposed Improvement is out of character with the existing view.

Table 5-3-5: Magnitude and Nature of Impact and Typical Descriptors (based on DMRB IAN135/10 Annex 2, Table 2)

Magnitude of Impact	Typical Criteria Descriptors
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view.
No Change	No part of the project, or work or activity associated with it, is discernible.

Determination of Significance

5.3.21 The determination of significance of the impact is a factor of the previously described sensitivity of the resource or receptor and the magnitude of the impact as described above. The range of significance of effects on the landscape and townscape resources and visual receptors is presented in Table 5-3-6 where there is a choice in significance score, professional judgement is used to determine the significance level.

Table 5-3-6: Significance of Effects Categories (based on DMRB IAN 135/10 Annex 1 Table 3 and Annex 2 Table 3)

		Magnitude of Impact				
		No Change	Negligible	Minor	Moderate	Major
Sensitivity	High	Neutral	Slight	Slight/ Moderate	Moderate/ Large	Large/ Very Large
	Moderate	Neutral	Neutral/ Slight	Slight	Moderate	Moderate/ Large
	Low	Neutral	Neutral/ Slight	Neutral/ Slight	Slight	Slight/ Moderate

Night time Assessment

5.3.22 The Institution of Lighting Engineers (now referred to as the Institution of Lighting Professionals (“ILP”)) has produced guidelines which identify Environmental Zones that define the broad night-time characteristics of areas in terms of relative brightness or darkness (Ref 12). The following Environmental Zones are considered to best describe the various locations covered by the Proposed Improvement, against which it can be assessed.

Table 5-3-7: Description of the lighting environmental zones, as adapted by IESNA

Zone Rating	Description
E0	Intrinsically dark landscapes covered by designation e.g. UNESCO Starlight Reserves. In the UK these include Exmoor National Park (2011) and Northumberland National Park (2013). The latter has also been granted Gold Tier Dark Sky Park status by the International Dark Skies Association (“IDA”);
E1	Dark landscapes, e.g. National Parks, Areas of Outstanding Natural Beauty and other rural areas
E2	Low district brightness areas, e.g. rural, small village or relatively dark urban locations
E3	Medium district brightness areas, e.g. small town centres or urban locations;
E4	High district brightness areas, e.g. town/city centres with high levels of night-time activity.

5.3.23 As part of the assessment the same viewpoints as used during the assessment of Landscape and Visual effects are used to represent the range of visual receptors and likely impact of the Proposed Improvement on the night time landscape. A baseline night time survey was carried out in March 2016 to ensure assessment robustness. The baseline Environmental Zones are reported in the baseline under each link and identified on Figure 5.3.17.

Cumulative assessment

5.3.24 Where there are two or more planned significant developments where study areas may overlap, a cumulative assessment may be required. Although individual sites may be judged to have insignificant environmental impacts when considered in isolation, these effects may be magnified when considered in conjunction with other existing or proposed developments. The following future development has been identified:

Snowdonia Enterprise Zone (SEZ) - Llanbedr Airfield

- 5.3.25 The site of Llanbedr airfield has been identified by Welsh Government as being part of the Snowdonia Enterprise Zone, containing the Snowdonia Aerospace Centre. It is considered that the site's natural seclusion, location, grid infrastructure, its own lake and the availability of a technically skilled workforce make this location ideal for ICT and low carbon energy businesses, potentially supporting a bid to be developed as a key UK Aerospace centre. To date around £1.5 million has been invested in the sites infrastructure and development in support of this designation and a number of studies have previously been developed for the site including a dedicated masterplan in 2013 which developed a series of future development options, and a series of Economic Impact Assessments, undertaken to establish the viability of development options identified.
- 5.3.26 The current development scenario for the site is based on the A496 Llanbedr Access Improvements Proposed Improvement being implemented and potential future development of the airfield site as follows;
- Business and Enterprise Park;
 - Maintenance, repair and overhaul (MRO); and
 - Remotely piloted aircraft systems (RPAS).
- 5.3.27 The Economic impact assessment undertaken on this development suggests that the main impacts would be in the development of RPAS activities at the airfield. At the same time, improved road access is also considered to consolidate the employment in the airfield rather than induce huge increases. MRO activity identified would be reliant in part on the development of the RPAS activities. Further development of the Business park is thought to be likely, although not a significant area of immediate growth.
- 5.3.28 In line with this, no specific physical development of the airfield site is currently planned or anticipated on a significant scale in the near future, with the economic model being based on the growth in industry primarily utilising existing infrastructure.
- 5.3.29 As such it is not considered necessary undertake a cumulative assessment of the impacts of the two Proposed Improvements.

Baseline Assessment

Landscape

Landscape Policy summary

- 5.3.30 Planning Policy Wales (Edition 8, January 2016) (Ref 8) advises that landscape considerations are to be taken into account in determining individual applications and contributing to the implementation of specific projects and that where development does occur it is important to ensure that all reasonable steps are taken to safeguard or enhance the environmental quality of land. The site of the proposed Development, as defined in Section 1 is located within to the west of Llanbedr and as such falls within the Snowdonia National Park. As a result, the Snowdonia Local Development Plan takes precedence over the Gwynedd Council Unitary Development plan.
- 5.3.31 The relevant planning policies which have been considered during the Proposed Improvement are contained in Volume 2, Appendix B Air Quality Technical: Appendix C. A summary of the national plans and policies that have been considered as part of this assessment is provided in Table 5-3-8.

Table 5-3-8: National landscape and visual regulatory and policy framework

Policy/ Legislation	Summary of Requirements	Proposed Improvement Response
Planning Policy Wales (Edition 8, January 2016)		
8.5.1	Local authorities should utilise available powers to reduce the need to use trunk roads and other through routes for short, local journeys.	The proposed development removes the trunk road from the village, reducing through traffic and allowing improved movement on local roads for residents. Direct access from the proposed Proposed Improvement to Llanbedr Airfield and business park removed goods and tourist traffic from the village centre.
8.5.7	Great care must be taken to minimise the adverse impacts of new transport infrastructure, or improvements to existing infrastructure, on the natural, historic and built environment.	Route of Proposed Improvement avoids nearby SAM and listed structures, and looks to minimise impact on surrounding landscape.
8.6.2	Minimise the adverse impacts of transport infrastructure projects on the natural, historic and built environment and on local communities.	Proposed Improvement designed to minimise the impact on local built environment. Mitigation measures to be considered to minimise the impact on the natural environment and aid integration into the surrounding landscape.
13.13	Development should seek to protect the natural and historic environment including wildlife, retain dark skies where appropriate, prevent glare and respect the amenity of neighbouring land uses and reduce the carbon emissions associated with lighting.	Lighting requirements for the Proposed Improvement to be minimised as far as possible, mitigation measures to be considered to minimise the impact of the Proposed Improvement on the surrounding natural and historic landscape
Snowdonia National Park Authority EYRI Local Development Plan 2007-2022		
Strategic Policy A	Seeks to ensure that new development promotes the principles of sustainable development in ways which further National Park purposes and duty whilst conserving and enhancing the National Park's 'Special Qualities'.	Proposed Improvement intended to minimise the impact on the Eryri, and conserve and improve the quality of Llanbedr village by reducing traffic and congestion, improving noise and air quality
Strategic Policy B	Major development will not be permitted within the National Park other than in exceptional circumstances where there is demonstrated to be an overriding public need	Proposed development works to ensure any increase in traffic does not adversely impact on the village of Llanbedr and surrounding air and noise quality whilst supporting

Policy/ Legislation	Summary of Requirements	Proposed Improvement Response
		development in identified enterprise zones
Strategic Policy D	Natural resources, biodiversity, geodiversity and ‘Special Qualities’ of the Snowdonia National Park will be protected from inappropriate development.	Proposed Improvement looks to minimise impact on the natural qualities of the National Park, with mitigation measures to be considered to reduce impact
Strategic Policy F	The historic landscape, heritage assets and cultural heritage of Snowdonia National Park will be conserved and enhanced, due to their contribution to the character and ‘Special Qualities’ of the National Park.	The Proposed Improvement and mitigation measures considered are designed as far as possible to protect and enhance the historic landscape as far as possible.
Strategic Policy L	Development will be supported where it will reduce or remove vehicle traffic from within town centres and where possible from rural areas.	The Proposed Improvement is intended to reduce traffic movement and congestion within the centre of Llanbedr
Development Policy 2	New developments should respect and conserve the character of the landscape; scale, design, setting and landscaping.	The proposed development and mitigation are intended to minimise the likely impact on the local landscape character
Development Policy 5	Public or private open space within or adjacent to the main built up area of settlements that contributes to the amenity of residents will be protected from development.	The Proposed Improvement and mitigation measures are intended to protect open space and access, including local PRoW’s.

Snowdonia National Park – Special Qualities

5.3.32 The study area is located wholly within the boundary of the Eryri national park. The special qualities of the Eryri are described as being:

- The diversity of high quality landscapes and coastal areas within a small geographic area – ranging from coast to rolling uplands to the rugged mountains for which Snowdonia is famed.
- The robust sense of community cohesion, belonging and vibrancy which combine to give a strong ‘sense of place’
- Continuing vibrancy of the Welsh language as the primary language in social and professional environments. This aspect is evident in local place names that reflect the area’s cultural heritage.
- An area which has inspired some of the nation’s most notable culture, folklore, art, literature and music, which continues to inspire to the present day.
- The opportunity for people to understand and enjoy the National Park actively, whilst maintaining areas of tranquillity and solitude, thus promoting aspects of health and wellbeing.
- Landscapes and townscapes which chart human impact over centuries, from Neolithic times to the present day. This is evident in archaeological remains, place and field names, oral and written history and present day land management practices. Its architectural heritage is reflected in the density of Listed Buildings and the wider historic environment.

- Complex, varied and renowned geology, vital in influencing the disciplines of geology and geography internationally.
- Varied biodiversity reflecting Snowdonia's landscapes, geology, land management practices and climate. Some notable species and habitats are of national and international significance, for example species which are remnants of the last ice age, providing a glimpse of semi-Arctic habitats. Snowdonia is the most southerly point in the UK for many such species.
- Extensive opportunities for recreation, leisure and learning for people of all ages and ability combined with areas of tranquillity.

5.3.33 In 2015 Snowdonia National Park was awarded Dark Skies Status by the International -Sky Association Dark Sky Association in recognition of the Parks proven quality of the night air and efforts to maintain and reduce levels of light pollution.

Landscape Character

5.3.34 The Proposed Improvement is located within the Morfa Dyffryn and Cefnwlad Arfordir Ardudwy Landscape Character Areas as identified within the Snowdonia National Park Authority SPG 07: Landscapes and seascapes of Eryri (Ref 13)

5.3.35 The Morfa Dyffryn LCA is summarised as being;

'A small character area lying to the west of the A496, lying just above sea level, almost entirely dominated by the former Royal Aircraft Establishment complex and associated airfield. The land edge is defined by a dune system. The A496 passes through a number of small settlements, Tal y Bont, Coed Ystumgwern and Llanbedr, and provides a visual and noise detractor. Likewise the Cambrian Coast railway runs through the area.'

5.3.36 The northern element of the proposed by-pass, from the Afon Artro to the existing line of the A496 is positioned on the eastern edge of this LCA. The area is described as a flat, generally low-lying (generally less than 10m AOD) coastal landscape on the fringes of the National Park comprising of deposits of shingle and sand with an underlying geology of Tertiary and Mesozoic rocks. The LCA is largely defined by the Afon Artro estuary to the north and the smaller Afon Ysgethin estuary to the south, with the landscape between broken up by drainage channels and streams. Vegetation is largely limited to small patches of woodland and scrub, with hedgerow trees providing more tree cover further inland to the east around pastoral fields in a small scale irregular pattern. The area is classed as a Site of Special Scientific Interest & a National Nature Reserve, with the dunes along the western edge designated a Special Area for Conservation.

5.3.37 The entire LCA is within the wider Ardudwy Landscape of Outstanding Historic Interest with extensive evidence of recurrent settlement and land use since the prehistoric period. The northern section of the LCA is dominated by the disused Llanbedr airfield and tourism-related developments scattered throughout, including camping and caravan sites and car parks (including on Shell Island,). There are scenic views along the Cambrian coast, with inland views dominated by the mountains of the National Park's core.

5.3.38 The Cefnwlad Arfordir Ardudwy LCA is summarised as;

'The area to the west of the Rhinog Mountains, sloping down dramatically towards the coastal edge. It extends from the mouth of the Afon Dwyrhyd and the edge of Coed Felinrhyd in the north to the National Park boundary north of Barmouth in the south.'

5.3.39 The southern section of the site from the Afon Artro to the line of the existing A496 alignment is within this LCA. Its key characteristics are defined as being;

- A rolling landscape of seaward facing hills dropping down from the adjacent Rhinog Mountains, which contain the landscape to the east.

- Altitude ranges from up to 300 metres on the fringes of the mountains, to 20 metres along the coastal edge.
- Bedrock geology of silty mudstones and thin coarse-grained sandstones of Cambrian age, frequently overlain by glacial till deposits resulting in a complex topography.
- Dissected by the valleys of the Afon Artro, Cwmnantcol, YGlyn and Ysgethin along with multiple streams draining westwards towards the coast. Small lakes are dotted throughout the landscape.
- Extensive broadleaved woodland cover clothing valley sides, with some mixed and coniferous plantations – including the extensive forestry at Coed Felinrhyd.
- An historic irregular field pattern marked by stone walls, punctuated by pockets of open hill summits. Mature trees along field boundaries contributing to a well-wooded character on valley slopes.
- Predominantly pastoral land use, with patches of rough grazing land on higher ground.
- Nationally and internationally important ancient semi-natural oak sessile oak woodlands with a rich ground flora (including areas within the Meirionnydd Oakwoods and Bat Sites SAC), interspersed with areas of species-rich grassland, flushes and wet pasture.
- Within the wider Arduwy Landscape of Outstanding Historic Interest, representing extensive evidence of recurrent settlement and land use since the prehistoric period – e.g. the Neolithic burial chambers at Dyffryn Arduwy, prehistoric settlement/field system remains, medieval deserted settlements and defensive sites (e.g. Clogwyn Arllef hillfort).
- The 13th century Harlech Castle, a World Heritage Site, occupying a prominent spur overlooking the sea and the flat expanse of Morfa Harlech (LCA 10). The historic Edwardian settlement of Harlech (a Conservation Area) occupies an elevated cliff-ledge previously open to the sea.
- Estate plantings, ornamental woodland and parkland associated with the 18th century Cors-y-Gedol (Grade II) and the 17th century Grade II* listed Glyn Cywarch manor house.
- Other settlement mainly concentrated along the A496 coastal road, including caravan parks and camp sites. This includes the villages of Coed Ystumgwern, Dyffryn Arduwy, Talsarnau and Tal y Bont, with some ribbon development.
- Elsewhere, scattered stone/slate-built farmsteads and hamlets linked by winding rural roads along valleys and over hillsides.
- Strong historic integrity retained due to topography limiting both access and settlement in the area. The A496 road and tourism-related developments erode these perceptions along the coastal fringe.
- Combined views of the coast and the Rhinog mountain range (LCA 13)

5.3.40 The NRW LANDMAP is set out under five aspect layers. These aspect layers identify the geological, cultural, habitat, historic and visual and sensory qualities of the landscape within the study area are shown on Figures 5.3.2-5.3.6. A summary of each of the five aspect layers is provided below.

Geological Landscape

5.3.41 The Proposed Improvement falls mostly within the Afon Artro geological aspect area, a fault valley which runs east to west dissecting the steep west facing slopes of the Rhinogydd Mountains, formed from coarse sandstone and conglomerated on higher ground. The shape and nature of the landform is largely a result of a glacial mountain valley with occasional moraines and drumlin fields to lower slopes to the west. The southern-most section of the Proposed Improvement falls within the Afon Ysgethin aspect area. This is an area of mountain and upland valleys with undulating upland terrain, notably with steep west facing slopes, partially dissected by the V-shaped Ysgethin valley.

- 5.3.42 Views are available towards the Proposed Improvement from the Mochras Farm aspect area to the west. This coastal area is largely formed of quaternary dunes to the west and glacial alluvium of sand and gravel deposited across the Morfa Harlech and Morfa Dyffryn lowlands.
- 5.3.43 All three aspect areas are considered to be of outstanding value and in good condition.

Historic Landscape

- 5.3.44 The Proposed Improvement falls within the Arduwy Lower Slopes and Arduwy Coastal Strip aspect areas. The Arduwy Lower Slopes aspect area is described as a rural agricultural land formed of irregular fieldscapes, interspersed with deciduous woodland and small non-nucleated settlements. It is considered to be of outstanding value due to its distinctive landscape of dry-stone walls and multi-period farmsteads dating to the post medieval period.
- 5.3.45 The Arduwy Coastal Strip aspect area is described as a rural agricultural landscape of regular fieldscapes, consisting of reclaimed land and water and wetlands located along the western edge of the Rhinogydd Mountains. Key features are dry stone wall field boundaries and cut drainage channels, interspersed with buildings and structures and industrial archaeology dating to the post medieval period. It is considered to be of moderate value, due to recent intrusion into the earlier landscape.
- 5.3.46 In addition, there are views towards the site from Llanbedr Airfield, Arduwy Upper Slopes, and Roads aspect areas. Llanbedr Airfield is classed as a built military landscape. A level area of land, it is distinctive due to its post and wire bounding fence and military buildings and structures. As a result, it is considered to be of moderate value, as a surviving example of and WWII airfield.
- 5.3.47 The Arduwy Upper Slopes aspect area is described as rural non-agricultural, marginal land. A narrow area running north east from Harlech on the coast, this is formed of both regular and irregular fieldscapes bounded by dry stone walls and containing relict earthworks, stone monuments and buildings and structures dating back to prehistoric and medieval periods. This aspect area is considered to be of outstanding value, due to the number of important relict archaeological remains.
- 5.3.48 The Roads aspect area is described as being a built environment located around a non-nucleated settlement reflecting the changing nature of built form. This contains features and structures dating from medieval, post-medieval, industrial and recent time periods. As a result, it is considered to be of outstanding value reflecting a historically important movement route.

Landscape Habitat

- 5.3.49 The Proposed Improvement falls within the Dry (Relatively) Terrestrial Habitats. The Dry Landscape Habitat is described as containing mostly improved grassland, with some semi-natural broad-leaved woodland and marshy grassland present. The area is interspersed with buildings and a caravan site, with other habitats provided from wet ditches within the area. As a result, it is considered to be of moderate value.

Visual & Sensory

- 5.3.50 The Proposed Improvement falls within the Coastal Lowland Level 3 Classification and comprises the Morfa Mawr, Morfa Mawr Coast and Coed Ystmgwern Farmland Coastal Farmland aspect areas. These aspects cover a varied landscape from coastal dunes and estuaries in the west to open rolling farmland in the east. These aspect areas are considered to be open, with a simple, muted random layout with texture provided by the vegetation and woodland blocks. The value within the Morfa Mawr and Coed Ystmgwern Farmland is considered to be high due to the attractive, accessible views along the coast with relatively few detractors, falling to moderate along the coastal edge within the Morfa Mawr Coast.

5.3.51 There is inter-visibility from the Proposed Improvement to the Harlech urban built development aspect area located in the north of the study area. This aspect is described as open due to the local topography and is diverse in appearance with a coarse texture and a constant level of human impact. It's built form strongly contrasts with the other aspect areas to the south. It is considered to have a moderate value.

Cultural Landscape

5.3.52 The Proposed Improvement falls within the Coastal Arduwly aspect area and the west edge of the Llanbedr-Dyffryn Arduwly-Tal y Bont aspect area surrounding Llanbedr. The Coastal Arduwly aspect area is described as an extensive rural coastal landscape with infrastructure and tourism influences. The aspect area is rich in archaeology with evidence of land use from prehistoric through to current times, impacted however by the number of caravan parks. The value of the landscape is considered to be outstanding, but reduces locally to moderate where caravan parks predominate.

5.3.53 The Llanbedr Dyffryn Arduwly-Tal y Bont aspect area is described as rural settlements with tourism influences. This is based around a series of villages spread along the coastal plain. The villages are a mix of design quality and appearance dating primarily from the Victorian, Edwardian and post-1950 periods. It is considered to have a high value.

Local Landscape Character

5.3.54 With reference to the SNPA landscape characterisation work and the NRW LANDMAP data identified previously the study area has been further subdivided into the following eight Proposed Improvement-specific Landscape Character Areas (LCA);

- LCA 01: Shell Island, Morfa Dyffryn Dunes & Morfa Estuary
- LCA 02: Llanbedr Airfield
- LCA 03: The settlement of Llanfair & surrounding open farmland
- LCA 04: Semi-wooded hillsides of the Rhinog Mountain foothills
- LCA 05: Low-lying Artro Estuary floodplain & surrounding farmland
- LCA 06: Llanbedr village
- LCA 07: The Afon Artro wooded valley & surrounding hillside
- LCA 08: The open rising hillsides of the Rhinog Mountain foothills.

LCA 01: Shell Island, Morfa Dyffryn Dunes & Morfa Estuary

5.3.55 This area falls within the Coastal Lowland and is identified as the coastal dunes and flats of the Morfa Dyffryn and Afon Artro estuary, with Shell Island on the eastern edge forming a prominent feature. The landform is low lying and exposed to the sea, tidal to the north running up the estuary towards Pensarn Harbour, with open beaches to the south. Nearby views east are limited by the local change in landform with the steep wooded sides Rhinogydd Mountains rising in the distance. Public Rights of Way cross the flats, with limited visual intrusion and in parts has a wild and remote sense of place.

5.3.56 As a result, this LCA is considered to be of **high** sensitivity.

LCA 02: Llanbedr Airfield

5.3.57 This area falls within the Coastal Lowland. It is a level and open area dominated by the airfield infrastructure i.e. hangars and outbuildings at the northern edge and the control tower to the west. The area is clearly defined by the perimeter security fence running with the majority of the area within consisting of managed grassland and large expanses of tarmac. Extensive views are available along the coast to the north south, and out to sea to the west. To the east, the rolling lower slopes of the Rhinogydd Mountains dominate, meeting the edge of the area in the centre.

5.3.58 As a result, this LCA is considered to be of **moderate** sensitivity

LCA 03: The settlement of Llanfair & surrounding open farmland

5.3.59 This area falls within the Coastal Lowland at the northern edge of the study area and takes in the settlement of Llanfair. This settlement is located on an open elevated hillside which affords expansive views west out to sea and south across LCA 05 to Llanbedr, and along the coastline and the edge of the Rhinogydd Mountain range beyond. It is a dispersed settlement with properties grouped together along localised ridgelines running across the hillside. At the western edge of this area is the smaller settlement of Llandanwg.

5.3.60 As a result, this LCA is considered to be of **moderate** sensitivity

LCA 04: Semi-wooded hillsides of the Rhinogydd Mountain foothills

5.3.61 This area falls within the Lowland Plain. It comprises an irregular pattern of agricultural fields rising up the hillside, broken up by dry stone walls and interspersed with broadleaved woodland to the south. Scattered properties accessed along minor roads and tracks are afforded wide views to the west and south, elevated above Llanfair and encouraged by the local topography wrapping around the north and east.

5.3.62 As a result, this LCA is considered to be of **high** sensitivity

LCA 05: Low lying Artro Estuary floodplain & surrounding farmland

5.3.63 This area falls within the Lowland Plain. This is a low lying typically flat open area with the west edge delineated by the Cambrian Coast railway. The rising landform to the south within LCA 08 and to the north and north west within LCA 03 and LCA 04 respectively enclose the area and restrict views out. The feature of this area is the Afon Artro delineated by riparian vegetation and low flood bunds. The floodplain is characterised by damp pasture and an irregular field pattern separated by open ditches, fences and scattered hedgerows. The existing A496 cuts through the north part of the area, with its alignment defined by road side trees and a low stone boundary wall. In the north part of the area the fields become more regulated in size and defined by traditional dry stone walls. The Llanbedr Standing Stones Scheduled Monument sits within the south east part of this area. The area generally has a high level of tranquillity, with pleasant views and little noise or activity, with main movement focussed on the road to the east and the rail line to the west.

5.3.64 As a result, this LCA is considered to be of **high** sensitivity

LCA 06: Llanbedr village

5.3.65 This area falls within the Lowland Plain and is defined by the built-up extent of Llanbedr village. It is a dispersed settlement centred on the A496 crossing over the Afon Arturo. The settlement spreads out north along the A496 and east and west along the Afon Arturo. Buildings are primarily of Victorian and Edwardian era, interspersed with modern infill development. The dense nature of properties and adjacent steep landform to the east and south limits views out. The north west part of the settlement has a strong relationship with the adjacent LCA 05 with views out across the Morfa Dyffryn.

5.3.66 As a result, this LCA is considered to be of **high** sensitivity

LCA 07: Afon Artro wooded valley sides & surrounding hillside

5.3.67 This area falls within the Lowland Plain. It is located along the steeply rising western slopes of the Rhinogydd Mountain foothills. Largely covered by broadleaved woodland punctuated by small watercourses, the area is more exposed and open on the hill tops to the east. Small irregular fields are located along the sheltered lower slopes to the west with more open exposed slopes to the east, where they are interrupted by crags and undulating land form. There are distant views out to the north, west and south from the elevated eastern edge. Views across the Morfa Dyffryn (LCA

05) and south to Llanbedr airfield (LCA 3) and towards LCA 08 are limited by the dense vegetation cover.

5.3.68 As a result, this LCA is considered to be of **high** sensitivity

LCA 08: Open rising hillsides of the Rhinogydd Mountain foothills

5.3.69 This area falls within the Lowland Plain. It is defined by a gradual rolling hillside which rises steadily from the Cambrian Coast railway running along the western edge with Llanbedr Airfield (LCA 02). There are medium to large irregular fields bounded by dry stone walls, punctuated by mature hedgerows and hedgerow trees with the occasional tree clump. Larger blocks of broad-leaved woodland are located around the settlement of Llanbedr. There are Intermittent views out to the west to LCA 01 and LCA 02. The north part of this area has a strong relationship with LCA 05 as it forms its southern backdrop.

5.3.70 As a result, this LCA is considered to be of **high** sensitivity.

Visual Amenity

5.3.71 The ZVI is based on the site survey carried out in March 2016 as illustrated on Figure 5.3.1, and identifies the area from which it may be possible to see the Proposed Improvement at ground level, and from the receptors identified within the VES.

5.3.72 Due to the local topography, the ZVI extends largely to the north and west of the Proposed Improvement, across the lower lying level landscape within the coastal lowland of LCA 02 and LCA 05 and the coastal slopes of LCA 03 beyond. Further west within LCA 01 the ZVI is limited to sporadic locations within the coastal dunes. The ZVI limited to the east and south by the rising slopes and woodland within LCA 04, LCA 07 and LCA 08.

5.3.73 Views of the Proposed Improvement may be available from the northern section of Llanbedr Airfield, however it was not possible to access this private land to establish the extent of the ZVI within this area and therefore an assumed ZVI is indicated by a separate hatch on figure 5.3.1.

Representative Viewpoints

5.3.74 The following representative viewpoints have been used for the assessment of potential visual effects;

- A: Entrance to Plas Y Bryn Hall from A496, looking west
- B: View from Mochras Road. Llanbedr, looking west
- C: View from A496, north of Llanbedr, looking south west
- D: View from PRoW (and the nearby Wales Coast Path) along the eastern bank of the Afon Artro, looking south
- E: View from PRoW at Pen Y San Farm, looking south
- F: View from Llanbedr Standing Stones (SAM), looking north
- G: View from Shell Island, looking east

Entrance to Plas Y Bryn Hall from A496, looking west

5.3.75 This viewpoint represents users on the A496 running south to north from Barmouth into Llanbedr. As a result, views from this position are considered to be of **low** sensitivity.

5.3.76 From this position, views out to the west are dominated by the locally undulating landform with small clumps of broadleaved and evergreen trees to the centre. Beyond this is the low-lying Llanbedr airfield (LCA 02) with Shell Island and the coastline beyond. To the north, in the foreground are the Artro Lodges, a relatively new development of 12 holiday luxury holiday homes, set below the wooded hillside beyond. The distant hills along the Pwllheli peninsular are visible above the tree line.

View from Mochras Road, Llanbedr, looking west

- 5.3.77 Located to the western edge of Llanbedr village (LCA 06), this viewpoint represents views for pedestrian and vehicular users on Mochras Road, running from Llanbedr to Shell Island. It also represents views from adjacent residential properties located along the southern side of the road. As a result, the sensitivity of views from this position are considered to be **high** for residential properties and pedestrians, and **low** for vehicular users.
- 5.3.78 Views from this position looking west are framed by the rising hillside within LCA 08 to the south of the road and the mature tree line along the banks of the Afon Artro to the north. Views are typically restricted to the road corridor, with filtered winter views out across LCA 05 to the north.

View from A496, north of Llanbedr, looking south west

- 5.3.79 This position represents views available to users on the A496 running north from Llanbedr towards Llanfair, and views from properties located along the eastern edge of the A496 at the north-west edge of Llanbedr (LCA 06). As a result, the sensitivity of views from this position are considered to be **high** for residential properties, and **low** for users on the existing A496.
- 5.3.80 Views from this position look out across the low lying and flat floodplain and farmland of LCA 05 to the mature tree line along the Afon Artro and the scrub embankment vegetation which delineates the Cambrian Coast railway. Telephone lines cross the skyline in the mid-ground with occasional isolated shrubs and trees providing relief from the flat topography.

View from PRow (and the nearby Wales Coast Path) along the eastern bank of the Afon Artro, looking south

- 5.3.81 This position represents views for users on the PRow and the nearby Wales Coast Path, on the slightly elevated flood bund of the Afon Artro travelling south. As a result, views from this position are considered to be of **high** sensitivity.
- 5.3.82 Views from this location focus on the Afon Artro and take in the adjacent open floodplains of the Morfa Dyffryd (LCA 05). The properties along the northern edge of Llanbedr (LCA 06) are visible amongst the bounding mature trees, with the wooded hillsides rising beyond to the south and east within LCA 04 and LCA 07.

View from PRow at Pen Y San Farm, looking south

- 5.3.83 This position represents views experienced by residential properties located along the minor road running from Pensarn Railway Station east along the valley side. This position also represents users on the minor road and the PRow running from Pen Y Sarn Farm north towards Llanfair. As a result, views from this position are considered to have a **high** sensitivity for residential properties and users on the PRow, and **low** for users on the minor road.
- 5.3.84 Views from this elevated position look south across the gently rolling lower slopes of the Ardudwy and the Morfa Dyffryn farmland (LCA 05), on either side of the Afon Artro estuary. Irregular fields are broken up by mature hedgerows and hedgerow trees and clumps, with blocks of broad-leaved woodland forming distinct features on the landscape. In the distance the wooded hillsides of the Rhinogydd Mountain foothills rise to the south and the east.

View from the Llanbedr Standing Stones (Scheduled Ancient Monument), looking north

- 5.3.85 This position represents views looking north from the SM located within the south-east part of LCA 05 and to the north west of Llanbedr (LCA 06). As a result, the view is considered to be of **high** sensitivity.

5.3.86 Views to the north from this location look out across the Morfa Dyffryn farmland (LCA 05) to the flood bund of the Afon Artro and the scrub embankment vegetation along the Cambrian Coast railway. Telegraph poles interrupt the open skyline. To the north west the view becomes filtered by nearby mature trees and vegetation along field boundaries. To the east, the view is framed by the properties located along the A496 with the rising rolling hillsides beyond.

View from Shell Island, looking east

5.3.87 This position represents views for recreational visitors on the island, looking east back towards the mainland. As a result, the sensitivity of views from this position are considered to be **high**.

5.3.88 Views from this location are expansive, looking out over the estuary and flats and the low-level farmland and Llanbedr Airfield beyond. In the distance are the rising farmed and wooded hillsides within LCA 04, LCA 07 and LCA 08 with the Rhinogydd mountain range forming a distinct and distant backdrop

Landscape & Visual Sensitivity

5.3.89 Of the eight Proposed Improvement-specific Landscape Character Areas, six are considered to be of high sensitivity, owing to their setting, qualities and characteristics. Llanbedr Airfield (LCA 02) and the settlement of Llanfair & surrounding open farmland (LCA 03) are considered to be of moderate sensitivity. Of the seven representative viewpoints, six are considered to be of high sensitivity with one, Viewpoint A, of low sensitivity. Table 5-3-9 summarises the sensitivity of each identified resource.

Table 5-3-9: Evaluation of Resources

Resource	Sensitivity
LCA 01: Shell Island, Morfa Dyffryn Dunes & Morfa Estuary	High
LCA 02: Llanbedr Airfield	Moderate
LCA 03: The settlement of Llanfair & surrounding open farmland	Moderate
LCA 04: Semi-wooded hillsides of the Rhinog Mountain range	High
LCA 05: Low lying Artro Estuary floodplain & surrounding farmland	High
LCA 06: Llanbedr village	High
LCA 07: Artro wooded valley sides & surrounding hillside	High
LCA 08: Open rising hillsides of the Rhinog Mountains	High
Viewpoint A: Entrance to Plas Y Bryn Hall from A496, looking west	Low
Viewpoint B: View from Mochras Road, Llanbedr, looking west	High
Viewpoint C: View from A496, north of Llanbedr, looking south west	High
Viewpoint D: View from PRow (and the nearby Wales Coast Path) along the eastern bank of the Afon Artro, looking south	High
Viewpoint E: View from PRow at Pen Y San Farm, looking south	High
Viewpoint F: View from Llanbedr Standing Stones (SM), looking north	High
Viewpoint G: View from Shell Island, looking east	High

Night-time Assessment

5.3.90 Table 12, as contained within Appendix B, provides detail of the night time environmental lighting conditions experienced within each of the character / urban areas considered as part of the night time assessment, in which three distinct character / urban areas have been identified. Figure 5.3.17 Existing Landscape Character, Darkness and Lighting outlines these character / urban areas, and the environmental lighting zones. Due to the generally dark night time characteristics of the study area, it was not possible to obtain supporting images from every representative viewpoint. Images were taken where night time lighting conditions allowed.

Night time Assessment Assumptions and Exclusions

5.3.91 The night time baseline data was collated during the evening of the 08th March 2016, during the hours of approx. 20:00 – 00:00. Weather conditions at the time of the survey were overcast but dry. The collated data and the establishment of the environmental lighting zones identified on figure 5.3.17 is considered to be representative of the night time environment, however it excludes temporary lighting which was not present during the hours of the survey such as floodlighting associated with sports facilities or other, nor lighting which may only be temporary, or only active during certain time periods of the night, i.e. road lighting which is switched off during the early hours of the morning, during lower periods of activity.

Mitigation

5.3.92 The mitigation measures to be incorporated into the Proposed Improvement are shown on the environmental masterplan (see Figures 7.1-7.4). These have been developed as part of the iterative design process to reduce the effects of the Proposed Improvement on the landscape and surrounding views.

Treatment of Highways Structures

5.3.93 Five new structures are proposed as part of the Proposed Improvement. These are the new overbridge across the Mochras Road and Afon Artro, a new single span bridge crossing the existing river inlet, and three new culverts located to the north and southern ends of the Proposed Improvement as shown on drawing (see Figures 7.1-7.4). In order to reduce the impact of these new structures on the local landscape it is proposed that all external concrete walls and abutments would be faced with stone-effect cladding in keeping with local materials.

5.3.94 To aid the integration of the Proposed Improvement into its local surroundings, highway boundary walls have been included within the design for the Proposed Improvement to be constructed of local stone in keeping with the appearance of the existing A496. These walls are located along the northern section of the route extending from the new junction into Llanbedr to the Afon Artro / Mochras Road overbridge, and the southern section of the Proposed Improvement from the edge of the proposed cutting to meet the existing road alignment. New boundary walls are also proposed to the highway edge at all three junctions, tying with existing boundary wall alignments where appropriate.

5.3.95 In order to soften the appearance of the proposed cutting, it is proposed to reduce the profile of the engineered slopes by softening the upper line and grading out the lower levels to create a more naturalistic flow in keeping with the local topography.

Changes to existing power lines

5.3.96 As part of the Proposed Improvement the existing overhead power lines located around the northern section of the Proposed Improvement outline will be renewed and replaced underground during the construction works. As part of this proposal, overhead power lines will be relocated running north to south from the sewage treatment works at the northern end, aligned to follow the

route of the proposed by-pass south as far as the Mochras road, at which point the services will continue underground.

- 5.3.97 It is not clear from the drawing what, if any equipment will be required at the point of transfer from overhead to underground and whether this will have any impact on local receptors in terms of additional new features within the landscape which may need to be considered.

Mitigation Planting

- 5.3.98 Landscape planting mitigation measures would be implemented to help over time to integrate the Proposed Improvement with the landscape and to screen it in sensitive views. These mitigation measures have also taken into consideration other ecological and heritage design requirements. However, in some situations a compromise has had to be achieved where there are conflicting requirements (see Fig 5.3.18-22 Landscape Proposals).

Landscape integration

- 5.3.99 To reduce the impact of the Proposed Improvement through the loss of existing vegetation a number of mitigation planting measures are proposed:
- New native species boundary hedgerow planting located to the western & eastern side of the highway to the southern end of the Proposed Improvement positioned to the back of the new grass verge.
 - New native species boundary hedgerow planting with hedgerow trees to the western and eastern side of the northern end of the Proposed Improvement.
 - New low level scrub planting species planting along the northern bank Afon Artro
 - New native species hedgerow translocation along the southern and eastern edges of the realigned Mochras Road leading from the station to the new Mochras road junction.
 - New block woodland planting is proposed to the northern side of the north junction to merge with the existing mature vegetation located along the boundaries of the existing A496.

Visual Screening

- 5.3.100 To reduce the impact of the Proposed Improvement on the wider landscape and views available the following screening planting is proposed;
- New woodland/ native scrub planting with trees located between the existing cutting and the Maes Artro Holiday Park.
 - New native scrub and tree planting wrapping around the end properties on the Mochras Road, connecting into the existing woodland block to the east of the Proposed Improvement and connecting as far as Mochras Road.
 - New 3m wide native species scrub planting with intermittent trees located along the southern edge of the Maes Artro holiday Park.
 - New planting along the proposed embankments to the western side of the Proposed Improvement to the southern end adjacent to the access to Tyddn Du Farm

- 5.3.101 As a result of this mitigation, the visual effects on views from the north looking south from viewpoints A and E would be reduced. In addition, the effect on views west from viewpoint B will also be reduced, in addition to views from a number of visual receptors as identified within the Visual Effects Schedule.

Offsite Planting

- 5.3.102 To reduce the impact of the Proposed Improvement on the setting of the Llanbedr Standing Stones SAM offsite mitigation planting has been proposed, in consultation with Snowdonia National Park & CADW:
- As a result, infill native scrub, shrub and tree planting is proposed to reinforce the existing mature tree line located west of the SAM .

- New understorey planting is proposed along the line of the tree line described above, to reinforce low level screening .
- New shrub and low level tree planting is proposed along the northern edge of the flood bund north of the unnamed watercourse to the north of the standing stones from Llanbedr village to the east and as far west as the woodland planting block (in bullet 4 below) then continuing with scrub planting to east of the bridge over Watercourse 2, to screen views towards the northern junction
- A small block of tree planting (four trees) is proposed directly north of the above screen planting to continue the existing tree line to the south the watercourse and improve screening north and west towards the Proposed Improvement.

This planting would be essential mitigation and included in the Proposed Improvements CPO.

Magnitude of Impact

Construction Phase

5.3.103 The assessment of the construction phase effects have been made based on the following assumptions:

- A construction compound and offices will be required by the contractor, this may be located within the scheme boundary or offsite. The details of this will be decided by a separate planning application.
- Construction traffic on the existing A496 through Llanbedr will be minimised as far as possible.
- Temporary construction compounds and working areas may be required along the length of the Proposed Improvement throughout the construction period during specific activities
- A working area with a 4 metre offset will be required to each side of the proposed improvement, with widened working areas to the northern side of the Afon Artro to allow crane access for installation of the new overbridge, and at each junction location.
- No on-site concrete batching plant will be required
- Storage of materials on site will be minimised as far as possible.
- Removal of vegetation required for construction working areas and access will be minimised as far as possible. A methodology for managing the identification and removal of vegetation would form part of the Construction Environmental Management Plan (CEMP).

5.3.104 It is assumed that the construction period will be for more than 18 months, as such any effects should be considered short term as opposed to temporary. The significance of effects has been assessed at the point of greatest construction activity. The need for compound or construction night time working are to be discussed and agreed. The CEMP would identify measures to minimise night time light intrusion on visual receptors and the Dark Skies status of the landscape.

5.3.105 Based on the above assumptions, the construction phase would result in impacts on landscape character and interruption of views which would be greater than the operational Proposed Improvement. The main construction activities which would result in a major or moderate magnitude of impact would be associated with the erection and operation of any compounds and working areas, the removal of mature vegetation as part of the site clearance works, the erection of the five structures, the excavation of the main cutting along with the creation of new earthworks and plant movement.

5.3.106 In terms of landscape character, LCA 05 and LCA 08 would incur a **major adverse** magnitude of impact during construction, resulting in a **large adverse** significance of effect. Three LCA's (02, 03 and 06) would incur a **minor adverse** magnitude of impact during construction, resulting in a **slight adverse** significance of effect. Two LCA's (01 and 04) will incur a **negligible adverse** magnitude of impact during construction, resulting in a **slight adverse** significance of effect while LCA 07 would experience **no change**, resulting in a **neutral** significance of effect.

5.3.107 In terms of views, the construction activities within the open low lying landscape within LCA 05 and the excavation of the cutting within LCA 08 would have a **major adverse** magnitude of impact on four out of the eight representative viewpoints (VP's B, C, D & F), resulting in a **large adverse** significance of effect for high sensitivity receptors. The view from Viewpoint E would experience a **minor adverse** magnitude of impact, resulting in a **moderate adverse** significance of effect. Construction activities within LCA 08 would also be visible from Viewpoint A, a low sensitivity receptor and potentially from the distant Viewpoint G. It is anticipated Viewpoint A would experience a major adverse magnitude of impact resulting in a slight adverse significance of effect and Viewpoint G would experience a **negligible adverse** magnitude of impact resulting in a **slight adverse** significance of effect.

5.3.108 Table 5-3-10 below, identifies the construction phase Magnitude of Impact and resulting Significance of Effect on each identified Landscape Character Area and representative Viewpoint.

Table 5-3-10: Summary of the Significance of Effects during construction period

Receptor	Landscape Sensitivity	Magnitude of Impact: Construction Period	Significance of Effect (Short Term)
LCA 01: Shell Island, Morfa Dyffryn Dunes & Morfa Estuary	High	Negligible adverse	Slight adverse
LCA 02: Llanbedr Airfield	Moderate	Minor Adverse	Slight adverse
LCA 03: The settlement of Llanfair & surrounding open farmland	Moderate	Minor adverse	Slight adverse
LCA 04: Semi-wooded hillsides of the Rhinog Mountain foothills	High	Negligible adverse	Slight adverse
LCA 05: Low lying Artro Estuary floodplain & surrounding farmland	High	Major adverse	Large adverse
LCA 06: Llanbedr village	High	Minor adverse	Moderate adverse
LCA 07: Afon Artro wooded valley sides & surrounding hillside	High	No change	Neutral
LCA 08: Open rising hillsides of the Rhinog Mountains foothills	High	Moderate adverse	Large adverse
Viewpoint A: Entrance to Plas Y Bryn Hall from A496, looking west	Low	Major adverse	Slight adverse
Viewpoint B: View from Mochras Road, Llanbedr, looking west	High – residential properties & pedestrians / Moderate – users of the Mochras road	Major adverse	Large adverse for residential properties & pedestrians / Moderate adverse for vehicular users
Viewpoint C: View from A496 north of Llanbedr, looking south west	High – residential properties / Low – users of	Major adverse	Large adverse – residential receptors / Moderate adverse – Users of the A496

Receptor	Landscape Sensitivity	Magnitude of Impact: Construction Period	Significance of Effect (Short Term)
	the A496		
Viewpoint D: View from PRoW (and the nearby Wales Coast Path) along eastern bank of Afon Artro, looking south	High	Major adverse	Large adverse
Viewpoint E: View from PRoW at Pen Y San Farm, looking south	High – residential properties & users of the PRoW / Low – users of the minor road	Minor adverse	Moderate adverse – residential properties & users of the PRoW / Slight adverse – users of the minor road
Viewpoint F: View from Llanbedr Standing Stones (SM), looking north	High	Major adverse	Large adverse
Viewpoint G: View from Shell Island, looking east	High	Negligible adverse	Slight adverse

Operation Phase (Opening Year) – Landscape Character

- 5.3.109 The Proposed Improvement at opening year (winter) would form a noticeable element within the landscape of LCA 05 and LCA 08, as a result of changes in landscape pattern and landform. The loss of mature vegetation along the Afon Artro and at the tie-ins with the existing A496, the presence of the five new structures and associated earthworks with stone walls and fast moving traffic on them, associated highway corridor boundary fencing, noise and ecological mitigation measures, and the new cutting to the south of the Afon Artro would result in noticeable damage to important features within these character areas.
- 5.3.110 New road signs would be kept to a minimum in both number and size and will be unlit at night. No street lighting is proposed in order to avoid light intrusion on the Dark Skies status of the Snowdonia national park. However, the existing lighting along the Mochras Road, between Llanbedr village and the railway station would be upgraded as part of the works, to provide the same level of local lighting but using modern technology would reduce light spillage and glare. It is considered that the proposed signs and the upgraded lighting proposals along Mochras Road would be relatively minor new elements in the landscape and night time landscape.
- 5.3.111 All the new structures would be clad in a stone finish which would resemble the natural stone material of the areas and help integrate them into the landscape, although overall, they would form noticeable features in the local landscape. The new planting associated with the landscape mitigation, other than the grass seeded areas, would form a barely perceptible feature. It is therefore considered that the Proposed Improvement at opening year would have a moderate magnitude of change on the character of LCA 05 and LCA 08 resulting in a moderate adverse significance of effect.
- 5.3.112 As the Proposed Improvement, would be unlit the effects on the night time landscape would be limited to intermittent vehicle headlights moving across the landscape, although the extent of car headlights would be limited by the road side stone walls and the parapets at the structures. Overall it is considered that this would have a barely noticeable loss in the night time rural character of LCA 05 and LCA 08 resulting in no additional adverse significance of effect to that reported above.

Operation Phase (Opening Year) – Visual Amenity

5.3.113 The Proposed Improvement at opening year (winter) would form a new element within the view for 137 residential visual receptors. Its location running across the open LCA 05 to the north of the Afon Arturo, combined with the proposed cutting into the existing hillside to the south would form a perceptible feature, but where the overall view composition is largely unaltered, in long distance views from PRow's and residential properties to the north of the Proposed Improvement at Llanfair and Llandanwg within LCA 03 and from low lying receptors within LCA 01 and LCA 02 to the south and west. However, in shorter, close range views from properties located along the A496 at the north edge of Llanbedr (LCA 06) and within the footpath network, including views from a section of the Wales Coast Path (Viewpoint D) and from the Llanbedr Standing Stones SM (Viewpoint F) the Proposed Improvement would be a noticeable element in the view.

Operation Phase (Design Year 15) – Landscape Character

5.3.114 The proposed landscape planting would use native species typical of the locality and reflect as far as possible the existing vegetation pattern. This would include boundary planting along highway edges where appropriate and blocks of trees and scrub to the elevated hills and along the Afon Artro corridor. Over time, as the planting establishes and matures it would help to soften and integrate the Proposed Improvement into the landscape

5.3.115 However, the Proposed Improvement at design year 15 (summer) would continue to form a noticeable element within the landscape of LCA 05 and LCA 08, as a result of the initial changes in landscape pattern and landform. Although the loss of mature vegetation along the Afon Arturo and at the tie-ins with the existing A496, would to some extent be replaced by the establishing planting, it would not be enough to integrate the Proposed Improvement at these locations. However, it is anticipated the new structures and earthworks within LCA 05 would be softened by the established planting but again they would still form noticeable elements in the landscape with the stone walls and fast moving traffic on them. The cutting within LCA 08 to the south of the Afon Arturo would also continue to form a noticeable local feature. At design year 15 the Proposed Improvement would have a moderate magnitude of impact resulting in a moderate adverse significance of effect within LCA 05 and LCA 08.

Operation Phase (Design Year 15) – Visual Amenity

5.3.116 Over time it is anticipated that the proposed landscape planting would help to soften the features of the Proposed Improvement such as the earthworks and the structures. However due to the limitations of the planting to be able to act as a filter or screen within the low lying and open floodplain of LCA 05, the Proposed Improvement at design year 15 (summer) would continue to form a noticeable element in some short range views, In particular from the footpath network, including a section of the Wales Coast Path (Viewpoint D) within LCA 05; and from the residential properties on the A496 at the north west edge of Llanbedr (LCA 06).

5.3.117 At design year 15 the Proposed Improvement would continue to have a moderate magnitude of impact on some views resulting in a moderate significance of effect.

Significance of Effects

5.3.118 Table 5-3-11, below provides a summary of the significance of effects resulting from the proposed Proposed Improvement at design year 15, taking into consideration potential mitigation measures as described above.

Table 5-3-11: Summary of the Significance of Effects

Receptor	Landscape Sensitivity	Opening Year (Winter)		Design Year 15 (Summer)	
		Magnitude of Impact	Significance of Effect	Magnitude of Impact	Significance of Effect

LCA 01: Shell Island, Morfa Dyffryn Dunes & Morfa Estuary	High	No Change	Neutral	No Change	Neutral
LCA 02: Llanbedr Airfield	Moderate	No Change	Neutral	No Change	Neutral
LCA 03: The settlement of Llanfair & surrounding open farmland	Moderate	Minor adverse	Slight adverse	Negligible adverse	Slight adverse
LCA 04: Semi-wooded hillsides of the Rhinog Mountain foothills	High	No Change	Neutral	No Change	Neutral
LCA 05: Low lying Artro Estuary floodplain & surrounding farmland	High	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
LCA 06: Llanbedr village	High	Negligible adverse	Slight adverse	No Change	Neutral
LCA 07: Afon Artro wooded valley sides & surrounding hillside	High	No Change	Neutral	No Change	Neutral
LCA 08: Open rising hillsides of the Rhinog Mountain foothills	High	Moderate adverse	Moderate adverse	Minor adverse	Slight adverse
Viewpoint A: Entrance to Plas Y Bryn Hall from A496, looking west	Low	Moderate adverse	Slight adverse	Minor adverse	Slight adverse
Viewpoint B: View from Mochras Road, Llanbedr, looking west	High – residential properties and pedestrians / Moderate – vehicular users of the Mochras Road	Moderate adverse	Large adverse – residential properties and pedestrians / Moderate adverse – vehicular users	Minor adverse	Moderate adverse – residential properties and pedestrians / Slight adverse – vehicular users
Viewpoint C: View from A496, north of Llanbedr, looking south	High – residential properties / Low – users of the A496	Moderate adverse	Moderate adverse – residential receptors / Slight	Moderate adverse	Moderate adverse – residential receptors / Slight adverse

west			adverse – Users of the A496		– Users of the A496
Viewpoint D: View from PRow (and from the nearby Wales Coast Path) along the eastern bank of the Afon Artro, looking south	High	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse
Viewpoint E: View from PRow at Pen Y San Farm, looking south	High – residential properties & users of the PRow / Low – users of the minor road	Minor adverse	Slight adverse – residential properties & users of the PRow / Neutral for users of the minor road	Minor adverse	Slight adverse – residential properties & users of the PRow / Neutral for users of the minor road
Viewpoint F: View from Llanbedr Standing Stones (SM), looking north	High	Moderate adverse	Moderate adverse	Minor adverse	Moderate adverse in winter months, reducing to slight adverse in summer
Viewpoint G: View from Shell Island, looking east	High	No change	Neutral	No Change	Neutral

Conclusions

Landscape Character

5.3.119 It is anticipated that the construction effects during the peak activity period would be greater than the operation effects of the Proposed Improvement. During construction two local landscape character areas (LCA 05 and LCA 08) would experience a **large adverse** significance of effect. Five of the remaining six LCAs would experience a **slight adverse** significance of effect and one (LCA 07), would experience a **neutral** significance of effect.

5.3.120 In winter of the opening year the magnitude of impact would reduce for all the LCAs affected by the Proposed Improvement resulting in two LCAs (LCA 05 and LCA 08) experiencing a **moderate adverse** significance of effect. The remaining six LCAs would all experience a **neutral** significance of effect. These reductions would be brought about by the inherent design features of the Proposed Improvement such as the cladding to the structures, the road side stone walls and the greening of the engineered earthworks due to the establishment of the grass seeding. Over time and by design year 15 the proposed planting mitigation would further help to soften the engineered elements of the Proposed Improvement and provide further integration. However due to the open low lying nature of LCA 05 the embankment with traffic on it would continue to be a noticeable element which new planting would not fully integrate. In addition, the cutting within LCA 08 would continue to form a noticeable element within the local landscape. LCA 03 would experience a slight adverse

significance of effect, whilst the remaining five LCA's (01, 02, 04, 06 & 07) would experience a neutral significance of effect.

Visual Amenity

5.3.121 During construction five representative viewpoints (B, C, D, E and F) would experience a **large adverse** significance of effect and two viewpoints (A and G) would experience a **slight adverse** significance of effect.

5.3.122 In the opening year (winter), of operation the magnitude of impact would be reduced, and over time the establishment of mitigation planting would help to soften the Proposed Improvement. By design year 15 (summer), three viewpoints (B, C and D) would experience a **moderate adverse** significance of effect, three viewpoints (A, E and F) would experience a **slight adverse** significance of effect, and viewpoint G would experience a **neutral** significance of effect.

Snowdonia National Park - Effects on the Special Qualities

5.3.123 This section looks at the effects of the Proposed Improvement on the special qualities of the Snowdonia National Park including the settlement of Llanbedr and the tranquillity experienced by users on a section of the Wales Coastal Path.

- There would be a moderate adverse effect on the local landscape of the Lowland Plain. It is recognised in both LANDMAP and within the landscape characterisation work undertaken by SNPA that this landscape is of high to moderate quality, with some recent developments including caravan parks affecting the overall appearance of the area.
- The view from two PRoW which traverse the banks of the Afon Artro within LCA 05, including a section of the Wales Coastal Path would be directly affected by the Proposed Improvement, resulting in a localised moderate adverse impact on the tranquillity and solitude experienced by walkers on the national trail.
- The Proposed Improvement, through the removal of through traffic on the A496, would have a potential local improvement on Llanbedr's townscape and associated listed structures along the A496 corridor.

Visual Effects on the SAM - Llanbedr Standing Stones

5.3.124 The Proposed Improvement would be visible on embankment and on structure as it crosses the Morfa Dyffrn (LCA 05) to the north. The removal of the overhead power lines running east to west would help to partially reduce the visual clutter in the view composition, although the repositioned line would remain visible against the skyline. The proposed improvement would have a noticeable change (moderate adverse magnitude of impact) on the north and west view from the standing stones (Viewpoint F), resulting in a moderate adverse significance of effect at opening year.

5.3.125 With reference to Chapter 5.7 Noise and Vibration, at opening year, the proposed improvement would result in a perceptible 3.5dB reduction in traffic noise levels at the standing stone when compared to the scheme not being constructed.

5.3.126 At year 15, with the establishment of the proposed mitigation planting, the passing traffic on the embankment would be increasingly filtered in east and north westerly views. However, it is anticipated there would be a framed filtered view to the traffic on structure as it crosses the watercourse 160m to the north west of the standing stone. The new screen planting along the watercourse to the north would help to restrict views towards the north and the proposed junction into Llanbedr. At year 15 the magnitude of impact would reduce to minor adverse, resulting in a slight adverse significance of effect in summer views, but rising to moderate adverse in winter as a result of the loss of leaf cover on the intervening planting.

- 5.3.127 With reference to Chapter 5.7 Noise and Vibration at year 15 the Proposed Improvement would result in a perceptible 3.1dB reduction in traffic noise levels when compared to the scheme not being constructed.
- 5.3.128 In terms of the overall tranquillity experienced at the standing stones, although there would be a perceived reduction in traffic noise, the Proposed Improvement would result in visual intrusion. Overtime the visual intrusion would reduce as the proposed mitigation establishes so that by summer year 15 there would be a slight adverse significance of effect on tranquillity.

REFERENCES

- 1. Council of Europe (2000), European Landscape Convention**
- 2. Highways Agency (2008) HA 205/08: DMRB Volume 11, Section 2, Part 5: Assessment and Management of Environmental Effects**
- 3. Highways Agency (2010) Interim Advice Note ("IAN") 135/10: 'Landscape and Visual Effects Assessment' (Ref 8-2). (IAN 135/10 supersedes Volume 11, Section 3, Part 5 of the DMRB**
- 4. LI & IEMA (2013) Guidelines for Landscape and Visual Impact Assessment: Third Edition.**
- 5. LI (2011) Photography and Photomontage in Landscape and Visual Impact Assessment.**
- 6. Highways Agency (2010) Interim Advice Note ("IAN") 135/10: 'Landscape and Visual Effects Assessment' (Ref 8-2). (IAN 135/10 supersedes Volume 11, Section 3, Part 5 of the DMRB**
- 7. Snowdonia National Park Authority, Eryri Local Development Plan 2007-2022**
- 8. Welsh Government Planning Policy Wales (Edition 8) 2016**
- 9. Ordnance Survey Terrain 50 data**
- 10. LANDMAP, Countryside Council for Wales interactive maps**
- 11. National Policy Statement for National Networks (2014), Department for Transport**
- 12. Institution of Lighting Engineers (2005) 'Guidance Notes on the Reduction of Obtrusive Light'**
- 13. Snowdonia National Park Authority SPG 07 (2014) Landscapes and Seascapes of Eryri**

5.4 Nature Conservation

5.4.1 This chapter documents the Ecological Impact Assessment (EclA) that has been completed for the Proposed Improvement. It explains the survey and assessment methodologies that have been applied, summarises the key nature conservation legislation and policy and describes the baseline condition of all important ecological features identified (including designated sites, habitats, species and ecosystem services). These features are described in terms of the geographic context of their importance. All potential impacts of the Proposed Improvement on these ecological features are then identified and described in detail, including the geographic context of their significance. Mitigation measures are identified where necessary (*i.e.* where significant negative impacts have been identified) and the significance of any residual effects is then assessed. Cumulative effects on nature conservation are also assessed (in Chapter 6.0: Assessment of Cumulative Effects) and compensation measures identified for any significant residual effects resulting from cumulative or scheme impacts. Enhancement measures are also outlined and a description of any monitoring required. To summarise, the overall ecological effects of the Proposed Improvement (both adverse and beneficial) are described in terms of their relevance to policy and legislation.

Methodology

5.4.2 Specific guidance on ecological impact assessment was taken from the DMRB Volume 11, Section 3, Part 4: *Ecology and Nature Conservation* (Highways Agency, 1993), as updated by IAN 130/10 *Ecology and Nature Conservation: Criteria for Impact Assessment* (Highways Agency, 2010) and the DMRB, Volume 11, Section 2, Part 5: HA 205/08: Assessment and Management of Environmental Effects. However, new guidelines on ecological impact assessment have recently been published by the Chartered Institute of Ecology and Environmental Management (CIEEM), namely the 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal' (CIEEM, 2016). Therefore, the ecological impact assessment process has been based on these, which propose an alternative method of characterising the value of ecological features, nature of potential impacts and significant effects. Instead of assigning a value for each receptor (*i.e.* low, medium, high, etc.), as previously described in DMRB guidance and still relevant for other topics, the 2016 CIEEM guidelines describe the identification of 'Important Ecological Features' in relation to the Proposed Improvement, characterising the importance of each feature in terms of its geographical context (*i.e.* internationally important, nationally, regionally, etc.). Any activities arising from the Proposed Improvement that could impact on the important ecological features are identified and described in detail in terms of magnitude and other characteristics, including whether or not they are likely to be significant and on what geographical level, rather than using the Value/Impact Magnitude matrix approach to determine level of significance, as described in the DMRB. Mitigation measures are proposed for all significant adverse impacts identified and then any likely residual effects are assessed in terms of the geographic context of their significance. Compensatory measures are proposed for any significant adverse residual effects and enhancement measures are also identified. Any monitoring required to assess the success of mitigation, compensation or enhancement is also identified and the overall residual significance of the Proposed Improvement in relation to policy and legislation is described. The methodology is described in more detail as follows.

Scope of the Assessment

5.4.3 An EIA Scoping report was produced for the Proposed Improvement in 2015, describing the process and outcomes of an EIA scoping exercise undertaken to determine the topics to be included in the Environmental Statement (ES) for the Proposed Improvement and the scope of surveys required for completion of the EIA assessment. This scoping exercise was based on data obtained from the local Environmental Records Centre, an Extended Phase 1 Habitat Survey and a Bat Activity Survey, both

undertaken in 2014. Consultation was also undertaken with Natural Resources Wales (NRW) and the Snowdonia National Park Authority (SNPA) in relation to the scope of the Nature Conservation chapter of the ES. The scoping process was undertaken with regard to guidance provided by the DMRB, Volume 11, Section 2, Part 4 and Part 6. However, it was acknowledged that Scoping is an iterative ongoing exercise that can contribute to EIA as further information about the project design and receptors becomes available. See 'Llanbedr Access Improvements: EIA Scoping Report' (November 2015) for further details of this EIA scoping exercise.

- 5.4.4 Responses were received from NRW and the SNPA regarding the proposed scope of surveys, which were used to inform the scoping exercise. NRW's comments included requests for more focussed bat survey effort, particularly to the south of the Afon Artro, full habitat survey of all areas to be affected and consideration of priority species and habitats as listed on Section 42 (NERC Act 2006) and the Eryri LBAP. The SNPA's response included comments about the location and status of ancient semi-natural woodland sites within 2km of the Proposed Improvement and the likelihood of great crested newt presence within the area.
- 5.4.5 As part of the assessment included within this report, further scoping has been undertaken to identify important ecological features that could be significantly affected by the Proposed Improvement, thus requiring mitigation and those that would not be significantly affected.

Zone of Influence

- 5.4.6 Following the latest CIEEM (2016) guidance, it is necessary to establish a Zone of Influence (Zoi) for the Proposed Improvement, identifying the area over which ecological features may be subject to significant effects. For the Proposed Improvement, this extends beyond the site boundaries, for example where there are ecological or hydrological links to sites, habitats or species elsewhere. The Zoi varies for different ecological features depending on their sensitivity to an environmental change. SACs designated for the highly mobile species lesser horseshoe bat and otter have been considered within a Zoi of 30km and 25km respectively, a much greater distance from the Proposed Improvement than SACs and other protected sites designated for more sedentary species or habitats that have been considered within 2km, and other important areas such as ancient woodland, which have been considered within a Zoi of 1km. The majority of habitats and species have been considered within a Zoi comprising the footprint of the Proposed Improvement and its surroundings, including an area between the Proposed Improvement footprint and the railway line to the west and the village of Llanbedr to the east, allowing a buffer of up to 300m in all directions for the purposes of determining a survey corridor. This will allow for direct impacts on species and habitats within the Proposed Improvement footprint during construction and indirect impacts relating to pollution or disturbance for example during both the construction and operational phases of the Proposed Improvement.
- 5.4.7 For bats, the Bat Conservation Trust have collated (undated but published in 2015) an evidence-based assessment of Core Sustenance Zones (CSZs). With reference to planning and development the CSZ is defined as:
- The area surrounding the roost within which development work can be assumed to impact the commuting and foraging habitat of bats using the roost, in the absence of information on local foraging behaviour. This will highlight the need for species-specific survey techniques where necessary.
 - The area within which mitigation measures should ensure no net reduction in the quality and availability of foraging habitat for the colony, in addition to mitigation measures shown to be necessary following ecological survey work.

These distances have been used to define the Zone of Influence for bats outside of SACs.

Selection of Important Ecological Features

5.4.8 According to the CIEEM (2016) guidance it is necessary to undertake a systematic assessment of 'important' ecological features that could be significantly affected (including negative and positive effects), based on the likely direct and indirect impacts of the Proposed Improvement. Important ecological features have been identified based on the key sites, habitats and species for nature conservation in the UK listed in the CIEEM (2016) guidance, as follows:

Designated Sites

- Statutory sites designated or classified under international conventions or European legislation, for example
 - World Heritage Sites, Biosphere Reserves, Wetlands of International Importance (Ramsar sites), Special Areas of Conservation, Special Protection Areas³⁶
- Statutory sites designated under national legislation, for example
 - Sites of Special Scientific Interest
 - National Nature Reserves
 - Local Nature Reserves
- Locally designated wildlife sites

Country Biodiversity Lists

- Habitats and species of principal importance for the conservation of biodiversity in Wales (Section 7 lists)

Biodiversity Action Plan lists

- UK BAP³⁷ priority habitats and priority species
- Local BAP priority species and habitats (specifically the Snowdonia/Eryri LBAP is of relevance to the Proposed Improvement)

Red Listed, Rare, Legally Protected Species

- Species of conservation concern, Red Data Book (RDB) species (UK and Wales)
- Birds of Conservation Concern (UK)
- Nationally rare and nationally scarce species (UK)
- Legally protected species (UK and European)

5.4.9 Other ecological features not included in the list above have also been considered for other reasons where relevant, such as features that might play a key functional role in the ecological landscape allowing species to move between sites (e.g. 'stepping stone habitat'). Legally controlled species are also considered, such as the non-native invasive species listed on Schedule 9 of the Wildlife and Countryside Act 1981. According to the CIEEM (2016) guidelines, ecosystem services and natural capital have also been considered in the compilation of a list of ecological features potentially affected. These could include supporting services (e.g. photosynthesis and water cycling), provisioning services (including products such as food, fuel and natural medicines), regulating services (e.g. air quality or erosion regulation) and cultural services (e.g. recreation and aesthetic experiences).

5.4.10 A list of important ecological features to be included in the impact assessment has then been produced by scoping out any features that are not considered important enough to warrant further

³⁶ Including candidate SACs and proposed SPAs, SACs and Ramsar sites

³⁷ The UK BAP lists of priority habitats and species have been superseded by the country biodiversity lists, but they are a useful reference source.

consideration in the assessment process or which would clearly not be significantly affected. This is consistent with EIA Regulations, DMRB guidance (including IAN 130/10) and CIEEM guidance (2016) which only require investigation of likely significant effects. Where impacts on a feature are uncertain the feature has been 'scoped-in' for more detailed assessment.

- 5.4.11 The importance of each 'important ecological feature' has been defined in a geographical context, based on the CIEEM (2016) guidance, with the following categories used in this assessment:
- International
 - National
 - Regional
 - County (including Vice-County)
 - Local
- 5.4.12 For designated sites, importance should reflect the geographical context of the designation. For example, Local Wildlife Sites may be designated according to criteria applied in a county or district context, and should be considered important accordingly. Similarly, internationally and nationally designated sites such as SACs and SSSIs respectively should be classified accordingly.
- 5.4.13 For other features including habitats and species, legislative lists such as Annex I, II, IV and V of the Habitats Directive, Annex I of the Birds Directive and Section 7 of the Environment (Wales) Act, have been used as a guide for determining scale of importance but these features are predominantly considered in the context of the site and locality, based on their distribution locally and on a wider scale. In this way it is possible to provide a more accurate assessment of the impacts and their potential significance in the context of local resources.

Desk Study

- 5.4.14 A desktop study was undertaken to inform the baseline conditions, impact assessment and scoping process, including data from the following sources:
- A search of biodiversity records held by the North Wales Environmental Information Service (Cofnod) was undertaken in February 2016, providing records of Category 1, 2 and 3 species within a 2km buffer of the scheme centre point at SH582269; and Annex II bat species within a 5km buffer;
 - Gwynedd Council's GIS system (Map Gwynedd) provided information on statutory and non-statutory designated sites (2km buffer for statutory internationally and nationally protected sites; internationally protected sites with otter or lesser horseshoe bat as a mobile species feature within a 25km and 30km buffer respectively; non-statutory sites including County Wildlife Sites and Ancient Semi-Natural Woodland sites within a 1km buffer) – Statutory sites data originally sourced from NRW;
 - Detailed information about protected sites was obtained from the JNCC (Joint Nature Conservation Committee) and NRW websites;
 - Information about current baseline populations and conservation status was obtained from JNCC, NRW, Snowdonia National Park Association (SNPA), Bat Conservation Trust (BCT), RSPB and Birdlife International websites; and the European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC); and the Second Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2001 to December 2006 Conservation status assessment for Species;
 - Information about future baseline conditions was obtained from MONARCH: Modelling Natural Resources Responses to Climate Change: a Synthesis for Biodiversity Conservation; The Climate Change Risk Assessment for Wales (Welsh Government and DEFRA, 2012); The Terrestrial Biodiversity Climate Change Impacts Report Card 2012-13 (Living with Environmental Change Partnership, 2013); and the Biodiversity Impacts Climate Record

Card Technical Paper: 2. The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015; and

- Information about drainage and watercourses was obtained from Map Gwynedd – data originally sourced from NRW.

Field Survey

- 5.4.15 Detailed ecological information has been gathered from the site during the development of the Proposed Improvement. Detailed methodology can be found within the survey reports located in Technical Appendix C. A summary is given as follows:

Extended Phase 1 Habitat Survey

- 5.4.16 An extended phase 1 habitat survey of the Proposed Improvement corridor was undertaken by YGC in September 2014 to identify the habitats present and search for evidence of protected species within the survey area. Target notes were used to describe and highlight features of interest with regard to habitat types, protected species and non-native invasive plant species and these, along with habitat types were mapped on an extended phase 1 habitat plan. Features with potential to provide suitable habitat for protected species were also included, with the exception of bats as separate surveys for such features were to be undertaken by Arcadis.
- 5.4.17 The phase 1 habitat survey was updated during comprehensive protected species surveys undertaken by YGC between April and November 2015, including areas where access had previously been denied.

Otter

- 5.4.18 Between April and November 2015, YGC undertook a comprehensive otter survey of the Proposed Improvement corridor. Suitable habitat within the survey area was searched for field signs in accordance with the methodology outlined in 'Otters and River Habitat Management' (Conservation Technical Handbook No. 3, National Rivers Authority 1993).

Dormouse

- 5.4.19 Between April and November 2015, suitable habitat within the survey area was searched for signs indicating the presence of dormouse, such as gnawed hazel nuts and active season daytime nests, by YGC, in accordance with the methodology outlined in 'A Practical Guide to Dormouse Conservation' (Bright and Morris, The Mammal Society, 1989).
- 5.4.20 A dormouse nest tube survey was undertaken by YGC between July and November 2015, two months into the accepted active season for dormice and three months after the recommended survey set-up time for nest tube surveys as described in the 'Dormouse Conservation Handbook' (English Nature, 2006), due to the previous lack of land owner permission to access parts of the survey area. 90 tubes were set-up within suitable habitat that could be affected by the Proposed Improvement, located approximately every 10m along the edge/boundary habitat targeted. The tubes were checked monthly for evidence of use by dormice.

Great Crested Newt

- 5.4.21 Due to the previously recorded presence of great crested newts within Llanbedr airfield (located outside the survey area and to the west of the railway line), a survey for great crested newts was undertaken by YGC of all ponds and suitable breeding habitat within 250m of the Proposed Improvement on 27th, 28th and 29th April and 11th, 12th and 13th May 2015. These surveys consisted of bottle trapping, egg searches of aquatic vegetation and night torch surveys, according to methodology described in the 'Great Crested Newt Conservation Handbook' (Langton, Beckett and Foster, Froglife, 2001).

Bats

- 5.4.22 A preliminary daytime walkover survey was undertaken by Arcadis (formerly Hyder, formerly Cresswell Associates) on 4th to 7th August 2014 to identify features potentially suitable for use by roosting bats, areas of potential value for foraging and commuting bats and the most appropriate transect routes for bat activity surveys.
- 5.4.23 Manual transect surveys were undertaken along three different transects on 22nd September 2014 by Arcadis. An automated survey was also undertaken using Anabats located at three different points along each of the three transects between 18th and 22nd September 2014.
- 5.4.24 Arcadis undertook further walkover surveys on 6th August and 21st September 2015 to update the identification of potential roost features following updated plans of the proposed route corridor.
- 5.5.25 Inspections of some of the buildings identified as providing potential habitat for roosting bats was undertaken by Arcadis between the 21st and 24th September 2015, although access was not permitted to all of them. Following the identification of a number of active roosts within four of the buildings within the survey area, an emergence survey was undertaken of the former aquarium roost on 3rd June 2015 and two of three old MOD buildings in the wooded area at the northern end of the builders' yard on 23rd September 2015.
- 5.5.26 Monthly bat activity surveys were undertaken by Arcadis along four transect routes from April to October 2015, with 12 static Anabat detectors positioned in suitable locations across this area and left to record for at least four nights as agreed with NRW. The manual transect surveys included 15 minute listening points wherever the proposed route was expected to cross a linear feature, except where it was already covered by an Anabat.
- 5.5.27 In order to clarify potential bat commuting routes from the Former Aquarium roost and determine if they cross the new road route an additional bat emergence and activity survey was also undertaken on 6 July 2016. Four surveyors were positioned along the potential bat commuting route and another four at the maternity roost (to confirm that the bats were emerging and to provide a reference for the quantity of activity recorded along the route that evening).

Water Vole

- 5.4.28 Between April and November 2015, YGC surveyed suitable habitat within the survey area for signs of water voles, including burrows, latrines, feeding stations, footprints, runs and pathways, according to methodology described in 'The Water Vole Conservation Handbook' (Strachan and Moorhouse, Wildlife Conservation Research Unit, Oxford University, 2006).

Badger

- 5.4.29 Between April and November 2015, YGC surveyed suitable habitat within the survey area for evidence of badgers, including setts (active and inactive), footprints, trapped hairs, dung pits and latrines and pathways, according to methodology describes in 'Surveying Badgers' (Harris, Cresswell and Jefferies, Mammal Society, 1989). In addition to this, in February to March 2016, YGC undertook a badger bait marking survey by laying bait mixed with coloured plastic markers in numerous locations around each sett identified in the 2015 survey on five different occasions during this period, followed by surveys to check for the coloured markers in previously identified latrines and dung pits. This information was used to map the likely badger territories present within the scheme corridor.

Reptiles

- 5.4.30 During July and August 2015, YGC surveyed suitable habitat within the survey area for reptile species such as common lizard, slow worm, grass snake and adder, using artificial reptile refugia in accordance with methodology described in 'Froglife Advice Sheet 10: Reptile Survey' (Froglife,

1999). Approximately 160 reptile survey refugia made of 0.5m² sheets of roofing felt and corrugated metal were placed in the habitats throughout the survey area during the week beginning 24th July 2015 and left to 'bed in' for a two week period. The survey was then undertaken on days with suitable weather conditions for five visits between 11th and 26th August 2015.

Breeding Birds

- 5.4.31 A breeding bird survey following BTO/RSPB/JNCC breeding bird survey methodology (1994) was conducted by YGC during suitable weather conditions on 4th and 29th June 2015. A transect, following the approximate line of the proposed route was walked and any bird species heard or seen were recorded on the standard Breeding Bird Survey (BBS) recording sheets.

Lower Plants

- 5.4.32 A lichen and bryophyte survey of the Proposed Improvement corridor was undertaken by ADAS in conjunction with lichenologist Steve Chambers in January 2016. A field survey was undertaken on 8th January 2016, with thorough searches of each of the trees within or adjacent to the Proposed Improvement footprint, and species identification undertaken using a hand lens or microscope where required. Chemical testing was also used to aid lichen identification. This survey was updated in December 2016 to include areas previously not included within the scheme footprint.

Vegetation Surveys

- 5.4.33 Between June and July 2015, YGC undertook a National Vegetation Classification (NVC) survey in accordance with methodology outlined in the 'National Vegetation Classification User's Handbook' (Rodwell, JNCC, 2006), of the area of marshy grassland to the north of the Afon Artro at the centre of the Proposed Improvement corridor. A total of 20 x 2m² quadrats were used to cover the area requested by NRW for detailed vegetation survey. Quadrat analysis of areas of homogenous vegetation was undertaken on 3rd, 9th and 16th June and 1st July 2015, with all higher plant species identified and given an estimate of abundance within the quadrat using the Domin Scale. Other species recorded outside of the quadrats were also recorded where observed to give a more comprehensive overall species list.
- 5.4.34 Species lists and an estimate of abundance using the Domin Scale were also recorded by YGC for each section of watercourse and boundary feature that would be intercepted by the Proposed Improvement, on 1st and 7th July 2015, as requested by the SNPA.

Trees

- 5.4.35 An arboricultural survey of all trees with potential to be affected by the Proposed Improvement was undertaken by TMN Arboriculture on 5th and 11th August 2015, in accordance with BS5837:2012. This included measurement, visual appraisal and accurate mapping of trees. An additional arboricultural survey was undertaken in January 2017 to include additional trees not previously included within the scheme footprint due to changes in the scheme design. This was undertaken by Fairley Trees and Landscapes.

Limitations and Assumptions

- 5.4.36 A number of limitations apply for the ecological surveys and desk study that have been undertaken.

Field Survey

- 5.4.37 Many species are only apparent seasonally so that surveys at certain times of year are better able to detect them. Some species or evidence of their field signs are also affected by weather conditions and may not be recorded during adverse weather even if usually present at that time of year. Access restrictions also created limitations for some of the surveys, resulting in a lack of bat survey data for Maes Artro mitigation bat roost and some of the buildings at Plas y Bryn Farm. Access was never obtained for the parcel of land containing Maes Artro Holiday Village for any of

the survey work. A period of high rainfall prior to the lower plant survey rendered some bankside trees inaccessible due to high river levels but all trees within the footprint of the Proposed Improvement were surveyed. As far as possible all surveys were undertaken during optimal times and conditions for recording the target species, although this was sometimes not possible. However, wherever possible this was compensated by increased survey effort at an alternative time of year or further surveys the following season. A precautionary approach has also been taken where there is any uncertainty to allow a realistic assessment of potential impacts and mitigation required.

Desk Study

- 5.4.38 A limitation of the desk study undertaken is that the distribution of records obtained from the Environmental Information Service is determined by the level of survey effort undertaken in a given area and may also be skewed towards areas where people are more likely to come into contact with certain species, such as road casualties and bat roosts in houses. The records do not show where a species is absent and therefore the findings of the desk study have not been relied on alone but have been used as a guide to identify areas where further survey is required or to indicate the likelihood of a species being present within the general area. For further details of the limitations of specific surveys, see Technical Appendix C, Volume 2.

Assessment

Baseline Conditions

- 5.4.39 The baseline conditions have been described within the Zone of Influence of the Proposed Improvement, both generally and in relation to each of the 'Important Ecological Features' identified from the consultations, desk study and field surveys undertaken.
- 5.4.40 The 2016 CIEEM guidance describes how the baseline conditions must constitute the conditions predicted to exist at the expected time of the different phases of the scheme to be assessed, i.e. construction and operation in this case, in the absence of the Proposed Improvement.
- 5.4.41 This is due to the dynamic nature of ecosystems due to a number of natural and human-influenced factors, including the following:
- Trends in species population and distribution;
 - Rates of potential colonisation by new species and habitats;
 - Ecological processes, such as succession;
 - Likely changes in agricultural practice, including agri-environment schemes;
 - Expected outcomes from current and predicted management practices;
 - Trends in habitat quality e.g. resulting from pollution or pollution control;
 - Environmental trends e.g. climate change;
 - Management plans and conservation objectives for designated sites; and
 - The effects of other projects.
- 5.4.42 The factors listed above and anything else that could cause a change in the condition of species populations, habitats and sites identified as important ecological features affected by the Proposed Improvement, have been used to assess the baseline conditions at the time of construction and operation of the Proposed Improvement.
- 5.4.43 As there is not expected to be a significant delay between the publishing of this document and construction of the Proposed Improvement, the baseline projection for construction is generally based on the assumption that the present management regime continues and other factors are unlikely to have a significant effect on the condition of the important ecological features identified (unless an external factor is identified as likely to have a significant impact on an ecological feature).

5.4.44 According to the DMRB (Volume 11, Section 2, Part 5, HA 205/08), the assessment of the operational phase of the Proposed Improvement should consider conditions expected in Year 15 of operation. Therefore, the impacts described for the operational phase have been based on any differences predicted with the Proposed Improvement in Year 15 of its operation, compared with the predicted baseline 15-20 years from now (allowing time for construction and any delays following publication of this ES). Therefore baseline conditions have been projected for Year 15 of the Proposed Improvement, or 17-20 years from now, in the absence of the Proposed Improvement.

Identification and Characterisation of Impacts

5.4.45 For each important ecological feature that would potentially be significantly affected by the Proposed Improvement, likely impacts have been described for both the construction and operational phases, including consideration of the following aspects, as described in the CIEEM (2016) guidance:

- Available resources;
- Environmental processes;
- Ecological processes;
- Human influences;
- Historical context;
- Ecological relationships;
- Ecological role or function;
- Ecosystem properties;
- Other environmental influences.

5.4.46 Each potential impact identified has then been characterised according to the following criteria where relevant (as described in the CIEEM 2016 guidance):

- Positive (beneficial) / negative (adverse);
- Extent (area over which the impact may occur);
- Magnitude (severity, e.g. size/amount/intensity/volume);
- Duration (e.g. permanent/temporary);
- Timing (in relation to ecologically sensitive periods);
- Frequency;
- Reversibility (whether recovery is possible within a reasonable timescale).

5.4.47 All impacts have been assessed in relation to the baseline conditions as projected to occur at the time of construction and Year 15 of operation of the Proposed Improvement. They are described according to how these baseline conditions will change as a result of the Proposed Improvement and associated activities, and include any cumulative impacts of the Proposed Improvement and those arising from other developments.

Cumulative Impacts

5.4.48 Assessment of cumulative effects and impacts has been undertaken according to the CIEEM (2016) guidance, considering both additional and incremental effects associated with other developments or activities.

5.4.49 Developments considered in the cumulative impact assessment have included the following types:

- Planning applications and other proposals for which consent has been applied and which are awaiting determination;
- Projects which have been granted consent but which have not yet been completed;
- Proposals which have been refused permission but which are subject to appeal and the appeal is undetermined;
- Proposed projects that will be implemented by a public body but for which no consent is needed from a competent authority;

- Constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline;
- Developments specifically referenced in a National Policy Statement, a National Plan or a Local Plan.

5.4.50 Consultation with SNPA, NRW, Network Rail, North and Mid Wales Trunk Road Agency (NMWTRA), Gwynedd Council and Welsh Water was undertaken to assist in the compilation of developments to be considered.

Residual Impacts

5.4.51 Avoidance or mitigation measures for all impacts considered to be significant (see paragraph 5.4.52-53 below) are described where these are possible and any residual impacts are then assessed to determine the significance of their effects on ecological features. Where significant residual effects remain, compensatory measures would be required proportional to the scale of significance and these have also been described.

Determination of Significant Effects

5.4.52 According to the CIEEM (2016) guidance, for the purpose of Ecological Impact Assessment a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. These conservation objectives may be specific (e.g. for a designated site), broad (e.g. national/local nature conservation policy) or more wide-ranging (e.g. enhancement of biodiversity).

5.4.53 Effects can be considered significant at a wide range of scales from international to local level and therefore the significance of any effects considered to be significant has been qualified in a geographical context, which may not be the same as the geographical context in which the feature is considered important. For example, an effect on a species which is on a national list of species of principal importance for biodiversity may not have a significant effect on its national population. The terminology used to describe the geographical scale of the significance is the same as that used to describe the scale of importance of the ecological features (see paragraph 5.4.11 - 12 above). The determination of the scale of significance has been based on the CIEEM (2016) guidance.

Limitations and Assumptions

5.4.54 A number of limitations apply for the assessment methodology described above. When predicting the baseline conditions at Year 15 of operation, it is obviously not possible to accurately predict the impact or magnitude of every factor influencing population trends or habitat condition and in what way they would act together on a species, habitat or site in this timeframe. It is therefore only discussed as a guide in the assessment, with no solid predictions made. Equally, it is very difficult to identify every other scheme or project that could combine to act on each of the important ecological features identified in this assessment for the assessment of cumulative effects. This section will therefore represent an estimate of possible external influences resulting from other major schemes that have been identified.

Policy Framework

5.4.55 This section summarises the key legislation in relation to nature conservation and ecology that is considered relevant to the Proposed Improvement, which primarily concerns protected sites and protected species/habitats. Policies and plans relating to the environment in general are summarised in Chapter 2.0: The Proposed Improvement.

Key Legislation

Conservation of Habitats and Species Regulations (2010, as amended)

- 5.4.56 The Conservation of Habitats and Species Regulations 2010 (as amended) transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the EC Habitats Directive) into national law. The Regulations provide for the designation and protection of European sites and the protection of European protected species and habitats as listed in the EC Habitats Directive and EC Birds Directive (Council Directive 2009/147/EC). The regulations provide guidance on undertaking assessment of impacts on European and Protected Sites (Special Areas of Conservation - SACs, Special Protection Areas – SPAs and Ramsars) through the Habitat Regulations Assessment (HRA) process. A number of European protected sites are located within the Zone of Influence (see paragraph 5.4.6) of the Proposed Improvement, as shown in Table 5.4.4 and have been assessed under this legislation (see the HRA for the Proposed Improvement: 'A496 Llanbedr Access Improvements: Habitat Regulations Assessment' available as a separate document). European protected species previously recorded within the vicinity of the Proposed Improvement include otters and several bat species.

Wildlife and Countryside Act (1981, as amended)

- 5.4.57 The Wildlife and Countryside Act (WCA) governs the designation and protection of Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR), and protection of various plant and animal species. Schedule 1 of the Act lists protected bird species, Schedule 5 lists other protected animal species, and Schedule 8 lists protected plant species. Schedule 9 of the Act lists invasive alien species which it is an offence to introduce or allow to spread in the wild. A number of SSSIs and an NNR are located within the vicinity of the Proposed Improvement, as shown in Table 5.4.5, Schedule 1 bird species potentially nesting within the vicinity of the Proposed Improvement include barn owl and red kite and animals listed on Schedule 5 previously recorded within the vicinity of the Proposed Improvement include bat species, water vole and otter. A number of non-native invasive plant species listed on Schedule 9 of the Act have also been recorded within the Proposed Improvement corridor, including Japanese knotweed, *Rhododendron ponticum*, Himalayan Balsam and Montbretia.

National Parks and Access to the Countryside Act (1949)

- 5.4.58 This act makes provision for National Parks and the establishment of a National Parks Commission to confer on the Nature Conservancy Council (now NRW in Wales) and local authorities powers for the establishment and maintenance of nature reserves and to make further provision for the recording, creation, maintenance and improvement of public paths and securing access to open country and to amend the law relating to rights of way; to confer further powers for preserving and enhancing natural beauty, and other matters relating to these. National Nature Reserves (NNRs) and Local Nature Reserves (LNRs) can be designated under this act. An NNR is located in the vicinity of the Proposed Improvement.

The Countryside and Rights of Way (CRoW) Act (2000)

- 5.4.59 The CRoW Act further enhances protection given to some species through the WCA by introducing an offence of recklessly disturbing a Schedule 5 animal. It also provides further guidance regarding the protection of SSSIs. The CRoW Act required the compilation of a list of species and habitats of principal importance for biodiversity in Wales but this was superseded by the NERC Act and subsequently the Environment (Wales) Act 2016 (see below).

Environment (Wales) Act (2016)

- 5.4.60 This act became law in Wales on 21st March 2016, and includes legislation that supersedes the Natural Environment and Rural Communities (NERC) Act 2006. Part 1 of the Act sets out Wales' approach to planning and managing natural resources at a national and local level with a general purpose linked to statutory 'principles of sustainable management of natural resources' defined within the Act.

- 5.4.61 Section 6 of the Act places a duty on public authorities to ‘seek to maintain and enhance biodiversity’ so far as it is consistent with the proper exercise of those functions. In doing so, public authorities must also seek to ‘promote the resilience of ecosystems.’ Public authorities will be required to report on the actions they are taking to improve biodiversity and promote ecosystem resilience.
- 5.4.62 Section 7 replaces the duty in Section 42 of the NERC Act 2006. The Welsh Ministers will publish, review and revise lists of living organisms and types of habitat in Wales, which they consider are of principle importance for the conservation and enhancement of biodiversity in Wales. The Welsh Ministers must also take all reasonable steps to maintain and enhance the living organisms and habitats included in any list published under this section, and encourage others to take such steps. A number of habitats and species included under Section 7 of this act have been recorded in the vicinity of the Proposed Improvement and are therefore considered in the assessment.
- 5.4.63 The Section 7 list of habitats and species of principle importance for the conservation of biodiversity in Wales is currently being revised but will remain the same as the former Section 42 list until the revised list is published. Table 5.4.1 below lists habitats and species from this list that are known to be present within the Zone of Influence of the Proposed Improvement (see paragraph 5.4.6 above), or that have previously been recorded within 2km.

Table 5.4.1: Section 7 Habitats and Species Previously Recorded within 2km of the Proposed Improvement (Cofnod, CCW Phase 1 Habitat Data and Survey Data)

Habitats	Species
<ul style="list-style-type: none"> • Upland oak woodland • Lowland mixed deciduous woodland • Hedgerows • Arable field margins • Coastal and floodplain grazing marsh • Upland flushes and fens • Purple moor grass and rush pasture • Reedbeds • Blanket bog • Rivers • Ponds • Inland rock outcrops • Coastal sand dunes • Coastal saltmarsh • Intertidal mudflats 	<ul style="list-style-type: none"> • Water vole (<i>Arvicola terrestris</i>) • West European hedgehog (<i>Erinaceus europaeus</i>) • Brown hare (<i>Lepus europaeus</i>) • Otter (<i>Lutra lutra</i>) • Polecat (<i>Mustela putorius</i>) • Barbastelle bat (<i>Barbastella barbastellus</i>) • Noctule (<i>Nyctalus noctula</i>) • Common pipistrelle (<i>Pipistrellus pipistrellus</i>) • Soprano pipistrelle (<i>Pipistrellus pygmaeus</i>) • Brown long-eared bat (<i>Plecotus auritus</i>) • Greater horseshoe bat (<i>Rhinolophus hipposiderus</i>) • Lesser horseshoe bat (<i>Rhinolophus hipposideros</i>) • Skylark (<i>Alauda arvensis arvensis</i>) • Tree pipit (<i>Anthus trivialis</i>) • Lesser redpoll (<i>Carduelis cabaret</i>) • Common linnet (<i>Carduelis cannabina autochthona/cannabina</i>) • Ringed plover (<i>Charadrius hiaticula</i>) • Lesser spotted woodpecker (<i>Dendrocopus minor comminutus</i>) • Yellowhammer (<i>Emberiza citrinella</i>) • Reed bunting (<i>Emberiza schoeniclus</i>) • Pied flycatcher (<i>Ficedula hypoleuca</i>) • Herring gull (<i>Larus argentatus argenteus</i>) • Black-headed gull (<i>Larus ridibundus</i>) • Bar-tailed godwit (<i>Limosa lapponica</i>) • Common grasshopper warbler (<i>Locustella naevia</i>) • Common scoter (<i>Melanitta nigra</i>) • Spotted flycatcher (<i>Muscicapa striata</i>) • Eurasian curlew (<i>Numenius arquata</i>) • House sparrow (<i>Passer domesticus</i>) • Wood warbler (<i>Phylloscopus sibilatrix</i>) • Dunnock (<i>Prunella modularis occidentalis</i>) • Common bullfinch (<i>Pyrrhula pyrrhula pileata</i>) • Song thrush (<i>Turdus philomelos clarkei</i>) • Northern lapwing (<i>Vanellus vanellus</i>) • Slow-worm (<i>Anguis fragilis</i>) • Common lizard (<i>Zootica vivipara</i>) • Grass snake (<i>Natrix natrix</i>) • Common toad (<i>Bufo bufo</i>) • Great crested newt (<i>Triturus cristatus</i>) • Latticed heath (<i>Chiasmia clathrata</i>) • Small heath (<i>Coenonympha pamphilus</i>) • Oak lutestring (<i>Cymatophorima diluta</i>) • Dingy skipper (<i>Erynnis tages</i>) • Grayling (<i>Hipparchia semele</i>) • Heath rustic (<i>Xestia agathina</i>) • Wall mason bee (<i>Osmia parietina</i>) • Hornet robberfly (<i>Asilus crabroniformis</i>) • Lesser searcher beetle (<i>Calosoma inquisitor</i>) • Pale scalewort (<i>Radula voluta</i>) • Olive earthtongue (<i>Microglossum olivaceum</i>) • A lichen (<i>Parmelinopsis horrescens</i>) • The Lobarion lichen community

The Water Environment (Water Framework Directive) England and Wales Regulations (2003)

5.4.64 These regulations are the transposition into UK legislation of the EU Water Framework Directive (Council Directive 2000/60/EC). The basic principles are:

- Enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, which depend on the aquatic ecosystems.
- Promote the sustainable use of water.
- Reduce pollution of water, especially by 'priority' and 'priority hazardous' substances.

- Ensure progressive reduction of groundwater pollution.

The Eels (England and Wales) Regulations (2009)

5.4.65 These regulations are the transposition into UK legislation of a European Council Regulation to establish measures for the recovery of the stock of European eel. Regulation 12 of this legislation requires the Environment Agency (now NRW in Wales) to be notified of the construction of any structure that could constitute an obstruction to eel passage and Regulation 14 gives NRW the right to serve notice for the construction of an eel pass following such a notification. Further regulations deal with the maintenance, repair, damage or obstruction of eel passes.

The Protection of Badgers Act (1992)

5.4.66 This legislation protects badgers against wilful killing, injury or ill-treatment, and disturbance in their setts, and also prohibits interference with or obstruction of badger setts. Although primarily intended to protect badgers against deliberate persecution, the legislation is also relevant in the context of development work. This is relevant because badgers and their setts have been recorded within the Proposed Improvement corridor.

Wild Mammals Protection Act (1996)

5.4.67 This act operates in parallel with legislation listed above conferring specific protection on rare or threatened mammal species, by protecting all wild mammals from any actions intended to cause unnecessary suffering.

The Hedgerow Regulations (1997)

5.4.68 This legislation governs the assessment and protection of hedgerows, although it should be noted that the Proposed Improvement does not fall within the requirements of the Hedgerow Regulations as it is consented through the planning process. As good practice however, all affected hedgerows have been assessed against the Hedgerows Regulations criteria and appropriate mitigation undertaken where 'important' hedgerows have been recorded.

Key Policies and Plans

Wales National Transport Strategy

5.4.69 This strategy sets out to promote sustainable transport networks that safeguard the environment while strengthening Wales' economic and social life. It identifies a series of high-level outcomes and sets out the steps for their delivery. The following are of relevance to this chapter:

Outcome 13: Adapting to Climate Change

5.4.70 This outcome is to ensure that transport networks are adapted to cope with the impacts of climate change and support increased resilience. This includes changes to habitats and species and the role transport has to play in supporting habitat connectivity.

Outcome 17: Biodiversity

5.4.71 This outcome is to ensure that biodiversity, for both land and marine environments, is protected and enhanced when improving or developing transport measures. It states that mitigatory and compensatory measures are to be provided where transport has a significant negative effect.

Technical Advice Note (TAN) 5, Nature Conservation and Planning (2009)

5.4.72 TAN 5 provides advice to local planning authorities on the application of the law relating to planning and nature conservation and its impact within the land use planning system. The most recent revision of TAN 5 brings it in line with the strategic policy in Planning Policy Wales (PPW, issued in 2002 and revised in 2014) and advises how planning policy with regard to ecology needs to be interpreted to be in compliance with Planning Policy Wales.

5.4.73 TAN 5 provides advice on the following:

- Positive planning for nature conservation;
- Nature conservation and Local Development Plans;
- Nature conservation in development management procedures;
- Development affecting protected internationally and nationally designated sites and habitats;
- Development affecting protected and priority habitats and species.

Planning Policy Wales - Edition 7 (July 2014)

5.4.74 Of particular relevance to this assessment is Chapter 5 - Conserving and Improving Natural Heritage and the Coast which outlines the Welsh Government's commitments to Nature Conservation. The Welsh Government's objectives for the conservation and improvement of the natural heritage are to:

- promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;
- ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;
- ensure that statutorily designated sites are properly protected and managed;
- safeguard protected species,
- promote the functions and benefits of soils, and in particular their function as a carbon store.

Wales Action Plan for Pollinators (2013)

5.4.75 The Action Plan for Pollinators in Wales recognises that:

'Pollinators are an essential component of our environment. Honey bees and wild pollinators including bumblebees, solitary bees, parasitic wasps, hoverflies, butterflies, moths and some beetles are important pollinators in Wales for crops such as fruit and oilseed rape, clovers and other nitrogen-fixing plants that are important to improving the productivity of pasture systems for livestock grazing and wildflowers.'

5.4.76 The Welsh government has worked with industry and stakeholders to look in more detail at the evidence and issues around pollinators and their conservation in Wales. The action plan produced aims to reduce and reverse the decline in wild and managed pollinator populations.

United Kingdom Biodiversity Action Plan (UKBAP)

5.4.77 In 1992 the UK signed the Convention on Biological Diversity at the Rio Convention pledging the UK to develop national strategies for the conservation and sustainable use of biological diversity.

5.4.78 The UK Government subsequently produced *Biodiversity: The UK Action Plan* in 1994 which described the biological resources of the UK as a whole and in turn led to the production of Biodiversity Action Plans for individual habitats and species. A total of 1150 Priority Species and 65 Priority Habitats were identified (following update to list in 2007) as those most in need of protection. The UKBAP lists of priority habitats and species have now been superseded by the country biodiversity lists (i.e. Section 42 in Wales) but they are a useful reference source.

Local Biodiversity Action Plans (LBAPs)

5.4.79 *Biodiversity: The UK Biodiversity Steering Group Report* was published in 1995. This recognised that to successfully implement the UKBAP at a local level and translate national policy into action, it would be necessary to produce Local Biodiversity Action Plans (LBAPs) across the UK. In response to this, local authorities throughout the UK produced LBAPs; the Snowdonia BAP (or Eryri BAP) is the LBAP of relevance to the proposed improvement and the species and habitats included within it that could be present within 2km of the Proposed Improvement are summarized in Table 5.4.2 below.

Table 5.4.2: Summary of Snowdonia/Eryri BAP Species and Habitats Previously Recorded within 2km of the Proposed Improvement (Cofnod, CCW Phase 1 Habitat Data and Survey Data)

Habitats	Species
<ul style="list-style-type: none"> • Buildings • Gardens • Sand dunes • Lowland hay meadows • Lowland heath • Upland dwarf shrub heath • Coastal and floodplain grazing marsh • Purple moor-grass and rush pastures • Mixed ashwoods • Upland oakwoods • Scrub woodlands • Wet woodlands 	<ul style="list-style-type: none"> • Curlew (<i>Numenius arquata</i>) • Green Woodpecker (<i>Picus viridis</i>) • Lapwing (<i>Vanellus vanellus</i>) • Lesser Black Backed Gull (<i>Larus fuscus</i>) • Pied Flycatcher (<i>Ficedula hypoleuca</i>) • Redstart (<i>Phoenicurus phoenicurus</i>) • Skylark (<i>Alauda arvensis</i>) • Song Thrush (<i>Turdus philomelos</i>) • Twite (<i>Carduelis flavirostris</i>) • Wood Warbler (<i>Phylloscopus sibilatrix</i>) • Brown Hare (<i>Lepus europeaus</i>) • Dormouse (<i>Muscardinus avellanarius</i>) • European Polecat (<i>Mustela putorius</i>) • Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) • Natterer's Bat (<i>Myotis nattereri</i>) • Noctule Bat (<i>Nyctalus noctula</i>) • Otter (<i>Lutra lutra</i>) • Pipistrelle Bat (<i>Pipistrellus pipistrellus</i>) • Water Vole (<i>Arvicola terrestris</i>) • Great crested newt (<i>Triturus cristatus</i>) • Western Gorse (<i>Ulex gallii</i>)

Eryri Local Development Plan 2007 – 2022 (Snowdonia National Park Authority, 2011)

5.4.80 The Eryri Local Development Plan has replaced the existing Eryri Local Plan, the Gwynedd Structure Plan relating to the National Park and the Eryri Affordable Housing Delivery Statement (2009) as the policy context for assessing development proposals within Snowdonia National Park, up to 2022. The plan was formally adopted on 13th July 2011. The policies relevant to nature conservation include:

Strategic Policy D: Natural Environment

5.4.81 The natural resources, biodiversity, geodiversity and ‘Special Qualities’ of the Snowdonia National Park will be protected from inappropriate development. Where development is deemed acceptable developers will be expected to ensure that the natural environment is protected and enhanced.

5.4.82 Proposals should not adversely affect the National Park’s biodiversity resources including designated sites from an international through to a local level, as well as wider biodiversity resources e.g. habitats and species outside designated sites.

5.4.83 Development proposals which are likely to adversely affect the integrity of European designated sites (wither alone or in combination with other plans or projects) will not be permitted unless the requirements of the Conservation of Habitats and Species Regulations 2010 have been fulfilled and hence the following criteria can be met:

- i. There is no alternative solution
- ii. There are imperative reasons of over-riding public interest for the development.

The following requirements will apply to development affecting nationally and locally designated sites:

- iii. The location, design and construction of the development are such that damage to nature conservation features are mitigated and opportunities for nature conservation gain are taken.
- iv. Compensatory measures are provided if necessary.
- v. The remaining nature conservation features are protected and enhanced and provision is made for their management.

5.4.84 Development will only be permitted within the Undeveloped Coast where it can be demonstrated that a coastal location is essential. Development which harms the unspoilt landscape character of wildlife habitats will not be permitted.

5.4.85 Development proposals which are likely to adversely affect habitats and species listed in the Local Biodiversity Action Plan will be subject to the guidelines of the Supplementary Planning Guidance on Local Biodiversity.

Snowdonia National Park Management Plan 2010 – 2015

5.4.86 The Snowdonia National Park Management Plan sets out a number of objectives and targets in relation to improving habitats and enhancing landscapes. A summary of the ecology and nature conservation objectives relevant to the Proposed Improvement, along with notable actions that are recommended in order to achieve those objectives are provided below.

Objective 4

5.4.87 Protect and enhance habitats and species as notified in the Local Biodiversity Action Plan and all Natura 2000 sites:

- Implement actions emanating from the revised LBAP as appropriate.

Objective 5

5.4.88 Promote ecological connectivity between sites within Snowdonia and its environs:

- Continue efforts to reduce the land area covered by invasive species;
- Ensure the quality of groundwater, rivers, lakes and coastal areas is maintained and enhanced. Land management must be sympathetic to conserving fresh and salt water environments.

Objective 6

5.4.89 Ensure sustainable use of high quality inland and coastal waters including the marine environment:

- Ensure land management practices are sympathetic to maintaining and enhancing water quality.

Wales Environment Strategy 2006 to 2026

5.4.90 The Environment Strategy is the Welsh government's long-term strategy for the environment of Wales setting the strategic direction for the next 20 years. The strategy has five main themes:

- Addressing climate change;
- Sustainable resource use;
- Distinctive biodiversity, landscape and seascapes;
- Our local environment; and
- Environmental hazards.

Baseline Conditions

Important Ecological Features

5.4.91 As previously stated, according to the CIEEM (2016) guidance, the selection of Important Ecological Features should be based on those features considered to be of importance to nature conservation that could be affected by the likely direct or indirect impacts of the Proposed Improvement. A list of such impacts likely to occur during the construction and operational phases of the Proposed Improvement is provided below:

Construction Impacts:

- Direct loss or damage to habitats and species during site clearance and construction activities;
- Disturbance or disruption of species (including severance) due to construction activities, vehicular access, lighting, noise and increased human presence;
- Pollution of watercourses due to in-channel works, run-off and environmental incidents, leading to damage to sites, habitats and species;
- Construction dust and emissions leading to damage to sites, habitats and species;
- Potential for the spread of non-native invasive plant species due to construction activities; and
- Potential for a loss or reduction in value of ecosystem services provided by the natural environment during construction.

Operational Impacts:

- Damage or disturbance of adjacent habitats or species due to maintenance activities;
- Increased mortality, disturbance or disruption of species (including severance) due to the presence of the Proposed Improvement and associated traffic, noise and lighting;
- Pollution of watercourses due to run-off and environmental incidents on the new route;
- Damage to sites, habitats or species due to air pollution from traffic on the new route;
- Positive impacts such as a reduction in air, noise or other pollution benefitting sites, habitats or species in locations where the main volume of traffic would be moved further away; and
- Potential for a loss or reduction in value of ecosystem services provided by the natural environment during operation.

5.4.92 Based on the data collated from surveys, consultation, historical records and GIS systems, a list of ecological features considered to be of importance within the ZOI and potentially affected by the Proposed Improvement has been compiled and is provided in Table 5.4.3 below. All field survey reports can be found in Technical Appendix C (Volume 2). Features that were initially considered to be potentially present and were therefore surveyed for but not recorded have been scoped out and are therefore not included on this list (dormouse, water vole, and great crested newts for example). The geographical scale of the importance of these features is also provided in the table.

Table 5.4.3: Summary of Important Ecological Features

Ecological Feature	Reason for inclusion as an Important Ecological Feature in relation to the Proposed Improvement	Geographical Scale of Importance
Sites:		
Coedydd Derw a Safleoedd Ystlumod Meirion SAC	85m to the east of the construction footprint. A European Protected Site under the EU Habitats Directive within 2km of the Proposed Improvement.	International
Pen Llyn a'r Sarnau	200m to the northwest. A European Protected Site under the EU	International

SAC	Habitats Directive within 2km of the Proposed Improvement.	
Morfa Harlech a Morfa Dyffryn SAC	1.2km to the west. A European Protected Site under the EU Habitats Directive within 2km of the Proposed Improvement.	International
Afon Eden – Cors Goch Trausfynydd SAC	12.3km to the east. A European Protected Site under the EU Habitats Directive with otter as a feature within 25km of the Proposed Improvement.	International
Afon Gwyrfai a Llyn Cwellyn SAC	24.9km to the north. A European Protected Site (EU Habitats Directive) with otter as a feature within 25km of the Proposed Improvement.	International
Glynllifon SAC	26.1km to the north. A European Protected Site (EU Habitats Directive) with lesser horseshoe bat as a feature within 30km of the Proposed Improvement.	International
Morfa Dyffryn NNR	1.9km to the southwest. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) and National Parks and Access to the Countryside Act 1949 within 2km of the Proposed Improvement.	National
Morfa Dyffryn SSSI	200m to the northwest. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Proposed Improvement.	National
Caeau Bwlch SSSI	265m to the east. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Proposed Improvement.	National
Coed Lletywalter SSSI	1.3km to the east. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Proposed Improvement.	National
Coed Aber Artro SSSI	1.75km to the east. A UK Protected Site under the Wildlife and Countryside Act 1981 (as amended) within 2km of the Proposed Improvement.	National
Ancient Semi-Natural Woodland Sites	26 sites listed on the Ancient Woodland Inventory (NRW) including 17 Ancient Semi-Natural Woodland (ASNW) sites and nine Restored Ancient Woodland Sites (RAWS) within 1km of the Proposed Improvement. Although this habitat it not uncommon in Gwynedd, it's effectively irreplaceable nature makes it considerably more important	Regional (ASNW); Local (RAWS)
Habitats:		
Trees and hedgerows	Scattered trees and hedgerows are present within the footprint of the Proposed Improvement, including a number of mature trees. Hedgerows are a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016. Trees and hedgerows can also provide important connecting habitat, acting as a wildlife corridor for a range of other species. All mature trees have innate value for biodiversity, providing habitat for a great diversity of invertebrates and lower plants as well as larger species such as bats and birds due to rot holes and other features that increase as trees mature. There are no veteran trees within the survey area and trees and hedgerows are abundant throughout Gwynedd	Local
Lowland mixed deciduous woodland	Small pockets of mixed deciduous woodland are present within the scheme boundary, some of which would be directly affected by the Proposed Improvement. Lowland mixed deciduous woodland is a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016. There are no veteran trees within the woodland to be affected and this habitat is abundant throughout Gwynedd	Local

Coastal and floodplain grazing marsh	A small area of this habitat is present within the scheme footprint and would be directly affected by the Proposed Improvement. Coastal and floodplain grazing marsh is a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016 and is also listed on the Eryri LBAP. The small area within the scheme corridor is a small proportion of the total area within Gwynedd (<1%)	Local
Lowland meadow	An area of this habitat is present within the scheme footprint and would be directly affected by the Proposed Improvement. Lowland meadow is a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016 and is also listed on the Eryri LBAP. The area within the scheme corridor is likely to represent more than 1% of the total area within Gwynedd	County
Purple moor grass and rush pastures	A small area of this habitat is present within the scheme footprint and would be directly affected by the Proposed Improvement. Purple moor grass and rush pastures are a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016 and is also listed on the Eryri LBAP. The small area within the scheme corridor is a small proportion of the total area within Gwynedd (<1%)	Local
Reedbeds	A small area of this habitat is present within the scheme footprint and would be directly affected by the Proposed Improvement. Reedbeds are a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016. The small area within the scheme corridor is a small proportion of the total area within Gwynedd (<1%)	County
Rivers	The Afon Artro is a main river that flows through the footprint of the Proposed Improvement. There are five other watercourses that would be affected by the Proposed Improvement, including two main rivers, all of which are tributaries of the Afon Artro. Rivers are a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016. Rivers are relatively abundant throughout Gwynedd but the Afon Artro is one of only about 50 catchments in the county that are assigned 'Good' Status under the Water Framework Directive	County
Ponds	There is a small pond located in the vicinity of the Proposed Improvement. Ponds are a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016. Ponds are common throughout Gwynedd and the small area within the scheme corridor is a small proportion of the total area within Gwynedd (<1%)	Local at most
Coastal saltmarsh	This habitat is present downstream of the scheme footprint. Coastal saltmarsh is a Habitat of Principal Importance in Wales under Section 7 of the Environment (Wales) Act 2016. The area downstream of the Proposed Improvement is likely to represent more than 1% of the total area of this habitat within Gwynedd	National
Species:		
Lesser horseshoe bat	European Protected Species (EPS) under the EU Habitats Directive and Conservation of Habitats and Species Regulations, 2010; also, listed in Annex II of the Habitats Directive (species of Community interest which require the designation of SACs), included in Section 7 of the Environment (Wales) Act 2016 and listed on the Eryri LBAP. Nationally rare in the UK with a restricted distribution, although	Regional

	<p>relatively widespread in Gwynedd.</p> <p>Common and widespread activity within the Proposed Improvement corridor, which supports a maternity colony of at least 23 individuals (confirmed to be considerably bigger (50-70 bats) when recording began in 2006) and low numbers of hibernating bats have also been recorded.</p> <p>Use a wide range of habitats within the Proposed Improvement corridor (and particularly reliant on the riparian habitat provided by the Afon Artro), but other habitats are not essential for maintaining their Favourable Conservation Status.</p>	
<p><i>Myotis</i>, pipistrelle and brown long-eared bats</p>	<p>All species within this assemblage are EPS under the EU Habitats Directive and the Conservation of Habitats and Species Regulations, 2010. Common and soprano pipistrelle and the brown long-eared bat are listed within Section 7 of the Environment (Wales) Act 2016. Pipistrelles and Natterer's bats are also included in the Eryri LBAP. Nationally common and widespread in the UK and Gwynedd apart from Nathusius' pipistrelle. This species is uncommon and sparsely recorded in the UK; its status in Gwynedd is unknown but it is likely to have been under-recorded historically.</p> <p>These species are widely active within the Proposed Improvement corridor with the exception of brown long-eared bat (widely recorded, but likely to be under-represented in activity surveys) and Nathusius' pipistrelle (present in low numbers).</p> <p>No evidence of maternity colonies within the Proposed Improvement corridor, but likely to be present within the ZoI. The majority are likely to hibernate outside of the red line boundary.</p> <p>These species are generalists and are unlikely to be reliant on these habitats within the Proposed Improvement corridor.</p>	<p>Local (except for Nathusius' pipistrelle: Unknown)</p>
<p>Noctule bat</p>	<p>An EPS under the EU Habitats Directive and the Conservation of Habitats and Species Regulations, 2010, listed within Section 7 of the Environment (Wales) Act 2016 and included in the Eryri LBAP.</p> <p>Noctules are common and widespread throughout the UK/Gwynedd;</p> <p>Noctules were recorded in very low numbers within the Proposed Improvement corridor.</p> <p>There was no evidence of a maternity colony or of hibernation roosts within the Proposed Improvement corridor, although these are likely within the ZoI.</p> <p>Not reliant on the habitats within the red line boundary; nor dependent on linear features for traversing it.</p>	<p>Local</p>
<p>Leisler's and serotine bats</p>	<p>Both species are EPS under the EU Habitats Directive and the Conservation of Habitats and Species Regulations, 2010.</p> <p>Serotines common and widespread throughout the UK but sparse in Wales, and at the edge of their range in Gwynedd (they may be under-recorded because of call overlap in this group); the status of Leisler's bat in Wales is unclear, but is sparsely recorded in Gwynedd, although similarly likely to be under-recorded.</p> <p>Serotines were recorded in very low numbers within the Proposed Improvement corridor; Leisler's bat was not confirmed.</p> <p>There was no evidence of a maternity colony or of hibernation roosts within the Proposed Improvement corridor, although these are likely within the ZoI.</p> <p>Not reliant on the habitats within the red line boundary; nor dependent on linear features for traversing it.</p>	<p>Regional</p>

Greater horseshoe and barbastelle bats	<p>European Protected Species (EPS) under the EU Habitats Directive and Conservation of Habitats and Species Regulations, 2010; also, listed in Annex II of the Habitats Directive (species of Community interest which require the designation of SACs) and within Section 7 of the Environment (Wales) Act 2016.</p> <p>Nationally rare; restricted distribution in the UK. Very uncommon and rarely recorded within the Proposed Improvement corridor; present infrequently and in low numbers within Gwynedd</p>	Regional
Otter	<p>The Afon Artro is known to support a population of otters.</p> <p>The otter is a European Protected Species under the EU Habitats Directive and Conservation of Habitats and Species Regulations 2010. It is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and an Eryri LBAP species.</p> <p>Otters are widely distributed throughout Gwynedd and the UK</p>	County
Badger	<p>An active badger population is known to be located within the Zone of Influence of the Proposed Improvement.</p> <p>Badgers are UK protected species under the Badger Protection Act 1992.</p> <p>They are abundant and widespread throughout Gwynedd and the UK</p>	Local / Negligible
Polecat	<p>There are three records of this species within 1km of the Proposed Improvement. A Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and an Eryri LBAP species.</p> <p>Polecats are widely distributed throughout Gwynedd and much of the UK</p>	Local
Hedgehog	<p>There is a record of this species within 1km of the Proposed Improvement.</p> <p>A Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act.</p> <p>Hedgehogs are widely distributed throughout Gwynedd and the UK</p>	Local
Brown hare	<p>There are four records of this species within 1km of the Proposed Improvement. A Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and an Eryri LBAP species.</p> <p>Brown hares are widely distributed throughout Gwynedd and the UK</p>	Local
Lesser spotted woodpecker	<p>There are two records for this species within 1km of the Proposed Improvement, including one within the scheme footprint and one of nest excavation.</p> <p>The lesser spotted woodpecker is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and is scarce in North Wales.</p>	Regional
Barn owl	<p>A barn owl has been recorded within 2km of the Proposed Improvement and there is potential nesting habitat within the immediate vicinity.</p> <p>Barn owls are protected under the Wildlife and Countryside Act 1981 (Schedule 1, Part 1), as amended, which prohibits nesting sites from being disturbed.</p>	County
Red kite	<p>There are several records of red kite within 2km of the Proposed Improvement, including three records within 1km and potential nesting habitat within the Zol.</p> <p>Red kites are protected under the Wildlife and Countryside Act 1981 (Schedule 1, Part 1), as amended, which prohibits nesting sites from being disturbed.</p>	County
Green woodpecker and lapwing	<p>There are records of green woodpecker and lapwing within 2km of the Proposed Improvement and potential nesting and foraging habitat for these species within the Zol.</p> <p>Lapwing is a Species of Principal Importance in Wales under Section</p>	County

	<p>7 of the Environment (Wales) Act and both species are listed on Eryri LBAP.</p> <p>Both species are relatively scarce on a county level.</p>	
Other breeding birds	<p>There is potential habitat within the ZOI for locally important breeding birds that have been recorded within 2km of the Proposed Improvement.</p> <p>All nesting birds are protected under the Wildlife and Countryside Act 1981. Some of these species are listed as Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act and some are also listed on the Eryri LBAP.</p>	Local
Reptiles	<p>There is potential habitat for the more common species (slow worm, common lizard and grass snake) within the footprint of the Proposed Improvement. There have been 4 records of common lizard and slow worm and 3 of grass snake within 1km of the Proposed Improvement. The Wildlife and Countryside Act 1981 prohibits the intentional killing, injury and trade of these species, which are also Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act.</p>	Local
Amphibians	<p>There is potential amphibian habitat within the footprint of the Proposed Improvement.</p> <p>Common toad is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act.</p>	Local
Migratory fish and brook lamprey	<p>The Afon Artro is known to support the Atlantic salmon, brown/sea trout, European eel and the three native lamprey species: brook, river and sea lamprey. Brook lamprey (non-migratory) has also been recorded on a minor watercourse flowing into the scheme corridor from the northeast. Atlantic salmon and all three lamprey species are listed on Annexe IIa of the Habitats Directive and Atlantic salmon, brown/sea trout, European eel and river and sea lamprey are also Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act. Provision for the European eel is also made under the Eels (England and Wales) Regulations 2009.</p>	Local
Latticed Heath moth (<i>Chiasmia clathrata</i>)	<p>There is potential habitat for this moth species which has been recorded within the footprint of the Proposed Improvement and is uncommon in North Wales.</p> <p>It is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act.</p>	Regional
Wall mason bee (<i>Osmia parietina</i>)	<p>There is potential habitat for this nationally rare species within the footprint of the Proposed Improvement and previous records within 1km, although these are very old (1902). Wall mason bee is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act.</p>	National
Sharp rush (<i>Juncus acutus</i>)	<p>This Nationally Scarce plant species (occurring in only 16-100 hectads in Great Britain) was recorded within the survey corridor during the 2015 surveys.</p>	National
<i>Schimatomma graphidioides</i> (a lichen)	<p><i>Schimatomma graphidioides</i> is present on two trees within the Proposed Improvement corridor.</p> <p>This is a Species of Principal Importance in Wales under Section 7 of the Environment (Wales) Act. It is also listed as Vulnerable on both the Red Data lists for Wales and Britain, is Nationally Scarce and considered to be an International Responsibility.</p>	Regional
<i>Gyalecta carneola</i> (a lichen)	<p>This lichen species is present on a tree located within the Proposed Improvement corridor.</p> <p>It is listed as Near Threatened on the Red Data list for Wales.</p>	Local
<i>Punctelia reddenda</i> (a lichen)	<p>This lichen species is present on two trees within the Proposed Improvement corridor.</p>	Local

	It is listed as Near Threatened on the Red Data list for Wales.	
Non-native Invasive Plant Species:		
<i>Rhododendron ponticum</i> , Japanese knotweed, Himalayan balsam and Montbretia	<i>Rhododendron ponticum</i> , Japanese knotweed, Himalayan Balsam and Montbretia are present within the footprint of the Proposed Improvement. These are non-native invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981.	Not applicable
Ecosystem services:		
Cultural services provided by the natural river corridor in the vicinity of the picnic area off Mochras Road	A car park and picnic area located immediately adjacent to the footprint of the Proposed Improvement provides local people and visitors an opportunity to obtain cultural services from the natural river corridor in this location. Part 1 of The Environment (Wales) Act 2016 introduces the sustainable management of natural resources to ensure that the way in which we use and the impacts on our natural resources do not result in their long-term decline, ensuring continued delivery of economic, social and environmental benefits.	Local
Cultural services provided by the natural landscape in the vicinity of the Public Right of Way (PRoW) running along the top of the flood embankment	A PRoW running along the flood embankment to the east of the Afon Artro to the northwest of the village of Llanbedr provides local people and visitors an opportunity to obtain cultural services from the natural environment. Part 1 of The Environment (Wales) Act 2016 introduces the sustainable management of natural resources to ensure that the way in which we use and the impacts on our natural resources do not result in their long-term decline, ensuring continued delivery of economic, social and environmental benefits.	Local
Services to agriculture provided by pollinators benefitting from semi-natural habitat within the scheme corridor	Much of the semi-natural habitat within the scheme corridor supports the local pollinator population that provides pollination services to agriculture in the local area. Part 1 of The Environment (Wales) Act 2016 introduces the sustainable management of natural resources to ensure that the way in which we use and the impacts on our natural resources do not result in their long-term decline, ensuring continued delivery of economic, social and environmental benefits.	Local

Describing the Baseline

- 5.4.93 This section describes the general baseline conditions within the Zone of Influence of the Proposed Improvement along with those of the important ecological features identified within Table 5.4.3 above.
- 5.4.94 As mentioned previously, species and habitats are dynamic, affected by natural processes as well as human intervention. Consequently the presence or distribution of species and habitats is likely to change over time. Where possible and if relevant, an indication of likely future baseline conditions for the features described below is provided, to allow a comparison of potential conditions during construction and operation (Year 15) of the Proposed Improvement Scheme with the predicted conditions of ecological features at those respective future time periods without the scheme in place. As the construction period is likely to occur within the next couple of years, the baseline conditions at construction are not considered likely to differ significantly from those at the time of this assessment, so this is assumed to be the case. Year 15 of operation has been assumed to be 2035 based on the likely timescale of construction if no significant delays are incurred.

General

- 5.4.95 The Proposed Improvement corridor lies within a largely pastoral landscape between the town of Llanbedr at the bottom of the wooded valley of the Afon Artro rising steeply into the Rhinog mountains to the east, and the estuary at the mouth of the Artro to the west, as it enters Tremadog Bay. Llanbedr airfield and the extensive dune system of Morfa Dyffryn lie to the southwest.
- 5.4.96 The Afon Artro flows through the centre of the Proposed Improvement corridor, which would cut across the fluvial and tidal floodplains to the north. The fluvial floodplain extends between the river and a brackish reed-lined ditch joining the Artro to the north, which would both be bridged by the new road. This lightly grazed area of marshy grassland consists of a mosaic of rush pasture (MG23) and drier mesotrophic grassland (MG11), intersected by ditches lined with willow and alder scrub. A flood embankment running parallel with the ditch keeps the area to the north drier and this area of poor semi-improved grassland has been more intensively grazed. The existing A496 at the northern tie-in is lined with semi-mature and mature trees, mainly comprising sessile oak. The Afon Artro itself is lined with mature trees (largely sessile oak, ash, sycamore and alder) and grey willow scrub to the east and within the scheme footprint, although it opens up further to the west. To the south of the river, the land rises as a rounded hill covered with grazed semi-improved pasture and a few small pockets of mature broad-leaved woodland before the scheme ties in with the existing A496 again at the southern end, where the road is bordered by broad-leaved semi-natural woodland to the east and a small pocket of younger broad-leaved woodland adjacent to a builder's yard to the west, before opening up into a landscape of grazed pasture with occasional broad-leaved trees.

Internationally Designated Sites

- 5.4.97 Internationally protected sites considered to potentially fall within the Zol of the Proposed Improvement include all those within 2km of the Proposed Improvement footprint and any additional sites with otter as a feature within 25km and lesser horseshoe bats as a feature within 30km, due to the highly mobile nature of these particular features. These sites are summarised in Table 5.4.4 below and shown on Figures 5.4.1 and 5.4.2, Volume 1a. See also Habitat Regulations Assessment (HRA) that has been prepared for this scheme, 'A496 Llanbedr Access Improvements: Habitats Regulations Assessment' (see Technical Appendix G, Volume 2).

Table 5.4.4: Internationally designated sites potentially within the Zol of the Proposed Improvement

Site (and Area)	Approximate Distance from Proposed Improvement	Qualifying Features Potentially Affected
Coedydd Derw a Safleoedd Ystlumod Meirion SAC (2,813ha)	85m to east	Lesser horseshoe bat; Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles; Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-padion, Alnion-incanae, Salicion albae); Watercourses of plain to montane levels with the Ranunculion fluitantis and Callitriche-batrachion vegetation; Northern Atlantic wet heaths with <i>Erica tetralix</i> ; European dry heaths; Tilio-Acerion forests of slopes, screes and ravines; Bog woodland
Pen Llyn a'r Sarnau SAC (146,011ha)	200m to northwest	Otter; Bottlenose dolphin; Grey seal; Sandbanks which are slightly covered by sea water all the time;

		Estuaries; Coastal lagoons; Large shallow inlets and bays; Reefs; Mudflats and sandflats not covered by seawater at low tide; <i>Salicornia</i> and other annuals colonising mud and sand; Atlantic salt meadows (<i>Glauco-puccinellietalia maritimae</i>); Submerged or partially submerged sea caves
Morfa Harlech a Morfa Dyffryn SAC (1,060ha)	1.2km to west	Petalwort; Embryonic shifting dunes; Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes"); Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salicion arenariae</i>); Humid dune slacks
Afon Eden – Cors Goch Trawsfynydd SAC (281ha)	12.3km to east	Otter
Afon Gwyrfai a Llyn Cwellyn SAC (112ha)	24.9km to north	Otter
Glynllifon SAC (187ha)	26.1km to north	Lesser horseshoe bat

Coedydd Derw a Safleoedd Ystumod Meirion SAC

Construction Baseline

- 5.4.98 This large composite site is designated for its woodland habitats, largely comprised of old sessile oak woods located in scattered pockets between Dolgellau and Barmouth to the south and Snowdon to the north. These support a rich flora of lichens and bryophytes, including numerous rare species, and form a mosaic with smaller areas of other Annex I woodland habitats, including small-leaved lime woodland, bog woodland and alluvial forests. Other important habitats within the site include areas of dry heath and the Afon Glaslyn as an example of a river with floating vegetation often dominated by water crowfoot.
- 5.4.99 The lesser horseshoe bat population is the only species feature of the site and is an Annex II species of primary importance for selection of the site. This species of bat has over 20 known roosts within the site and forages widely within the SAC's woodlands, associated habitats and surrounding countryside.
- 5.4.100 The nearest components of the Coedydd Derw a Safleoedd Ystumod Meirion SAC to the Proposed Improvement are located approximately 85m, 1.27km and 1.71km to the east on the wooded slopes of the Afon Artro valley, with numerous other pockets of the SAC scattered further afield in this area. These are all located to the east of the current and proposed route of the A496. The four components within 2km of the Proposed Improvement are Units 34 (Coed Hafod-y-Bryn, 85m away), 15 (1.27km away and underpinned by Coed Lletywalter SSSI), 40 (part of Coed Aber Artro, 1.23km away) and 10 (1.71km away and underpinned by Coed Aberartro SSSI). According to the Core Management Plan (CMP) for the site (CCW, 2008), the key habitat features of the SAC included within these Units are old sessile oak woods (Units 34, 40 and 10), an Annex I habitat that is a primary reason for the selection of the site, and bog woodland (Unit 15), an Annex I habitat present as a qualifying feature but not a primary reason for the selection of the site. Lesser horseshoe bats are not the main focus of management of any of these four units but are an important feature of all of them. See Figure 5.4.?, Volume 1a.
- 5.4.101 Due to the distance of Units 10, 15 and 40 that are all located over 1km away from the Proposed Improvement, it is considered very unlikely that there would be any impact on the habitat features of these Units, so only lesser horseshoe bats (throughout the SAC) and old sessile oak woods (within Unit 34) are considered in the assessment in relation to this SAC.

5.4.102 The Conservation Status of the old sessile oak woods within the SAC was assessed as being 'Unfavourable: recovering' in the 2008 CMP for the site. The reasons for this assessment were low volumes of deadwood, a lack of mature-veteran trees, locally high levels of non-native species and locally poor condition of the field layer. Management measures are included in the CMP for this habitat but it is considered unlikely that the Conservation Status would have changed between 2008 and the construction of the Proposed Improvement.

5.4.103 The Conservation Objectives of the woodland SAC features, including old sessile oakwoods, are for it to be at Favourable Conservation Status, where all of the following conditions are satisfied:

1. The total extent of the woodland area, including woodland canopy and scrub, woodland glades and associated dry heath, bracken and grassland shall be maintained as indicated on maps, see Annex 2, some 1826 ha in total;
2. The location of the different woodland SAC features, will be as shown in Annex 2. The distribution of these woodland communities is largely a reflection of the topography, soils, geology and aspect and is unlikely to change;
3. The tree canopy percentage cover within the woodland area for the whole SAC (see maps in Annex 2) shall be no less than 80%, 87% being the current canopy cover (excepting natural catastrophic events). Some units will have a lower canopy cover which is acceptable provided this is compatible with safeguard of the habitat, features and special interest;
4. The canopy and shrub layer comprises locally native species, see Table 2 for the relevant species for each woodland SAC feature;
5. There shall be sufficient natural regeneration of locally native trees and shrubs to maintain the woodland canopy and shrub layer, by filling gaps and allowing the recruitment of young trees, and encouraging a varied age structure;
6. The typical ground layer species of each woodland SAC feature will be common, see Table 2. It is important for most of the woodland SAC that the vegetation does not become rank and overgrown with a height above 40cm and/or dominated by species such as bramble, ivy and young holly. Limits may be set on a unit or compartment basis;
7. The abundance and distribution of common and typical (Atlantic, sub-Atlantic, western, oceanic) mosses and liverworts, lichens (and slime moulds), will be maintained or increased. Refer to indicative lists in Tables 3 and 4;
8. The abundance and distribution of uncommon mosses and liverworts, lichens and slime moulds, will be maintained or increased. Refer to indicative lists in Tables 5 & 6 in Annex 3;
9. There will be a scattering of 5 mature trees per hectare within the existing tree canopy or parkland, that is trees of c60cm diameter plus for oak and ash and/or with signs of decay, holes etc. In the longer-term, by 2060 there should be 1 veteran tree per hectare that is trees of c.100cm diameter plus for oak and ash and 75cm for birch;
10. The volume of dead wood will exceed 30 cubic metres per hectare throughout and consist of a mixture of fallen trees (minimum 1 per hectare), broken branches, dead branches on live trees, and standing dead trees (minimum 1 per hectare). Volumes of deadwood are currently at relatively low levels because the woodlands, in general, have an even-age structure and lack mature trees and any quantity of deadwood because of past silvicultural management. Some lower plants are dead wood specialists but these woodlands tend to lack the rare dead wood invertebrate assemblage found in other parts of the UK;
11. Invasive non-native species such as rhododendron, Japanese knotweed and Himalayan balsam will not be present; and
12. All factors affecting the achievement of these conditions are under control.

5.4.104 The Conservation Status of the lesser horseshoe bat feature of this SAC is described as Favourable in the 2008 CMP for the site, with the nursery roosts continuing to provide good conditions for breeding and the hibernation roosts providing cool stable temperatures for hibernation, free from disturbance. For the purposes of this assessment, it is assumed that this condition remains in a

similar state at the current time and also at the likely time of construction of the Proposed Improvement.

5.4.105 The Conservation Objective for the lesser horseshoe bat feature of the SAC is to maintain the species at Favourable Conservation Status where all of the following conditions are satisfied:

1. The population of lesser horseshoe bats should be maintained at its current size and encouraged where possible to increase. As there has been an upward trend in lesser horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase.
2. There are sufficient breeding roosts (buildings, structures and trees) and hibernation roosts (mines and buildings) of appropriate quality. The other types of roost such as night, transitional, leks and swarming sites, should also be maintained as our knowledge of these often significant roosts improves.
3. Foraging or feeding habitat in the SAC and surrounding countryside, including grasslands and some gardens, is of appropriate quality, extent and connectivity across the range.
4. The range of the population within the SAC/Gwynedd is stable or increasing.
5. All factors affecting the achievement of these conditions are under control.

Operational Baseline (Year 15 – Without Scheme)

5.4.106 The management requirements identified in the 2008 CMP for Unit 34 of the SAC in terms of its old sessile oak woods habitat include continuing to maintain the Unit's rhododendron-free status and field visits to establish whether grazing should be re-introduced or whether any woodland management such as thinning is required.

5.4.107 Assuming that management actions are undertaken as required above and all other factors remain the same, it is possible that the old sessile oak woods feature of Unit 34 of the SAC could improve and even reach Favourable Conservation Status by 2035 as there was no rhododendron present within the Unit in 2008, there should be an increase in mature trees and resulting deadwood, and the field layer should improve due to an appropriate grazing regime where required. However, climate change is likely to have some impact on the nature of woodland habitats in the UK, including the potential for tree death due to drought, an increase in pests and diseases, shifts in food webs due to effects on animal species, and changes in woodland structure resulting in epiphytic communities, including lower plants (Biodiversity Climate Change Impacts Report Card 2015, Living with Environmental Change Partnership). It is uncertain what the timeframe of these changes would be and whether they would have a significant effect by 2035 but overall it is considered likely that the habitat within Unit 34 may have improved by this time although in the longer term, the prospects are less positive.

5.4.108 The management requirements identified in the 2008 CMP for the lesser horseshoe bat feature of the SAC include two relating to the maintenance and prevention of disturbance of the roosts as well as the following two relating to flight lines and road developments:

- There should be no loss or decline in the quality of physical features used as flight lines. There should be no clearance of vegetation, trees or shrubs right by the roost without assessment of likely impact. New planting of hedgerows/rows of trees could be considered in places where few other flight lines exist.
- Maintain closed canopy crossings over roads with connectivity to hedges and tree lines to foraging sites and roosts. Lighting should be avoided.

5.4.109 Assuming that these actions are implemented by NRW, it is likely that the lesser horseshoe bat feature of the SAC would remain at least in the same condition as it is at present by 2035 without the scheme in place if all other factors remained the same. This projection is supported by changes in suitable climate space of lesser horseshoe bats as predicted by the 'Monarch 3: Modelling Natural Resource Responses to Climate Change' project (2007) that indicates that the area of

suitable climate conditions available to the species in Britain is likely to increase by 140 – 150%, including an increase in suitability within the area of the Proposed Improvement as currently they are at the northern limit of their range in this location. Welsh-level population trends for lesser horseshoe bat obtained from the Bat Conservation Trust also show a steady increase since 1990 of about 5.8% per year. On the other hand, increases in the human population of Wales (projected to increase by 5-6% by 2035) may lead to increased pressures on the species such as habitat loss and fragmentation. However, overall it is assumed, as a worst case scenario and assuming that other factors do not change significantly from the current situation, that the condition of the lesser horseshoe bat feature of this SAC is unlikely to degrade significantly by Year 15 of operation, and may well improve.

Pen Llyn a'r Sarnau SAC

Construction Baseline

- 5.4.110 The boundary of this extensive marine site extends from Nefyn on the north coast of the Llyn peninsular, around the Llyn coast to the northern part of Cardigan Bay and down to Clarach in Ceredigion, south of the Dyfi estuary. Much of the site is subtidal but there are also extensive intertidal areas included.
- 5.4.111 Of the nine habitats for which the site is designated (see Table 5.4.4 above), those in the vicinity of the Proposed Improvement include 'large shallow inlets and bays', namely Tremadog Bay encompassing the area between Trwyn Cilan on the south Llyn and Morfa Dyffryn to the southwest of Llanbedr; and 'intertidal reefs' which, in the vicinity of the Proposed Improvement, are located along the coast from Llanfair to the north down to Mochras (Shell Island) to the west of Llanbedr. These are both Annex I habitats that are a primary reason for the selection of the site and are both located approximately 1.5km to the west of the Proposed Improvement at the nearest point or 2.5km along the shortest fluvial pathway. Due to these distances along the shortest aerial or fluvial pollution pathways, it is considered unlikely that these habitats would be significantly affected by the Proposed Improvement.
- 5.4.112 The three species features of the site, namely bottlenose dolphin, otter and grey seal are all Annex II species present as a qualifying feature but not a primary reason for the selection of the site. Of these, only otters are considered likely to be potentially affected by the Proposed Improvement, as the grey seal population of the SAC is concentrated around the north-west of the SAC including Pen Llŷn and Bardsey Island, and bottlenose dolphin is a highly mobile but purely marine species. Evidence of otters has been recorded within the footprint of the Proposed Improvement, and these animals are very likely to be linked to the population within the SAC, due to the distance of 200m from the proposed works, or 575m fluvially along the Afon Artro, and 415m along a minor watercourse linked to the northern end of the Proposed Improvement, the large range size of the species and the need for coastal otter populations to utilise freshwater habitat in the vicinity.
- 5.4.113 The Conservation Status of the otter feature of the SAC could not be found but the current Conservation Status of Otters in the UK is considered to be Favourable³⁸.
- 5.4.114 The 'Regulation 33 Advice for the Pen Llyn a'r Sarnau SAC' (CCW, 2009) states that the Conservation Objective of the SAC for the otter feature is that "*Otters will continue to be widespread throughout the SAC both within areas of open coast and within the estuaries. Otters will have sufficient availability of prey and widespread availability and access to good quality essential habitats including freshwater and undisturbed resting and breeding sites to allow the otter population to thrive. The distribution, breeding centres and actual/potential breeding sites of otters within the site and adjacent catchments will be maintained or improved through appropriate management.*"

³⁸ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012. JNCC, produced on 11/10/2013

Operational Baseline (Year 15 – Without Scheme)

5.4.115 A number of actions are described in the Regulation 33 Advice document for the site (CCW, 2009) to ensure that the Conservation Objectives for the otter feature of the SAC are fulfilled in relation to operations which may be detrimental to its Favourable Conservation Status (FCS). These can be summarised as follows:

- Determination of the effects of damaging and potentially damaging activities;
- Consenting bodies to ensure appropriate integration, inclusion and consultation;
- Consenting bodies to ensure assessment of cumulative effects;
- Revision/establishment of management practices and operational limits suitable to secure the FCS of otters;
- Monitoring of compliance and enforcement;
- Provision of environmental advice to those involved in activities detrimental to the FCS of otters.

5.4.116 The number of otters within the SAC is not known but the distribution of otters in Wales has increased significantly over the past decades, with 90% of sites surveyed recording evidence of otters in 2009-10, compared to 72% in 2002, 53% in 1991, 38% in 1984-85 and only 20% in 1977-78 (Otter Survey of Wales, NRW, 2015). Although this cannot be directly translated into an increase in numbers, such a significant increase in distribution implies that the population is also currently increasing in size in Wales.

5.4.117 The likelihood of more variable river flow rates due to increases in floods and droughts could have an adverse effect on fish stocks and also on the ability of otters to hunt and catch prey (Biodiversity Impacts Climate Record Card Technical Paper: 2. The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015). However, it is not considered likely that this would have a significant impact on the otter population of the SAC by 2035.

5.4.118 Assuming that every effort is made to undertake the actions described in paragraph 5.4.115 above and the increasing population trend continues throughout Wales, it is possible that the otter population of the SAC could have increased by 2035. However, as a feature of a European protected site, it would remain of importance at an international level.

Morfa Harlech a Morfa Dyffryn SAC

Construction Baseline

5.4.119 This SAC is comprised of two separate sand dune systems: Morfa Harlech to the north and Morfa Dyffryn to the south. The latter is located in the vicinity of the Proposed Improvement, to the west and southwest of Llanbedr. The site includes four sand dune Annex I habitats and an Annex II liverwort species (see Table 5.4.4 above) that are all primary reasons for selection of the site. According to the CMP for the site (CCW, 2008), none of these features are located within 2km of the Proposed Improvement or are fluvially connected to the Proposed Improvement. It is possible that this may have changed by the time of scheme construction, as the dunes are a naturally dynamic and fluctuating mosaic of habitats. However, the nearest point within the SAC is 1.2km to the west of the Proposed Improvement and the site is only connected fluvially via the Artro estuary, at a distance of approximately 2km downstream. Therefore, as all the features of the SAC are (relatively) static habitat and species features, and due to the distance from any of the SAC features via any pollution pathways, it is considered that this site would not be affected by the Proposed Improvement during construction.

Operational Baseline (Year 15 – Without Scheme)

5.4.120 By 2035 it is not expected that the habitats present within this site would differ substantially from their existing condition, except that the current extent of mobile dune habitat may fluctuate and expand or contract its range, which could be exacerbated by increased speed and frequency of

storm force winds associated with predicted climate change. However, even with these changes to the extent and/or exact location of the sand dunes, they would not be affected by the Proposed Improvement during operation in 2035 due to their distance via any pollution pathways, as described in Construction Baseline above.

5.4.121 As this site would not be affected by the Proposed Improvement during construction or operation, it has been scoped out of any further assessment.

Afon Eden – Cors Goch Trawsfynydd SAC

5.4.122 Due to its distance approximately 12.3km to the east of the Proposed Improvement, the only feature of this SAC with potential to be affected is otters, as a highly mobile species feature. The catchment of the Afon Eden lies immediately adjacent to the east of the Artro catchment, separated by the Rhinog mountain range. Due to the close proximity of the upper reaches of the two catchments, there is likely to be some genetic mingling of the two populations, with otters likely to occasionally disperse from one catchment to the other.

5.4.123 The Conservation Status of the otter feature of the Afon Eden – Cors Goch Trawsfynydd SAC was assessed as Unfavourable in the CMP for the site (CCW, 2008). This was based on an assessment made in 2006 for the whole Mawddach catchment of which the Afon Eden is a component, and could therefore have changed in the ten years since then. The Unfavourable assessment was made due to the poor distribution of otters within the catchment, despite the favourable number of actual or potential breeding sites.

5.1.124 The Conservation Objectives of this site are for the otter feature to achieve Favourable Conservation Status, where all of the following conditions are satisfied:

1. The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour;
2. The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. A number of potential and breeding sites have been identified (Lyles, 2006) in the upper reaches of the Afon Eden. The size of breeding territories may vary depending on prey abundance;
3. The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site is subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance are managed. Survey information shows that otters are widely distributed in the Mawddach catchment;
4. The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing *etc.* at road bridges and other artificial barriers; and
5. All factors affecting the achievement of these conditions are under control.

5.4.125 As the population of the SAC is likely to be distinct from the local population with the Artro catchment, apart from occasional dispersal, it is considered that none of the Conservation Objectives described above would be affected during the construction or operation of the Proposed Improvement, so this site is not considered further within this assessment.

Afon Gwyrfai a Llyn Cwellyn SAC

5.4.126 The Afon Gwyrfai a Llyn Cwellyn SAC is located in the former district of Arfon in the northwest of Gwynedd and comprises the Afon Gwyrfai and Llyn Cwellyn, as well as a small tributary of the Afon

Gwyrfai called the Afon Treweunydd, and the small lake it flows from on the slopes of Snowdon. The site is designated for its lake and river habitats, Atlantic salmon and otter. Due to its distance approximately 24.8km to the north of the Proposed Improvement, the only feature of this SAC with potential to be affected is the otter. The Afon Gwyrfai a Llyn Cwellyn SAC is known to support a high density of otters, with good quality habitat features for feeding and breeding. Although otters have been recorded within the corridor of the Proposed Improvement, and it is possible that very occasionally otters might disperse from the SAC to habitat within the corridor of the Proposed Improvement, it is very unlikely that otters using the habitat in the vicinity of the Proposed Improvement form part of the otter population of the this SAC.

5.4.127 The Conservation Status of the otter feature of the Afon Gwyrfai a Llyn Cwellyn SAC was assessed as Unfavourable in 2006 according to the CMP for the site (CCW, 2008) due to the low number of actual or potential breeding sites that are insufficiently spread throughout the site.

5.1.128 The Conservation Objectives of this site are for the otter feature to achieve Favourable Conservation Status, where all of the following conditions are satisfied:

1. The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour;
2. The natural range of otter in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. The size of breeding territories may vary depending on prey abundance;
3. The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site is subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance are managed;
4. The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc. at road bridges and other artificial barriers; and
5. All factors affecting the achievement of these conditions are under control.

5.4.129 As the population of the SAC is very likely to be distinct from the local population with the Arthro catchment, apart from occasional dispersal, it is considered that none of the Conservation Objectives described above would be affected during the construction or operation of the Proposed Improvement, so this site is not considered further within this assessment.

Glynllifon SAC

5.4.130 Glynllifon SAC is also located in the northwest of Gwynedd south of Caernarfon and is designated solely for its population of lesser horseshoe bats, including maternity and hibernation roosts. Although this SAC is located approximately 26.1km to the north of the Proposed Improvement, due to the large range of the lesser horseshoe bat, it is possible that a small number of the bats recorded within the corridor of the Proposed Improvement could have links with Glynllifon SAC, such as utilisation of maternity or hibernation roosts within the site.

5.4.131 The Conservation Status of the lesser horseshoe bat feature of this SAC is described as Unfavourable in the 2008 CMP for the site, based on suboptimal summer roost counts at two of the roosts in 2007 and a lack of entrance grilles to secure one of the hibernation roosts. For the purposes of this assessment, it is assumed that this condition remains in a similar state at the current time and also at the likely time of construction of the Proposed Improvement.

5.4.132 The Conservation Objectives for the lesser horseshoe bat feature of Glynllifon SAC are as follows:

1. The natural range of lesser horseshoe bats will not be reduced, nor be likely to be reduced for the foreseeable future;
2. There is, and will continue to be, sufficient habitat to maintain the lesser horseshoe bat population on a long-term basis;
3. The following three maternity roosts will continue to be occupied annually by lesser horseshoe bats and their babies:
 - Glynllifon Mansion (Unit 16)
 - Melin y Cim (Unit 32)
 - Pen y Bont (Unit 36);
4. There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved and coniferous woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water; and
5. All factors affecting the achievement of these conditions are under control.

5.4.133 Due to the distance and topographical barriers between this SAC and the Proposed Improvement, it is very unlikely that a significant proportion of the local lesser horseshoe population would be connected with the Glynllifon SAC population and therefore none of the Conservation Objectives described above would be affected by the construction or operation of the Proposed Improvement. It has therefore been scoped out of any further assessment.

Nationally Designated Sites

5.4.134 Nationally protected sites considered to potentially fall within the ZoI of the Proposed Improvement include all those within 2km of the Proposed Improvement footprint. These sites are summarised in Table 5.4.5 below and shown on Figure 5.4.3, Volume 1a.

Table 5.4.5: Nationally Designated Sites within 2km of the Proposed Improvement

Site (and Area)	Distance	Qualifying Features
Morfa Dyffryn SSSI (739ha)	200m to the northwest	Coastal geomorphology – Sand dunes and the processes by which they are formed; Sand dunes; Salt marsh; A mosaic of habitats including dune grassland, marshy grassland, swamp, shingle and scrub; Nationally rare and scarce plants including Petalwort; Nationally rare and scarce invertebrates; Honeycomb worm reefs; Population of great crested newts
Morfa Dyffryn NNR (198ha)	1.9km to the southwest	Sand dunes; A mosaic of habitats including dune grassland, marshy grassland, swamp, shingle and scrub; Nationally rare and scarce plants including Petalwort
Caeau Bwlch SSSI (26ha)	260m to the east	Hornet robberfly (<i>Asilus crabroniformis</i>)
Coed Lletywalter SSSI (39ha)	1.3km to east	Oak woodland
Coed Aber Arto SSSI (10ha)	1.75km to east	Oak woodland; Bryophytes

Morfa Dyffryn SSSI

Construction Baseline

5.4.135 This site has been selected for its biological (terrestrial and marine intertidal) and geomorphological features. The special features of the site include sand dunes, the sea shore, saltmarsh and

grassland. The site is also notified for its nationally rare and scarce higher plants, mosses and liverworts, nationally rare and scarce invertebrates, a population of great crested newts, and honeycomb worm reefs. The majority of the coastline is backed by sand dunes, with some till cliffs in places. Extending offshore from the northern end of the site is Sarn Badrig, the largest of three Sarnau, which are glacial in origin and unique reef features within Cardigan Bay. As the Morfa Dyffryn SSSI is located approximately 420m downstream along the shortest fluvial connection from the site of the proposals, there is potential for this site to be affected by the Proposed Improvement due to potential water pollution. It is also within 50m of the road network leading into the proposed works from the north and could therefore potentially be susceptible to air quality impacts during construction. Morfa Dyffryn SSSI will therefore be included within this assessment.

Operational Baseline (Year 15 – Without Scheme)

5.4.136 The Site Management Statement (SMS) for Morfa Dyffryn SSSI includes the following measures required to maintain the features of the SSSI in at least the condition they are in now:

- Sensitive coastal zone management to avoid any changes to the natural transport of sand and shingle and damage to honeycomb worm reefs;
- Maintenance and extension of existing work to plant marram grass and provide boardwalks, interpretation panels and fencing around badly eroded areas of the dunes;
- Maintenance of the existing grazing levels on areas of sand dune and saltmarsh, and modification of grazing levels where required within areas of other habitat;
- Mowing within the airfield to take place after the end of July to avoid destruction of nests of ground-nesting birds such as skylark;
- Dumping of material to be discouraged within the SSSI;
- No dredging within the site without consent from NRW;
- No disposal of dredgings within the saltmarsh;
- Interpretation panels and agreed management of camping activities, including marking out sensitive areas, to prevent further damage to nationally rare and scarce plants, including petalwort; and
- Digging of new ponds for the population of great crested newts if required, due to the function of the existing ponds as water holding sites to aid firefighting at the airbase.

5.4.137 It is likely that the extent and exact location of the dune and saltmarsh habitats within the site will have changed to some extent by 2035 due to natural shifts in erosion, hydrology and coastal processes. These changes could also be affected by erosion due to public access and recreation. Climate change is also likely to impact on the site due to rising sea levels leading to a loss of coastal habitats such as saltmarsh through coastal squeeze. However, it is also possible that a decrease in fluvial volume due to warmer, drier summers could balance out this effect in estuarine areas such as the Artro estuary. It is uncertain what effect climate change will have on the higher plant interest of the site as warmer winters will benefit many species, increasing their abundance and allowing expansion into new areas, but for other species winter warming will offset advances in spring green-up as winter chill requirements are not met for flower or seed development, reducing reproductive success. The bryophytes are less likely to be impacted by climate change due to their microclimatic buffer. Great crested newt populations, like other amphibians, may suffer due to warmer drier summers drying up suitable habitat, exacerbated by further habitat fragmentation (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). It is therefore likely that the site will have changed to some extent by 2035 but assuming the actions described in paragraph 5.4.136 above continue to be undertaken it would remain of importance at a national level and the habitats likely to be affected by the Proposed Improvement should be assumed to be of a similar extent and location as they are currently.

Morfa Dyffryn NNR

5.4.138 National Nature Reserves are all legally protected as SSSIs and sometimes SACs as well (as in this case), so the features of Morfa Dyffryn NNR are the same as those described for Morfa Dyffryn SSSI

and Morfa Harlech a Morfa Dyffryn SAC. Morfa Dyffryn NNR is a smaller area of designated habitat than that of the wider SSSI and SAC, is not connected to the site of the proposed works via fluvial pathways and is located approximately 1.9km to the west of the Proposed Improvement at its nearest point so is unlikely to be affected by any changes in air quality. It will therefore be scoped out of further assessment.

Caeau Bwlch SSSI

5.4.139 The site supports one or more populations of hornet robberfly, *Asilus crabroniformis*, a rare species of fly which was first recorded here in 1992. This is one of the most important sites for the species in Wales and is currently one of only two known sites in north-west Wales. Adult robberflies have been observed feeding on small dung beetles such as *Aphodius foetans* and *Aphodius fossor*. Female hornet robberflies are known to oviposit on decaying cow dung. The maintenance of populations may therefore be dependent upon a continuation of low intensity cattle grazing, particularly just prior to and during the adult flight period from mid-July to early October. Scrub and bracken on the site appear to provide suitable roosting stations for adult robberflies. There is no cattle-grazed pasture within the footprint of the Proposed Improvement, Caeau Bwlch SSSI is not connected to the site of the proposals via any fluvial pathways, and lies outside the threshold for significant impacts due to air quality during construction or operation (see Chapter 5.1: Air Quality) so this site will be scoped out of any further assessment.

Coed Lletywalter SSSI

5.4.140 A large area of broadleaved woodland at low altitude with a bedrock of Cambrian grit. Most of the woodland is comprised of sessile oak with birch and some sycamore. Beech, a tree not native to North Wales, is abundant in parts of the wood. The almost complete absence of old trees indicates substantial selected felling, perhaps during World War II. The wood is extremely varied with cliffs, rocky knolls, streams, small glades and boulder-strewn slopes. Mosses and liverworts carpet areas of the wood where boulders and rock outcrops are abundant. Bilberry heath has developed in places with bracken in more open parts of the wood. The ground flora reflects the predominantly acidic soils but localised enrichment increases the range of flowering plants to include wood false-brome, dog's mercury and tutsan. Wetter areas introduce further diversity with species such as golden-saxifrage and paniced sedge. A small lake has a range of wetland plants with stands of bottle sedge, common club-rush and marsh cinquefoil. The wood is ungrazed and tree regeneration is more than adequate. It supports a good breeding population of typical oak woodland birds. Coed Lletywalter SSSI has no mobile species features other than the woodland breeding bird population that is unlikely to be significantly affected due to the distance, it is not connected to the site of the proposals via fluvial pathways and is unlikely to be affected by any changes in air quality due its distance of approximately 1.3km from the Proposed Improvement. It will therefore be scoped out of any further assessment.

Coed Aber Artro SSSI

5.4.141 The Afon Nantcol flows into a reservoir above a sheer sided gorge strewn with rocks with such species as *Harpalejeunea ovata*, *Grimmia hartmanii* and *Lophocolea fragrans* growing upon the rocks and trees. Several species of fern occur including hartstongue (*Phyllitis scolopendrium*), tunbridge filmy fern (*Hymenophyllum tunbrigense*) and wilsons filmy fern (*H. wilsonii*). The gorge is dominated by sessile oak (*Quercus petraea*) with ash (*Fraxinus excelsior*) and old wych elms (*Ulmus glabra*). Beech (*Fagus sylvatica*) occurs in the gorge and is predominant above in the main wood. The ground flora consists of heather *Calluna vulgaris*, bilberry *Vaccinium myrtillus* and wavy hair grass *Deschampsia flexuosa*. Bryophytes carpet the ground with bluebells *Hyacinthoides non-scriptus*, wood avens *Geum urbanum* and cow-wheat *Melampyrum pratense*. The Coed Aber Artro SSSI has no mobile species features, is not connected to the site of the proposals via fluvial pathways and is located 1.75km to the east of the scheme, so is unlikely to be affected by any changes in air quality. It will therefore be scoped out of any further assessment.

Other Sites

5.4.142 There are no local Sites of Importance for Nature Conservation (SINCs) or other local wildlife sites within the ZOI for the Proposed Improvement as the site is located within Snowdonia National Park which is considered as a whole to be of ecological value. However, there are several sites included on the inventory of Ancient Semi-Natural Woodland located within 1km of the Proposed Improvement, as described below.

Ancient Semi-Natural Woodland Sites

Construction Baseline

5.4.143 NRW provide an inventory of ancient semi-natural woodland sites, including Ancient Semi-Natural Woodland (ASNW), Plantations on Ancient Woodland Sites (PAWS) and Restored Ancient Woodland Sites (RAWS). These sites are not legally protected, but form a useful frame of reference for identifying ecologically important woodland areas. They are considered to be **regionally** important. Within 1km of the Proposed Improvement there are 26 sites listed on this inventory, as shown in Table 5.4.6 below (and Figure 5.4.4, Volume 1a):

Table 5.4.6: Ancient Semi-Natural Woodland Sites located within 1km of the Proposed Improvement

Site Code	Name of Woodland	ASNW	RAWS	Area (ha)	Distance from Proposed Improvement (m)
25334			✓	2.01	0
25332			✓	0.41	0
25336	Lower Wood		✓	2.08	30
25306	Coed Hafod y Bryn		✓	5.55	80
25333			✓	1.06	270
25320		✓		1.56	290
24488		✓		0.26	360
25309			✓	5.06	430
25305		✓		3.47	445
25325		✓		0.31	570
25327		✓		0.41	585
25329		✓		0.27	610
25321	Coed Aberartro	✓		0.91	630
25330		✓		0.62	640
24486		✓		0.4	645
25302		✓		0.44	655
25346			✓	1.63	700
25348			✓	0.69	725
25303		✓		0.44	760
25319	Coed Aberartro	✓		0.31	765
25323		✓		1.25	780
25338	Coed Aberartro		✓	6.98	800
25312		✓		0.39	870
25318		✓		2.98	880
25322		✓		0.99	915
25311	Coed Aberartro	✓		1.23	970

5.4.144 Due to the effectively irreplaceable nature of ancient woodland, present within the Ancient Semi-Natural Woodland (ASNW) sites, and the habitat that they provide for such a diversity of species, including many that have become scarce on a regional or even national scale, it is considered that these are important at a **regional** scale. The closest ASNW site to the Proposed Improvement is 290m away but as there would be no direct impacts on these sites, none are fluvially connected to the site and Chapter 5.1: Air Quality rules out any significant impacts from air pollution arising from

the Proposed Improvement at this distance, all the ASNW sites have been scoped out of further assessment.

5.4.145 Designated ecological sites within 200m are considered in the air quality impact assessment (Chapter 5.1) according to DMRB guidance and there are four Restored Ancient Woodland Sites (RAWS) within this threshold as shown in Table 5.4.6 above. These four sites (25334, 25332, 25336 and 25306) have therefore been scoped into the impact assessment but all the other sites have been scoped out as there would be no significant air quality impacts, there are no fluvial pathways leading to these sites from the proposed construction area and there would be no other direct or indirect impacts on these sites due to their distance. Sites 25334 and 25332 are located immediately adjacent to the Proposed Improvement and could be directly affected by the works in addition to any potential air quality impacts.

5.4.146 Restored Ancient Woodland Sites are sites that have been found to have had woodland present as far back as 1600AD but have since been planted with non-native species such as conifers. To restore them, action has been taken to gradually remove the non-native canopy to allow the regeneration of native woodland species.

5.4.147 Site 25334 is known to contain *Rhododendron ponticum* and due to its close proximity it is fairly likely that this invasive species is present within 25332 and the adjacent 25306 (Coed Hafod y Bryn) as well, although this site is predominantly the same footprint as Unit 34 of the Coedydd Derw a Safleoedd Ystlumod Meirion SAC, which was described as free of rhododendron in the 2008 Management Plan for the site. Due to the inclusion of most of site 25306 within the SAC, considered as a separate important ecological feature, only the parts of this site that are outside the SAC boundary will be included in the impact assessment on RAWS. Site 25336 (Lower Wood) is known to contain cherry laurel, a non-native invasive species, although not included on Schedule 9 of the Wildlife and Countryside Act, and is bordered to the north by a site containing Japanese knotweed and rhododendron, which are likely to colonise the site if no management is undertaken to control them. Although the seed bank of all these sites is likely to contain a diverse range of native ancient woodland indicator flora, the trees themselves would not be classed as ancient and such sites are relatively abundant throughout Gwynedd, so it is considered that they are of importance at a **local** scale.

Operational Baseline (Year 15 – Without Scheme)

5.4.148 The woodland habitat within the RAWS sites within the vicinity of the Proposed Improvement would have become more mature by 2035 but it is also likely that the non-native invasive plant species present within and immediately adjacent to these sites would have spread further throughout the sites. Overall however, it is considered that the resource would remain important at a local level due to the ancient seedbank that should be present within all these sites.

Habitats

5.4.149 According to the Phase 1 Habitat Survey undertaken in September 2014 (see Technical Appendix C, Volume 2) the main habitat component within the survey corridor is semi-improved pasture grazed by sheep with occasional cattle and horses. This is interspersed with occasional scattered mature broad-leaved trees, including the tree-lined Afon Artro, and small pockets of semi-natural broad-leaved or mixed woodland. Within the floodplain of the Afon Artro to the north of the river, the ground is wetter and forms an area of rush pasture interspersed with drier areas of mesotrophic grassland, also grazed by sheep although less intensively. This area is bounded to the north by a reed-lined ditch running parallel to a flood embankment. A field to the west of the river at this location and bounded to the south by the Mochras Road is also dominated by rush pasture. Two fields grazed by horses located to the south of Mochras Road comprise species-rich lowland meadow. Boundary habitat mainly comprises dry stone walls, post and wire fences, lines of trees

and scrub and the occasional hedgerow. Scattered bracken and bramble scrub are also present within the Proposed Improvement corridor.

Trees and Hedgerows

Construction Baseline

5.4.150 The arboricultural survey carried out in 2015 updated and added to the Phase 1 Habitat survey information and can be found in Technical Appendix C (Volume 2). An additional arboricultural survey of trees previously not affected by the scheme design was undertaken in January 2017. Figure 5.4.13 (Volume 1a) shows the locations of mature trees and woodland in relation to the Proposed Improvement.

Trees

5.4.151 The 2015 and 2017 arboricultural surveys map the distribution of trees within and close to the Proposed Improvement boundary and provide a detailed description of them. At the northern tie-in of the Proposed Improvement with the existing A496, adjacent to the sewage treatment works, the road is currently lined with trees ranging from young to mature, including six mature sessile oaks: four to the east and two to the west of the road. Within the fluvial floodplain to the north of the proposed bridge over the Afon Artro, an isolated mature sessile oak lies within the area of grazed rush pasture.

5.4.152 The northern bank of the river is lined with broad-leaved trees ranging from young to mature, although these become sparse and are replaced by gorse scrub within and to the west of the Proposed Improvement corridor. The southern bank is lined with mature trees including three mature ash trees and a sycamore within the footprint of the proposed bridge. As the scheme corridor moves south there is a small copse of semi-natural mixed trees, including five mature trees (two beech, two Scots pine and a sessile oak) and a number of young broad-leaved trees (elm, birch, sycamore and sweet chestnut) followed by another copse to the south of this composed of young to mature broad-leaved trees dominated by sycamore, beech and Scot's pine.

5.4.153 At the location of the proposed junction with Mochras Road to the west, including an improvement of part of Mochras Road, there are a number of mature broad-leaved trees forming the boundary of a car park located adjacent to the river, including mature sycamore and alder trees. As the existing Mochras Road heads south before sharply turning to the west, a mature sycamore and a mature oak are located within a field boundary to the east.

5.4.154 At the southern junction with the existing A496 going into Llanbedr, a small copse of mature broad-leaved woodland lies between the existing A496 and a builder's yard, and comprises oak, sycamore and sweet chestnut, although with no trees of more than 250mm Diameter at Breast Height (DBH). At the southern tie-in, a few mature broad-leaved trees are located along the existing road boundary on both sides, including mature sessile oak (three), ash (two), sycamore (two), beech (one), and sweet chestnut (one).

5.4.155 The majority of these mature trees are classed as Category B in the arboricultural report, as trees of moderate quality with an estimated remaining life expectancy of at least 20 years and present in numbers that are collectively of more value than they would be as individuals. A few, including a mature ash on the southern bank of the Artro and many of the trees within the southern copse, are placed in Category C, or a tree of low quality with an estimated remaining life expectancy of at least 10 years and only of value as a contribution to a group or as a temporary landscape benefit. Three trees likely to be affected by the Proposed Improvement are classed as Category U, or poor quality trees that should be removed irrespective of the scheme footprint.

5.4.156 There are no oak trees with a DBH greater than 1m or any other tree species that could be considered to be veteran or valuable in terms of conservation of veteran trees according to a report

produced for Natural England³⁹, within or immediately adjacent to the Proposed Improvement footprint.

Hedgerows

5.4.157 A species-rich hedgerow extends along much of the southern boundary of the Mochras road to the west of the car park by the river and another species-rich hedgerow forms the northern boundary of the sewage works located at the northern end of the Proposed Improvement. The hedgerow at the northern end is unlikely to be affected by the Proposed Improvement but the hedgerow bordering Mochras Road would be directly affected so is included in the assessment. This hedgerow would be classified as 'important' under the Hedgerow Regulations 1997 for wildlife and landscape reasons because it includes holly, field maple, elder, blackthorn, ash and sessile oak, is supported by a retaining wall and includes at least one standard tree per 50m length. A Hedgerow Removal Licence would not be required for the removal of any of the hedgerows present on site as it is part of work which would be consented under other legislation (through the planning process). However, as good practice, appropriate mitigation measures would be incorporated where 'important' hedgerows would be affected by the Proposed Improvement.

Importance of the Trees and Hedgerows

5.4.158 The trees within the corridor of the Proposed Improvement range from young to mature and do not include any over-mature or veteran specimens, so are considered to be important on a **local** scale, providing habitat for a range of other species, and having some potential to develop into veteran mature trees or ancient woodland with time. The hedgerows provide habitat connectivity and also habitat for other species including birds, mammals, reptiles, amphibians, invertebrates, plants and fungi. They are a Section 7 habitat but considering the small area of hedgerow within the scheme corridor compared to the surrounding landscape and throughout Gwynedd, it is considered that the hedgerows are also important at a **local** level.

Operational Baseline (Year 15 – Without Scheme)

5.4.159 With increased maturity, by 2035 the trees and hedgerows within the corridor of the Proposed Improvement are likely to have increased slightly in ecological value. Although some of them may have succumbed to pests and diseases, which are likely to increase due to climate change (The Terrestrial Biodiversity Climate Change Impacts Report Card 2012-13, Living with Environmental Change Partnership, 2013), this could initially increase their value for biodiversity before they eventually fall and decompose. However, it is considered that they would still be of importance at a local level.

Lowland Mixed Deciduous Woodland

Construction Baseline

5.4.160 As discussed in Trees and Hedgerows above, there are three small copses of mature broad-leaved or mixed semi-natural woodland that lie completely or partially within the footprint of the Proposed Improvement. These are the two copses located on the hillside to the south of the Afon Artro, and the wooded area adjacent to the builder's yard to the south of this area.

5.4.161 The most northern of these three copses, located at NGR SH 58194 26768 and surrounded by open pasture (but fenced), is approximately 0.16ha in size and composed of mature beech, Scots pine and a sessile oak, with young and semi-mature elm, birch, sycamore and sweet chestnut. The maximum DBH within this copse is 450mm, which is that of a sessile oak and a beech in this area.

5.4.162 The middle copse of approximately 0.2ha (located at SH 58196 26602) is also surrounded by pasture (but fenced), and is predominantly comprised of mature sycamore, beech and Scot's pine.

³⁹ Veteran Trees: A Guide to Good Management, The Veteran Tree Initiative, 2000

- 5.4.163 The wooded area located immediately to the east of the builder's yard at NGR SH 58286 26404, is composed of young, semi-mature and early mature oak, sycamore and sweet chestnut, with no trees more than 250mm DBH. This area is approximately 0.1ha in size and is also fenced off from the adjacent grazed pasture to the north. There is some *Rhododendron ponticum* in this area, which is also very prevalent within the woodland across the road to the east.
- 5.4.164 There are four additional blocks of broad-leaved or mixed semi-natural woodland that lie within 200m and could therefore be subject to indirect impacts such as changes in air quality during construction or operation of the Proposed Improvement, two of which lie immediately adjacent to the construction area and could therefore also be subject to direct impacts during construction due to physical damage. These comprise another small copse to the south of the Afon Artro and east of Mochras Road (NGR SH 58127 26801); Lower Wood RAWS located 35m to the east of the Proposed Improvement construction area (NGR SH 58383 26747), as described in Ancient Semi-Natural Woodland Sites above; the woodland immediately adjacent to the east of the proposed and existing route of the A496 at the southern tie-in of the Proposed Improvement and encompassing RAWS sites 25334, 25332 and 25306 (NGR SH 58360 26383) as described above; and the block of woodland to the west of Taltreuddyn Farm located approximately 150m southwest of the southern extent of the proposed works (NGR SH 58109 25882). However, as this last block of woodland described above is outside the Zol for construction impacts (including air quality) and the section of the Proposed Improvement within 200m of this area is online, with no expected increase in traffic volume or speed, no impacts are anticipated and it has been scoped out of further assessment.
- 5.4.165 Due to the relative abundance of lowland mixed deciduous woodland throughout Gwynedd and on a wider scale, it is considered that the habitat of this type within the scheme corridor is of importance at a **local** scale.

Operational Baseline (Year 15 – Without Scheme)

- 5.4.166 It is unlikely that the woodland within the corridor of the Proposed Improvement would have changed significantly by 2035, other than to become slightly more mature and possibly to include a greater area of the invasive *Rhododendron ponticum* within the area adjacent to the builder's yard towards the southern end of the Proposed Improvement, as there is no management of this species here at present. Overall, it is considered that the resource would remain important at a local level.

Coastal and Floodplain Grazing Marsh

Construction Baseline

- 5.4.167 This habitat is defined as periodically inundated pasture or meadow with ditches that maintain the water levels which contain standing brackish or fresh water. The ditches are especially rich in plants and invertebrates. Almost all areas are grazed and some are cut for hay or silage. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities but not extensive areas of tall fen species like reeds, although they may abut with fen and reed swamp communities. Grazing marshes are particularly important for large numbers of breeding waders and also wintering wildfowl (Snowdonia Biodiversity Action Plan).
- 5.4.168 Within the scheme corridor, the area within the fluvial floodplain, between the Afon Artro and Watercourse 2 to the north, can be defined as floodplain grazing marsh according to the criteria in paragraph 5.4.167 above (See Figure 5.4.13, Volume 1a)). This area is lightly grazed by sheep and periodically inundated by floodwater from the adjacent river during periods of heavy rainfall, combined with occasional tidal inundation at extreme spring tides. Following NVC survey of this area in 2015, apart from an enclosed field of improved grassland at the eastern end, the area was found to comprise a mosaic of about 50% M23 (*Juncus effuses/acutiflorus* – *Galium palustre* rush pasture) and 50% MG11 (*Festuca rubra* – *Agrostis stolonifera* – *Potentilla anserina* neutral grassland) and although not as species-rich as these communities can be in optimal conditions, the area contains much higher diversity than the neighbouring areas of more intensively grazed grassland to the north of Watercourse 2 and to the south of the Afon Artro.

5.4.169 Coastal floodplain and grazing marsh is listed under Section 7 of the Environment (Wales) Act and is also included on the Eryri LBAP.

5.4.170 With reference to the Coastal and Floodplain Grazing Marsh BAP Priority Habitat Wales Distribution Map (NRW) the area of this habitat that is located within the Zol of the Proposed Improvement appears to be less than 1% of the total area of this habitat in Gwynedd and it is therefore considered to be of importance on a **local** scale.

5.4.171 The objectives of the Eryri Action Plan for coastal floodplain and grazing marsh are as follows:

- Maintain the existing extent and quality of grazing marsh;
- Rehabilitate areas that have become too dry or intensively managed; and
- Create grazing marsh from arable land in targeted areas.

Operational Baseline (Year 15 – Without Scheme)

5.4.172 The Eryri Action Plan for coastal floodplain and grazing marsh includes the following actions:

- Liaise with national working group;
- Continue to ensure that flood defence works are undertaken in an ecologically sensitive manner;
- Notify important sites in Snowdonia;
- Maintain and enhance the extent and status of the resource;
- Prevent/reduce threats;
- Assist/promote water level management plans in Snowdonia;
- Influence land use to protect and enhance existing habitat;
- Support projects that quantify the remaining extent and distribution of the habitat;
- Promote public awareness; and
- At appropriate sites encourage educational use and public access with proper interpretation.

5.4.173 Climate change is causing coastal grazing marsh to be threatened by increases in salinity due to increased percolation and inundation of sea water during storm tides and flooding (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). This will ultimately cause their transformation into saltmarsh, and saltmarsh plants are already apparent along the northwest edge of the habitat within the scheme corridor, where there is the most tidal influence. This could lead to the squeezing out of suitable space available for coastal floodplain grazing marsh. It may also be that coastal flood defences are developed, particularly in the vicinity of populated areas that lead to the loss of coastal floodplain grazing marsh. It therefore seems likely that the extent of this habitat will continue to decrease, and it is likely to either remain of local importance or increase in importance to a county level by 2035.

Lowland Meadow

Construction Baseline

5.4.174 Lowland meadows as a UK BAP Priority Habitat (as all Section 7 habitats are) are taken to include most forms of unimproved neutral grassland across the enclosed lowland landscapes of the UK. In terms of NVC plant communities, they primarily embrace each type of *Cynosurus cristatus* – *Centaurea nigra* grassland, *Alopecurus pratensis* – *Sanguisorba officinalis* floodplain meadow and *Cynosurus cristatus* – *Caltha palustris* flood-pasture. The plan is not restricted to grasslands cut for hay, but also takes into account unimproved neutral pastures where livestock grazing is the main land use (UK Biodiversity Action Plan Priority Habitat Descriptions, BRIG, 2008).

5.4.175 Within the Proposed Improvement corridor, two fields lightly grazed by horses to the south of the Afon Artro and immediately adjacent to the east of Mochras Road (NGR SH 58067 26842) have been identified as species-rich grassland likely to constitute a community such as MG5: *Cynosurus*

cristatus – *Centaurea nigra* neutral grassland, which would constitute lowland meadow habitat. The NVC community has not been confirmed as this area was not included within the NVC survey area requested by NRW. These two fields comprising 1.35ha of species-rich grassland (probable lowland meadow) lie partially within the footprint of the Proposed Improvement and would therefore be directly affected by the works (See Figure 5.4.13, Volume 1a).

5.4.176 Lowland meadow is listed under Section 7 of the Environment (Wales) Act and is also included on the Eryri LBAP.

5.4.177 It is estimated that the total area of lowland meadow habitat within Gwynedd is approximately 100ha (using data from Eryri LBAP and Natur Gwynedd), which would mean that the 1.35ha of habitat present within the two fields within the scheme corridor represents more than 1% of this. It is therefore considered to be of **county** importance.

5.4.178 The relevant objectives of the Eryri Action Plan for lowland hay meadow are as follows:

- Map the extent of unimproved grassland;
- Maintain and/or improve quality of all unimproved neutral grassland or haymeadow within current agri-environment schemes;
- Promote species diversity and encourage reversion of more improved and neglected grassland types as an ongoing long-term objective; and
- Encourage more appreciation of, and greater public contact with, neutral grasslands.

Operational Baseline (Year 15 – Without Scheme)

5.4.179 The Eryri Action Plan for lowland hay meadow includes the following relevant actions:

- Increase area under statutory protection;
- Protect unimproved grassland in relevant development plans or related policy;
- Improve consultation and vetting of forestry grant applications to ensure old grassland sites are not planted;
- Prepare management agreements for all statutory sites;
- Continue acquisition of sites for sympathetic management;
- Ensure agri-environment schemes include appropriate management regimes for maintaining and promoting species diversity of old and more improved grassland types;
- Update and ensure implementation of road verge management plan;
- Provide advice on sympathetic management to landowners/managers;
- Encourage sympathetic management and/or creation of unimproved grassland of school grounds and churchyards;
- Use strategically located old grasslands as demonstration sites;
- Collate and update research findings for maintaining and restoring old grasslands;
- Continue to survey and monitor known and newly found unimproved grasslands and the species contained in them, maintain databases of survey findings;
- Collate and update databases, encourage liaison between groups;
- Establish several monitoring sites and assess effects of management agreements;
- Seek opportunities to raise public awareness of old grassland in the scientific press and popular media; and
- Raise profile of unimproved grasslands as a viable agricultural resource.

5.4.180 It is possible that increasing pressure from population growth leading to limited resources and agricultural intensification could lead to the improvement or over-grazing of these fields in the future to increase productivity. Climate change however is not expected to significantly alter the lowland meadow resource directly as long-established low-nutrient grassland communities show relatively little change through warm, dry summers, and many grasslands are likely to remain similar in character with a rise in temperature of a few degrees, although with some changes in species composition likely (Biodiversity Climate Change Impact: Report Card 2015, Living with

Environmental Change). The actions described in paragraph 5.4.179 above are likely to help conserve the pockets of lowland meadow that remain within the National Park and perhaps create new areas. It is therefore not certain whether this area of habitat within the scheme corridor would still be present by 2035 without the scheme in place but it should be assumed that it would be and that it would remain of county importance or more.

Purple Moor Grass and Rush Pastures

Construction Baseline

- 5.4.181 Purple moor grass and rush (*Molinia - Juncus*) pastures occur on poorly drained usually acidic soils in lowland areas of high rainfall in Western Europe. The habitat in general covers a wide altitudinal range, but in the uplands *Molinia* vegetation in particular has often replaced blanket mire and wet heath communities of primary conservation interest. It is thus in the lowlands that *Molinia-Juncus* pastures assume special importance for wildlife protection. Due to its structural diversity, this habitat can support quite a diverse range of plant species, including a number of small sedge species in shorter lawns and marsh bedstraw and greater bird's-foot trefoil in areas dominated by rushes. The habitat is generally important for amphibians and also supports a diverse invertebrate fauna, breeding birds such as skylark and reed bunting and can be utilised by mammals such as brown hare and otter. The main NVC communities associated with purple moor grass and rush pastures include M23 (*Juncus effusus/acutiflorus - Galium palustre* rush pasture), M25 (*Molinia caerulea – Potentilla erecta* mire), M26 (*Molinia caerulea – Crepis palidosa* mire) and MG10 (*Holco-Juncetum effuse* rush pasture) (Snowdonia Biodiversity Action Plan).
- 5.4.182 As described in paragraph 5.4.168 above, the area of floodplain grazing marsh within the floodplain of the Afon Artro between the river and Watercourse 2 is comprised of a mosaic of about 50% rush pasture and 50% drier neutral grassland habitat (See Figure 5.4.13, Volume 1a). The results of the NVC survey suggest that the rush pasture within this area is M23 (*Juncus effusus/acutiflora – Galium palustre* rush pastures). Although some quadrats were quite diverse, the habitat was not in optimal condition which could be due to encroachment of coarse grass species such as perennial ryegrass from the area of improved grassland at the eastern end or over-grazing and nutrient enrichment due to inappropriate stocking densities.
- 5.4.183 Purple moor grass and rush pastures is listed on Section 7 of the Environment (Wales) Act and is also included on the Eryri LBAP.
- 5.4.184 According to the Eryri LBAP, there is approximately 3800ha of purple moor grass and rush pastures habitat within Snowdonia. As the extent of this habitat within the Proposed Improvement corridor is approximately 1.8ha, this is significantly less than 1% of the total area of this habitat in Snowdonia and therefore also in Gwynedd and it is therefore considered to be of importance on a **local** scale.
- 5.4.185 The objectives of the Eryri Action Plan for purple moor grass and rush pastures cover habitat conservation, restoration and expansion. Key components are the need to secure favourable conservation status and, where necessary, restoration management at SSSIs and other significant localities, and also to develop carefully researched guidelines to restore and expand the habitat.

Operational Baseline (Year 15 – Without Scheme)

- 5.4.186 The Eryri Action Plan for purple moor grass and rush pastures includes the following actions:
- Encourage uptake of available sources of funding for management and restoration;
 - Ensure all areas with statutory protection are adequately protected;
 - Ensure management plans within the National Park are targeted to improving the condition of purple moor grass and rush pastures and reflect the importance of this habitat;
 - Review present SSSI and SAC boundaries;

- Ensure due care is taken to protect and enhance this habitat during statutory land drainage operations;
- Ensure that the importance of this habitat is recognised in the preparation of any relevant Environmental Assessments for all proposed developments;
- Ensure all landowners are aware of the importance of this habitat;
- Provide advice for landowners/land managers with purple moor grass and rush pasture;
- Establish inventory of all research relevant to this habitat;
- Establish a map (compatible with GIS) of this habitat within the National Park;
- Ensure adequate monitoring of all management agreements is undertaken;
- Establish inventory of all nationally scarce and Red Data Book species within the habitat in the National Park; and
- Undertake interpretation which leads to an understanding and appreciation of this habitat and species which are associated with it.

5.4.187 Grasslands associated with waterlogged conditions for all or part of the year are likely to be very sensitive to changes in rainfall and an increase in summer droughts could lead to a decline in distinctive wet grassland communities such as purple moor grass and rush pastures. However, this could be offset by changes in winter precipitation and in catchment characteristics (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). It is therefore uncertain what the status of this habitat will be in 2035 but assuming the actions described above are undertaken it is likely that the rush pasture within the scheme corridor will remain of importance at a local level.

Reedbeds

Construction Baseline

5.4.188 Reedbeds are wetlands dominated by stands of the common reed (*Phragmites australis*) wherein the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them. There are about 5000ha of reedbed habitat in the UK and these are amongst the most important habitats for birds supporting a distinctive breeding bird assemblage including nationally rare and scarce species, as well as providing roosting and feeding sites for migratory species and several raptor species in the winter. Reedbeds are also an important habitat for a diverse range of invertebrate species.

5.4.189 Within the scheme corridor, dense reedbed habitat dominates the majority of Watercourse 2, with scattered reeds extending north and south along the banks of the Afon Artro in the vicinity of the confluence of these two watercourses. Scattered reeds are also present within Watercourses 3 and 4 but are too sparse in these areas to constitute reedbed habitat. The area described above within Watercourse 2 constitutes approximately 0.11ha of reedbed but there is also a more extensive area of reedbed habitat to the west of Plas y bryn Farm to the south and throughout the ditch running along the base of the railway embankment to the west (See Figure 5.4.13, Volume 1a).

5.4.190 Reedbeds is a habitat listed on Section 7 of the Environment (Wales) Act. There are approximately 35ha of reedbed habitat within Gwynedd outside the National Park and there is likely to be significantly less within the Park due to its composition of predominantly upland areas. There is an estimated 460ha of this habitat in Wales, amounting to approximately 10% of the total UK extent. As the extent of reedbed habitat within the Proposed Improvement corridor, including all the areas identified in the Extended Phase 1 Habitat Survey undertaken in 2014/2015 and described in paragraph 5.4.189 above, amounts to approximately 1.3ha, this is likely to constitute more than 1% of the total habitat within Gwynedd and is therefore considered to be important at a **county** scale.

Operational Baseline (Year 15 – Without Scheme)

5.4.191 As reedbed habitat is usually only a short-lived stage in the succession from open water to woodland, it is possible that the area of habitat within Watercourse 2 that could potentially be affected by the Proposed Improvement could have become colonised by scrub such as willow and alder, present within nearby tributary ditches within the floodplain grazing marsh to the south. On the other hand, the reeds within the ditch could have been cleared out by the farmer to increase the drainage capacity. A reduction in rainfall in the summer months due to climate change could adversely affect reedbed habitat, potentially speeding up its transition to woodland. It is therefore uncertain what the extent and quality of this area of habitat would be by 2035 but it is likely to decrease in quality to some extent without appropriate management. However, the reedbed habitat remaining within the vicinity of the Proposed Improvement is likely to remain of county importance.

Rivers

Construction Baseline

5.4.192 The Proposed Improvement crosses three watercourses, including two main rivers, and three more watercourses (including one main river) lie partly within or immediately adjacent to the scheme footprint. All of these six watercourses form part of the Afon Artro catchment and have been referred to as Watercourses 0 – 5 throughout this document, going from south to north, with Watercourse 1 being the Afon Artro (see Figures 7.1-5: Environmental Master Plan, Volume 1a).

5.4.193 Watercourse 0 is located on the west side of the Proposed Improvement, in the vicinity of the proposed junction with Mochras Road. This is an ordinary watercourse and forms a slow-flowing drainage ditch across a marshy pasture to the north of the existing Mochras Road, with aquatic, emergent and bankside vegetation. It drains east to west and flows into a larger drainage ditch containing dense reedbed that flows north along the bottom of the railway embankment. During surveys for great crested newts within Watercourse 0, palmate newts were recorded along with three-spined stickleback, greater diving beetle, water boatman, water scorpion and various dragonfly and damselfly larvae, indicating good ecological quality.

5.4.194 The Afon Artro main river (Watercourse 1) flows east to west through the scheme corridor, becoming brackish as it heads towards the estuary to the north. Between the Proposed Improvement footprint and Pont Llanbedr within the village to the east, the river is bordered by mature broad-leaved trees and scrub but to the west the river corridor is largely open as it flows through its floodplain to the north. There is little aquatic or emergent vegetation due to the nutrient-poor soils associated with this area. The water quality of the Afon Artro is considered to be Good according to the Water Framework Directive river waterbody catchment classification 2015 undertaken by NRW (see Chapter 5.10: Road Drainage and the Water Environment) and the river is known to support good populations of fish species, including salmonids, eel and lamprey species.

5.4.195 Watercourse 2 is a substantial slow-flowing ditch running along the northern boundary of the fluvial floodplain adjacent on the south side of the flood embankment between Llanbedr village and the Afon Artro to the west. This ditch is classified as a main river and supports dense reedbed habitat for most of its length until it enters the Artro to the west, providing suitable habitat for a range of species such as invertebrates including dragonfly and damselfly species, amphibians, grass snake, a number of breeding bird species, otters and foraging bats.

5.4.196 At the northern end of the scheme corridor, Watercourses 3 – 5 form part of a network of smaller freshwater drainage ditches flowing into Watercourse 5 located on the eastern side of the existing A496 at the proposed northern tie-in, before it enters the Afon Artro to the northwest of the scheme corridor. Watercourse 5 is classified as a main river but Watercourses 3 and 4 are ordinary watercourses. These three watercourses all appear to be regularly cleaned out by the farmer and

are therefore fairly sparsely vegetated with scattered reeds. Watercourse 3 flows northeast through grazed pasture to the west of the existing A496, while Watercourses 4 and 5 run along the eastern side of the road, in the shade of a line of native broad-leaved trees and scrub in between the ditch and the road.

5.4.197 The Afon Artro catchment is one out of approximately 50 river catchments in Gwynedd that are classified as Good according to the Water Framework Directive. It is therefore considered to be of **county** importance.

Operational Baseline (Year 15 – Without Scheme)

5.4.198 It is not considered likely that the rivers and streams within the corridor of the Proposed Improvement would have changed significantly by 2035 although it is possible that there could be a lower volume of flow during the summer months due to an increased frequency and magnitude of droughts (The Climate Change Risk Assessment for Wales, Welsh Government and DEFRA, 2012). Therefore, the baseline conditions at operation are assumed to be the same as those at construction or possibly slightly reduced in their ecological value. However, it is likely that the Afon Artro would remain of importance at a county level.

Ponds

5.4.199 Ponds, for the purpose of UK BAP priority habitat classification, are defined as permanent and seasonal standing water bodies up to 2ha in extent, which meet one or more of a number of criteria including habitats of international importance, species of high conservation importance, exceptional assemblages of key biotic groups, ponds of high ecological quality and other important ponds. The nearest pond is located approximately 40m to the east of the proposed construction area and is unlikely to be significantly affected by the proposed works (see Figure 5.4.13, Volume 1a). It is also unlikely to meet any of the criteria mentioned above required to be classified as a UK BAP / Section 7 habitat of principal importance. There are no other ponds located within the Zol of the Proposed Improvement and ponds have therefore been scoped out of any further assessment.

Coastal Saltmarsh

5.4.200 The closest area of saltmarsh is located approximately 285m to the northwest of the Proposed Improvement and lies downstream of the proposed construction area, with the shortest fluvial pathway measuring 500m. Although there is potential for impacts on this habitat due to fluvial pollution during construction, all of the saltmarsh habitat within the Zol of the Proposed Improvement is included in Morfa Dyffryn SSSI and will therefore be assessed as part of that important ecological feature. Coastal saltmarsh as a separate ecological feature has therefore been scoped out of any further assessment.

Species

Bats

Construction Baseline

5.4.201 The following species were recorded either from the desk-study or from survey: lesser horseshoe bat, greater horseshoe bat, barbastelle, *Myotis* (including Natterer's bat and 'probable' Daubenton's bat); brown long-eared bat; Nathusius' pipistrelle, common pipistrelle; soprano pipistrelle; noctule (potentially also the related Leisler's bat); and serotine.

5.4.202 Six bat roosts were identified within the study area:

- a lesser horseshoe maternity and Natterer's bat roost within the Former Aquarium (maximum number recorded in 2015: 23 bats);
- a purpose-built bat roost within Maes Artro Holiday Village, created as compensation for the removal of a bat roost, which has now been confirmed as being utilised by breeding lesser horseshoe bats;

- a lesser horseshoe day roost and brown long-eared/medium *Myotis* roost within Building 1 of the Builder's Yard;
- a day roost supporting lesser horseshoe bats and brown long-eared bats within Building 2 of the Builder's Yard; and
- a day roost supporting lesser horseshoe bat, brown long-eared bat and medium *Myotis* bat within Plas-y-bryn Farm.

5.4.203 A number of trees and a wall alongside the Afon Artro were also suitable for use by roosting bats.

5.4.204 The majority of species were recorded during activity surveys using the full extent of the study area right through their 'active' season, with the exception of barbastelle and greater horseshoe which were only recorded infrequently. *Myotis* bats (including Natterer's bats and 'probable' Daubenton's bats) were not distinguished to species. Brown long-eared bat passes were recorded less often; however, this is more likely under recording (due to their quiet calls) rather than absence.

5.4.205 For those species most frequently recorded (lesser horseshoe bat, pipistrelle species and *Myotis*), it was evident that the Afon Artro was the key foraging resource and the main commuting feature, within the study area. A small area of rush pasture immediately north of the river was also a valued foraging resource, along with the vegetated ditch along its northern boundary.

5.4.206 A detailed account of the results is presented in the baseline report provided in Technical Appendix C, Volume 2.

5.4.207 Records received from the Local Environmental records Centre (Cofnod) identified barbastelle, common pipistrelle, lesser horseshoe, pipistrelle of unknown species, Natterer's bat and soprano pipistrelle within the study area. Brandt's bat, brown long-eared bat, Daubenton's bat, greater horseshoe, noctule, serotine and whiskered bats were also recorded within 5km of the study area boundary. The data search provided 16 records of lesser horseshoe bat within the study area. Nine records were associated with the lesser horseshoe bat maternity roosts at the Former Aquarium and Maes Artro holiday park, and the mitigation roost at the holiday park. Seven records of lesser horseshoe activity associated with these roosts were also provided. Further details of the desk study are presented in the baseline report provided in Technical Appendix C, Volume 2.

5.4.208 All bats are European protected species under the Habitats Directive and are also protected under the Wildlife and Countryside Act 1981 (as amended). Barbastelle, noctule, soprano pipistrelle, brown long-eared, greater horseshoe and lesser horseshoe bats are UKBAP species and all of these as well as common pipistrelle are included on Section 7. The Eryri LBAP includes natterer's, noctule, lesser horseshoe and pipistrelle bats.

5.4.209 The current Conservation Status of lesser horseshoe bats in the UK is considered to be Favourable⁴⁰ in terms of range, habitat and future prospects although it has suffered widespread population declines in Europe as a whole, especially in the more northern parts of its range. The UK currently supports one of the largest populations of this species in Western Europe and recent monitoring suggests that populations are increasing, particularly in Wales, with increased densities in wooded areas. The Conservation Statuses of common and soprano pipistrelles, natterer's, daubenton's, brown long-eared and greater horseshoe bats in the UK are also considered to be Favourable⁵ in terms of range, population, habitat and future prospects, but the Conservation Status of serotine and noctule bats is Unknown⁵, as although their range and population are noted as being favourable, their future prospects are unknown due to the quality of population monitoring data

⁴⁰ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012. JNCC, produced on 11/10/2013

for these species. The Conservation Status of barbastelle and Nathusius' pipistrelle is also unknown because, although the range of these species is assessed as Favourable, all the other parameters are Unknown due to insufficient data.

5.4.210 The Eryri Species Action Plan for the lesser horseshoe bat includes the following objectives:

- Maintain and enhance known hibernation and summer maternity roosts;
- Develop strategy for sympathetic management of key habitat, particularly close to known roosts;
- Maintain monitoring of summer roosts and hibernation sites;
- Ensure adequate protection of less frequently used sites as required;
- Identify all breeding roosts and major hibernation sites within SNP and map current and historic distribution.

5.4.211 The Eryri Species Action Plan for the natterer's bat includes the following objectives:

- Maintain existing populations and increase range of natterer's bats;
- Maintain existing hibernating, roosting and maternity sites and increase opportunities for further site occupancy;
- Identify and map distribution of nursery roosts within Snowdonia;
- Ensure sympathetic habitat management at key sites, for example creation of Local Nature Reserves and enhance important landscape features, *e.g.* linear features, between roosts and foraging sites; and
- Encourage monitoring of summer roosts and hibernation sites to establish baseline data.

5.4.212 The Eryri Species Action Plan for the noctule bat includes the following objectives:

- Develop effective survey methodology;
- Identify key sites for surveying;
- Investigate roosting requirements and colony mobility;
- Collate European autoecological research to identify further conservation research requirements;
- Investigate the feasibility of creating artificial roost sites;
- Develop strategies for protecting and enhancing suitable roost and feeding habitats; and
- Raise awareness and train forestry workers, tree surgeons, arboricultural consultants and Local Authority tree officers and planners.

5.4.213 The Eryri Species Action Plan for the pipistrelle bats includes the following objectives:

- Maintain existing populations and range of pipistrelles;
- Map distribution of pipistrelle species within Snowdonia National Park;
- Develop strategy for sympathetic habitat management; and
- Devise methods to alleviate problems caused to roost owners by large pipistrelle roosts.

5.4.214 The geographical scale of importance considered to be appropriate for each of the species recorded within the scheme corridor is shown in Table 5.4.3 above and is based on their relative abundance and distribution both locally and on a wider geographic scale. The importance of the species recorded ranges from **locally** important (*Myotis* species, common and soprano pipistrelle, brown long-eared and noctule) to **regionally** important (lesser horseshoe, Leisler's, serotine, greater horseshoe and barbastelle).

Operational Baseline (Year 15 – Without Scheme)

5.4.215 Although the numbers of lesser horseshoe bats recorded in the Former Aquarium maternity roost have more or less plateaued over the last five years, they are predicted to increase over the next 15 to 20 years to match the national trend. Climate change is also likely to influence the population's success in the long-term, contributing to their increase in this more northerly location. Studies suggest that increasing temperatures will improve the overall reproductive success of bat species.

However, the occurrence of extreme weather events, including increased precipitation, is considered likely to threaten breeding success (extreme weather may affect the abundance and assemblage of prey available to bats during times when they are most vulnerable), which may slow this increase but is unlikely to cause it to reverse.

5.4.216 The Former Aquarium is in a state of disrepair. Without intervention, the structure of the building is likely to continue to deteriorate, to the extent that in 15 to 20 years' time it may no longer provide a suitable breeding environment for the bats. While the loss of this roosting site is unlikely to have a significant long-term negative effect on the population (as the quality of the habitat in the surrounding area is very high and it is likely that many suitable roosting opportunities exist), it will mean the loss of a maternity roosting site which has been in use for at least 10 years, and potentially a change in the use of the surrounding bat features as a result.

5.4.217 The Eryri Action Plans for lesser horseshoe, natterer's, noctule and pipistrelle bats include numerous actions required to meet the objectives described in paragraphs 5.4.211-213 above. These can be found in the Snowdonia Biodiversity Action Plan.

5.4.218 The latest data from the Bat Conservation Trust (BCT) and JNCC indicate that lesser horseshoe, common and soprano pipistrelle and natterer's bats are increasing in population in the UK, with lesser horseshoe and natterer's also thought to be increasing in Wales (insufficient data to confirm this for pipistrelles). Brown long-eared, Daubenton's and whiskered/Brandt's bats are stable in the UK and Wales, while noctule, serotine and greater horseshoe bats are stable in the UK but there is insufficient data available to confidently assess their population trends in Wales. Barbastelles have shown a slight increase in range in the UK since 2007 but there is insufficient data to confidently assess population trends. There is insufficient data to determine the range or population trends of Nathusius' pipistrelle in Wales or the UK.

5.4.219 According to the Monarch Project⁴¹, climate conditions in Gwynedd, including the area of the Proposed Improvement, are likely to improve significantly for certain bat species including the lesser horseshoe. This species would no longer be at the northern extent of its range, which would likely lead to a further increase in numbers if all other conditions remained the same (as discussed in paragraph 5.4.215 above). This also applies to the greater horseshoe bat, which could increase in the area of the Proposed Improvement by 2035 if other factors allow it to thrive, as at present it has entered a period of population decline since 2012 (BCT), although the population has increased significantly since 1990. Barbastelle bats could also increase in the Llanbedr area due to likely increases in range further north due to a warmer climate. Population trends relating to climate change are not known for the other bat species, but other factors are thought to pose threats to certain species. For example, recent outbreaks of arboricultural disease such as ash dieback may lead to a long-term reduction in suitable roosting habitat for obligate tree roosting species such as noctules, even if it could lead to a short-term increase in suitable habitat first, which may be the case by 2035.

5.4.220 Assuming that every effort is made to undertake the relevant Eryri LBAP actions and the trends identified above continue, it is possible that lesser horseshoe, common and soprano pipistrelle and natterer's bats may have increased in the area of the Proposed Improvement and throughout Gwynedd by 2035, while brown long-eared, Daubenton's, whiskered/Brandt's, noctule and serotine bats may remain in similar numbers to those recorded in baseline surveys. It is also possible that higher numbers of greater horseshoe bats and barbastelle would be present in the vicinity of the Proposed Improvement by 2035 due to changes in climate. As a result it is possible that lesser horseshoe bats could be reduced to local importance by 2035, while barbastelle and greater horseshoe are likely to remain of regional importance due to their current small population size in

⁴¹ Monarch 3: Modelling Natural Resource Responses to Climate Change project (2007)

Wales and particularly North Wales. All other bat species are likely to remain at the same scale of importance.

Otter (Lutra lutra)

Construction Baseline

- 5.4.221 During the baseline survey in 2015, a series of otter resting places with fresh, recent and old otter spraints together with feeding remains were recorded on the northern bank of the Afon Artro under the roots of semi-mature trees including grey willow, alder and sycamore, located between NGR SH 58160 26995 and SH 58241 26906. Otter feeding remains comprising crustacean shells were also recorded at this location as well as numerous otter spraints. In addition, a juvenile otter was recorded at the location of the proposed Afon Artro bridge crossing on 3rd September 2015, again at the same location on 1st October 2015 and there is anecdotal evidence from June 2015 of an adult with two cubs in this location. These records indicate use of this section of the Afon Artro by a family group of otters. Additional evidence of otter presence and activity recorded throughout the survey area include; a potential otter resting site with crustacean feeding remains and spraints, located under the eastern bank abutment of Coronation footbridge over the Afon Artro directly adjacent to the Dŵr Cymru waste water treatment works. A potential otter boundary breach and commuting pathway was recorded to the north of the Afon Artro on the small unnamed reed-lined watercourse that feeds into the east bank of the Afon Artro. A potential otter boundary breach was recorded to the east and west of the Afon Artro in the north of the survey area. Spraints were recorded under Pont Llanbedr on the Afon Artro to the east of the survey area. In addition, spraints located on the very small unnamed watercourse that flows south to north through Lower Wood in the centre of the survey area. See Figure 5.4.11, Volume 1a.
- 5.4.222 There are 14 records of otters within 2km of the Proposed Improvement from the Local Environmental Records Centre, including three road fatalities, all of which were beyond the scheme corridor, with the closest 145m to the north. A further record of an otter road fatality was received from the SNPA, and is located within the scheme corridor, on west side of the existing A496, where Watercourse 3 diverges away from the road (NGR SH 58279 27422). One live sighting of an adult with two cubs, was observed on Watercourse 5 in 2006, approximately 640m upstream of the Proposed Improvement, which could corroborate the conclusion that otters have been breeding in the vicinity of the Proposed Improvement for a number of years.
- 5.4.223 Historically, otters occurred over most of the UK. However, persecution, habitat loss and, more recently, the impact of toxic organochlorine insecticides caused a marked reduction in the range of the species. At present, the majority of the otter population in Great Britain occurs in Scotland, with a significant proportion of this number being found in the north and west of the country. Other strong populations survive in Wales and Ireland. The otter is still scarce over much of England, where the highest concentrations are in the south-west. However, recent surveys suggest that the otter population is recovering well and recolonising parts of its former range (JNCC).
- 5.4.224 Otters have been returning to many river catchments in Gwynedd in recent years. Increasing road mortalities indicate increasing numbers in areas such as the Llŷn Peninsula and the largest populations are found in the Glaslyn, Gwyrfai and Seiont mountain rivers and within the Dyfi and Dysynni catchments (Natur Gwynedd, 2004).
- 5.4.225 Otters are a European protected species under the Habitats Directive and are also protected under the Wildlife and Countryside Act 1981 (as amended). Otters are a UKBAP priority species, a Section 7 species, and feature within the Eryri LBAP. The current conservation status of Otters in the UK is

considered to be favourable⁴² in terms of range, habitat and future prospects, with an estimated UK population of 10,395⁷.

5.4.226 The relevant objectives of the Otter Species Action Plan from the Eryri LBAP are as follows:

- Continue surveys to monitor distribution and to assess habitat on all Snowdonia rivers;
- Safeguard existing widespread populations on the Key Catchments – the Snowdonia mountain rivers and the Dyfi and Dysynni catchments, and populations on the upper Dee catchment (Tryweryn and Llyn Tegid and tributaries);
- Improve habitats and food availability on rivers immediately adjacent to these “stronghold” populations, especially on the Dwyfor/Dwyfach, Desach, Llifon, Llyfni, Ogwen, Conwy and tributaries, and the Wnion and southern tributaries of the Mawddach estuary;
- Carry out research to identify limiting factors to the otter expansion on the Mawddach catchment, the Afon Prysor and Llyn Trawsfynydd.

5.4.227 The baseline data at the location of the Proposed Improvement indicates the presence of breeding otters within the Afon Artro corridor and its catchment and due to the current distribution of otters throughout Gwynedd and North Wales it is considered that this population is important at a **county** level.

Operational Baseline (Year 15 – Without Scheme)

5.4.228 The Eryri Action Plan for otters includes the following relevant actions:

- Ensure that the SNPA and National Trust (NT) policies on waterside management and developments do not conflict with the habitat requirements of otters;
- Stricter controls on sheep dipping and disposal of sheep dip, in particular the Synthetic Pyrethroids, is required;
- Encourage policies that better manage watercourses and wetlands for the conservation of otters by fencing, controlled grazing regimes, etc.;
- Where possible protect breeding sites through SSSI scheduling or acquisition as nature reserves;
- Set up “Otter Havens” on Key Catchments to protect resting sites, breeding areas and feeding sites;
- Ensure that all road improvements and maintenance schemes have little or no impact on otter survival. Bridges and culverts should be designed to enable otters to travel through them at times of high water;
- Continue to provide training on otter conservation and habitat management to countryside organisations;
- Ensure that advice on otters and habitats is provided to angling clubs and landowners;
- Identify existing breeding areas within Key Catchments from existing habitat data;
- Genetic fingerprint identification of individual otters using spraints should be used to determine population levels within catchments and genetic variability when the technique is available;
- Continue surveys to locate important otter sites, e.g. resting and breeding sites, feeding areas; and
- Continue collection and post-mortem of dead otters.

5.4.229 The distribution of otters in Wales has increased significantly over the past decades, with 90% of sites surveyed recording evidence of otters in 2009-10, compared to 72% in 2002, 53% in 1991, 38% in 1984-85 and only 20% in 1977-78 (Otter Survey of Wales, NRW, 2015). Although this cannot be

⁴² Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012. JNCC, produced on 11/10/2013

directly translated into an increase in numbers, such a significant increase in distribution implies that the population is also currently increasing in size in Wales.

- 5.4.230 As otters are currently distributed throughout the UK, it is unlikely that changes in the distribution of climate space would significantly affect this species, although the likelihood of more variable river flow rates due to increases in floods and droughts could have an adverse effect on fish stocks and also on the ability of otters to hunt and catch prey (Biodiversity Impacts Climate Record Card Technical Paper: 2. The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015). However, it is not considered likely that this would have a significant impact on the otter population of Wales by 2035.
- 5.4.231 Assuming that every effort is made to undertake the LBAP actions described in paragraph 5.4.228 above and the increasing population trend continues, it is possible that the otter population of Gwynedd could have increased by 2035. It is therefore possible that the otter population within the ZoI of the Proposed Improvement would be of importance at a local level by this point in the future but due to the uncertainty of this assumption, it may be best to consider that it would remain of county importance.

Badger (Meles meles)

Construction Baseline

- 5.4.232 During the protected species survey undertaken in 2014 and updated in 2015, evidence of badger activity was recorded throughout the survey area, including active setts, latrines, boundary breaches with badger guard hairs and frequent foraging scrapes. Five active badger setts were identified in total, including three main setts. One of these is located outside the scheme corridor to the east of Llanbedr village to the north of the Afon Artro. The remaining two are located to the south of the Afon Artro within the scheme corridor. The additional active setts are smaller and likely to constitute annexe setts to the two main setts south of the river. These are also located within the Proposed Improvement corridor and one of these would be directly affected by the Proposed Improvement.
- 5.4.233 The badger bait marking survey undertaken in March 2016 identified five potential badger territories within the Proposed Improvement corridor, two of which would be crossed by the Proposed Improvement. An additional four active badger setts were also identified within the survey corridor during this survey, none of which would be directly affected by the works. See Figure 5.4.12, Volume 1a.
- 5.4.234 There are 20 records of badgers within 1km of the Proposed Improvement from the Local Environmental Records Centre (Cofnod), including three road fatalities on the existing A496; one adjacent to the sewage works at the northern extent of the scheme footprint and the other two 875m and 990m to the south of the scheme footprint.
- 5.4.235 Badgers and their habitat are afforded protection on a domestic level through the Protection of Badgers Act 1992. They are also included on Schedule 6 of the Wildlife and Countryside Act 1981 (as amended), and Appendix III of the Bern Convention. The Eurasian badger is listed as Least Concern on the IUCN (International Union for Conservation of Nature) Red List due to its wide distribution, large population, occurrence in many protected areas, high densities in anthropogenic habitats in large parts of its range, and because it is highly unlikely to be declining at nearly the rate required to qualify for listing even as Near Threatened. Although this species is not of particular importance for nature conservation, badger has been included as an Important Ecological Feature due to the legislation protecting badgers in the UK (which is mainly for welfare reasons) and the need for a licence to disturb, damage or destroy a sett.

5.4.236 The density of the local badger population within the survey area is concluded to be relatively high due to the amount of evidence of badger activity recorded throughout the survey area and the number of active setts and territories found to be present. However, due to the widespread abundance of badgers throughout Gwynedd, Wales, UK and Europe, a badger population of this size is considered to be of **local** importance at most.

Operational Baseline (Year 15 – Without Scheme)

5.4.237 In the UK there was an estimated 55% increase in the badger population between 1988 and 1997, when there were thought to be approximately 310,000 adult badgers. The population is now probably stable with road traffic accidents a major cause of death. There are many climatic factors that annually affect the recruitment and mortality rates of badgers, such as quantity of rainfall affecting availability of earthworms and winter temperatures affecting badger condition. However, according to the Biodiversity Report Card Paper 2 (The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015), badger numbers in the UK seem only about as likely as not to change as a result of climate change. It is therefore anticipated that the badger population in 2035 would be similar to the existing population.

Water Vole (Arvicola amphibius)

5.4.238 Water vole surveys were undertaken during the baseline surveys for the Proposed Improvement due to the presence of suitable habitat within the scheme footprint and two records within 2km from the Local Environmental Records Centre (Cofnod), with the closest approximately 930m to the east. However, none were recorded during the surveys in 2015 and water voles have therefore been scoped out of any further assessment.

Dormouse (Muscardinus avellanarius)

5.4.239 There is suitable habitat for dormice within the Proposed Improvement corridor but no records within 2km from the Local Environmental Records Centre (Cofnod), and the closest record available is near Dolgellau, approximately 15km to the southeast. No dormice were recorded during the baseline surveys undertaken in 2015 so they have been scoped out of any further assessment.

Polecat (Mustela putorius)

Construction Baseline

5.4.240 The Proposed Improvement corridor provides habitat suitable for polecats and there are six records of polecat within 2km of the scheme footprint from the Local Environmental Records Centre (Cofnod), including three within 1km and two road fatalities including one within the scheme footprint, adjacent to the builder's yard. The other two records within 1km are within the northern half of the scheme corridor, including one to the east of the Proposed Improvement, adjacent to the wooded area around the properties including Mor Awelon and Bryn.

5.4.241 In the past the polecat was widespread and common in Britain but the population underwent a severe decline and range contraction during the 19th century, which coincided with the rise in the sporting estate and game keeping profession. By 1915 the polecat had become extinct across much of Britain and confined to a stronghold in mid-Wales, with small populations in Herefordshire, Shropshire, Yorkshire, Cumberland and parts of northern Scotland. From the 1930s onwards the polecat population started to recover in Wales, attributed to a reduction in game keeping pressure during and following the First World War. During the 20th century polecats extended their range into the Welsh borders and parts of the English midlands (Vincent Wildlife Trust, 2016). A recent survey by the Vincent Wildlife Trust suggests that polecats are still widespread in Wales, maintaining their range in their historical stronghold and that polecats are now more widespread in Britain than at any time in the last 100 years (The distribution and status of the polecat (*Mustela putorius*) in Britain 2014-2015, Croose, 2016). In contrast, in parts of Europe the polecat population is declining including in Germany, Spain, Portugal, Austria, Belarus, Croatia, Luxembourg, Belgium, Poland and Italy, with habitat fragmentation and degradation and drainage of wetlands suggested

as the principal causes. Therefore in light of these reported declines over much of its range, the recovery of the polecat in Britain could be regarded as significant for the overall status of the global population.

5.4.242 Polecat is listed on Section 7 of the Environment (Wales) Act 2016 and is an Eryri LBAP species. The current UK Conservation Status of the polecat is Favourable⁴³, with all parameters assessed as Favourable (Range, Population, Habitat and Future Prospects).

5.4.243 The objectives of the Polecat Species Action Plan from the Eryri LBAP are as follows:

- Maintain existing status of the polecat as a common species in Snowdonia;
- Improve habitat and prey availability by limiting adverse effects of grazing;
- Establish widespread awareness and tolerance of polecats and minimise conflicts with game and poultry keepers.

5.4.244 Taking into account the status and relative abundance of the polecat population in Gwynedd compared with the number of records of polecat within 2km of the Proposed Improvement, the local polecat population has been considered of importance at a **local** level.

Operational Baseline (Year 15 – Without Scheme)

5.4.245 The Species Action Plan for polecats in the Eryri LBAP includes the following relevant actions:

- Generally reduce grazing pressure by domestic stock;
- When necessary advise keepers of game and poultry of legal position, of the benefits of sound husbandry over lethal polecat control, and of the requirement for a licence prior to deliberate trapping;
- Continue monitoring distribution and status in Snowdonia as part of national programme;
- Promote awareness and understanding of the polecat among general public, landowners and land managers, stressing its long-term survival in Snowdonia and its role as an important rabbit predator.

5.4.246 Estimates of the Welsh population of polecats in 1997 and 2006 have shown an increase of 4.3% to 18,448 in 2006, although it is considered that this could be an underestimate⁸. It is therefore assumed that the population is increasing, at least in the short-term. Although polecats, like most mustelids, have a thermally inefficient body-shape, making them vulnerable to any variations in their food supply due to climatic factors, it is considered that they are unlikely to respond significantly to climate change (Biodiversity Report Card Paper 2: The Implications of Climate Change for Terrestrial UK Mammals, Newman and MacDonald, 2015).

5.4.247 In summary, should actions be taken as described in the LBAP for this species (see paragraph 5.4.245 above), it is likely that the polecat population in Wales, and in Gwynedd, may have increased by 2035. However, it is considered that it would remain of importance at a local level.

Hedgehog (Erinaceus europaeus)

Construction Baseline

5.4.248 There is suitable habitat for hedgehogs within the Proposed Improvement footprint and one record within 1km, located within the southern half of the scheme corridor, although this was from 1976.

5.4.249 The UK hedgehog population is in sharp decline, with an estimated 50 million in the 1950s dropping to 1.5 million in 1995. This is thought to be continuing with a long-term rate of loss of 23% over ten

⁴³ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December, JNCC, produced on 11/10/2013

years, with risks to hedgehogs predominantly relating to habitat loss, road traffic accidents, molluscicide poisoning and predation by badgers.

5.4.250 Accurate figures for the hedgehog population in Wales are not available, but a 1995 study (A Review of British Mammals: Population estimates and conservation status of British mammals other than cetaceans, Harris, Morris, Wray and Yalden) estimated a Welsh population of 145,000. They found that the UK hedgehog population seemed to be very variable in density across its range, with lower densities in areas with more badgers and large differences in areas with different habitat availability. For areas with semi-natural mixed woodlands and semi-improved and improved grassland, such as the habitat mosaic in the vicinity of the Proposed Improvement, they estimate a population density of 1 hedgehog per 20ha, compared with 1 in 10ha for built-up areas and 1 in 2-5ha for semi-natural broad-leaved, mixed and recently felled woodlands, parkland, scrub, lowland unimproved grassland and amenity grassland.

5.4.251 Hedgehog is listed on Section 7 of the Environment (Wales) Act 2016 but the current UK Conservation Status of the hedgehog is unknown due to insufficient data.

5.4.252 Taking into account the relative abundance of the hedgehog throughout Gwynedd despite its decline in recent years, it is considered that the local population of this species is likely to be of importance at a **local** level.

Operational Baseline (Year 15 – Without Scheme)

5.4.253 The Wales Biodiversity Action Plan for the hedgehog (2013) includes the following targets:

- Halt the decline and maintain the current range of hedgehogs in Wales;
- Set up and run surveys to improve knowledge of hedgehog distribution. Ensure a national long-term monitoring system is in place with sufficient power to detect population changes at an agreed level;
- Promote and support a prioritised research programme to study population genetics, population fragmentation and its causes and linking hedgehog densities to habitat types. Use the resulting data to focus conservation efforts;
- Ensure agri-environment prescriptions are available that support and encourage the maintenance and development of habitat features helpful to hedgehogs;
- Raise awareness of and urge people to consider the need for providing hibernacula in otherwise 'tidy' garden habitats and encourage better management of urban sites;
- Investigate the effect on populations of incidental take by gamekeepers (several thousand per year in the UK);
- Investigate the effects of slug pellets on hedgehogs that they ingest from eating slugs and snails.

5.4.254 The UK hedgehog population is thought to still be declining at a fairly rapid rate, although there is some evidence to suggest that this may be in rural areas only. The existing threats to the species from badger predation, habitat loss and fragmentation, road traffic accidents and molluscicide poisoning are likely to continue, although the targets described above in paragraph 5.4.253 may help to curb some of these effects. Risks relating to climate change including disruption to torpor due to warmer winters, drier springs limiting earthworm prey and temporary flooding of foraging grounds, would also be detrimental to the population. The Biodiversity Report Card Paper 2: The Implications of Climate Change for Terrestrial Mammals (Newman and MacDonald, 2015) concludes that hedgehogs are likely to be vulnerable to population decline in the UK in response to climate-related pressures against a backdrop of more major population drivers. It is therefore considered likely that the local hedgehog population may have decreased fairly significantly by 2035 but would remain important at a local level.

Brown Hare (*Lepus europaeus*)

Construction Baseline

5.4.255 Most of the habitat within the footprint of the Proposed Improvement is suitable for brown hares, who prefer open grassland habitat, although taller rougher grassland is preferable, such as the area within the fluvial floodplain between the Afon Artro and Watercourse 2. There are 11 records of brown hares within 2km from the Environmental Records Centre (Cofnod) data, including six within 1km, with the closest record 90m to the west on the other side of the railway line. One of these records is of a road traffic fatality on the A496 approximately 670m to the south.

5.4.256 Widespread throughout the lowlands of Europe, the brown hare is a common farmland species throughout most of Britain, probably introduced by the Romans. The brown hare has undergone a substantial decline in numbers since the early 1960s and a study in 1996 estimated the British population to be around 800,000⁴⁴, which is only 20% of the estimate for 1880 of 4 million brown hares. The Welsh population has also declined since 1960, with the population estimated to be about 58,000 in 2004. This population is patchily distributed, with very few records from Pembrokeshire and a sparse distribution in mountainous regions such as Snowdonia. Reasons for the recent population decline, as identified in the 2008 Biodiversity Action Plan reporting, include:

- Changes in predator species dynamics, particularly foxes; and
- Habitat degradation and loss due to changes in agricultural practices, including loss of mixed farming, loss of set aside, use of agrichemicals and agricultural machinery.

5.4.257 Brown hare is listed on Section 7 of the Environment (Wales) Act 2016 and is also listed on the Eryri LBAP. The current UK Conservation Status of the brown hare is not known but they are of Least Concern globally, according to the IUCN Red List.

5.4.258 Due to the relative abundance of the brown hare throughout Gwynedd, it is considered to be of importance at a **local** level.

5.4.259 The objective of the Eryri Species Action Plan for brown hare is to maintain and expand the existing population, particularly in pastoral areas.

Operational Baseline (Year 15 – Without Scheme)

5.4.260 The Eryri Action Plan for brown hares includes the following relevant actions:

- Consider the requirements of the brown hare in any negotiations on changes to, or reform of, agricultural support, seeking to enhance the integration of livestock with arable farming;
- Review the use of legislation pertaining to shooting and selling of hares in the light of research findings on the seasonality of reproduction;
- Seek to develop a strategy for the conservation and monitoring of the brown hare;
- Implement strategy at a local level;
- Distribute a management advisory booklet for hares once prepared through the UK Brown Hare Steering Group;
- Investigate the relative economic importance of hares as either a game species or a pest to assist farmers in making informed choices in hare management;
- Encourage public participation in the National Hare Survey at appropriate intervals;
- Pass information gathered during survey and monitoring of this species to JNCC in order that it can be incorporated in a national database and contribute to the maintenance of an up-to-date Red list; and
- Use the popularity of brown hares to highlight the impact on biodiversity of modern agricultural practices and loss of mixed farms.

⁴⁴ Hutchings, MRW and Harris, S. 1996. Current status of the brown hare in Britain. Report of the Joint Nature Conservation Committee, Peterborough

5.4.261 The rate of decline of the brown hare seems to have slowed in recent years, with the population thought to be increasing in many parts of England now although there is insufficient data to establish the presence of a similar trend in Wales. The existing threats to the species identified above are likely to continue, although the actions described in paragraph 5.4.260 may help to curb the impact from changes in agricultural practices. Risks relating to climate change include an increase in extreme climatic events leading to increased juvenile mortality, although the warmer winters predicted could lead to greater overwinter survival and breeding success. The Biodiversity Report Card Paper 2: The Implications of Climate Change for Terrestrial Mammals (Newman and MacDonald, 2015) concludes that it is about as likely as not that climate change will be a major driver of lagomorph population success and therefore it is uncertain what the population trend will be for brown hares between now and 2035 but it is likely that they will remain of importance at a local level.

Breeding Birds

Construction Baseline

5.4.262 Mature and semi-mature trees and woodland, marshy grassland, bracken and scrub, river corridor, reedbed, boundary habitat and buildings provide suitable habitat for a variety of breeding birds within the Zol. A breeding bird survey was undertaken in June 2015, including one transect on 4th June and another on 29th June. During the survey, a total of 43 bird species were recorded, of which 36 were considered to have the potential to breed within habitat within or immediately adjacent to the Proposed Improvement. The following areas were identified as having the highest value for nesting birds within the Proposed Improvement corridor:

- the isolated copses within the higher grazed pasture to the south of the Afon Artro;
- the Afon Artro and its banks; and
- the grazed floodplain and willow scrub to the north of the Afon Artro.

5.4.263 Species listed on Schedule 1 (WCA), Eryri LBAP, Section 7 (Environment (Wales) Act 2016) or Birds of Conservation Concern (BoCC) Red List⁴⁵ that have been recorded either during the breeding bird survey, any of the other baseline surveys, or are included in the data obtained from the Environmental Records Centre (Cofnod – data for a 2km radius) are shown in Table 5.4.7 below.

Table 5.4.7: Eryri LBAP, Section 7, BoCC Red List and Schedule 1 birds recorded within a 2km radius of the Proposed Improvement

Species	BoCC Status	Eryri LBAP	Section 7	Schedule 1	2015 BBS	Cofnod Data
Skylark (<i>Alauda arvensis</i>)	Red	☐	☐			☐
Tree pipit (<i>Anthus trivialis</i>)	Red		☐			☐
Lapland bunting (<i>Calcarius lapponicus</i>)	Amber			☐		☐
Lesser redpoll (<i>Carduelis cabaret</i>)	Red		☐		☐	☐
Common linnnet (<i>Carduelis cannabina</i>)	Red		☐		☐	☐
Ringed plover (<i>Charadrius hiaticula</i>)	Red		☐			☐
Black-headed gull (<i>Chroicocephalus ridibundus</i>)	Amber		☐			☐
Lesser spotted woodpecker (<i>Dendrocopos minor</i>)	Red		☐			☐
Yellowhammer (<i>Emberiza citrinella</i>)	Red		☐			☐
Reed bunting (<i>Emberiza schoeniclus</i>)	Amber		☐		☐	☐
Kestrel (<i>Falco tinnunculus</i>) – identified in Extended Phase 1 Habitat Survey (2014)	Amber		☐			
Pied flycatcher (<i>Ficedula hypoleuca</i>)	Red	☐	☐			☐
Red-throated diver (<i>Gavia stellata</i>)	Green			☐		☐

⁴⁵ BoCC 4 (2015)

Herring gull (<i>Larus argentatus</i>)	Red		?		?	?
Lesser black-backed gull (<i>Larus fuscus</i>)	Amber	?				?
Bar-tailed godwit (<i>Limosa lapponica</i>)	Amber		?			?
Grasshopper Warbler (<i>Locustella naevia</i>)	Red		?			?
Common scoter (<i>Melanitta nigra</i>)	Red		?	?		?
Red kite (<i>Milvus milvus</i>)	Green			?		?
Grey wagtail (<i>Motacilla cinerea</i>)	Red				?	?
Spotted flycatcher (<i>Muscicapa striata</i>)	Red		?			?
Curlew (<i>Numenius arquata</i>)	Red	?	?			?
Whimbrel (<i>Numenius phaeopus</i>)	Red			?		?
House sparrow (<i>Passer domesticus</i>)	Red		?		?	?
Redstart (<i>Phoenicurus phoenicurus</i>)	Amber	?				?
Wood warbler (<i>Phylloscopus sibilatrix</i>)	Red	?	?			?
Green woodpecker (<i>Picus viridis</i>)	Green	?				?
Dunnock (<i>Prunella modularis</i>)	Amber		?		?	?
Bullfinch (<i>Pyrrhula pyrrhula</i>)	Amber		?			?
Common starling (<i>Sturnus vulgaris</i>)	Red		?		?	
Greenshank (<i>Tringa nebularia</i>)	Amber			?		?
Mistle thrush (<i>Turdus viscivorus</i>)	Red				?	?
Song thrush (<i>Turdus philomelos</i>)	Red	?	?		?	?
Barn owl (<i>Tyto alba</i>)	Green			?		?
Lapwing (<i>Vanellus vanellus</i>)	Red	?	?			?

5.4.264 As shown in Table 5.4.7 above, a number of birds listed on Schedule 1, Section 7, the Eryri LBAP or the BoCC Red list, have been recorded in the vicinity of the Proposed Improvement, although many of these would not be found breeding in habitat within or immediately adjacent to the scheme footprint. A number of species have therefore been scoped out of any further assessment due to a lack of suitable breeding habitat within the ZoI, and a level of importance has been assigned to each remaining species based on their distribution within Gwynedd, North Wales and the UK. Table 5.4.8 below includes all species that have not been scoped out of the assessment, with the scale of their importance.

Table 5.4.8: Scale of Importance of bird species scoped into the Impact Assessment

Scale of Importance	Species	Reason for Scale of Importance
Local	Skylark; Tree pipit; Common linnnet; Reed bunting; Kestrel; Pied flycatcher; Grasshopper warbler; Grey wagtail; Spotted flycatcher; House sparrow; Redstart; Wood warbler; Dunnock; Bullfinch; Common starling; Mistle thrush; Song thrush	These species could potentially nest within habitat affected by the Proposed Improvement but the loss of the breeding population within the ZoI would not be of significance at a county scale or above due to their relatively widespread distribution throughout Gwynedd. However, due to their inclusion on the BoCC Red list, Section 7 or Eryri LBAP, they are considered to be locally important species
County	Red kite; Green woodpecker;	Based on previous records, there is potential for these species to breed within the ZoI and the loss of the breeding

	Barn owl; Lapwing	population of these species within the ZoI of the Proposed Improvement would be significant at a county level but not on a wider regional scale or above
Regional	Lesser spotted woodpecker	There is potential for this species to breed within the ZoI of the Proposed Improvement as a pair has previously been recorded within the scheme footprint and suitable habitat is present. The loss of the breeding population of this species would be significant at a regional level due to the low numbers previously recorded in North Wales

5.4.265 Two species listed on Schedule 1 of the Wildlife and Countryside Act have previously been recorded within 2km of the Proposed Improvement, namely barn owl and red kite. Although none of the records were of breeding activity, there is habitat with some suitability for them to breed within the ZoI and they have therefore been considered separately due to the greater level of protection afforded to their nest sites. Green woodpecker and lapwing have both been recorded within 2km of the Proposed Improvement but not within the scheme corridor itself, and although there is suitable habitat for these species of county importance within the scheme footprint, they are more likely to nest elsewhere where their preferred habitat is more abundant and better quality, such as in more coastal areas to the west for lapwing and more wooded areas to the east for green woodpecker. They have therefore been scoped out of further assessment. The remaining bird species have been grouped according to their scale of importance, with baseline data described separately for lesser spotted woodpecker as a regionally importance species.

Operational Baseline (Year 15 – Without Scheme)

5.4.266 In the absence of the scheme, it is likely that the population of breeding birds within the corridor of the Proposed Improvement would remain in a similar condition by 2035, although the proportional composition may change very slightly due to the declining populations of some species such as those on the BoCC Red list (see Table 5.4.7 above). It is likely that climate change will eventually significantly change the composition of bird species present in North Wales due to shifts in suitable climate space changing the range and distribution of many species. Those that are likely to significantly change in the shortest timeframe include skylark, common linnets and song thrush. None of these however are expected to increase or decline significantly within Gwynedd by 2035 according to the Monarch Project⁴⁶.

Lesser spotted woodpecker (Dendrocopos minor)

Construction Baseline

5.4.267 There are two records of lesser spotted woodpecker within 1km of the Proposed Improvement in the Environmental Records Centre (Cofnod) data, with the closest lying within the scheme footprint to the west of the proposed new junction with Mochras Road and the other approximately 380m to the east of the northern tie-in, the latter being a record of nest excavation. The species nests in dead wood high up in the canopy, foraging within the narrow crown branches and favours open woodland, riverside woodland, copses, parkland, gardens and orchards, so there is suitable habitat within the ZoI and footprint of the Proposed Improvement.

5.4.268 In the UK the lesser spotted woodpecker is mainly limited to the south, with the highest density of population occurring in the south-east of England. They do not breed in Scotland and are absent from Ireland, while in northern England they are extremely local in Yorkshire, rare in Lancashire and in Wales scattered pairs occur apart from in the far west (RSPB). It is estimated that there are 1000 – 2000 breeding pairs of this species in the UK but the population has declined by 72% between

⁴⁶ Monarch 3: Modelling Natural Resource Responses to Climate Change project (2007)

1974 and 1999 (RSPB) and so they have been placed on the BoCC Red List. This decline may be due to changes in forest management including the removal of rotting trees, tree crowding leading to a reduction in crown development, the loss of so many elms to Dutch elm disease, or increased competition with other species, such as the great spotted woodpecker.

5.4.269 Lesser spotted woodpecker is listed on Section 7 of the Environment (Wales) Act 2016. The current UK Conservation Status of the lesser spotted woodpecker is not known but they are of Least Concern globally, according to the IUCN Red List.

5.4.270 Due to the scarcity of the lesser spotted woodpecker in Gwynedd and North Wales, and the potential for the species to be breeding within the ZoI of the Proposed Improvement, it is considered to be of importance at a **regional** level.

Operational Baseline (Year 15 – Without Scheme)

5.4.271 The following actions have been identified for the lesser spotted woodpecker in the UK BAP:

- Identify the causes of decline including the role of landscape scale processes. If appropriate trial management solutions;
- Develop and implement an effective monitoring scheme; and
- Ensure needs of woodland birds are incorporated into, and well targeted in, forestry policies, support measures and HAPs.

5.4.272 It is likely that the severe population decline of the lesser spotted woodpecker will continue over the next couple of decades as many of the pressures on this species will continue, although the actions described in paragraph 5.4.271 above may help to reduce these pressures. As an insectivorous bird species, the drier summers predicted in relation to climate change may be detrimental to the availability of prey leading to reduced breeding success, although warmer winters could also lead to higher survival rates. Overall, it is considered likely that the lesser spotted woodpecker will continue to decline but is likely to remain of importance at a regional scale in North Wales by 2035.

Barn owl (Tyto alba)

Construction Baseline

5.4.273 The data from the Environmental Records Centre (Cofnod) includes only one record of a barn owl, located approximately 1.2km to the west, in the vicinity of the Artro estuary in 2005. However, the scheme corridor does include habitat suitable for foraging, roosting and nesting barn owls and it is likely that they forage occasionally across the scheme footprint at least. There are no road traffic fatality or nest site records within the data for a 2km radius but there are anecdotal records of previous breeding and roosting in farm buildings and foraging over adjacent land immediately to the west of the Proposed Improvement corridor, including evidence of roosting within two of the outbuildings at Plas-y-Bryn Farm recorded during the preliminary scoping surveys for bats in 2015. The habitat within the fluvial floodplain of the Artro and also much of the habitat to the west of the Proposed Improvement corridor is considered to be the best foraging habitat in the vicinity as it is more open than that to the east and includes areas of rougher less improved grassland.

5.4.274 Widely distributed across the UK and the world, the barn owl has suffered declines through the 20th century and is thought to have been adversely affected by organochlorine pesticides such as DDT, in the 1950s and 60s. The population in the UK is estimated to be approximately 9000 breeding pairs (Colin Shawyer, 2014), and although monitoring is poor due to their nocturnal lifestyle, it is considered that they may have increased since then (RSPB). The 2004 population estimate for Wales was around 200 pairs and data suggest that there were an average of 20 pairs nesting in Gwynedd each year during the last quarter of the 20th century.

5.4.275 Barn owls are listed on Schedule 1 of the Wildlife and Countryside Act, which prohibits nesting sites from being disturbed.

5.4.276 Taking into account the status of the barn owl population in Gwynedd, Wales and the UK, it is considered that they are of **county** importance.

Operational Baseline (Year 15 – Without Scheme)

5.4.277 The UK barn owl population is thought to be increasing and they have recently been changed from amber to green status on the Birds of Conservation Concern 4 list published by BTO in 2015, although the breeding success in the last few years has been relatively poor according to the Barn Owl Trust. The main threats to barn owls include habitat loss (including loss of nesting habitat due to barn conversions and loss of veteran trees), traffic mortality and reduction in prey numbers due to agricultural intensification and pesticide use. The impacts of climate change on barn owls are not certain but there could be impacts due to different patterns of rainfall, as barn owls generally avoid hunting in wet weather due to their soft and silent, but not very water resistant, feathers. Conversely, warmer temperatures may increase prey abundance, which has been shown to be very closely linked to barn owl survival rates. Overall, it is uncertain whether the barn owl population of Gwynedd, Wales and the UK in 2035 will have increased or decreased significantly from its existing population so it is assumed that it would remain of county importance.

Red kite (Milvus milvus)

Construction Baseline

5.4.278 The Environmental Records Centre (Cofnod) data includes six records of red kite within 2km of the Proposed Improvement, including four within 1km, dating from between 2002 and 2013, only one of which was outside of the breeding season but none of which actually confirm the presence of breeding kites. Another sighting of a red kite in flight was recorded during the baseline extended Phase 1 habitat survey for the Proposed Improvement in June 2014. There is suitable habitat for breeding and foraging red kites within and adjacent to the footprint of the Proposed Improvement, as the species favours broad-leaved woodland, agricultural land, valleys and wetland edges for foraging and require a fairly large tree with open access for breeding.

5.4.279 The red kite suffered from intensive human persecution through much of its world range, which is mainly in Europe, until the mid-1950s, but especially so between 1850 and 1900. This resulted in the species becoming extinct in several countries following a marked long-term decrease in range and numbers. Since the 16th century the red kite has been persecuted by gamekeepers and as it has become rarer it has also been targeted by egg collectors and taxidermists, all of which led to its extinction in England by 1871 and Scotland by 1879. By 1903 when protection for this species was introduced, only a handful of pairs were left in remote parts of central Wales leading to a genetic bottleneck where all remaining birds were descended from a single female. Only in the 1960s did the population start to increase and by the mid-1990s there were over 100 breeding pairs in Wales and 350-400 pairs by 2003. A reintroduction program in 1989 helped to establish red kites in several areas of England and Scotland and their range and numbers are now slowly expanding (RSPB).

5.4.280 Red kites are listed on Schedule 1 of the Wildlife and Countryside Act, which prohibits nesting sites from being disturbed. They are also listed as Near Threatened on the IUCN Red List.

5.4.281 Due to the status of the red kite population in Gwynedd, Wales and the UK, it is considered that the red kite is of **county** importance

Operational Baseline (Year 15 – Without Scheme)

5.4.282 The population and range of red kites in Wales and the UK is currently increasing and they are given green status on the Birds of Conservation Concern 4 list published by BTO in 2015. Although the

species still faces threats from illegal poisoning by bait left out for foxes and crows, secondary poisoning by rodenticides and collisions with power cables, these problems are currently being addressed to reduce their impacts on kites (RSPB). The impacts of climate change on the red kite are uncertain although there is some evidence to suggest that milder, wetter winters and hot summers may benefit the species due to an increase in food availability (Climate Change Potential Impacts on Wales, Phil Hurst, Friends of the Earth Cymru, 1997). Overall it is therefore possible that the red kite population in Gwynedd, Wales and the UK, may have increased by 2035, although it is still likely to be of importance at a county level.

Reptiles

Construction Baseline

- 5.4.283 There is potential habitat for three of the more common species of the British reptiles, namely slow worm, common lizard and grass snake, within the footprint of the Proposed Improvement, including woodland, marshy grassland, boundary habitats, bracken, scrub and reedbed. The local Environmental Records Centre (Cofnod) data includes four records of common lizard, four of slow worm and three of grass snake within 1km of the Proposed Improvement. The baseline reptile survey undertaken in August 2015 recorded eight slow worms, including juveniles and a dead juvenile slow worm was also recorded within one of the air raid shelters to the southwest of the survey area, indicating possible use as a hibernaculum. See Technical Appendix C, Volume 2, for survey results.
- 5.4.284 Although slow worms and common lizards are widespread and locally common, all reptile species have suffered a dramatic decline in Wales and Britain over the last century due to loss, degradation and fragmentation of habitat. Slow worms are found throughout mainland Britain but are most common in Wales and southwest England, while the common lizard is the UK's most common and widespread reptile. Grass snakes are distributed throughout England and Wales but are absent from much of Scotland and from Ireland, with the British pre-breeding population estimated to be 320,000 (British Wildlife Centre, 2012). This species has become gradually scarcer over recent years in Britain, with threats largely arising from human activity, such as habitat loss and modification due to urbanisation, road building and agricultural intensification.
- 5.4.285 The reptiles species likely to be present within the vicinity of the Proposed Improvement receive protection against killing, injury and sale under Schedule 5 of the Wildlife and Countryside Act 1981, and are listed on Section 7 of the Environment (Wales) Act.
- 5.4.286 Taking into account the status of the reptile population in Gwynedd, Wales and the UK, it is considered that the reptile population in the vicinity of the Proposed Improvement is of **local** importance.

Operational Baseline (Year 15 – Without Scheme)

- 5.4.287 Modelling of climatic suitability suggests that suitable climate space for the common lizard may decrease in the UK over the next few decades, as they move north (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). Grass snakes may be adversely affected by warmer drier summers leading to a reduction in suitable wet habitat. Slow worms on the other hand may benefit from warmer conditions. These effects would be balanced against the existing threats of habitat loss and fragmentation and overall it is considered that the future status of reptile populations in Gwynedd and on a wider scale is uncertain.

Great crested newt (*Triturus cristatus*)

- 5.4.288 There are four records of great crested newt within 2km of the Proposed Improvement from the Environment Records Centre (Cofnod) data, with the closest approximately 400m to the southwest in the vicinity of the disused airfield (2003). However, none were recorded during the baseline surveys for this species in 2015 so they have been scoped out of any further assessment.

Other amphibians

Construction Baseline

- 5.4.289 There is one record of common toad within 1km of the Proposed Improvement from the Environment Records Centre (Cofnod) data and potential habitat for the four more common British species, namely common toad, common frog, palmate newt and smooth newt, within the Proposed Improvement footprint, particularly within the smaller watercourses/ditches and rush pasture habitat within the fluvial floodplain. Palmate newts were also recorded during the baseline surveys for great crested newts within Watercourse 0 and the pond within the floodplain to the east of the scheme footprint.
- 5.4.290 All of these species are widespread throughout the UK with common frog the most abundant, with an estimated UK population of about 16,000,000 (DEFRA, 2003), and palmate newts the least abundant, having an estimated population of 1,800,000 in 2003 (DEFRA). Within Gwynedd however, palmate newts are more abundant than smooth newts, which are typically a lowland species. All of these species are thought to be declining, largely due to habitat loss and fragmentation and some, such as the common frog, also suffer from a number of diseases such as *Ranavirus* and *Batrachochytrium dendrobatidis*. The main reasons for the decline of the common toad are thought to be wetland drainage, agricultural activities, pollution and road mortality, with the highest road mortality rate of all the UK amphibians, due to the severance of migration routes.
- 5.4.291 The common toad is listed on Section 7 of the Environment (Wales) Act.
- 5.4.292 Taking into account the status of the amphibian population in Wales and the UK, it is considered that the amphibian population in the vicinity of the Proposed Improvement would be of **local** importance.

Operational Baseline (Year 15 – Without Scheme)

- 5.4.293 Recent reductions in frog and toad populations are consistent with low summer rainfall and consequent lower soil moisture during the drier summers between 2003 and 2006, alongside loss of suitable habitats, habitat fragmentation and road mortality (Biodiversity Climate Change Impact: Report Card 2015, Living with Environmental Change). These trends are likely to continue, particularly as climate change research indicates the likelihood of increasingly hotter, drier summers in the UK. Modelling suggests that the suitable climate space for the common toad could expand in the UK, allowing northward range expansion, although this will depend on their ability to move between habitat fragments. Smooth newts are projected to lose suitable climate space across England but may expand their range in Scotland. Overall it seems likely that amphibian populations will continue to decline in the UK and Wales and are likely to be less abundant by 2035, by which time they may remain of local importance or could become important on a county scale.

Migratory fish and brook lamprey

Construction Baseline

- 5.4.294 NRW have advised that Atlantic salmon, brown/sea trout, European eel and all three native lamprey species (brook, river and sea) are likely to be present within the Afon Artro. There is a Cofnod record of brook lamprey upstream to the northeast of the Proposed Improvement footprint within a tributary of the Afon Artro.
- 5.4.295 The European Eel, Atlantic salmon and Brown/Sea trout are all included on Section 7 of the Environment (Wales) Act. Provision for the European eel is also made under the Eels (England and Wales) Regulations 2009 (see paragraph 5.4.65 in Policy Framework above) and Atlantic salmon is also listed on Annex IIa of the Habitats Directive. The UK Conservation Status of the Atlantic salmon

(*Salmo salar*) is currently Stable⁴⁷ and the UK salmon population comprises a significant proportion of the total European stock. Brown/Sea trout (*Salmo trutta*) are widespread throughout England and Wales, occupying 67% of the total river length in 2002 (Gray and Mee, 2002) and are particularly prevalent in Wales, northern England and southwest England. Catches of migratory trout and salmon are declining in Gwynedd although brown trout still appears to be maintaining steady numbers. Reasons for this decline in salmonids are thought to be due to pollution, invasive non-native plant species (leading to severe erosion as they outcompete native marginal flora), habitat degradation due to river works, stocking with non-native trout, illegal poaching and by-catches, possible effects of global rise in sea temperatures and international fisheries catch during their marine phase.

5.4.296 The European eel (*Anguila anguila*) stock is facing an unprecedented level of decline and is on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2010)⁴⁸. It is also listed as 'Critically Endangered' on the IUCN red list. Reasons for this decline include barriers to migration including damage by hydropower turbines; poor body condition; climate change and/or changes in oceanic currents; disease and parasites (particularly *Anguillocola crassus*, a nematode worm); exploitation and trade of glass, yellow and silver eels; changing hydrology; habitat loss; pollutants; and predation (The IUCN Red List of Threatened Species, 2016).

5.4.297 All three native species of lamprey are listed on Annexe IIa of the Habitats Directive and river and sea lamprey are also listed on Section 7 of the Environment (Wales) Act. Although there are no accurate survey data for lampreys in Gwynedd, they are routinely recorded during fish rescues on many of the watercourses in the county (NRW). The sea lamprey, *Petromyzon marinus*, is reasonably widespread in UK rivers. In some places it is still common, but it has declined in parts of its range and has become extinct in a number of rivers. It appears to reach its northern limit of distribution in Scotland and does not occur north of the Great Glen. It occurs in estuaries and easily accessible rivers over much of the Atlantic coastal area of western and northern Europe (from northern Norway to the western Mediterranean) and eastern North America but has declined in some parts of its European range. The river lamprey, *Lampetra fluviatilis*, is widespread in the UK, occurring in many rivers from the Great Glen in Scotland southwards, and populations are strong. It is found only in western Europe, where it has a wide distribution from southern Norway to the western Mediterranean. The UK populations are considered important for the conservation of the species at an EU level. The brook lamprey, *Lampetra planeri*, is not migratory or parasitic like the other lamprey species and has declined in parts of the UK, although it is still widespread. This species is the most abundant and widespread of the British lampreys and is often found in the absence of the other two species, for example above a barrier that precludes the presence of the migratory species. It is common in many areas of England but is absent from much of Scotland north of the Great Glen, including Orkney and Shetland and all but a few of the Western Isles.

5.4.298 Taking into account the status of lampreys, salmonids and eels in Gwynedd, the migratory fish likely to be present within the vicinity of the Proposed Improvement are considered to be of importance at a **local** level.

Operational Baseline (Year 15 – Without Scheme)

5.4.299 The declining populations of salmonids and eel in Gwynedd are likely to continue due to continued pressure from further barriers to migration as there is increasing demand for sustainable energy sources including hydroelectricity; further increases in sea temperature; potential for changes in hydrology of watercourses due to altered rainfall patterns; expected increases in diseases and

⁴⁷ Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December, JNCC, produced on 11/10/2013

⁴⁸ OSPAR is the mechanism by which 15 governments and the EU cooperate to protect the marine environment of the North-East Atlantic

parasites due to warmer temperatures; likely increases in invasive non-native plant species due to increased temperatures; and increased pressure from fisheries due to an expanding human population. Many of these threats are also likely to impact on UK lamprey populations, leading to future declines, although brook lamprey may be more resilient due to their non-migratory lifestyle. Conversely, the Eels (England and Wales) Regulations 2009 and legislation protecting salmonids such as the Salmon and Freshwater Fisheries Act 1975 and the Salmon Act 1986 should help to reduce these pressures, along with BAP actions such as those described above. There has been an apparent rise in European eel recruitment levels in 2011, 2012 and 2013 (IUCN) but this should be regarded with caution. Overall, it is considered likely that the populations of migratory fish and brook lamprey in the vicinity of the Proposed Improvement will have declined by 2035. However, it is likely that they would remain important on a local scale.

Invertebrates

Construction Baseline

5.4.300 Invertebrate surveys were not undertaken during baseline surveys for the Proposed Improvement as it was not considered that the habitats within the scheme footprint warranted this during the scoping stage. The data from the Environmental Records Centre (Cofnod) includes records within 1km of the Proposed Improvement footprint of the following notable species of invertebrate, all of which are listed on Section 7 of the Environment (Wales) Act 2016 as species of principal importance for the conservation of biodiversity in Wales:

- Hornet robberfly (4 records 400m to the east);
- Small heath butterfly (2 records within 1km to the north);
- Heath rustic moth (1 record, 800m to the east);
- Oak lutestring moth (4 records 700m to the east);
- Latticed heath moth (1 record within scheme footprint, at the tie-in with Mochras Road);
- Lesser searcher beetle (1 record within 1km of the southern half of the scheme footprint); and
- Wall mason bee (2 records within 1km of the southern half of the scheme footprint).

5.4.301 Of these species, the hornet robberfly, small heath butterfly, heath rustic, oak lutestring and lesser searcher beetle are unlikely to occur frequently within the ZoI of the Proposed Improvement due to a lack of suitable or optimal habitat but there is habitat suitable for the latticed heath moth and wall mason bee that would be affected.

Latticed heath moth (Chiasmia clathrata)

5.4.302 The latticed heath is a moth of open habitats, including bogs, heaths, sand dunes and unimproved grassland, where the larval foodplants comprising bedstraws, clovers, trefoils, lucerne and meadow vetchling can be found. The species is fairly common in England and southern Scotland but less common in North Wales and has undergone a dramatic decline throughout the UK of 87% over a 35 year period (1968 – 2002) causing it to be listed as a UK BAP Priority species. This decline is thought to be due to a number of factors, including habitat change, pollution and the use of pesticides. Globally, the species is present throughout Europe, eastern Siberia and Japan. Due to its sparse distribution within North Wales, the species is considered to be **regionally** important. The species was recorded within the footprint of the Proposed Improvement at the tie-in with Mochras Road in 2006 and three of its larval foodplants (*Trifolium repens*, *Galium palustre* and *Lotus corniculatus*) were recorded frequently within the rush pasture and grassland located in the fluvial floodplain of the Artro during the baseline NVC survey in 2015.

Wall (or Western) mason bee (Osmia parietina)

5.4.303 The wall mason bee is a solitary bee species whereby the queen constructs individual nest cells without forming colonies. Like other mason bees, this species prefers to nest in cavities in dry stone walls but sites in rock faces and dead standing trees are also used. The species shows a preference for unimproved mesotrophic grassland and woodland glades and clearings with an

abundance of its sole pollen resource, common bird's foot trefoil (*Lotus corniculatus*). Suitable nesting sites are also required as described above. This bee is found across most of Europe but is confined mostly to hilly or mountainous wooded areas. In the UK it has recently been recorded in Lancashire and Cumbria, and is present in small numbers in scattered localities in Scotland and two sites in North Wales (www. Arkive.org). It is classified as rare in the UK and is therefore considered to be **nationally** important. The species was recorded twice within the same 1km square as the southern half of the Proposed Improvement in 1902 but according to NRW is under-recorded and could still be present within the area due to the presence of the foodplant, common bird's-foot trefoil, which was recorded within half of the quadrats within the rush pasture and grassland in the fluvial floodplain of the Artro during the 2015 baseline NVC survey.

- 5.4.304 Agricultural change, through increased grazing of herb-rich upland meadows with bird's foot trefoil, and the reduction in the management of woodland resulting in the loss of open, sunny, flower-rich glades and clearings have accelerated the decline of the wall mason bee. Conversion of meadows to silage, rye-grass leys or arable production has also affected this bee. The loss of sunny, rocky outcrops through scrub encroachment and the removal or destruction of dry-stone walls and standing dead wood has limited the availability of nest sites. The principal conservation measure for this species has been found to be the management of bird's-foot trefoil (www. Arkive.org).

Operational Baseline (Year 15 – Without Scheme)

Latticed heath moth (Chiasmia clathrata)

- 5.4.305 The existing threats to the latticed heath in the UK include agricultural intensification, habitat fragmentation, inappropriate and inconsistent management including excessive tidying such as hedge flailing, use of pesticides, herbicides and fertilisers, climate change and possibly light pollution. According to the Biodiversity Climate Change Impacts: Report Card 2015 (Living with Environmental Change) climate change is likely to have negative effects on lepidopteran species such as the latticed heath that overwinter as caterpillars or pupae, due to warmer wetter winters. All or most of these threats are likely to continue and increase over the next few decades, so it is likely that this species will continue to decline but due to its relative abundance throughout England but scarcity in North Wales, it is likely to remain of regional importance in North Wales by 2035.

Wall (or Western) mason bee (Osmia parietina)

- 5.4.306 It is likely that the existing threats to the wall mason bee will continue over the next few decades, with a continued reduction in suitable habitat due to agricultural intensification and removal of dry stone walls and standing dead wood. It is unlikely that climate change would significantly affect the species, although they may benefit from warmer drier summers increasing the number of days with suitable foraging conditions. Overall however, it is likely that the species would continue to decline due to the changes in agricultural practices but is likely to remain of national importance by 2035.

Higher Plants

Construction Baseline

- 5.4.307 A few clumps of sharp rush (*Juncus acutus*) were recorded adjacent to the Afon Artro, approximately 20m to the west of the construction area of the Proposed Improvement during the Extended Phase 1 Habitat Survey undertaken in 2014 (see Figure 5.4.13, Volume 1a). This is a Nationally Scarce species, which means it has been recorded in only 16-100 hectads in Great Britain and is considered to be of importance on a **national** scale.

- 5.4.308 Sharp rush is a tall, tussock-forming perennial herb typically occurring in saline or brackish dune slacks, in the uppermost levels of dry saltmarsh and on shingle banks. It is sparsely distributed within the British Isles, with the main populations occurring along the coast lines of South-East Ireland, North-West Wales, South Wales and South-West England. Although it is Nationally Scarce,

the status of this species seems relatively stable and there have been very few 10km-square losses since 1962 (Online Atlas of the British and Irish Flora).

Operational Baseline (Year 15 – Without Scheme)

5.4.309 Although the current status of the sharp rush is relatively stable, climate change could cause changes in distribution and abundance. It is possible that rising sea levels could reduce the habitat available to the species due to coastal squeeze but conversely the range of the species may increase in the UK as it currently only occurs in the southern half of the country and increases in temperature could create increased suitable climate space further north. It is therefore uncertain what the population trend will be for sharp rush in the coming decades but it is likely to remain nationally important by 2035.

Lower Plants

Construction Baseline

5.4.310 The Local Environmental Records Centre (Cofnod) search included a record of the following notable bryophyte species located within 1km of the Proposed Improvement:

- *Andreaea rothii* subsp. *rothii* (a moss, 490m to the east).

5.4.311 The Local Environmental Records Centre (Cofnod) search included records of the following notable lichen species located within 1km of the Proposed Improvement:

- *Gyalecta (Pachyphiale) carneola* (2 records 500-600m to the east; 3 further records within 2km);
- *Catinaria atropurpurea* (500m to the northeast; 4 further records within 2km);
- *Bacidia biatorina* (560m to the east; 3 further records within 2km);
- *Agonimia octospora* (550m to the east);
- *Arthonia anombrophila* (550m to the east); and
- *Normandina acroglypta* (550m to the east).

5.4.312 None of the lichen or bryophyte species included in the Cofnod data (listed above) could be directly impacted by the proposed works or indirectly impacted due to air pollution for example, as they are all located over 400m away from the scheme footprint and are therefore considered too far away to be significantly affected by any changes in air quality likely to result from the construction of the Proposed Improvement. They are therefore not considered further within the assessment.

5.4.313 The baseline lower plant survey undertaken in January 2016 and updated in December 2016 recorded a low diversity of bryophytes, with predominantly only common or widespread species observed. The only exception to this was a liverwort, *Porella pinnata*, which was found on a number of rocks within the Afon Artro, upstream of the location of the proposed bridge over the Artro, in the vicinity of the proposed footway between the proposed bridge and Llanbedr village (NGR SH 58346 26838). This liverwort is relatively scarce in the UK, being predominantly confined to Wales and southwest England. However, as this area is upstream of the proposed river crossing and no in-river works are proposed in the vicinity of the proposed footway, it is considered that there is no potential for any significant impact on this species and it has been scoped out of any further assessment.

5.4.314 Most of the lichens recorded were also widespread species, with the exception of three notable species that will be included in the impact assessment. These are listed in Table 5.4.9 below, with the scale of their importance and reasons for inclusion (see Figure 5.4.13, Volume 1a for locations).

Table 5.4.9: Notable lichens recorded within or immediately adjacent to the Proposed Improvement footprint (Threat levels from: A Lichen red Data List for Wales, Plantlife 2010)

Species	Wales Red List Threat Status	British Red List Threat Status	Rarity	International Responsibility	Section 7	Scale of Importance
<i>Schismatomma graphidioides</i>	Vulnerable	Vulnerable	Nationally Scarce	☑	☑	Regional
<i>Gyalecta (prev. Pachyphiale) carneola</i>	Near Threatened	Least Concern	-	-	Listed as part of the Lobarion Community	Local
<i>Punctelia reddenda</i>	Near Threatened	Least Concern	-	-	Listed as part of the Lobarion Community	Local

Schismatomma graphidioides

5.4.315 A very small patch of *Schismatomma graphidioides* is present on a mature sycamore within one of three isolated copses (the central one) located on the hillside to the south of the Afon Artro (NGR SH 58912 26764) and also on another mature sycamore within the car parking and picnic area between the Afon Artro and Mochras Road (NGR SH 58112 26967).

5.4.316 The species is a trunk epiphyte occurring on a wide range of broad-leaved trees including sycamore, hornbeam, beech, ash, aspen, oak and wych elm. In terms of habitat, *Schismatomma graphidioides* is a species of semi-open wooded situations, most commonly found at woodland-parkland interfaces, in sheltered glades, wood pasture, and at woodland edges. Like other epiphytes with similar ecology it is probably highly sensitive to eutrophication from artificial fertilisers, ammonia and NOx compounds etc. that raise bark pH and fertility above normal levels (Lichens of Wales, www.wales-lichens.org.uk).

5.4.317 *Schismatomma graphidioides* is sparsely distributed throughout the UK, within only a few locations, mainly in Scotland, southwest England and mid-Wales. For this reason and because of its continuing population decline, it is included on the UKBAP and Section 7. It is considered that the UK has an international responsibility for the species because the UK supports more than 25% of the global population. Due to its sparse distribution, it is likely that the population within the scheme corridor could be considered **regionally** important in North Wales, but due to its small size is unlikely to be of national importance.

5.4.318 The main threats to the *Schismatomma graphidioides* include the following (UK priority species pages – Version 2, JNCC, 2010):

- Inappropriate grazing;
- Felling / Loss of trees;
- Limited dispersal;
- Low population density/size;
- Nitrogen deposition; and
- Agricultural nutrient enrichment.

Gyalecta carneola

5.4.319 A very small patch of this species was recorded on the trunk of a mature sessile oak located on the east side of the existing A496 carriageway, on the north side of the trackway entrance to Cae Nest Farm on the north side of Llanbedr (NGR SH 58317 27392).

5.4.320 *Gyalecta carneola* is a crustose lichen, occurring on somewhat shaded, often mossy, rough-barked deciduous trees in long-established woodlands and is an ancient woodland indicator species (Lichens: An Illustrated Guide to the British and Irish Species, Dobson, 2011).

5.4.321 The distribution of *Gyalecta carneola* within the UK is concentrated along the west and south coasts of Scotland, Wales and England, being largely absent from central and eastern England and eastern Scotland. Although it is not listed individually on Section 7 under the Environment (Wales) Act, it is included as one of the constituent species of the *Lobarion* community, which is on this list. The *Lobarion* is a group of lichen species that often grow together forming a distinct community and it grows on trees with mildly acidic or alkaline bark such as ash, sycamore, willow, rowan and old oak. It is characterised by large leafy lichens, especially the four *Lobaria* species but also includes crustose species such as *Gyalecta carneola*. At one time members of the *Lobarion* were found throughout the British Isles but largely as a result of the air pollution of the 19th and 20th centuries it is now largely restricted, outside of Scotland north of the central valley, to parts of the southern uplands, Wales, southern, western and the far north of England. It is mostly found in old parklands, wood pasture and in sheltered gorge woodlands. Occasionally it also occurs on coastal cliffs and among heather in maritime heathland.

5.4.322 Most of the constituent species of the *Lobarion* community are highly sensitive to sulphur dioxide, acid rain and excessive ammonia levels and many examples of the *Lobarion* in Wales are now species poor. *Gyalecta carneola* itself is listed as Near Threatened on the Lichen Red List for Wales (Plantlife, 2010).

Punctelia reddenda

5.4.323 This species was recorded on the trunks of two mature sessile oaks also located on the east side of the existing A496 (at NGR SH 58291 27483 and SH 58208 27541), to the north of the oak supporting *Gyalecta carneola* described above.

5.4.324 *Punctelia reddenda* is an 'old forest' foliose species of humid sites that is found on shaded trees and moss-covered rocks (Lichens: An Illustrated Guide to the British and Irish Species, Dobson, 2011).

5.4.325 The distribution of this species in the UK is concentrated in southwest England and the southern English coast, western Wales and along the southwest and western Scottish coast. There are also a few records scattered throughout Ireland, Shetland and Orkney. As with *Gyalecta carneola* above, this species is not listed on Section 7 individually but is included as one of the constituent species of the *Lobarion* community, the distribution and sensitivities of which are described above.

Operational Baseline (Year 15 – Without Scheme)

Schismatomma graphidioides

5.4.326 The population status of *Schismatomma graphidioides* is currently estimated to be stable in England, Wales, Scotland and the UK, although there is insufficient data to confirm this (UK priority species pages – Version 2, JNCC, 2010). The existing threats to the species described in paragraph 5.4.318 above are likely to continue and climate change could also impact on epiphytic communities including lichen and bryophyte flora due to changes in woodland structure resulting from the phenological responses of different species and also potential increases in herbivore numbers due to warmer winters. The likely increased prevalence of tree diseases, such as ash die-back, could also lead to impacts relating to changes in woodland structure and loss of suitable substrate. However, the microhabitats associated with lichen flora may provide a buffer weakening their direct sensitivity to macroclimatic change (Biodiversity Climate Change Impacts: Report Card 2015, Living with Environmental Change). It is therefore likely that the population of this species may have decreased to some extent by 2035 but it is likely to remain of importance at a regional level.

Gyalecta carneola and *Punctelia reddenda*

5.4.327 Although the Lobarion community has suffered a serious decline over the last two centuries, the current population trend of this community is not known but air quality is likely to have improved to some extent in recent years, which could have led to a stabilisation. According to the Biodiversity Climate Change Impacts Report Card technical paper No. 8: Implications of climate change for UK bryophytes and lichens (Ellis, 2015), for the globally important oceanic bryophyte and lichen flora (including the *Lobarion* community), sensitivity to climate change remains unknown and represents a key area of uncertainty. The status of *Gyalecta carneola* and *Punctelia reddenda* in 2035 is therefore uncertain but it is likely that they would remain of local importance at least.

Non-Native Invasive Plant Species

Construction Baseline

5.4.328 The baseline Extended Phase 1 Habitat Survey undertaken in 2014 and updated in 2015 identified the following four non-native invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act that could be disturbed during site clearance or construction activities (see Figure 5.4.13, Volume 1a):

- Japanese knotweed (*Fallopia japonica*);
- Rhododendron (*Rhododendron ponticum*);
- Himalayan balsam (*Impatiens glandulifera*); and
- Montbretia (*Crocasmia x crocosmiiflora*).

5.4.329 *Rhododendron ponticum* is present on the east side of the existing A496 at the northern end of the scheme corridor; on the south side of Mochras Road to the east of the scheme corridor; and along both sides of the existing A496 at the location of the southern tie-in of the Proposed Improvement.

5.4.330 Japanese knotweed, Himalayan balsam and Montbretia are all present in the vicinity of the car park on the south bank of the Afon Artro and extending along the southern bank to the east, in the location of the proposed bridge over the Afon Artro, with Japanese knotweed also present on the north bank to the east and on the northern and southern sides of Mochras Road as it enters the village. There is another area of Japanese knotweed at the extreme southern limit of the scheme corridor. For locations see Figure 7.1-5: Environmental Master Plan (Volume 1a).

5.4.331 The introduction of exotic alien species has been identified as the largest threat to biodiversity globally, larger than habitat loss, deforestation and pollution. Exotic invasion is the third biggest threat to biodiversity in Welsh NNRs and to SAC sites. Through the deliberate or unwitting actions of man, alien organisms are present in the Welsh countryside, some of which are aggressive colonizers and have the potential to displace native flora, fauna or ecosystems

5.4.332 *Rhododendron* has invaded large tracts of the Snowdonia National Park and is also widespread in many areas of Gwynedd, particularly in woodlands but also in heath and grassland areas. Japanese knotweed is also present throughout Gwynedd and is a particular problem on roadsides and riverbanks. Both Himalayan balsam and giant hogweed are also of particular concern on many ditch, river and stream banks in Gwynedd (Natur Gwynedd, 2004).

5.4.333 A number of factors act to cause the spread of these plants in Gwynedd, including escape from gardens; lack of natural enemies; dispersal by watercourses; movement of contaminated soil and/or material from affected sites; inappropriate and/or illegal disposal of cut material; and activities that disturb vegetation and the underlying soil (particularly for rhododendron and Japanese knotweed).

5.4.334 Japanese knotweed, *Rhododendron ponticum*, Himalayan balsam and Montbretia are all listed on Schedule 9 of the Wildlife and Countryside Act 1981, making it illegal to introduce them or allow them to spread in the wild.

5.4.335 As non-native invasive plant species are not a valued ecological feature, they are not assigned a level of importance in this assessment.

Operational Baseline (Year 15 – Without Scheme)

5.4.336 The non-native invasive plant species currently present within Gwynedd are likely to continue to spread and it is possible that factors relating to climate change, such as increased temperatures, increased carbon dioxide concentrations and stormier weather could provide conditions more favourable to non-native species, which could further assist their spread within the UK in the future.

Ecosystem Services

Construction Baseline

Cultural services provided by the natural river corridor in the vicinity of the car park

5.4.337 The car park located adjacent to the Afon Artro on the north side of Mochras Road between the village of Llanbedr and the railway to the west is currently also a picnic area and a popular location for fishing and dog walking (see Figure 7.4: Environmental Master Plan, Volume 1a). This riverside location is very pleasant aesthetically due to the natural river corridor bordered by mature trees and its associated wildlife, including several anecdotal records of otter sightings, which are uncommon in Wales. Immediately adjacent to the car park a dam has been constructed creating a pool often used for fishing and likely to provide good foraging habitat for otters, hence the sightings. The cultural services provided by the natural environment in this location are considered to be of importance on a **local** level.

Cultural services provided by the semi-natural habitat in the vicinity of the PRoW along the flood embankment

5.4.338 There is a Public Right of Way (PRoW Llanbedr No.1, see Figure 7.3: Environmental Master Plan, Volume 1a) that traverses the top of the flood embankment between the existing A496 within the northern half of Llanbedr and the Afon Artro, before crossing via the footbridge adjacent to the sewage treatment works to the north, where it joins the Wales Coastal Path. The visual amenity of this route is enhanced by the semi-natural landscape, including the reedbed habitat within the adjacent ditch (Watercourse 2), rush pasture and willow scrub within the floodplain grazing marsh beyond, and views over the Afon Artro river corridor. All these different habitats also support a diversity of flora and fauna, such as dragonflies and damselflies, breeding birds such as skylark and reed bunting, and potentially glimpses of brown hares and otters, adding to the experience of the walker. The cultural services provided by the natural landscape in the vicinity of this footpath are considered to be of **local** importance.

Services to agriculture provided by pollinators benefitting from semi-natural habitat within the scheme corridor

5.4.339 Much of the semi-natural habitat within the scheme corridor is good foraging habitat for pollinator species such as honey bees, bumble bees, solitary bees, parasitic wasps, hoverflies, butterflies, moths and beetles. Such habitat includes areas of lowland meadow, floodplain grazing marsh and rush pasture. As recognised by the Wales Action Plan for Pollinators (2013), pollinator species are important in Wales for crops such as fruit and oilseed rape, clovers and other nitrogen-fixing plants that are important for improving the productivity of pasture systems for livestock grazing and wildflowers. It is considered that the services provided by the species likely to utilise habitat within the scheme corridor are important on a **local** level.

Operational Baseline (Year 15 – Without Scheme)

Cultural services provided by the natural river corridor in the vicinity of the car park

5.4.340 By 2035, the car park, picnic area and adjacent river habitat is unlikely to have changed significantly without the Proposed Improvement in place although climate change may have an impact on the

volume of water within the Afon Artro, particularly during the summer months, if they are to become warmer and drier as predicted. However, it is anticipated that the site would remain of importance at a local level.

Cultural services provided by the semi-natural habitat in the vicinity of the PRow along the flood embankment

5.4.341 The habitat in the vicinity of PRow Llanbedr No.1 between the Afon Artro and Llanbedr village is unlikely to have changed significantly by 2035, although it is possible that the floodplain grazing marsh to the south would have more of a saltmarsh component due to rising sea levels. There could also be negative changes due to agricultural intensification/improvement and ditch clearance for example. However, it is considered that the cultural services provided by the natural habitat in this location would remain of importance at a local level.

Services to agriculture provided by pollinators benefitting from semi-natural habitat within the scheme corridor

5.4.342 It is possible that the availability or quality of the habitat available to pollinators within the scheme footprint could have decreased slightly by 2035 due to agricultural intensification resulting from pressure from an increased human population, however if this is the case it may be that the population within this area would be even more important due to greater agricultural need and potential decline in pollinators elsewhere. It is also possible that some pollinator species may change their habitat requirements through behavioural or evolutionary processes. For example, as a result of increases in temperature, the requirements of some warmth-loving species (including some butterflies) for sparse or short vegetation may be reduced and taller vegetation providing cooler, shaded microclimates may become suitable. This could result in a negative impact if increased grazing pressure due to agricultural intensification results in a shorter and less diverse sward. However, this is very speculative and the diversity of pollinator species likely to be present increases the uncertainty of the effects of climate change but it is likely that their pollination services would remain important at a local level.

Scoping Out Important Ecological Features

5.4.343 Following the compilation of baseline data for all important ecological features potentially affected by the Proposed Improvement, it is clear that some would not be impacted either directly or indirectly when considering the types of impacts likely to arise (see paragraph 5.4.91 above). Therefore some of these features have been scoped out of the impact assessment at this stage as summarised in Table 5.4.10 below.

Table 5.4.10: Important ecological features scoped out of the impact assessment

Important Ecological Feature	Scale of Importance	Rationale for Scoping Out of the Impact Assessment
Morfa Harlech a Morfa Dyffryn SAC	International	There are no mobile species features of this site, none of the features are fluvially connected to the Proposed Improvement, and, at a distance of 1.2km from the Proposed Improvement, the site is outside the ZOI for air quality impacts during construction or operation, ensuring that none of the Conservation Objectives of any of the features of the SAC would be affected by the Proposed Improvement, so there is no likelihood of an impact on this SAC.
Afon Eden – Cors Goch Trawsfynydd SAC	International	This site is located 12.3km to the east of the Proposed Improvement and as a European protected site within 25km with otter as a mobile qualifying feature, it has been considered in this assessment. However, although it is acknowledged that there could be impacts on the local otter population (without mitigation), and there is likely to be occasional dispersal of otters between the two catchments, none of the Conservation Objectives of the otter feature of this SAC could be affected by the Proposed Improvement, so there is no likelihood of an impact on this SAC. Otters have been considered as a separate Important Ecological Feature in this assessment.
Afon Gwyrfaï a Llyn Cwellyn SAC	International	This site is located 24.9km to the north of the Proposed Improvement and as a European protected site within 25km with otter as a mobile qualifying feature, it has been considered in this assessment. However, although it is acknowledged that there could be impacts on the local otter population (without mitigation), the population in the vicinity of the proposed works is considered very unlikely to be part of the population of the SAC due to the distance and separate river catchments involved, although occasional dispersal between the populations could occur. None of the Conservation Objectives of the otter feature of the SAC would therefore be affected by the Proposed Improvement, so there is no likelihood of an impact on this SAC. Otters have been considered as a separate Important Ecological Feature in this assessment.
Glynllifon SAC	International	This site is located 26.1km to the north of the Proposed Improvement and as a European protected site within 30km with lesser horseshoe bat as a mobile qualifying feature, it has been considered in this assessment. However, although it is acknowledged that there could be impacts on the local lesser horseshoe bat population (without mitigation), the population in the vicinity of the proposed works is not considered likely to be part of the population of the SAC due to the distance and abundance of good quality habitat in the surrounding area, including Coedydd Derw a Safleoedd Ystumod Meirion SAC located 100m to the east. Therefore, none of the Conservation Objectives of the SAC would be affected by the Proposed Improvement so there is no likelihood of an impact on this SAC. Lesser horseshoe bats have been considered as a separate Important Ecological Feature in this assessment.
Morfa Dyffryn NNR	National	There are no mobile species features of this site, no fluvial pathways linking this site to the Proposed Improvement and, at a distance of 1.9km from the Proposed Improvement, the site is outside the ZOI for air quality impacts during construction or operation, so there is no likelihood of an impact on this site.

Important Ecological Feature	Scale of Importance	Rationale for Scoping Out of the Impact Assessment
Caeau Bwlch SSSI	National	The only feature of this site is the hornet robberfly, which require cattle dung for breeding. There is no cattle grazed pasture within the footprint of the Proposed Improvement, the scheme is not fluvially connected to the site and due to its distance 265m to the east, it is outside the ZoI for air quality impacts during construction and operation.
Coed Lletywalter SSSI	National	There are no mobile species features of this site, no fluvial pathways connecting it to the Proposed Improvement and due to its distance 1.3km to the east, it is outside the ZoI for air quality impacts during construction and operation.
Coed Aber Artro SSSI	National	There are no mobile species features of this site, no fluvial pathways connecting it to the Proposed Improvement and due to its distance 1.75km to the east, it is outside the ZoI for air quality impacts during construction and operation.
Ancient Semi-Natural Woodland (ASNW) sites	Regional	None present that could be directly affected by the Proposed Improvement, or that are fluvially connected or within the 200m threshold for consideration in relation to air quality impacts. Four Restored Ancient Woodland Sites (RAWS) are however scoped into the assessment.
Ponds	Local at most	No ponds located within, immediately adjacent or fluvially connected downstream of the construction area or permanent footprint of the Proposed Improvement. The closest pond is located approximately 40m to the east of the construction area and 65m from the permanent scheme footprint so direct or indirect impacts are unlikely. This pond is also unlikely to be classified as a habitat of principal importance based on the JNCC criteria.
Coastal saltmarsh	National	All the coastal saltmarsh within the ZoI of the Proposed Improvement is included in Morfa Dyffryn SSSI and impacts on this habitat have been assessed as part of the assessment on this site.
Dormouse	Not applicable as not present within ZoI	No dormice recorded during baseline surveys for this species and nearest record approximately 15km to the southeast
Water vole	Not applicable as not present within ZoI	There are two records of water voles within 2km of the Proposed Improvement, with the closest approximately 930m to the east but none were recorded within the ZoI during baseline surveys for this species
Green woodpecker and Lapwing	County	There are records of these species within 2km of the Proposed Improvement but none within the ZoI and they are unlikely to be nesting within the ZoI due to better habitat in the surrounding area
Great crested newt	Not applicable as not present	There are records of great crested newts approximately 470m to the southwest of the Proposed Improvement footprint but none were recorded within the ZoI during baseline surveys for this species

Important Ecological Feature	Scale of Importance	Rationale for Scoping Out of the Impact Assessment
	within ZOI	

Assessment of Environmental Effects

5.4.344 This section outlines the likely effects of the Proposed Improvement on the important ecological features identified for impact assessment, both during its construction and at Year 15 of operation. This initial assessment is undertaken under the assumption that no mitigation measures would be utilised, other than those that are considered to have been designed into the integral structure of the scheme, which will be referred to as ‘embedded mitigation’. Embedded mitigation measures that have been incorporated into the scheme design are described in Table 5.4.11 below. These include aspects of the scheme design that have been provided as mitigation for other topics included in the Environmental Impact Assessment such as Road Drainage and the Water Environment and Community and Private Assets, as well as mitigation for potential impacts on Nature Conservation that have been incorporated into the scheme design through the iterative design process. All these measures are also included in the description of the scheme design in Chapter 2.3: Description of the Proposed Improvement and shown on Figure 7.1-5: Environmental Master Plan (Volume 1a).

Table 5.4.11: Embedded mitigation measures considered as part of the scheme design

Embedded Mitigation Measure (with Location in Chainages)	Impact Avoided/Mitigated	Features Potentially Affected
<p>During consideration of alternative solutions, a T junction was selected for the proposed junction with Mochras Road, rather than a roundabout, due to the lighting requirements associated with a roundabout and the potential negative impacts on bats</p> <p>Ch. 800</p>	<ul style="list-style-type: none"> Avoidance of a potential impact from increased light levels in the vicinity of the former aquarium lesser horseshoe bat maternity roost and bat foraging habitat during operation. Also beneficial for other nocturnal species likely to utilise habitat in the vicinity 	<p>Bats; Badger; Polecat; Hedgehog</p>
<p>Numerous 900mm flood alleviation pipes provided at 2.9m centres at the base of the embankment that crosses the fluvial floodplain between the two proposed bridges (provided as flood mitigation, see Chapter 5.10: Road Drainage and the Water Environment). As mitigation specifically for ecological features, a 900mm pipe would also be located centrally higher in the embankment between the two bridges to provide access at times of inundation</p> <p>Ch. 900 – 1100</p>	<ul style="list-style-type: none"> Reduction in the impact of severance of commuting/foraging routes for a number of animal species that would be able to pass through these pipes; Reduction in the impact from increased road mortality due to animals attempting to cross over the new road; Reduction in changes to the hydrology of habitats to the east of the Proposed Improvement within the floodplain that could have indirect effects on other species due to loss of habitat 	<p>Coastal and floodplain grazing marsh; Purple moor grass and rush pastures; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Reptiles; Amphibians</p>
<p>2.2m x 2.2m box culvert for Watercourse 3 to the north of the proposed northern junction with Llanbedr (provided as mitigation for severance of a badger territory and also access to an area of habitat creation provided as compensation for habitat lost). This culvert would include 400mm mammal ledges on each side, with 600mm head room and 150mm height above the water level in a 1 in 100 year flood event</p> <p>Ch. 1230 - 1250</p>	<ul style="list-style-type: none"> Reduction in the impact of severance of commuting/foraging routes for a number of animal species; Reduction in the impact from increased road mortality due to animals attempting to cross over the new road 	<p>Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Reptiles; Amphibians</p>

<p>2.3m high cattle underpass at northern end (provided as mitigation for severance of pastoral agricultural land (see Chapter 5.9: Community and Private Assets)) Ch. 1180</p>	<ul style="list-style-type: none"> • Reduction in the impact of severance of commuting/foraging routes for a number of animal species; • Reduction in the impact from increased road mortality due to animals attempting to cross over the new road 	<p>Badger; Polecat; Hedgehog; Brown hare</p>
<p>Single span bridge (approximately 16m square span between abutments) over Watercourse 2 to the north of the proposed Artro bridge (provided as mitigation for a number of species, including otters and bats) allowing approximate headroom above water level of the ditch of 3.3m Ch. 1100</p>	<ul style="list-style-type: none"> • Reduction in the impact of severance of commuting/foraging routes for a number of animal species; • Reduction in the impact from increased road mortality due to animals attempting to cross over the new road; • Reduction in potential pollution/disruption/disturbance impacts for this minor watercourse and Afon Artro downstream, including impacts on associated habitats and species 	<p>Pen Llyn a'r Sarnau SAC; Coedydd Derw a Safleoedd Ystumod Meirion SAC; Reedbed; River; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Riparian breeding birds; Reptiles; Amphibians; Migratory fish</p>
<p>Double span bridge (approximately 42m between abutments) over the Afon Artro (integral part of scheme design, to allow passage for the river, Mochras Road and livestock on each side of the river) allowing approximate headroom above river of at least 5.8m Ch. 900</p>	<ul style="list-style-type: none"> • Reduction in the impact of severance of commuting/foraging routes for a number of animal species; • Reduction in the impact from increased road mortality due to animals attempting to cross over the new road; • Reduction in potential pollution/disruption/disturbance impacts for Afon Artro, including impacts on associated habitats and species 	<p>Pen Llyn a'r Sarnau SAC; Coedydd Derw a Safleoedd Ystumod Meirion SAC; River; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Barn owl; Riparian breeding birds; Reptiles; Amphibians; Migratory fish</p>
<p>Permanent underbridge lighting of road/footway to be located at edge of footway and directed away from the Afon Artro river and wildlife corridor at locations where light spill would be screened by proposed bridge piers to ensure minimal lighting of river corridor (<1 lux at southern bank) as mitigation for ecological features including lesser horseshoe bats and otters. Low level bollard lighting with baffles / directional</p>	<ul style="list-style-type: none"> • Reduction in the impact of severance of commuting/foraging routes for a number of animal species; • Reduction in the impact from increased road mortality due to animals attempting to cross over the new road instead of crossing safely under the bridge; • Reduction in potential pollution/disruption/disturbance impacts for Afon Artro, including 	<p>Pen Llyn a'r Sarnau SAC; Coedydd Derw a Safleoedd Ystumod Meirion SAC; River; Bats; Otter; Badger; Polecat; Hedgehog;</p>

<p>hoods and planting would be used to achieve this Ch. 890 No additional lighting proposed throughout the rest of the scheme corridor</p>	<p>impacts on associated habitats and species</p>	<p>Barn owl; Migratory fish</p>
<p>2.6m x 2.6m wildlife and cattle underpass adjacent to Maes Artro (provided as mitigation for lesser horseshoe bats and severance of pastoral agricultural land) Ch. 530</p>	<ul style="list-style-type: none"> • Reduction in the impact of severance of commuting/foraging routes for a number of animal species; • Reduction in the impact from increased road mortality due to animals attempting to cross over the new road 	<p>Coedydd Derw a Safleoedd Ystlumod Meirion SAC; Bats; Badger; Polecat; Hedgehog; Brown hare</p>
<p>Provision of two covered attenuation areas, one on each side of the proposed road, to the south of the proposed Artro bridge (Ch. 850); and an open attenuation pond to the east of the Proposed Improvement to the south of Maes Artro (Ch. 370). The pond would be fenced off with stock-proof fencing, which would allow a marshy/wet area providing suitable habitat for a number of species. Filter strips and filter drains would be also be incorporated into the scheme design (Ch. 900 - 1100)</p>	<ul style="list-style-type: none"> • Reduction in the impact from loss of foraging habitat for a number of animal species; • Pollution prevention mitigation for operational phase 	<p>Morfa Dyffryn SSSI; Bats; Badger; Polecat; Hedgehog</p>
<p>1m high boundary walls to be provided on each side of the new road (provided as mitigation for visual impacts on landscape, see Chapter 5.3: Landscape), which would reduce light spill from traffic to the adjacent habitats. These would extend through most of the Proposed Improvement corridor, except for the main cutting and northern and southern tie-ins (Ch.300 – 550 and 830 - 1400)</p>	<ul style="list-style-type: none"> • Reduction in the impact of severance of commuting/foraging routes for a number of animal species 	<p>River; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Barn owl; Migratory fish</p>

5.4.345 A list of the types of impacts that could occur as a result of both the construction and operational phases of the Proposed Improvement are provided in paragraph 5.4.91 in Baseline Conditions above. The following paragraphs provide a summary of how these potential impacts would affect the important ecological features, with each impact characterised in detail in Tables 5.4.12 (construction impacts) and 5.4.13 (operational impacts). In this section and in these tables, the impacts are described without mitigation in place, other than the embedded mitigation described in Table 5.4.11 above. The tables also assign a scale of significance to each impact on each ecological feature, according to the methodology described in paragraphs 5.4.52 – 53, including reasons why an impact would not be significant where relevant.

Construction Impacts

Direct loss or risk of physical damage to habitats and species

Ecological Features Potentially Affected: **RAWS; Trees and hedgerows; Lowland mixed deciduous woodland; Coastal and floodplain grazing marsh; Lowland meadow; Purple moor grass and rush pasture; Reedbed; Bats including Lesser Horseshoe (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC); Otter (and therefore Pen Llyn a'r Sarnau SAC); Badger; Polecat; Hedgehog; Brown hare; Breeding birds; Reptiles; Amphibians; Fish; Invertebrates; Sharp Rush; Lichens**

5.4.346 During site clearance, there would be permanent loss of 14 scattered mature trees, 150m of species-rich hedgerow, three areas of mixed and broad-leaved woodland amounting to 0.4ha, including a sycamore supporting the notable lichen *Schismatomma graphidioides*, 0.63ha of coastal and floodplain grazing marsh, including 0.35ha of purple moor grass and rush pasture, and 0.79ha of lowland meadow. The loss of these areas would also constitute loss of habitat used by a number of animal species, including all the bat species recorded in the vicinity of the Proposed Improvement; otter; badger; polecat; hedgehog; brown hare; breeding birds including notable species such as lesser spotted woodpecker, barn owl and red kite; reptiles and amphibians; latticed heath moth and wall mason bee. As the local otter and lesser horseshoe bat populations are likely to be linked with the SAC populations of these species within Pen Llyn a'r Sarnau SAC and Coedydd Derw a Safleoedd Ystumod Meirion SAC respectively, there is potential for this habitat loss to affect these sites as well. The embedded provision of an open attenuation pond adjacent to the proposed southern junction leading into Llanbedr at Ch. 370 would reduce the impact from loss of foraging habitat to some extent for many species by providing alternative suitable foraging habitat for species such as bats, polecats, hedgehogs and amphibians.

5.4.347 Two Restored Ancient Woodland Sites, mature trees and retained areas of mixed deciduous woodland located immediately adjacent to the construction area would also be at risk of physical damage during the proposed works due to construction traffic and damage to the root protection areas due to soil compaction, alterations to local drainage and root damage during excavation for example. Areas of the habitats described as suffering direct loss in paragraph 5.4.346 above that are outside the Proposed Improvement footprint but lie within the temporary construction area, would also be liable to physical damage due to construction traffic and activities. Sharp rush and the three notable lichen species recorded (*Schismatomma graphidioides*, *Gyalecta carneola* and *Punctelia reddenda*) are also at risk of physical damage, particularly due to construction traffic.

5.4.348 During clearance and construction activities within areas of habitat used by ecologically important animal species, there may be some potential for injury or mortality of individuals of these species, which could include bats during tree clearance and demolition (particularly of the roosts in the builder's yard); badgers during works in the vicinity of active setts, including the destruction of an annexe sett; breeding birds during removal of suitable vegetation; reptiles and amphibians during site clearance and watercourse realignment; fish during in-channel works; and notable invertebrate species including latticed heath moth and wall mason bee during site clearance.

5.4.349 There would be no direct loss or direct physical damage to any internationally or nationally protected sites.

Disturbance or disruption of species

Ecological Features Potentially Affected: **Bats including Lesser Horseshoe (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC); Otter (and therefore Pen Llyn a'r Sarnau SAC); Badger; Breeding birds**

5.4.350 Bats, otters and badgers are all at risk of disruption due to severance of commuting routes or foraging habitat due to construction activities, temporary lighting, noise and the presence of construction machinery, materials or personnel during the construction period (approximately 18

months). Lesser horseshoe, greater horseshoe, barbastelle, *Myotis* and brown long-eared bats are particularly sensitive to increased light levels. The corridor of the Afon Artro is a particularly important commuting and foraging route for bats and otters. There is also potential for disturbance of the resting places of these species, including otter resting places located along the banks of the Artro; bat roosts including lesser horseshoe roosts in the builder's yard, in the former aquarium building and Maes Artro, the latter two being known maternity roosts for this species; and a main and annexe badger sett. There is also potential for disturbance of breeding birds, including a low risk of disturbing nests of important species such as lesser spotted woodpecker, barn owl and red kite. Again, because of the potential impacts on otters and lesser horseshoe bats, there is potential for impacts on Pen Llyn a'r Sarnau SAC and Coedydd Derw a Safleoedd Ystlumod Meirion SAC due to potential disturbance or mortality of these species during construction.

Changes in water quality

Ecological Features Potentially Affected: Pen Llyn a'r Sarnau SAC; Morfa Dyffryn SSSI; Coastal and Floodplain Grazing Marsh; Purple Moor Grass and Rush Pastures; Reedbeds; Afon Artro River; Bats including Lesser Horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter; Amphibians; Fish; and Cultural Services provided by the River Corridor

5.4.351 There is potential for siltation or other pollution of the watercourses and fluvial floodplain within the corridor of the Proposed Improvement, which could lead to impacts on receptors further downstream including Pen Llyn a'r Sarnau SAC and Morfa Dyffryn SSSI. Habitats that could be directly affected include the rivers and watercourses, all part of the Afon Artro catchment, along with habitats and species directly associated with these including reedbeds, fish and amphibians. Habitats within the fluvial floodplain of the Artro, including coastal and floodplain grazing marsh and purple moor grass and rush pasture are also at risk from construction-related water pollution. In addition, a number of species utilise the habitats described above for foraging, including bats and otters, and these could be affected due to degradation of the foraging resource available to them. As the natural environment of the river corridor could be compromised by these impacts arising from construction-related pollution, this would also have a negative effect on the cultural services provided by the river corridor in the vicinity of the car parking, picnic and fishing area located between Mochras Road and the river.

Changes in air quality

Ecological Features Potentially Affected: Coedydd Derw a Safleoedd Ystlumod Meirion SAC; Pen Llyn a'r Sarnau SAC, Morfa Dyffryn SSSI, Restored Ancient Woodland Sites (RAWS); and Lichens

5.4.352 Coedydd Derw a Safleoedd Ystlumod Meirion SAC, Pen Llyn a'r Sarnau SAC, Morfa Dyffryn SSSI and four RAWS are located within the thresholds identified in Chapter 5.1: Air Quality as being at risk from dust associated with construction activities, earthworks or trackout during the construction period. Trackout is the transport of dust and dirt from the construction site onto the road network, where it may be deposited and then re-suspended by vehicles using the network. The four trees supporting notable lichen species that would be retained within the scheme corridor would also be at risk from dust due to construction, earthworks and trackout.

Spread of invasive species

Ecological Features Potentially Affected: Pen Llyn a'r Sarnau SAC; Morfa Dyffryn SSSI; RAWS; Lowland Mixed Deciduous Woodland; Coastal and Floodplain Grazing Marsh; Lowland Meadow; Purple Moor Grass and Rush Pastures; Reedbeds; Rivers; and Cultural Services Provided by the Natural Landscape

5.4.353 There is potential for the spread of *Rhododendron ponticum*, Japanese knotweed, Himalayan balsam and Montbretia throughout the proposed construction area and beyond due to insufficient biosecurity measures. This could have an adverse impact on the majority of the habitat features present within the scheme corridor, as well as the potential for transportation via fluvial pathways to the two protected sites downstream of the proposed works (Pen Llyn a'r Sarnau SAC and Morfa

Dyffryn SSSI), and also via construction traffic to the two RAWs immediately adjacent to the construction area at the southern end of the scheme corridor.

Loss or degradation of ecosystem services

Ecological Features Potentially Affected: Cultural Services Provided by the Natural Landscape; and Services to Agriculture Provided by Pollinators

5.4.354 There are two public assets in the vicinity of the proposed works that allow the public enjoyment of the natural environment in the vicinity, namely the Public Right of Way along the top of the flood embankment (PROW 1) and the car parking, picnic and fishing area between Mochras Road and the Afon Artro. The use of these assets would be lost completely during the construction period due to need for their closure due to their close proximity to the proposed works.

5.4.355 Some of the important habitat features that would be affected by the Proposed Improvement also provide a valuable resource for numerous pollinator species that in turn provide an important service to local agriculture. Due to the permanent loss and short-term damage to areas of these habitats, including lowland meadow, coastal floodplain and grazing marsh and purple moor grass and rush pastures, there would be a net loss in foraging resource available to the local pollinator population without mitigation/compensation.

Operational Impacts

Increased mortality of species

Ecological Features Potentially Affected: Bats including Lesser Horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter (and therefore Pen Llyn a'r Sarnau SAC); Badger; Polecat; Hedgehog; Brown Hare; Barn Owl; Reptiles; and Amphibians

5.4.356 The Proposed Improvement bisects two badger territories and is known to cut across commuting and foraging routes used by other species, including bat species and otters. Lesser horseshoe bats are particularly sensitive to obstruction of commuting routes due to the presence of new roads as they tend to fly low over the road surface, making them vulnerable to road traffic collision. Polecats, hedgehogs, brown hares, barn owls, reptiles and amphibians are also likely to need to cross from one side of the scheme to the other, as the scheme bisects suitable habitat for all of these species, and they also have the potential to be struck by traffic in doing so. Two wide span bridges, an oversized box culvert, two large underpasses for use by stock and wildlife, numerous 900mm pipes to be provided at the base of the embankment throughout the fluvial floodplain, and a 900mm dry pipe higher up within this section, are all included in the scheme design as embedded mitigation. These features would significantly reduce the risk of road traffic mortality faced by the species mentioned above, particularly for species within the wetter habitats such as otters and amphibians. The heights of the proposed bridges over the Afon Artro and Watercourse 2 (5.8m and 3.3m respectively), the oversized culvert for Watercourse 3 (2.2m) and the underpasses adjacent to Maes Artro (2.6m) and south of the northern proposed junction with Llanbedr (2.3m) would all be sufficient for use by lesser horseshoe bats and all the underpasses proposed (including the flood alleviation pipes and dry pipe) would be suitable for use by badgers, otters, polecats, hedgehogs, brown hares, reptiles and amphibians. Barn owls may occasionally cross underneath the two proposed bridges, and even potentially the stock underpasses but would be unlikely to use any of the other structures provided and are more likely to cross elsewhere above the road, making them vulnerable to road traffic collision.

5.4.357 Amphibians and possibly reptiles could also be at risk of mortality from becoming trapped within gully pots if these are incorporated into the design at the detailed design stage.

Disturbance/disruption of species

Ecological Features Potentially Affected: *Bats including Lesser Horseshoe (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC); and Otter (and therefore Pen Llyn a'r Sarnau SAC)*

5.4.358 It is considered that the only significant impacts that could arise from disturbance or disruption of species during operation would be those affecting bat species or otters. Roosting, commuting or foraging bat could be subject to disturbance or disruption due to light and noise from traffic using the new route, and foraging/commuting bats could also suffer disruption due to the proposed lighting of the road and footway underneath the new bridge over the Artro and Mochras Road, although this would be minimised by the embedded lighting design to reduce lightspill to the river corridor and is therefore not likely to be significant, particularly as the existing Mochras road is lit by streetlights in this location. These factors could also cause disturbance to otters that are known to use resting sites and foraging habitat along the Artro river corridor in the vicinity of the proposed bridge and these resting sites could also be subject to some disturbance during future maintenance of the two proposed bridges.

Water quality

Ecological Features Potentially Affected: *Pen Llyn a'r Sarnau SAC; Morfa Dyffryn SSSI; Reedbed; Afon Artro; Bats (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC); Otter; Amphibians; Fish; and Cultural Services provided by the River Corridor*

5.4.359 Due to the embedded pollution prevention mitigation including three attenuation areas, filter strips and filter drains throughout the scheme corridor, the predicted risk of pollution events affecting the watercourses during operation is not considered significant (see Chapter 5.10: Road Drainage and the Water Environment).

Air quality

Ecological Features Potentially Affected: *Coedydd Derw a Safleoedd Ystumod Meirion SAC; RAWs; and Lichens*

5.4.360 Coedydd Derw a Safleoedd Ystumod Meirion SAC and four Restored Ancient Woodland Sites (RAWs) are located within 200m of the Proposed Improvement footprint, which is the threshold for potentially significant effects due to traffic emissions during operation (see Chapter 5.1: Air Quality). The new road would move the majority (an estimated 90%) of traffic currently using the A496 through Llanbedr further away from the SAC and therefore a reduction in air pollution from vehicle emissions is expected for the closest unit (Unit 34) of this site. The same is true for the four RAWs, although the Proposed Improvement would move the route of the A496 to the southwest of one (Lower Wood), which could balance out this positive effect due to the prevailing winds.

5.4.361 Two of the trees supporting notable lichen species are also located in areas likely to benefit from a reduction in air pollution from vehicle emissions during operation. The new route of the A496 would be moved closer to another of the notable lichen populations but this species, *Schismatomma graphidioides*, is considered less susceptible to pollutants associated with vehicle emissions and the tree supporting this species would remain upwind of the new route.

Spread of invasive species during maintenance operations

Ecological Features Potentially Affected: *Pen Llyn a'r Sarnau SAC; Morfa Dyffryn SSSI; Coastal and Floodplain Grazing Marsh; Purple Moor Grass and Rush Pastures; Reedbeds; and Rivers*

5.4.362 There is potential for non-native invasive plant species, particularly the Japanese knotweed, Himalayan balsam and Montbretia in the vicinity of the proposed bridge over the Artro, to be disturbed and potentially caused to spread during future maintenance operations. These could then colonise areas further downstream, including important habitats and the two protected sites, Pen Llyn a'r Sarnau SAC and Morfa Dyffryn SSSI.

Loss or degradation of ecosystem services

Ecological Features Potentially Affected: Cultural Services Provided by the Natural Landscape

5.4.363 Due to the impacts described above on ecological features (habitats and species) in the vicinity of public assets such as the Public Right of Way along the top of the flood embankment (PROW 1) and the car parking, picnic and fishing area between Mochras Road and the Afon Artro, the experience of the natural environment whilst using these assets could be compromised during the operational period.

Significant Effects Without Mitigation

5.4.364 Tables 5.4.12 and 5.4.13 below characterise the potential impacts on the important ecological features identified during construction and operation respectively and describe their significance in the absence of mitigation measures (other than embedded mitigation, see Table 5.4.11 above).

Table 5.4.12: Summary of Potential Construction Impacts Without Mitigation

***Explanation of Impact Characterisation**

Sign: Positive (beneficial) or Negative (adverse)

Extent: Area measures and percentage of total (e.g. area of habitat/territory lost)

Size: Description of level of severity of influence (e.g. complete loss, number of animals affected)

Reversibility: Reversible or Not Reversible (can the effect be reversed, whether or not this is planned?)

Duration: Permanent or Temporary in ecological terms. Where differing timescales are determined in relation to the life-cycle of the receptor, these should be defined.

Timing and frequency: Important seasonal and/or life-cycle constraints and any relationship with frequency considered.

N/A = Not Applicable

Important Ecological Feature	Scale of Importance	Description of Impact	Characterisation of Impact *	Scale of Significance (Without Mitigation)
Sites:				
Coedydd Derw a Safleoedd Ystumod Meirion SAC	International	Potential for impacts on lesser horseshoe bats likely to represent part of the lesser horseshoe bat feature of the SAC (see 'Lesser horseshoe bat' as a separate feature below)	<p>See impacts described for the local lesser horseshoe bat population, characterised separately below. These include loss and degradation of foraging habitat; loss of roosts; and disturbance/disruption to roosting, commuting and foraging bats due to construction activities. As the lesser horseshoe bat population in the vicinity of the Proposed Improvement includes two maternity colonies and the nearest component of the SAC is only 85m away, it is considered that the local lesser horseshoe population could represent a significant proportion of the SAC population and therefore the impacts described below as being significant to the local population could also result in a significant impact on the SAC.</p> <p><u>SAC features potentially affected:</u> Lesser horseshoe bat</p> <p><u>SAC Conservation Objectives potentially affected:</u></p> <ol style="list-style-type: none"> 1. The population of lesser horseshoe bats should be maintained at its current size and encouraged where possible to increase. As there has been an upward trend in lesser horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase; 2. There are sufficient breeding roosts (buildings, structures and trees) and hibernation roosts (mines and buildings) of appropriate quality. The other types of roost such as night, transitional, leks and swarming sites, should also be maintained as our knowledge of these often significant roosts improves; 3. Foraging or feeding habitat in the SAC and surrounding countryside, including grasslands and some gardens, is of appropriate quality, extent and connectivity across the range. 	International

		Potential for damage to 'old sessile oakwoods' within Unit 34 of the SAC due to dust arising from trackout during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> With reference to Chapter 5.1: Air Quality, Unit 34 of this SAC lies within within 50m (37.5m to the southeast) of the road network within 500m of the site accesses, putting it at medium risk of impacts from dust arising from trackout</p> <p><u>Size:</u> The old sessile oakwoods feature is likely to be particularly sensitive to impacts on air quality including dust, due to the lower plant communities associated with this habitat type, which could potentially include notable species</p> <p><u>Duration:</u> Construction period (18 months)</p> <p><u>Timing and Frequency:</u> Risk of trackout dust throughout construction, particularly during periods of dry weather</p> <p><u>SAC features potentially affected:</u> Old sessile oakwoods</p> <p><u>SAC Conservation Objectives potentially affected:</u></p> <ol style="list-style-type: none"> 7. The abundance and distribution of common and typical (Atlantic, sub-Atlantic, western, oceanic) mosses and liverworts, lichens (and slime moulds), will be maintained or increased. Refer to indicative lists in Tables 3 and 4; 8. The abundance and distribution of uncommon mosses and liverworts, lichens and slime moulds, will be maintained or increased. Refer to indicative lists in Tables 5 & 6 in Annex 3. 	International
Pen Llŷn a'r Sarnau SAC (otter only)	International	Potential for damage to otter habitat within the SAC due to dust arising from trackout during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> With reference to Chapter 5.1: Air Quality, this site lies within 50m (40m to the west) of the road network within 500m of the site accesses, putting it at medium risk of impacts from dust arising from trackout</p> <p><u>Size:</u> 0.04ha of the site lies within the threshold distance for impacts due to trackout dust. However, the only feature of the SAC present within this area is habitat suitable for otters. Otters and their habitat are not considered particularly sensitive to a short-term increase in dust levels, which is unlikely to be extensive, as there is only a very small part of the trackout corridor within 50m of the SAC, located between 345m and 390m from the scheme boundary and the site does not lie down-wind of the prevailing winds, so overall it is considered that this impact would not be significant, even without mitigation</p> <p><u>Duration:</u> Construction period (18 months)</p> <p><u>Timing and Frequency:</u> Risk of trackout dust throughout construction, particularly during periods of dry weather</p> <p><u>SAC features potentially affected:</u> Otter</p> <p><u>SAC Conservation Objectives potentially affected:</u></p> <p>Otters will have sufficient availability of prey and widespread availability and access to good quality essential habitats including freshwater and undisturbed resting and breeding sites to</p>	Not significant

			allow the otter population to thrive.	
		Potential for damage to otter habitat within the SAC due to siltation and pollution incidents affecting watercourses during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Limited to areas in the vicinity of hydrological pathways from the footprint of the Proposed Improvement, i.e. the Afon Artro. The site is located 420m downstream via a minor watercourse and 570m via the Afon Artro.</p> <p><u>Size:</u> The area within the SAC likely to be affected during a pollution incident during construction is not designated for any of the habitat features of the SAC and is therefore likely to be purely included as habitat for otters. The area likely to be affected by a pollution incident is a very small proportion of the total extent of otter habitat within the SAC due to the dilution/dispersion of contaminants likely to occur prior to entering the SAC boundary. Due to the extensive habitat that would remain available to the otter population of the SAC lying outside the Zol of any potential construction pollution, this impact is not considered to be significant</p> <p><u>Duration:</u> Short-term period of risk (18 month construction period anticipated) and the effects are also likely to remain for a relatively short-term period</p> <p><u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p> <p><u>SAC features potentially affected:</u> Otter</p> <p><u>SAC Conservation Objectives potentially affected:</u> Otters will have sufficient availability of prey and widespread availability and access to good quality essential habitats including freshwater and undisturbed resting and breeding sites to allow the otter population to thrive.</p>	Not significant
		Potential for impacts on otters likely to represent part of the otter feature of the SAC (see 'Otter' as a separate feature below)	<p>See impacts described for the local otter population, characterised separately below. These include loss and degradation of foraging habitat; loss and disturbance of resting sites; and severance of commuting routes due to construction activities. Although these impacts are considered to be significant to the local otter population without mitigation, it is not considered that any of them would have a significant effect on the Conservation Status of the otter population of the SAC.</p> <p><u>SAC features potentially affected:</u> Otter</p> <p><u>SAC Conservation Objectives potentially affected:</u> Otters will have sufficient availability of prey and widespread availability and access to good quality essential habitats including freshwater and undisturbed resting and breeding sites to allow the otter population to thrive.</p>	Not significant

Morfa Dyffryn SSSI	National	Potential for damage to features of the SSSI due to dust arising from trackout during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> With reference to Chapter 5.1: Air Quality, this site lies within 50m (40m to the west) of the road network within 500m of the site accesses, putting it at medium risk of impacts from dust arising from trackout</p> <p><u>Size:</u> 0.04ha (0.00000054%) of the SSSI lies within the threshold distance for impacts due to trackout dust.</p> <p>However, the only feature of the SSSI likely to be present within this area is coarse sand, cobbles and boulders extending along the length of the site at the back of the shore, with sand hoppers in the strandline. This habitat is not considered likely to be particularly sensitive to a short-term increase in dust levels, which is unlikely to be extensive, as there is only a very small part of the trackout corridor within 50m of the SSSI, located between 345m and 390m from the scheme boundary and the site does not lie down-wind of the prevailing winds. Any impact is therefore not likely to be significant</p> <p><u>Duration:</u> Construction period (18 months)</p> <p><u>Timing and Frequency:</u> Risk of trackout dust throughout construction, particularly during periods of dry weather</p> <p><u>SSSI features potentially affected:</u> Shingle</p>	Not significant
		Degradation of the SSSI features arising from siltation and pollution incidents affecting watercourses during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Limited to areas in the vicinity of hydrological pathways from the footprint of the Proposed Improvement, i.e. the Afon Artro. The site is located 420m downstream via a minor watercourse and 570m via the Afon Artro.</p> <p><u>Size:</u> The area of habitats and species that are likely to be affected during a pollution incident during construction is likely to be a relatively small proportion of their total extent within the SSSI due to the dilution/dispersion of contaminants likely to occur prior to contact with the SSSI features</p> <p><u>Duration:</u> Short-term period of risk (18 month construction period anticipated) and the effects are also likely to remain for a relatively short-term period.</p> <p><u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p> <p><u>SSSI features potentially affected:</u> Faunal and floral communities of the Artro estuary; Saltmarsh; and associated nationally scarce higher plants, namely lax flowered sea-lavender (<i>Limonium humile</i>) and perennial glasswort (<i>Sarcocornia perennis</i>)</p>	National
Restored Ancient Woodland Sites (25332, 25334,	Local	Potential for construction damage to sites located immediately adjacent or	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Four RAWS sites could be subject to damage during construction. All four of these sites are located within 50m of the trackout corridor (see Chapter 5.1: Air Quality) and would</p>	Not significant

25336 – Lower Wood and 25306 – Coed Hafod-y-Bryn)		within 50m of the construction footprint due to physical damage and/or construction dust	<p>be at risk from trackout dust; three sites (all except 25306 – Coed Hafod-y-bryn) are located within 50m of the scheme construction area and would therefore be at risk from dust due to earthworks and other construction activities; and two of these sites (25332 and 25334) could also be subject to physical damage due to their location immediately adjacent to the construction area</p> <p><u>Size:</u> The severity of this impact is minimal as only Restored Ancient Woodland Sites would be affected, rather than Ancient Semi-Natural Woodland Sites, so there is less potential for highly sensitive woodland species such as lower plants to be affected. Also only a small proportion of these sites would be within the threshold to be considered at risk from construction/trackout dust, particularly as there are a large number of such sites within the local area, along with a number of ASNW sites, which would remain unaffected</p> <p><u>Duration:</u> Risk during works/construction traffic within 50m of these sites, but dust risk mainly during periods of dry/windy weather. As all of these sites are clustered within the southern half of the scheme corridor, it is estimated that there would be a risk of damage for less than half of the construction period (about 9 months maximum)</p>	
Habitats:				
Trees and hedgerows	Local	Loss/damage to trees and hedgerows during site clearance and construction activities	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> 150m of hedgerow to be removed along Mochras Road between the railway line and the riverside car park. Approximately 0.4ha of woodland and 14 scattered mature trees scattered throughout the scheme and a small area of semi-mature to early mature woodland adjacent to the Builder’s yard towards the southern end of the scheme (0.14ha – maximum DBH of 0.25m). There is also potential for permanent damage to trees due to construction activities within the root protection areas</p> <p><u>Size:</u> This number of mature trees and length of hedgerow to be removed represent a small proportion of the retained trees and hedgerows present within the vicinity of the Proposed Improvement.</p> <p><u>Reversibility:</u> Reversible (in long term) for hedgerows; effectively irreversible for mature trees</p> <p><u>Duration:</u> Permanent loss</p>	Local
Lowland mixed deciduous woodland	Local	Permanent loss of approximately 0.4ha of broad-leaved semi-natural woodland	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> 0.4ha of broad-leaved semi-natural woodland would be lost during site clearance. This is comprised of a small copse of young to mature trees located within the pastoral land to the south of the Afon Artro (0.18ha), part of another copse of similar age structure to the south of this (0.08ha) and a small area of semi-mature woodland adjacent to the Builder’s yard towards the southern end of the scheme (0.14ha)</p> <p><u>Size:</u> In relation to the extensive mature woodland that would remain to the east of the Proposed Improvement, this is considered to constitute a minor loss</p> <p><u>Reversibility:</u> Effectively irreversible for mature woodland; reversible in the long-term for semi-</p>	Local

			mature woodland <u>Duration:</u> Permanent loss	
Coastal and floodplain grazing marsh	Local	Permanent loss of approximately 0.63ha of this habitat to the scheme footprint and temporary loss/degradation of up to an additional 0.43ha during construction	<u>Sign:</u> Negative <u>Extent:</u> 0.63ha of coastal and floodplain grazing marsh would be permanently lost during site clearance and 0.43ha is located within proposed temporary construction areas so is likely to be subjected to some damage due to compaction by construction traffic <i>etc.</i> The provision of 900mm flood alleviation pipes every 2.9m along the base of the embankment through the fluvial floodplain would minimise this impact by removing the loss of the habitat to the east of the Proposed Improvement due to hydrological changes <u>Size:</u> In relation to the extensive area of this habitat that would remain to the west of the Proposed Improvement, this is considered to constitute a minor loss <u>Duration:</u> Permanent (0.63ha); and temporary (0.43ha) as this would regenerate following construction	Local
Lowland meadow	County	Permanent loss of approximately 0.79ha of this habitat to the scheme footprint and temporary loss of an additional 0.36ha during construction	<u>Sign:</u> Negative <u>Extent:</u> 0.79ha of lowland meadow would be permanently lost during site clearance and 0.36ha is located within proposed temporary construction areas so is likely to be subjected to some damage due to compaction by construction traffic <i>etc.</i> <u>Size:</u> 58.5% of the two existing meadows constituting this habitat within the scheme corridor would be permanently lost <u>Duration:</u> Permanent (0.79ha); and temporary (0.36ha) as this would regenerate following construction	County
Purple moor grass and rush pastures	Local	Permanent loss of approximately 0.35ha of this habitat to the scheme footprint and temporary loss/degradation of up to an additional 0.2ha during construction	<u>Sign:</u> Negative <u>Extent:</u> 0.35ha of purple moor grass and rush pasture would be permanently lost during site clearance and 0.2ha is located within proposed temporary construction areas so is likely to be subjected to some damage due to compaction by construction traffic <i>etc.</i> The provision of 900mm flood alleviation pipes every 2m along the base of the embankment through the fluvial floodplain would reduce this impact by removing the loss of the habitat to the east of the Proposed Improvement due to hydrological changes <u>Size:</u> In relation to the extensive area of this habitat that would remain throughout Gwynedd, and also in the immediate vicinity of the Proposed Improvement, this is considered to constitute a minor loss <u>Duration:</u> Permanent (0.35ha); and temporary (0.2ha) as this would regenerate following construction	Local
Reedbeds	County	Damage/loss up to 0.04ha of reedbed habitat due to	<u>Sign:</u> Negative <u>Extent:</u> Approximately 0.04ha of reedbed habitat is located within proposed temporary	Not significant

		construction activities	<p>construction areas within Watercourse 2 so could potentially be subject to some damage/loss during construction</p> <p><u>Size:</u> In relation to the area of this habitat that would remain throughout Gwynedd, and also in the vicinity of the Proposed Improvement, this is not considered to be significant, particularly as all open areas would be likely to regenerate following construction</p> <p><u>Duration:</u> Short-term (except for area deep underneath the bridge where light levels may be too low for regeneration (this impact covered in operational impacts))</p>	
Rivers	County	Degradation of the Afon Artro catchment within the corridor of the Proposed Improvement arising from siltation/pollution or other disruption during construction (including light and noise)	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to affect any of the six watercourses, including the Afon Artro, that flow through the corridor of the Proposed Improvement. Three of these are main rivers, and all of these form part of the catchment of the Afon Artro, classified as 'Good' quality under the Water Framework Directive.</p> <p><u>Size:</u> Due to the widespan bridges proposed over the two largest watercourses, including the Afon Artro, the potential for water-borne pollution, degradation and disturbance of the habitat is much reduced although there is also potential for light and noise pollution due to construction activities</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Temporary</p> <p><u>Timing and Frequency:</u> Risk throughout construction, particularly during works within and adjacent to the watercourses</p>	Local
Species:				
Lesser horseshoe bat	Regional	Direct loss of roosting habitat during site clearance, demolition and excavation for the Proposed Improvement footprint	<p>Permanent loss of two transitional/opportunistic roosts from within the Builder's Yard.</p> <p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of two confirmed roosts; evidence indicates infrequently used by small numbers of bats (maximum recorded in Building 1: two bats, Building 2: one bat). Many roosts exist within the Zol of the scheme, including within the adjacent SAC. Potential for injury or death of bats during demolition of roosts in the absence of adequate measures to avoid this. This would affect a very small percentage of the total number of bats in the local population, which is likely to encompass individuals from the nearby SAC</p> <p><u>Size:</u> In the unlikely event of the death of a small number of bats, this would be unlikely to jeopardise the survival of the local or wider population (and is entirely avoidable)</p> <p><u>Reversibility:</u> Irreversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and frequency:</u> One-off event during site clearance</p>	Local
		Direct and indirect loss of	Permanent loss of foraging habitat comprising improved/semi-improved grazed pasture,	Not significant

		<p>foraging habitat during vegetation clearance and excavation for the Proposed Improvement footprint, temporary access routes and site compound</p>	<p>woodland, woodland edge, rush pasture and lowland meadow. Potential for degradation of habitats dissected by the new road (due to the changes this would cause to the water table) and those used for construction compound and access due to trampling or tracking over them.</p> <p><u>Sign</u>: Negative. <u>Extent</u>: Permanent loss of approximately 6.1ha of potential foraging habitat of which approximately 30% is of good quality (woodland/woodland edge, rush pasture and lowland meadow). This is a very small proportion (less than 1%) of the overall foraging resource available to the bats within their typical 2 km CSZ. Potential also exists for habitat degradation in the absence of adequate pollution control measures. <u>Size</u>: Minor loss of foraging habitat of which the majority is low quality; this will not have a detrimental effect on the Favourable Conservation Status of the local population. This impact would also be reduced slightly due to the provision of an open attenuation pond adjacent to the southern junction with Llanbedr that would provide a new area of foraging habitat <u>Reversibility</u>: Habitat loss: irreversible. Habitat degradation: reversible. <u>Duration</u>: Habitat loss: permanent. Habitat degradation: short-term. <u>Timing and frequency</u>: One-off event during site clearance (loss), but impacts of degradation long-term in the absence of treatment.</p>	
		<p><u>Disturbance/disruption due to:</u> Construction noise (and vibration) causing disturbance/disruption to roosting bats</p> <p>Light pollution due to temporary construction lighting causing disruption to bats</p> <p>Other factors, such as increased human and vehicular presence, causing temporary disturbance/disruption to bats during construction</p> <p>Severance of important</p>	<p>Disturbance to roosting, commuting and foraging bats during their 'active' season: April to October. Outside of this time, the effects of disturbance affect bat hibernation, including winter foraging (lesser horseshoe bats wake up relatively frequently during the winter to feed close to roosts, so the maintenance of vegetation in the vicinity of their winter roosts is important). Activities with the potential to cause disturbance include: lighting, noise and vibration. Noise and light are only likely to have significant effect over relatively short distances (Berthinussen, 2015) and the extent of this effect depends on both frequency and intensity.</p> <p>Roosting <u>Sign</u>: Negative. <u>Extent</u>: Potential for disturbance of maternity colony (currently 23 bats) if work carried out in the vicinity of the roost during the active season but particularly June to August when the females have dependent young. <u>Size</u>: Lesser horseshoe bats tend to be faithful to their roosts, which often comprise a complex of different sites, with a number of satellite roosts in the vicinity of the main roost. There is potential for bats to abandon the maternity roost closest to the road in the short term. Long term abandonment is considered unlikely. This is unlikely to prevent long-term breeding success, as a number of other roost sites were confirmed within the bats' CSZ and the adjacent SAC. This includes a roost built as compensation for an unrelated development; records of</p>	<p>Local</p>

		<p>commuting corridors due to construction activities</p>	<p>breeding at this site have not yet been confirmed. While hibernating, the bats are likely to be less sensitive to light, noise and vibration. <u>Reversibility:</u> Reversible. <u>Duration:</u> Temporary/short term. <u>Timing and frequency:</u> Duration of construction of local section of the road, with recovery thereafter predicted.</p> <p>Commuting <u>Sign:</u> Negative. <u>Extent:</u> Potential to disturb bats using commuting routes within the study area, potentially deterring them from using some routes. Of particular significance was the Afon Artro. The quality of the wider landscape is very good and there are a number of established, well-linked commuting routes in the area; however, the Afon Artro appears to be the one most frequently used. <u>Size:</u> The proposed road crosses the Afon Artro, main commuting feature for bats, heading east/west across the local area. This may also be used by bats commuting from outside of the study area. Effects exacerbated if disturbance takes place over an extended period and particularly the bats' active season. Potential effect of preventing bats from accessing roosting/commuting and foraging sites further along this commuting route. <u>Reversibility:</u> Reversible. <u>Duration:</u> For the duration of the construction of the Afon Artro bridge and adjacent sections of the road. <u>Timing and frequency:</u> One-off/short term.</p> <p>Foraging <u>Sign:</u> Negative. <u>Extent:</u> Potential for disturbance of foraging along the extent of the new road although limited other than along the Afon Artro which is used extensively. However, there are significant opportunities for foraging within the remainder of the colony's CSZ and the wider ZOI and links to these habitats are good. <u>Size:</u> Disturbance of foraging along the Afon Artro could impact the colony during the bats' active season. The extent of impact will depend on how sustained the disturbance is, and its timing. <u>Reversibility:</u> Reversible. <u>Duration:</u> Duration of construction work. <u>Timing and frequency:</u> One-off/short term.</p>	<p>Local</p> <p>Not significant</p>
		<p>Potential pollution/siltation of</p>	<p>The impacts on foraging habitat described above would be exacerbated if water courses become polluted, particularly the Afon Artro as they could affect the ability of bats to forage</p>	<p>Local</p>

		watercourses due to in-river works, run-off from construction areas or pollution incidents such as spillages	successfully along the Afon Artro. Minor pollution events are unlikely to affect the insect resource of the Afon Artro.	
<p><i>Myotis</i>, pipistrelle and brown long-eared bats</p> <p>Greater horseshoe and Barbastelle bats</p>	Local	Direct and indirect loss of foraging habitat during vegetation clearance, demolition and excavation for the Proposed Improvement	<p>Permanent loss of foraging habitat comprising semi-improved grassland grazed by livestock, a small isolated woodland copse, a small triangle of woodland, an area of lowland meadow and a small area of rush pasture. Potential for habitat degradation of areas used for construction compound and access due to trampling or tracking over them.</p> <p><u>Sign</u>: Negative.</p> <p><u>Extent</u>: Permanent loss of approximately 6.1ha of suitable foraging habitat of which approximately 30% is of good quality (woodland/woodland edge, rush pasture and lowland meadow). This is a small proportion (less than 1%) of the overall foraging resource available to the bats within the typical CSZs for these species (the CSZs for these species range from 1 to 4km). Potential for habitat degradation in the absence of suitable control measures.</p> <p><u>Size</u>: All foraging habitat due to be lost falls within the CSZ of a known roosting site. However, a significant quantity of habitat of equal value or better is present within these CSZs meaning that its loss is of limited significance. This impact would also be reduced slightly due to the provision of an open attenuation pond adjacent to the southern junction with Llanbedr that would provide a new area of foraging habitat</p> <p><u>Reversible</u>: Loss: irreversible. Habitat degradation: reversible.</p> <p><u>Duration</u>: Habitat loss: permanent. Habitat degradation: short-term.</p> <p><u>Timing and frequency</u>: One-off event during site clearance.</p>	Not significant
	Regional			

			<p>resource available to these species within their CSZs. There are 10 trees and two stone walls with bat roosting potential that would be lost or directly affected by the proposed works. <u>Size:</u> In the unlikely event of the death of a small number of bats as a one-off incident would be unlikely to jeopardise the survival of the local or wider population and it is entirely avoidable. <u>Reversibility:</u> Irreversible. <u>Duration:</u> Permanent. <u>Timing and frequency:</u> One-off event during site clearance.</p>	
		<p><u>Disturbance/disruption due to:</u> Construction noise (and vibration) causing disturbance/disruption to roosting bats</p> <p>Light pollution due to temporary construction lighting causing disruption to bats</p> <p>Other factors, such as increased human and vehicular presence, causing temporary disturbance/disruption to bats during construction</p> <p>Severance of important commuting corridors due to construction activities</p>	<p>Disturbance to roosting, commuting and foraging bats during their ‘active’ season (April to October). Outside of this time, the effects of disturbance affect bat hibernation including winter foraging. Activities with the potential to cause disturbance include: lighting, noise and vibration.</p> <p>Roosting <u>Sign:</u> Negative. <u>Extent:</u> Potential to disturb Natterer’s bats which are confirmed to roost within the Former Aquarium (the lesser horseshoe maternity roost). Also, sixteen trees with the potential to support bat roosts and a small number of crevices within a stone wall which lines the southern banks of the Afon Artro may contain bats during the period of the works and, if so, these individuals may be disturbed. This is a small proportion of the overall roosting resource available to these species within the study area and the wider Zol. <u>Size:</u> While temporary disturbance of these roosting sites is unlikely to result in the bats abandoning their roosts completely (except potentially where periods of sustained disturbance are expected i.e. a generator placed close to an occupied tree), disturbance during times when bats are more vulnerable may have a more significant effect (for example, if bats are sufficiently disturbed to move or abandon young). Hibernating bats are likely to be less sensitive to light, noise and vibration outside of their roost. <u>Reversible:</u> Reversible. <u>Duration:</u> Temporary/short term. <u>Timing and frequency:</u> Duration of construction of local section of the road, with gradual recovery thereafter predicted.</p> <p>Commuting <u>Sign:</u> Negative <u>Extent:</u> Potential to disturb bats using commuting routes within the study area, the Afon Artro was particularly significant. The quality of the wider landscape is very good and there are a number of established, well-linked commuting routes in the area; however, the Afon Artro appears to be one of the most significant</p>	<p>Local</p> <p>Local</p>

			<p><u>Size:</u> The proposed road crosses the Afon Artro, which is the main commuting feature for bats, heading east/west across the local area. This may also be used by bats commuting from outside of the study area. Effects exacerbated if disturbance takes place over an extended period and particularly during May to August when bats with dependent young are present. Potential effect of preventing bats from accessing roosting/commuting and foraging sites further along this commuting route</p> <p><u>Reversible:</u> Reversible</p> <p><u>Duration:</u> For the duration of the construction of the Afon Artro bridge and adjacent sections of the road</p> <p><u>Timing and frequency:</u> One-off/short term</p> <p>Foraging</p> <p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for disturbance of foraging exists along the extent of the new road although limited in extent other than the Afon Artro which is used extensively by pipistrelle and <i>Myotis</i> species and occasionally by barbastelle. In addition to the Afon Artro, there are significant opportunities for foraging within the remainder of the CSZ and the wider Zol, and links to these habitats are good</p> <p><u>Size:</u> Disturbance of foraging along the Afon Artro will impact the local population, particularly during the bats' active season. The extent of impact will depend on how sustained the disturbance is, and its timing</p> <p><u>Reversible:</u> Reversible</p> <p><u>Duration:</u> Duration of construction work</p> <p><u>Timing and frequency:</u> One-off/short term</p>	Local
		Potential pollution/siltation of watercourses due to in-river works, run-off from construction areas or pollution incidents such as spillages.	The impacts described above would be exacerbated if water courses become polluted, particularly the Afon Artro as they could affect the ability of bats to forage successfully along the Afon Artro. Minor pollution events are unlikely to affect the insect resource of the Afon Artro.	Local
Noctule Leisler's and Serotine bats	Local Regional	Direct and indirect loss of foraging habitat during vegetation clearance, demolition and excavation for the Proposed Improvement	<p>Permanent loss of foraging habitat. Potential for habitat degradation of areas used for construction compound and access due to trampling or tracking over them.</p> <p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of approximately 6.1ha of foraging habitat of which approximately 30% is of good quality (woodland/woodland edge, lowland meadow and rush pasture). This is a</p>	Not significant

		<p>small proportion (less than 1%) of the overall foraging resource available to the bats within their typical CSZs (3 to 4km). Potential also exists for habitat degradation in the absence of adequate control measures</p> <p><u>Size:</u> Loss of a small proportion of the overall foraging resource would have a negligible effect on the local population. This impact would also be reduced slightly due to the provision of an open attenuation pond adjacent to the southern junction with Llanbedr that would provide a new area of foraging habitat</p> <p><u>Reversible:</u> Habitat Loss: Irreversible. Habitat degradation: Reversible</p> <p><u>Duration:</u> Habitat loss: permanent. Habitat degradation: short-term</p> <p><u>Timing and frequency:</u> One-off event during site clearance</p>	
	<p>Direct loss of roosting habitat during vegetation clearance, demolition and excavation for the Proposed Improvement</p>	<p>Noctule and Leisler’s bats are tree-roosting species. Potential for permanent loss of tree roosts, should these be identified on inspection. There are 10 trees with bat roosting potential that would be lost or directly affected by the proposed works.</p> <p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for loss of roosts in trees could result in loss of a very small proportion of the overall roosting resource available to these species within the wider Zol</p> <p><u>Size:</u> Losing a maternity site (if identified from the inspection surveys) could decrease the breeding success of a proportion of the population through increased competition at other sites, but tree-roosting bats tend to use a large number of bats and switch roosts frequently, so there will be a number of suitable tree-roosts in the area. The unlikely (and entirely avoidable) death of a small number of bats through tree-felling would be unlikely to jeopardise the survival of the local or wider population</p> <p><u>Reversibility:</u> irreversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and frequency:</u> One-off event during site clearance</p>	Local
	<p><u>Disturbance/disruption due to:</u> Construction noise (and vibration) causing disturbance/disruption to roosting bats</p> <p>Light pollution due to temporary construction lighting causing disruption to bats</p>	<p>Disturbance to roosting, commuting and foraging bats during their ‘active’ season (April to October). Outside of this time, the effects of disturbance affect bat hibernation including winter foraging. Activities with the potential to cause disturbance include: lighting, noise and vibration.</p> <p>Roosting</p> <p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Sixteen trees with the potential to support bat roosts and a small number of crevices within a stone wall which lines the southern banks of the Afon Artro may contain bats during the period of the works and, if so, these individuals may be disturbed. This is a small proportion of the overall roosting resource available to these species within the study area and</p>	Local

		<p>Other factors, such as increased human and vehicular presence, causing temporary disturbance/disruption to bats during construction</p> <p>Severance of important commuting corridors due to construction activities</p>	<p>the wider Zol</p> <p><u>Size:</u> While temporary disturbance of these roosting sites is unlikely to result in the bats abandoning their roosts completely (except potentially where periods of sustained disturbance are expected i.e. a generator placed close to an occupied tree), disturbance during times when bats are more vulnerable may have a more significant effect (for example, if bats are sufficiently disturbed to move or abandon young). Hibernating bats are likely to be less sensitive to light, noise and vibration outside of their roost</p> <p><u>Reversible:</u> Reversible</p> <p><u>Duration:</u> Temporary/short term</p> <p><u>Timing and frequency:</u> Duration of construction of local section of the road, with gradual recovery thereafter predicted</p> <p>Commuting</p> <p>These species typically fly at height, and are less reliant on linear features for commuting; impacts from the severance of linear features are unlikely.</p> <p>Foraging</p> <p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Limited potential to disturb foraging bats. There are significant opportunities for foraging within the remainder of the CSZ and the wider Zol</p> <p><u>Size:</u> Temporary disturbance of these foraging habitats would have minimal negative impact on the local population</p> <p><u>Reversible:</u> Reversible</p> <p><u>Duration:</u> Duration of construction work</p> <p><u>Timing and frequency:</u> One-off/short term</p>	<p>Not significant</p> <p>Not significant</p>
		<p>Potential pollution/siltation of watercourses due to in-river works, run-off from construction areas or pollution incidents such as spillages.</p>	<p>The impacts described above would be exacerbated if water courses become polluted, particularly the Afon Artro as they could affect the ability of bats to forage successfully along the Afon Artro. Minor pollution events are unlikely to affect the insect resource of the Afon Artro.</p>	<p>Local</p>
<p>Otter</p>	<p>County</p>	<p>Loss/disturbance of resting sites located along the Afon Artro due to construction of the double span bridge, including</p>	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> An otter resting site recorded in 2015 is located within the northern river bank at the point where the Proposed Improvement bridges the Afon Artro. This would be lost during the construction of the bridge. Four other resting sites, recorded within 80m up- and downstream, are also likely to be subject to disturbance during construction. These sites are</p>	<p>Local</p>

		noise, lighting and construction activities	<p>not considered likely to include a breeding holt or natal den due to the sparse nature of the vegetation along the northern bank of the Artro at this location, providing minimal cover for otters</p> <p><u>Size:</u> Each otter occupies a home range of 10 – 40km of watercourse with up to 30 resting sites distributed throughout this range, with each site being used for shelter for only one to three days at a time (Eryri BAP). Due to the abundance of alternative suitable resting sites along the Afon Artro, including areas of dense vegetation providing better habitat for resting otters and particularly for breeding sites, it is considered that the loss of these sites would have a minor impact on the local otter population</p> <p><u>Duration:</u> Loss/disturbance during construction within the vicinity of the Afon Artro (up to 18 months) and loss of one site lasting into operation</p>	
		Severance of commuting/foraging routes due to construction works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for construction disturbance/disruption such as lighting, noise and presence of machinery/personnel to cause severance of commuting/foraging routes</p> <p><u>Size:</u> The Afon Artro is known to be used by otters as a foraging/commuting route and it is also likely that the other four smaller watercourses affected would be used for occasional foraging – evidence of otters has been recorded along Watercourses 2 and 5 in addition to the Afon Artro.</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> During periods of construction within the vicinity of watercourses (up to 18 months)</p> <p><u>Timing and Frequency:</u> Impact greatest outside of daylight hours as otters tend to be nocturnal</p>	Local
		Permanent loss of approximately 0.41ha of potential foraging habitat to the scheme footprint and temporary loss/deterioration of up to an additional 0.2ha during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Loss of approximately 0.61ha of foraging habitat in total during the construction period, 0.41ha of which would be permanent, including rush pasture, reedbed and watercourses. Also loss of 31m of Watercourse 3 (a minor drainage ditch) that would be culverted.</p> <p><u>Size:</u> Otters have an extensive home range including 10 – 40km of watercourse. The area of terrestrial habitat and culverted drainage ditch that would be permanently lost is only likely to be used occasionally by foraging otters as their main resource is likely to be the Afon Artro due to its good populations of fish. The small area affected by the Proposed Improvement is therefore likely to represent less than 1% of the total foraging resource used by the local otter population and this impact would therefore be minor</p> <p><u>Reversibility:</u> The permanent loss of 0.41ha of terrestrial habitat and 31m of drainage ditch to the footprint of the Proposed Improvement would be irreversible but the temporary loss of 0.2ha would regenerate over time</p> <p><u>Duration:</u> Loss would occur during the construction period but the impact would last into</p>	Not significant

			operation	
		Damage to the local otter population due to potential disruption / pollution / siltation of the watercourses adversely affecting prey populations during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for contamination/disruption of watercourses used by otters within and downstream of the scheme footprint, with potential for a negative impact on prey populations decreasing with distance downstream due to dilution, etc.</p> <p><u>Size:</u> The likelihood of prey populations being significantly affected is fairly low and likely to be short-term in nature and the impact on the otter population would be even less due to the alternative foraging habitat available to them in surrounding unaffected areas, so it is considered that the impact would be minor.</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> During periods of construction within or adjacent to watercourses</p> <p><u>Timing and Frequency:</u> Impact worse if pollution/disruption occurs during the fish spawning season</p>	Local
Badger	Local / Negligible	Loss of badger setts during site clearance / earthworks	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Part of an active annexe sett (entire sett = 8 active entrances; 9 inactive entrances) would be destroyed due to its location within the footprint of the Proposed Improvement</p> <p><u>Size:</u> Partial loss of an active annex sett within the badger territory to the south of the Afon Artro. This is considered to be a moderate impact on the social group affected but the significance is on a local scale only (within the Zone of Influence) due to the abundance and extensive distribution of badgers on a local, county, national and international level</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> One off loss. Impact worse if this occurs during breeding season (December to June inclusive)</p>	Local
		Mortality of badgers during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Any animal remaining in the part of the annexe sett to be destroyed at the time of removal</p> <p><u>Size:</u> The annexe sett to be affected (southern territory) is unlikely to support more than about 5 badgers at the present time due to the low number of active sett entrances, discarded fresh bedding, foraging scrapes and scats recorded in latrines. Therefore in the worst case scenario without mitigation, these could all be killed due to construction works, although this is unlikely. This is considered to be a moderate impact on the social group affected but the significance is on a local scale only (within the Zone of Influence) due to the abundance and extensive distribution of badgers on a local, county, national and international level</p> <p><u>Reversibility:</u> Not reversible, although it is likely that the population would recover within a fairly short time-frame and the Conservation Status of the local badger population would not</p>	Local

			<p>be affected in the long-term</p> <p><u>Duration:</u> Short-term reduction in badger numbers</p> <p><u>Timing and Frequency:</u> One off loss. Impact worse during breeding season (December to June inclusive)</p>	
		Disturbance to badgers from retained main sett due to construction works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Disturbance of badgers within the annexe sett to be partially destroyed or present within the retained main sett (25 active entrances; 15 inactive entrances) located approximately 15m away from the proposed construction area at its closest point. No other badger setts are likely to be disturbed by the proposed works</p> <p><u>Size:</u> The main and annex setts (southern territory) are unlikely to support more than about 15 badgers at the present time due to the low number of active sett entrances, discarded fresh bedding, foraging scrapes and scats recorded in latrines. All surviving badgers within the southern social group are likely to be disturbed. However, there is unlikely to be any direct disturbance of the badgers within the northern territory. This disturbance would be short-term and would be very unlikely to affect the Conservation Status of the local badger population</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Temporary</p> <p><u>Timing and Frequency:</u> At intervals during construction. Impact worse during breeding season (December to June inclusive)</p>	Not significant
		Loss of foraging habitat due to site clearance and severance due to construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> A direct temporary loss of 8.58ha of foraging habitat during construction, of which 6.1ha would be lost permanently to the scheme footprint. This includes broad-leaved woodland, hedgerow, improved and semi-improved grassland and rush pasture. This loss would affect the two social groups to the north and south of the Afon Artro. However, this loss would be increased slightly by the severance caused by the construction works that would bisect seven known badger commuting routes</p> <p><u>Size:</u> Two social groups could lose part of the foraging habitat within their territory, although the majority of the better quality (woodland) habitat would remain available. The effect of severance would presumably be fairly low as they would not be completely contained by stock-proof fencing due to their ability to burrow under it. Due to the low importance of badgers for nature conservation, and lack of legislation regarding loss of habitat, this impact is not considered to be significant</p> <p><u>Duration:</u> Permanent loss of habitat from the scheme footprint and potential for temporary severance of foraging habitat during construction</p>	Not significant
Polecat and	Local	Loss of foraging habitat	<u>Sign:</u> Negative	Local

Hedgehog		due to site clearance	<p><u>Extent:</u> For polecats, a direct temporary loss of 8.58ha of foraging habitat during construction, of which 6.1ha would be lost permanently to the scheme footprint. This includes broad-leaved woodland, hedgerow, improved and semi-improved grassland and rush pasture. Hedgehogs tend to avoid marshy areas so the area of the scheme footprint within the fluvial floodplain would not be particularly suitable for this species, leaving a temporary loss of 7.52ha, including 5.47ha of permanent loss.</p> <p><u>Size:</u> These temporary and permanent losses of foraging habitat are relatively small for a polecat, constituting about 15% of a home range at most. For hedgehogs, the proportion would be higher due to their smaller range size, with permanent habitat loss constituting up to 55% of a hedgehog's home range. However, due to the low number of hedgehog records within the area, the relatively high density of badgers, which predate on hedgehogs, and the open nature of much of the habitat to be lost, it is considered that the habitat to be lost is unlikely to be regularly used by hedgehogs. The loss of permanent habitat would also be reduced slightly due to the provision of an open attenuation pond adjacent to the southern junction with Llanbedr that would provide a new area of foraging habitat</p> <p><u>Duration:</u> Permanent and temporary loss of habitat from the scheme footprint and construction areas respectively</p>	
Brown hare	Local	Loss of foraging habitat due to site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> A direct temporary loss of 8.58ha of foraging habitat during construction, of which 6.1ha would be lost permanently to the scheme footprint. This includes broad-leaved woodland, hedgerow, improved and semi-improved grassland and rush pasture.</p> <p><u>Size:</u> As the home range of a brown hare is approximately 300ha, this loss would be less than 3% of their available foraging resource and is therefore unlikely to have a significant effect on the local hare population, particularly as suitable habitat for this species is abundant in the wider area</p> <p><u>Duration:</u> Permanent and temporary loss of habitat from the scheme footprint and construction areas respectively</p>	Not significant
Lesser spotted woodpecker	Regional	Destruction of active nests and/or disturbance of nesting birds during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Site clearance of 0.4ha of woodland and 18 scattered mature trees comprising suitable nesting habitat for the species, including habitat where the species may have nested in previous years according to Cofnod records</p> <p><u>Size:</u> No more than one breeding pair likely to be affected but this would still represent a significant proportion of the North Wales population (over 1%), so if a nest site were to be destroyed this could represent an impact of regional significance but this is unlikely. Loss of a regularly used nest site whilst inactive or disturbance of an active nest are also possible impacts of local to regional significance</p> <p><u>Duration:</u> Potential for impact during any clearance works undertaken during the breeding</p>	Up to Regional

			bird season (March to August inclusive) but particularly during the spring months	
		Loss of potential nesting and foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Site clearance of 0.4ha of woodland and 18 scattered mature trees comprising suitable foraging habitat for the species</p> <p><u>Size:</u> Unlikely to significantly affect the Conservation Status of the local/regional population due to the extent of habitat remaining in the vicinity</p> <p><u>Reversibility:</u> Effectively irreversible due to the habitat comprising mature trees</p> <p><u>Duration:</u> One off loss causing permanent impact</p>	Not significant
Barn owl	County	Destruction of active nests and/or disturbance of nesting birds during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Demolition of two buildings within the builder's yard with potential habitat for barn owls and removal of 0.4ha of woodland and 14 scattered mature trees could include suitable nesting habitat for the species. Additionally, owls could utilise habitat immediately adjacent to the construction area where disturbance of active nests could occur</p> <p><u>Size:</u> No more than one breeding pair likely to be affected but this could still represent a significant proportion of the Gwynedd population (over 1%), so if a nest site were to be destroyed this could represent an impact of county significance but this is unlikely and easily mitigated. Loss of a regularly used nest site whilst inactive or disturbance of an active nest are also possible impacts of local to county significance</p> <p><u>Duration:</u> Potential for impact during any clearance works but particularly during the main breeding season (March to August inclusive)</p>	Up to County
		Loss of potential nesting and foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Demolition of two buildings within the builder's yard with potential habitat for barn owls and removal of 0.4ha of woodland and 14 scattered mature trees could include suitable nesting habitat for the species and most of the scheme corridor provides suitable foraging habitat for the species, with the greatest potential provided by the lowland meadow habitat and the rougher grassland within the floodplain to the north of the Afon Artro</p> <p><u>Size:</u> Unlikely to significantly affect the Conservation Status of the local/county population due to the extent of habitat remaining in the vicinity</p> <p><u>Reversibility:</u> Effectively irreversible due to the habitat comprising mature trees and buildings, although barn owl boxes could be provided as mitigation</p> <p><u>Duration:</u> One off loss causing permanent impact</p>	Not significant
Red kite	County	Destruction of active nests and/or disturbance of nesting birds during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Site clearance of 0.4ha of woodland and 14 scattered mature trees a few of which may provide suitable nesting habitat for the species</p> <p><u>Size:</u> No more than one breeding pair likely to be affected but this is still likely to represent a</p>	Up to County

			<p>significant proportion of the Gwynedd population (over 1%), so if a nest site were to be destroyed this could represent an impact of county significance but this is unlikely and easily mitigated. Loss of a regularly used nest site whilst inactive or disturbance of an active nest are also possible impacts of local to county significance</p> <p><u>Duration:</u> Potential for impact during any clearance works undertaken during the breeding bird season (March to August inclusive) but particularly during the spring months</p>	
		Loss of potential nesting and foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Site clearance of 0.4ha of woodland and 14 scattered mature trees comprising suitable foraging/nesting habitat for the species</p> <p><u>Size:</u> Unlikely to significantly affect the Conservation Status of the local/county population due to the extent of habitat remaining in the vicinity</p> <p><u>Reversibility:</u> Effectively irreversible due to the habitat comprising mature trees</p> <p><u>Duration:</u> One off loss causing permanent impact</p>	Not significant
Other breeding birds	Local	Destruction of active nests and/or disturbance of nesting birds during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for destruction/disturbance of active nests of locally important bird species during site clearance of 0.4ha of woodland, 150m of hedgerow and damage/loss of up to 0.04ha of reedbed</p> <p><u>Size:</u> Without mitigation, this could have a minor impact on the local population of breeding birds</p> <p><u>Duration:</u> Potential for impact during any clearance works undertaken during the breeding bird season (March to August inclusive)</p>	Local
		Loss of potential nesting and foraging habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Site clearance of 0.4ha of woodland, 150m of hedgerow and damage/loss of up to 0.04ha of reedbed</p> <p><u>Size:</u> Due to the abundance of similar and better quality foraging and nesting habitat in the surrounding landscape, this small loss would be unlikely to have a significant impact on the Conservation Status of the local breeding bird population</p> <p><u>Duration:</u> One off loss causing permanent impact</p>	Not significant
Reptiles and amphibians	Local	Injury/mortality during site clearance works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential for reptiles/amphibians to be directly killed or injured during clearance/excavation within the existing verges, boundary habitats, woodland and scrub, ditches, rush pasture and rough grassland. The diversion of approximately 45m of Watercourse 0 is particularly sensitive as palmate newts were recorded within this ditch during baseline surveys</p> <p><u>Size:</u> Any loss is likely to affect only a small proportion of the local population of the more</p>	Up to Local

			<p>common species including slow worm, common lizard, common toad, common frog and palmate newt. Grass snakes are a bit more sparsely distributed in Gwynedd and unmitigated clearance could potentially have a significant impact on the Conservation Status of the local population of this species if a nest or gravid female is destroyed but this is unlikely and no grass snakes were recorded during baseline surveys</p> <p><u>Reversibility:</u> Irreversible although slow worm, common lizard and amphibian populations are likely to recover fairly quickly</p> <p><u>Duration:</u> During site clearance and construction within suitable habitat</p> <p><u>Timing and Frequency:</u> Larger impact during the winter hibernation period as animals will be torpid and therefore unable to escape</p>	
		Loss/degradation of habitat due to site clearance/pollution during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Loss during construction of 1.04km of boundary habitat (including walls, hedgerow and lines of trees/scrub), 0.4ha of woodland and 1.06ha of rush pasture and rough grassland within the fluvial floodplain, although some of this is within temporary construction areas that would regenerate following construction. There is also potential for pollution of the watercourses providing potential habitat for amphibians and grass snakes. The loss of permanent habitat would be reduced slightly due to the provision of an open attenuation pond adjacent to the southern junction with Llanbedr (Ch.370) that would provide a new area of foraging habitat, particularly for grass snakes and amphibians</p> <p><u>Size:</u> This loss would represent a very small proportion of the total area suitable for reptiles/amphibians within the surrounding area and is unlikely to have a significant impact on the Conservation Status of the local reptile/amphibian population</p> <p><u>Reversibility:</u> Reversible to some extent, although some would be permanently lost without mitigation</p> <p><u>Duration:</u> During site clearance and continuing into operation</p>	Not significant
Migratory fish and brook lamprey	Local	Injury/mortality of fish during in-channel works	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> In-channel works are likely to be minimal due to the proposed wide-span bridges over the Afon Artro and Watercourse 2 but a culvert will be provided for Watercourse 3, which will need to be diverted to the east of the Proposed Improvement</p> <p><u>Size:</u> All three native species of lamprey, Atlantic salmon, brown/sea trout and European eel are known to be present within the Artro catchment and could potentially be affected by the proposals. However, due to the low level of in-channel activity proposed there is unlikely to be a major loss to these populations with potential for impacts of up to local significance without mitigation</p> <p><u>Duration:</u> For the duration of all in-channel works during construction</p> <p><u>Timing and Frequency:</u> Impact greatest during fish spawning season (generally mid-October to mid-April)</p>	Up to Local

		Disturbance/disruption to fish and their habitats, due to construction activities including pollution risk and mobilisation of suspended solids	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to affect the area of works and areas downstream of the works within all five watercourses, including the Afon Artro in particular</p> <p><u>Size:</u> The minimal nature of in-channel works proposed minimises the risk of fluvial pollution, however, without mitigation a risk would remain, including from works on the banks of the watercourses and adjacent areas, where run-off of suspended solids could pose a problem during periods of wet weather, with potential for impacts on fish of up to local significance</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Mainly for the duration of all in-channel works during construction, but pollution potential also remains for works in the vicinity of the watercourses or from the site compound for example</p> <p><u>Timing and Frequency:</u> Impact greatest during fish spawning season (generally mid-October to mid-April)</p>	Up to Local
Latticed heath moth (<i>Chiasmia clathrata</i>)	Regional	Loss of potential habitat during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of 0.63ha of suitable foraging habitat, containing the larval food plants bird's-foot trefoil, white clover and marsh bedstraw, from within the fluvial floodplain of the Afon Artro</p> <p><u>Size:</u> The loss of foraging habitat compared to that which would remain in the surrounding area is unlikely to be significant, due to the relative abundance of suitable habitat containing the species' food plants likely to be present within the surrounding landscape</p> <p><u>Reversibility:</u> Reversible to some extent, although some would be permanently lost without mitigation</p> <p><u>Duration:</u> During site clearance and continuing into operation</p>	Not significant
Wall mason bee (<i>Osmia parietina</i>)	National	Loss of potential nesting and foraging habitat during site clearance	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of 0.63ha of suitable foraging habitat, containing common bird's-foot trefoil, the species' only source of pollen, from within the fluvial floodplain of the Afon Artro. Loss of approximately 200m of dry stone wall providing potential nesting habitat for the species.</p> <p><u>Size:</u> The species has not been confirmed as present in recent years and although it is under-recorded, it is unlikely that it would be nesting within the small section of wall to be removed so this is not considered to be significant. The loss of foraging habitat compared to that which would remain in the surrounding area is also unlikely to be significant, due to the relative abundance of suitable habitat containing the food plant likely to be present within the surrounding area, particularly within the upland habitats located to the east</p> <p><u>Reversibility:</u> Reversible to some extent, although some would be permanently lost without mitigation</p>	Not significant

			<u>Duration:</u> During site clearance and continuing into operation	
Sharp rush (<i>Juncus acutus</i>)	National	Potential for damage during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> A few clumps of sharp rush are located approximately 20m to the west of the proposed construction area in the vicinity of the bridge over the Afon Artro. There is also some located approximately 35m to the west of the construction area in the vicinity of the bridge over Watercourse 2. There is low potential for damage to these areas during the construction period due to physical damage or dust, leading to the loss of part of this population</p> <p><u>Size:</u> The risk of this happening is fairly low but due to the limited distribution of this nationally rare plant species, an impact of up to local significance could occur</p> <p><u>Duration:</u> Greatest risk during construction of the proposed bridge over the Artro</p>	Up to Local
<i>Schismatomma graphidioides</i> (a lichen)	Regional	Loss and potential damage of small populations of this species due to site clearance and construction activities	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> The population supported by a mature sycamore within the copse to be lost to the south of the Afon Artro is very small (a few tiny thalli). The population on the sycamore to be retained within the car parking and picnic area is of a similar small size (c.3-5mm across). This could be affected by construction dust and air pollution arising from construction traffic emissions</p> <p><u>Size:</u> The presence of the two small populations of this species within the survey area suggests that there is a larger population in the vicinity that would be retained. The species is also considered likely to be under-recorded. Therefore, taking into account the small size of the population to be lost and potentially damaged, this impact would be significant at a local level at most.</p> <p><u>Duration:</u> The loss of the sycamore within the copse would occur during site clearance and the potential for impacts on the sycamore to be retained would occur during construction activities within this area, i.e. during construction of the proposed junction with Mochras Road and potentially the Artro bridge.</p>	Up to Local
<i>Gyalecta carneola</i> (a lichen)	Local	Potential damage of a small population of this species due to construction activities	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> The population supported by a mature oak to the east of the existing A496 leading into Llanbedr from the north is very small (c.3 immature apothecia) and not located directly within the construction area of the Proposed Improvement, but would lie immediately adjacent to the old road that would be broken up to the northwest and an area of proposed ecological compensation (rush pasture creation). The existing road is however likely to be used as a haul route for construction traffic, which is likely to lead to increased dust levels and emissions</p> <p><u>Size:</u> There is likely to be an increase in air pollution at the location of this population during construction, due to dust generation and emissions from construction traffic. However, due to</p>	Up to Local

			the small size of the population of a species that has also been recorded 500-600m to the east (Cofnod data), it is considered that any impact would be locally significant at most <u>Duration:</u> Throughout the construction period only (about 18 months) as during operation there is likely to be a significant reduction in traffic volume in this location. The extent of the works in the vicinity of this population is minimal and the main impact would be from construction dust/emissions	
<i>Punctelia reddenda</i> (a lichen)	Local	Potential damage to small populations of this species due to construction activities	<u>Sign:</u> Negative <u>Extent:</u> This species is located on two mature oaks to the east of the existing A496 as it leads into Llanbedr from the north. The most northern of these would lie directly adjacent to the proposed northern tie-in of the scheme and is liable to physical damage during construction activities in this area as well as damage due to construction dust/emissions in the vicinity, particularly as construction traffic is likely to pass through this area throughout the construction period. The tree supporting this population is also liable to construction damage or even removal without mitigation, which would result in the loss of this population. The tree supporting this species a little further south would be outside the construction area but again lies immediately adjacent to the existing A496 that is likely to be used as a haul route during construction, subjecting the population to an increase in dust and construction vehicle emissions <u>Size:</u> As there is likely to be some damage during the construction period without mitigation, and potentially the loss of one of the populations, and the species has not been recorded previously within 2km, this impact is considered to be locally significant <u>Duration:</u> Throughout the construction period only (about 18 months) as during operation there will be no traffic passing immediately adjacent to the southern tree and no change in traffic volume adjacent to the northern tree if retained.	Local
Non-native Invasive Plant Species:				
<i>Rhododendron ponticum</i> ; Japanese knotweed; Himalayan balsam; Montbretia	N/A	Potential for <i>Rhododendron ponticum</i> , Japanese knotweed, Himalayan balsam and Montbretia to be spread more widely in the vicinity of the Proposed Improvement due to construction activities	<u>Sign:</u> Negative <u>Extent:</u> Potential to cause the spread of rhododendron, Japanese knotweed, Himalayan balsam and Montbretia within and/or outside the footprint of the Proposed Improvement <u>Size:</u> Some of these species, such as Japanese knotweed are particularly difficult to eradicate and are also easily dispersed via watercourses to areas downstream. This is likely to happen with or without the scheme in place but site clearance and construction activities, particularly in the vicinity of the Afon Arto, would exacerbate this effect. The presence of Pen Llyn a'r Sarnau SAC and Morfa Dyffryn SSSI downstream increases the severity of this impact. <u>Reversibility:</u> Reversible (via intensive control programmes) <u>Duration:</u> Potential for spread during construction but impact ongoing into the operational period <u>Timing and Frequency:</u> During site clearance activities at the northern and southern tie-ins	Local

			and in the vicinity of the Afon Artro and during construction activities in these areas, including the construction of the Artro bridge and the proposed footway to the east	
Ecosystem Services:				
Cultural services provided by the natural river corridor in the vicinity of the picnic / fishing area off Mochras Road	Local	Short-term loss of the picnic / fishing area adjacent to the proposed bridge over the Afon Artro during construction	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Short-term loss of an area used by tourists, particularly during the summer months, and local residents, potentially year-round</p> <p><u>Size:</u> A small site but highly amenable, the short-term loss of which would not constitute a major impact but would be a significant loss to local residents in particular</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Likely to be closed for the whole construction period (approximately 18 months)</p>	Local
Cultural services provided by the natural landscape in the vicinity of the Public Right of Way (PRoW) running along the top of the flood embankment	Local	Short-term closure of the PRoW along the flood embankment to the east of Afon Artro during the construction period	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Short-term loss of a pleasant path through a semi-natural landscape, that is likely to be used by local residents and tourists, particularly in the summer months, and provides a link from Llanbedr village to Wales Coastal Path to the west of the river</p> <p><u>Size:</u> It is considered that this would not constitute a major impact but would be a significant loss to local residents in particular who may regularly use the path to walk their dogs for example</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Likely to be closed for the whole construction period (approximately 18 months)</p>	Local
Services to agriculture provided by pollinators benefitting from semi-natural habitat within the scheme corridor	Local	Permanent loss of habitat used by pollinators due to the footprint of the Proposed Improvement	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Permanent loss of approximately 1.18ha of good quality foraging habitat suitable for a wide range of pollinator species from areas of lowland meadow and floodplain grazing marsh to be lost to the Proposed Improvement footprint</p> <p><u>Size:</u> This is likely to constitute a small but significant impact on the local pollinator population and the services they provide to agriculture in the area</p> <p><u>Reversibility:</u> Reversible (with compensatory habitat creation)</p> <p><u>Duration:</u> Permanent following site clearance</p>	Local

Table 5.4.13: Summary of Potential Operational Impacts without Mitigation

***Explanation of Impact Characterisation**

Sign: Positive (beneficial) or Negative (adverse)

Extent: Area measures and percentage of total (e.g. area of habitat/territory lost)

Size: Description of level of severity of influence (e.g. complete loss, number of animals affected)

Reversibility: Reversible or Not Reversible (can the effect be reversed, whether or not this is planned?)

Duration: Permanent or Temporary in ecological terms. Where differing timescales are determined in relation to the life-cycle of the receptor, these should be defined.

Timing and frequency: Important seasonal and/or life-cycle constraints and any relationship with frequency considered.

N/A = Not Applicable

Important Ecological Feature	Scale of Importance	Description of Impact	Characterisation of Impact *	Scale of Significance (Without Mitigation)
Sites:				
Coedydd Derw a Safleoedd Ystlumod Meirion SAC (lesser horseshoe bat only)	International	Potential for impacts on lesser horseshoe bats likely to represent part of the lesser horseshoe bat feature of the SAC (see 'Lesser horseshoe bat' as a separate feature below)	<p>See impacts described for the local lesser horseshoe bat population, characterised separately below. These include increased risk of road mortality; and permanent disturbance/disruption to lesser horseshoe bats and habitats used by them due to increased lighting/noise. As the lesser horseshoe bat population in the vicinity of the Proposed Improvement includes two maternity colonies and the nearest component of the SAC is only 85m away, it is considered that the local lesser horseshoe population could represent a significant proportion of the SAC population and therefore the impacts described below as being significant to the local population could also result in a significant impact on the SAC.</p> <p><u>SAC features potentially affected:</u> Lesser horseshoe bat</p> <p><u>SAC Conservation Objectives potentially affected:</u></p> <ol style="list-style-type: none"> 1. The population of lesser horseshoe bats should be maintained at its current size and encouraged where possible to increase. As there has been an upward trend in lesser horseshoe bats numbers in Wales it is reasonable to expect the Gwynedd population to increase. 2. There are sufficient breeding roosts (buildings, structures and trees) and hibernation roosts (mines and buildings) of appropriate quality. The other types of roost such as night, transitional, leks and swarming sites, should also be maintained as our knowledge of these often significant roosts improves. 3. Foraging or feeding habitat in the SAC and surrounding countryside, including grasslands and some gardens, is of appropriate quality, extent and connectivity across the range. 	International

		<p>A reduction in air pollution from vehicle emissions arising from moving the route of the A496, with the majority of the traffic flow, further away from the SAC</p>	<p><u>Sign:</u> Positive <u>Extent:</u> The route of the A496 would be moved approximately 115m further away to the west of Unit 34 of the SAC, which could benefit the old sessile oakwoods feature of this Unit of the SAC and particularly lower plant communities that could be associated with this feature that are particularly sensitive to changes in air quality. <u>Size:</u> According to Chapter 5.1: Air Quality there would potentially be a 1µm/m³ reduction in annual mean NO_x at the closest point of the SAC to the new route during the opening year, compared with a Do Minimum scenario without the scheme in place. Although this is a reduction, it is well below the ecological objective of 30µm/m³ and is therefore not considered significant <u>Duration:</u> Permanent following construction</p> <p><u>SAC features potentially affected:</u> Old sessile oakwoods <u>SAC Conservation Objectives potentially affected:</u></p> <ol style="list-style-type: none"> 7. The abundance and distribution of common and typical (Atlantic, sub-Atlantic, western, oceanic) mosses and liverworts, lichens (and slime moulds), will be maintained or increased. Refer to indicative lists in Tables 3 and 4; 8. The abundance and distribution of uncommon mosses and liverworts, lichens and slime moulds, will be maintained or increased. Refer to indicative lists in Tables 5 & 6 in Annex 3. 	<p>Not significant</p>
<p>Pen Llŷn a'r Sarnau SAC (otter only)</p>	<p>International</p>	<p>Potential for damage to otter habitat within the SAC due to pollution incidents affecting watercourses during operation</p>	<p><u>Sign:</u> Negative <u>Extent:</u> Limited to areas in the vicinity of hydrological pathways from the footprint of the Proposed Improvement, i.e. the Afon Artro. The site is located 420m downstream via a minor watercourse and 570m via the Afon Artro. <u>Size:</u> The area within the SAC likely to be affected during a pollution incident during operation is not designated for any of the habitat features of the SAC and is therefore likely to be purely included as habitat for otters. The area likely to be affected by a pollution incident is a very small proportion of the total extent of otter habitat within the SAC due to the dilution/dispersion of contaminants likely to occur prior to entering the SAC boundary. Due to the extensive habitat that would remain available to the otter population of the SAC lying outside the Zol of any potential operational pollution, this impact is not considered to be significant <u>Duration:</u> Long-term ongoing risk although the effects are also likely to remain for a relatively short-term period <u>Timing and Frequency:</u> Risk throughout operation</p> <p><u>SAC features potentially affected:</u> Otter <u>SAC Conservation Objectives potentially affected:</u></p>	<p>Not significant</p>

			<p>Otters will have sufficient availability of prey and widespread availability and access to good quality essential habitats including freshwater and undisturbed resting and breeding sites to allow the otter population to thrive.</p>	
		<p>Potential for impacts on otters likely to represent part of the otter feature of the SAC (see 'Otter' as a separate feature below)</p>	<p>See impacts described for the local otter population, characterised separately below. These include increased risk of road mortality; disturbance/disruption due to the presence of the Proposed Improvement and associated noise and lighting; and increased pollution of watercourses leading to a reduction in prey species and/or decrease in otter health. Although some of these impacts are considered to be significant to the local otter population without mitigation, it is not considered that any of them would have a significant effect on the Conservation Status of the otter population of the SAC.</p> <p><u>SAC features potentially affected:</u> Otter <u>SAC Conservation Objectives potentially affected:</u> Otters will have sufficient availability of prey and widespread availability and access to good quality essential habitats including freshwater and undisturbed resting and breeding sites to allow the otter population to thrive.</p>	Not significant
Morfa Dyffryn SSSI	National	<p>Degradation of the SSSI features arising from pollution incidents during operation</p>	<p><u>Sign:</u> Negative <u>Extent:</u> Limited to areas in the vicinity of hydrological pathways from the footprint of the Proposed Improvement, i.e. the Afon Artro and five minor tributaries. The site is located 420m downstream via a minor tributary and 570m via the Afon Artro. <u>Size:</u> The area of habitats and species that are likely to be affected during a pollution incident during operation is likely to be a relatively small proportion of their total extent within the SSSI due to the dilution/dispersion of contaminants likely to occur prior to contact with the SSSI features. However, due to the provision of three attenuation areas, filter strips and filter drains as embedded mitigation for operational pollution of watercourses, a significant operational impact is not anticipated</p> <p><u>SSSI features potentially affected:</u> Faunal and floral communities of the Artro estuary; Saltmarsh; and associated nationally scarce higher plants, namely lax flowered sea-lavender (<i>Limonium humile</i>) and perennial glasswort (<i>Sarcocornia perennis</i>)</p>	Not significant
Restored Ancient Woodland Sites (25332, 25334, 25336 – Lower Wood and 25306 – Coed Hafod-y-Bryn)	Local	<p>A reduction in air pollution from vehicle emissions arising from moving the route of the A496, with the majority of the traffic flow, further away from these sites</p>	<p><u>Sign:</u> Positive <u>Extent:</u> The route of the A496, and the majority (estimated 90%) of its associated traffic flow would be moved further away from all four of these RAWs, potentially decreasing the level of air pollution arising from vehicle emissions at these sites. Whilst this is likely to have a positive effect for three of the sites, as the Proposed Improvement would move the A496 further to the west of these sites, it is less certain whether the impact would be positive or negative for 25336 (Lower Wood) as the A496 would be moved from the eastern edge of this site to about</p>	Not significant

			<p>35m to the west of the site. This could increase emissions for Lower Wood as the prevailing winds would carry pollution towards the site. However, as the site would be further away from the road, the Proposed Improvement is expected to reduce overall vehicle emissions and pollution from vehicle emissions is expected to decrease between now and the opening year even without the scheme in place, it is unlikely that this would be a significant effect.</p> <p><u>Size:</u> The Proposed Improvement would move the A496 35m further to the west of site 25336 (Lower Wood), which is currently adjacent to the west of the road; the A496 would be moved 165m further to the west of site 25306 (Coed Hafod-y-bryn), which is currently 35m to the southeast of the road; the A496 would be moved 15m further to the west of site 25334, currently adjacent to the east; and the A496 would remain 30m away from site 25332 at its closest point but the section curving around the site to the north would be moved further away to the northwest. Overall there is likely to be a slight positive impact on RAWs in the vicinity of the Proposed Improvement, although this unlikely to be considered significant</p> <p><u>Duration:</u> Permanent following construction</p>	
Habitats:				
Reedbeds	County	Permanent loss of approximately 0.01ha of this habitat due to lack of sunlight underneath the proposed single span bridge	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> 0.01ha of reedbed habitat would be located underneath the proposed single span bridge, much of which would be likely to die off following construction of the bridge, due to the lack of light penetration underneath the bridge, which would cover an area of approximately 0.01ha at a height of 3.3m above the average water level of the ditch</p> <p><u>Size:</u> This loss would constitute an 8.5% loss from the reedbed habitat located within Watercourse 2 but in relation to the extensive area of this habitat that would remain throughout Gwynedd, and also in the immediate vicinity of the Proposed Improvement, this would constitute less than 1% of the total resource and is therefore not considered to be significant</p> <p><u>Duration:</u> Permanent</p>	Not significant
Rivers	County	Degradation of the Afon Artro catchment within the corridor of the Proposed Improvement arising from pollution (including light and noise) during operation	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to affect any of the five watercourses, including the Afon Artro, that flow through the corridor of the Proposed Improvement. Three of these are main rivers, and all of these form part of the catchment of the Afon Artro, classified as 'Good' quality under the Water Framework Directive.</p> <p><u>Size:</u> Due to the provision of three attenuation areas, and filter strips and filter drains throughout as embedded mitigation for operational pollution of watercourses, a significant operational impact is not anticipated</p> <p><u>Reversibility:</u> Reversible</p>	Not significant
		Loss/degradation of	<u>Sign:</u> Negative	Not significant

		<p>aquatic habitats within the Afon Artro due to the presence of the Proposed Improvement, including reduced levels of sunlight underneath the proposed Artro bridge and changes to hydrology/ecology due to the diversion of Watercourses 0 and 3 and culverting of Watercourse 3</p>	<p><u>Extent:</u> 0.02ha of river habitat would be located underneath the proposed widespan bridge, some of which may decrease in quality following construction of the bridge, due to the lack of light penetration underneath the bridge, which would cover an area of approximately 0.02ha at a height of at least 5.8m above the average river level. Approximately 45m of Watercourse 0 and 125m of Watercourse 3 would be diverted. Watercourse 3 would also be culverted for 31m</p> <p><u>Size:</u> The area of river habitat located underneath the proposed bridge crossing point is relatively devoid of aquatic vegetation and is not known to be used nor considered to be suitable as a spawning ground for salmonids. The height of the proposed bridge and inclusion of a number of bridge piers in the design rather than a solid central support, would allow reasonable levels of sunlight to penetrate most of the area underneath the bridge. Degradation of the whole area beneath the bridge (as a worst case scenario) would constitute a loss of significantly less than 1% of the habitat located within the Afon Artro and in relation to the extensive area of this habitat that would remain throughout Gwynedd, and also in the immediate vicinity of the Proposed Improvement, this is not considered to be significant. The permanent diversion of Watercourses 0 and 3 and culverting of Watercourse 3 would be undertaken 680m and 730m upstream respectively of the confluence of these minor watercourses (drainage ditches) with the Afon Artro and it is therefore not considered likely that these works would have a significant impact on the Artro catchment within the local area</p> <p><u>Duration:</u> Permanent</p>	
Species:				
Lesser horseshoe bat	Regional	Increased risk of bat mortality during operation of the Proposed Improvement due to permanent severance of commuting routes	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> The wide span bridges (for Watercourses 1 and 2), oversized culvert for Watercourse 3 and 2.6 x 2.6m underpass proposed to the west of Maes Artro holiday village (Ch. 530) included as embedded mitigation would help to minimise any risk of bat mortality by providing safe crossing points at three out of the four potential/confirmed commuting routes identified during baseline surveys. The remaining potential commuting route along the northern edge of the wooded area adjacent to the builder's yard (Ch. 330) including the existing transitional roosts, would no longer exist as this area would be lost to the scheme footprint, including the roosts the activity is likely to have been connected with. However, some bats may still return to this area and there could still be an increased risk of traffic collision compared to a Do Minimum scenario with no scheme, as it is possible that bats may cross at other locations due to the presence of retained vegetation or miss the safe underpasses due to a lack of navigational features leading into them</p> <p><u>Size:</u> Commuting routes are used by small numbers of bats, although this number may increase in the future</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Throughout operation – particularly during the bat active season</p>	Local

		Permanent disturbance/disruption to important species and habitats used by them due to increased traffic noise and lighting in the vicinity of the Proposed Improvement	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Lesser horseshoe bats are light-sensitive and therefore are likely to be deterred from flying in lit areas. The commitment of ensuring a maximum of 1 lux for the river corridor in the vicinity of the proposed bridge over the Artro, incorporated into the embedded mitigation (described in Table 5.4.11) would reduce the chances of disruption due to the proposed lighting of the road/footway underneath the bridge, particularly as there is currently street lighting in this location along Mochras Road. However, the removal of vegetation in the vicinity of the proposed bridge could lead to greater light spill onto the river corridor. As no other additional lighting is proposed, the only other impact from lighting/noise would be from traffic using the new route but this is only likely to have an effect over relatively short distances (Berthinussen, 2015)</p> <p><u>Size:</u> Small numbers of bats</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Throughout operation - particularly during the bat active season</p> <p><u>Timing and frequency:</u> Variable – potential increase in traffic during the summer tourist season.</p>	Local
<p><i>Myotis</i>, pipistrelle and brown long-eared bats</p> <p>Greater horseshoe and Barbastelle bats</p>	Local	Increased risk of bat mortality during operation of the Proposed Improvement due to permanent severance of commuting routes	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> As for same impact on lesser horseshoe bats, described above</p> <p><u>Size:</u> Commuting routes are used by relatively small numbers of <i>Myotis</i>/pipistrelle, brown long-eared bats, and very small numbers of greater horseshoe and barbastelle, although this number may increase in the future.</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Throughout operation – particularly during the bat active season</p>	Local
	Regional	Permanent disturbance/disruption to important species and habitats used by them due to increased traffic noise and lighting in the vicinity of the Proposed Improvement	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> As for same impact on lesser horseshoe bats, described above</p> <p><u>Size:</u> Relatively small numbers of <i>Myotis</i>/pipistrelle, brown long-eared bats, and very small numbers of greater horseshoe and barbastelle, although this number may increase in the future.</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Throughout operation - particularly during the bat active season</p> <p><u>Timing and frequency:</u> Variable – potential increase in traffic during the summer tourist season.</p>	Local
Noctule	Local	Increased risk of bat mortality during operation of the Proposed	These species typically fly high above the landscape and are therefore unlikely to be flying low enough to be struck by traffic.	Not significant
Leisler's and	Regional			

Serotine bats		Improvement due to permanent severance of commuting routes		
		Permanent disturbance/disruption to important species and habitats used by them due to increased traffic noise and lighting in the vicinity of the Proposed Improvement	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> As for same impact on lesser horseshoe bats, described above</p> <p><u>Size:</u> Small numbers of bats</p> <p><u>Reversibility:</u> Reversible</p> <p><u>Duration:</u> Throughout operation - particularly during the bat active season</p> <p><u>Timing and frequency:</u> Variable – potential increase in traffic during the summer tourist season.</p>	Local
Otter	County	Increased risk of road fatalities due to the presence of the Proposed Improvement bisecting otter habitat	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> A family group of otters are known to use the Afon Artro as a foraging/commuting route and are likely to use the other watercourses within the scheme corridor for occasional foraging, with evidence also recorded on Watercourses 2 and 5, so the Proposed Improvement would be likely to dissect the territory and foraging areas used by a group of breeding otters.</p> <p><u>Size:</u> There is already some risk of road mortality along the existing A496, with an otter road fatality recorded just to the north of the Proposed Improvement but this risk would be increased by the construction of a new offline section of the road that would directly cross areas of suitable foraging habitat and would support traffic at 60mph. Some of the embedded mitigation described in Table 5.4.11 would minimise this impact, such as the bridge proposed over the Afon Artro and Watercourse 2, the 2.2m box culvert for Watercourse 3 with mammal ledges and the provision of 900mm flood alleviation pipes every 2.9m at the base of the proposed embankment through the flood plain, with a dry pipe at a higher level located centrally between the two bridges. However, without additional mitigation in place, a low level of risk would remain.</p> <p><u>Duration:</u> Permanent following construction</p>	Local
		Increased disturbance of otters and habitats used by them due to the presence of the operating Proposed Improvement and associated noise, lighting and maintenance activities	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> As the Proposed Improvement incorporates a double span bridge over the Afon Artro, a single span bridge over Watercourse 2 and minimal light spill onto the river corridor due to the lighting design for the footway underneath the Artro bridge, little disturbance is anticipated during operation of the Proposed Improvement. However, there is likely to be a slight sporadic increase in noise and lighting, of the Artro river corridor, the other watercourses within the scheme corridor and foraging habitat within the fluvial flood plain of the Artro due to traffic using the new road. The 1m boundary walls proposed on each side of the new road throughout these sensitive areas would reduce the impact further. Maintenance</p>	Not significant

			<p>activities in the vicinity of either of the two bridges also have the potential to disturb resting otters</p> <p><u>Size:</u> It is considered that with the 1m high boundary walls and other embedded mitigation described above, the level of disturbance would be minimal and very unlikely to significantly affect the Conservation Status of the local otter population, which is likely to adjust to the slight increase in noise and light in these locations. Any maintenance works to the proposed bridges during the operational period would be screened for environmental impacts and would be unlikely to have a significant effect on the Conservation Status of the local otter population</p> <p><u>Duration:</u> Permanent following construction. Potential increase in traffic during the summer tourist season.</p>	
Badger	Local / Negligible	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting badger territories and increased traffic speed compared to the existing A496 through Llanbedr	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Predominantly badgers within the two territories immediately to the north and south of the Afon Artro could be at increased risk of road mortality due to severance of two badger territories and a total of seven known badger commuting routes, as well as an increase in traffic speed from 30mph to 60mph</p> <p><u>Size:</u> Up to about 15 badgers from the territory to the south of the Afon Artro and more than this again in the territory to the north (greater level of activity recorded in this territory) would be at an increased risk of road mortality due to the Proposed Improvement dissecting these two territories and regularly used commuting routes within them. There is already some risk of road mortality along the existing A496 as badger road fatalities have been recorded in the vicinity of the Proposed Improvement but this risk would be increased due to the severance and increased traffic speed. Much of the embedded mitigation described in Table 5.4.11 would minimise this impact, such as the 2.2m box culvert with mammal ledges, two bridges, 900mm flood alleviation pipes and a dry pipe within the fluvial floodplain, and two cattle underpasses (in the northern and southern halves of the Proposed Improvement). It is considered that these design measures would reduce the impact to moderate on these social groups but of significance on a local scale only due to the extensive distribution and abundance of badgers on a local, county, national and international level.</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	Local
Polecat and Hedgehog	Local	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting foraging habitat and	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> There are a few polecat records and only one hedgehog record within the scheme corridor (from 1976). It is likely that low numbers of polecat would be likely to cross the scheme corridor occasionally and are likely to suffer an increased risk of road traffic mortality due to the presence of the Proposed Improvement bisecting suitable foraging habitat and the</p>	Local

		increased traffic speed compared to the existing A496 through Llanbedr	<p>increased speed limit on the new road compared with the existing A496 through Llanbedr. The risk is lower for hedgehogs due to the likelihood of a very low, if not non-existent density of hedgehogs within the ZoI of the Proposed Improvement, likely to be due to relatively high badger density and sub-optimal habitat conditions</p> <p><u>Size:</u> The embedded mitigation including the 2.2m box culvert with mammal ledges, two bridges, 900mm flood alleviation pipes and a dry pipe within the fluvial floodplain, and two cattle underpasses (in the northern and southern halves of the Proposed Improvement) would reduce the impact to some extent but it is considered that a minor impact would remain with no additional mitigation in place, of greater significance to polecats than hedgehogs but considered of local significance to both as a precautionary approach</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	
Brown hare	Local	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting foraging habitat and increased traffic speed compared to the existing A496 through Llanbedr	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> From the Cofnod records, it seems likely that a low number of brown hares would cross the Proposed Improvement corridor occasionally and these are likely to suffer an increased risk of road traffic mortality due to the presence of the Proposed Improvement bisecting suitable foraging habitat and the increased speed limit on the new road compared with the existing A496 through Llanbedr</p> <p><u>Size:</u> The embedded mitigation including the 2.2m box culvert with mammal ledges, two bridges, 900mm flood alleviation pipes and a dry pipe within the fluvial floodplain, and two cattle underpasses (in the northern and southern halves of the Proposed Improvement) would reduce the impact to some extent but it is considered that a minor impact would remain with no additional mitigation in place</p> <p><u>Reversibility:</u> Not reversible</p> <p><u>Duration:</u> Permanent</p> <p><u>Timing and Frequency:</u> At any time during operation</p>	Local
Barn owl	County	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting foraging habitat and increased traffic speed compared to the existing A496 through Llanbedr	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> All previous records of barn owl activity and the majority of suitable habitat are located to the west of the Proposed Improvement corridor but it is likely that occasionally barn owls would cross the scheme footprint</p> <p><u>Size:</u> The presence of the new road with a 60mph and 50mph speed limit cutting across suitable foraging habitat (particularly where it crosses the floodplain) is likely to increase the risk of road mortality for any owls attempting to cross as barn owls do tend to fly fairly low over the ground. The new road would be very open as no planting is proposed along the verges in order to discourage crossing by other species such as bats. This could be a benefit to barn owls, allowing them greater visibility of oncoming traffic but on the other hand, the lack</p>	Local to County

			<p>of higher vegetation beside the road could encourage them to fly lower over the road, particularly where the road is supported on an embankment across the floodplain. The likely size and significance of this impact is therefore uncertain but the 1m high boundary walls proposed would be likely to lift them up a little above the height of the road</p> <p><u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> At any time during operation</p>	
Reptiles and amphibians	Local	<p>Increased risk of road mortality due to the presence of the Proposed Improvement bisecting potential habitat, increased traffic speed compared to the existing A496 through Llanbedr and potential for becoming trapped in gulley pots</p>	<p><u>Sign:</u> Negative <u>Extent:</u> The majority of reptiles were recorded within the southern half of the scheme corridor, to the south of the Afon Artro, and these records were all slow worms. It is possible that slow worms or common lizards may occasionally attempt to cross the proposed road within this section in particular. Grass snakes are much less likely to attempt to cross as they prefer to stay close to wetter habitat. Amphibians such as toads and frogs may attempt to cross during wet weather but this is more likely where the scheme would cross wetter habitat underneath the proposed bridges, or within the floodplain, where the flood alleviation pipes would provide safe access under the road, reducing this risk. Amphibians in particular are also known to suffer mortality through becoming trapped in gulley pots <u>Size:</u> It is unlikely that this would have a significant impact on the Conservation Status of these species, mainly due to the embedded mitigation including 900mm pipes at the base of the embankment every 2.9m within the fluvial floodplain <u>Reversibility:</u> Not reversible <u>Duration:</u> Permanent <u>Timing and Frequency:</u> At any time during operation</p>	Not significant
<i>Schismatomma graphidioides</i> (a lichen)	Regional	<p>Potential for damage to the retained population in the car parking and picnic area due to increases in air pollution from vehicle emissions during operation</p>	<p><u>Sign:</u> Negative <u>Extent:</u> The population on the sycamore to be retained within the car parking and picnic area is very small (c.3-5mm across) and not located directly adjacent to the proposed bypass, but would lie immediately adjacent to the proposed new junction with Mochras Road 45m to the west of the bypass. <u>Size:</u> There may be a slight increase in air pollution at the location of this population during operation, due to emissions from traffic using the new route of the A496 as it crosses the Afon Artro approximately 45m to the east. However, the volume of traffic using the section of Mochras Road immediately adjacent to this area is expected to significantly decrease (by 90%) so this could balance out any increase from the bypass. This species is also suited to moderate to high nutrient levels and due to the small size of the population and the likelihood of a larger population in the surrounding landscape, it is considered that this impact is unlikely to be significant, particularly as the prevailing winds are from the southwest and the majority of the emissions would therefore be blown away from this lichen population</p>	Not significant

			<u>Duration:</u> Ongoing during operation, particularly when winds are from the east	
<i>Gyalecta carneola</i> (a lichen)	Local	Potential for improved conditions for the population adjacent to the existing A496 due to a significant (over 90%) reduction in traffic leading to improved air quality during operation	<p><u>Sign:</u> Positive</p> <p><u>Extent:</u> The population supported by a mature oak to the east of the existing A496 leading into Llanbedr from the north is very small (c.3 immature apothecia) and not located directly adjacent to the Proposed Improvement, but would lie immediately adjacent to an area of proposed ecological compensation (rush pasture creation). At present, it is located immediately adjacent to the existing A496 and is likely to suffer from the air pollution associated with emissions from traffic currently using this route but during operation traffic would be significantly reduced at this location, with only vehicles from the six properties located along the minor road to the east, including guests at Cae Nest Farm Hotel, likely to use this road</p> <p><u>Size:</u> Although there could still be some air pollution blown across from traffic using the proposed bypass which would be located approximately 50m to the west at this location, the traffic volume is not expected to increase and this would represent a significant reduction compared to this volume of traffic passing immediately adjacent to the lichen population</p> <p><u>Duration:</u> Ongoing during operation</p>	Up to Local
<i>Punctelia reddenda</i> (a lichen)	Local	Potential for improved conditions for one of the populations adjacent to the existing A496 due to the removal of traffic from this location leading to improved air quality during operation	<p><u>Sign:</u> Positive</p> <p><u>Extent:</u> The southern tree supporting this species, located immediately adjacent to the existing A496 and just outside the scheme footprint, would be subject to a removal of all traffic passing immediately adjacent, as the old road would no longer be in use at this location. Although some air pollution is likely to disperse in the direction of this tree during operation (due to the prevailing winds) from the proposed bypass that would be located approximately 25m to the west, there should be a significant improvement in air quality at this location</p> <p><u>Size:</u> Although there could still be some air pollution blown across from traffic using the proposed bypass which would be located approximately 25m to the west at this location, the removal of traffic passing immediately adjacent to this lichen population should represent a significant improvement in air quality at this location</p> <p><u>Duration:</u> Ongoing during operation</p>	Up to Local
Non-native Invasive Plant Species:				
<i>Rhododendron ponticum</i> ; Japanese knotweed; Himalayan balsam; Montbretia	N/A	Potential for <i>Rhododendron ponticum</i> , Japanese knotweed, Himalayan balsam and Montbretia to be spread more widely in the vicinity of the Proposed	<p><u>Sign:</u> Negative</p> <p><u>Extent:</u> Potential to cause the spread of rhododendron, Japanese knotweed, Himalayan balsam and Montbretia within and/or outside the footprint of the Proposed Improvement</p> <p><u>Size:</u> Some of these species, such as Japanese knotweed are particularly difficult to eradicate and are also easily dispersed via watercourses to areas downstream. This is likely to happen with or without the scheme in place but maintenance activities, particularly those involving cutting or removing vegetation in the vicinity of the Afon Arto, could exacerbate this effect.</p>	Local

		Improvement due to maintenance works during operation	The presence of Pen Llyn a'r Sarnau SAC and Morfa Dyffryn SSSI downstream increases the severity of this impact. <u>Reversibility:</u> Reversible (via intensive control programmes) <u>Timing and Frequency:</u> Any maintenance activities required during the operational period, including maintenance of the proposed Artro bridge and any vegetation cutting/removal within the new verges	
Ecosystem Services:				
Cultural services provided by the natural river corridor in the vicinity of the picnic area off Mochras Road	Local	A decrease in the aesthetic value of this site, including the presence and setting of natural features and wildlife, due to the presence of the Artro bridge	<u>Sign:</u> Negative <u>Extent:</u> Permanent decrease in the aesthetic value and experience of natural resources due to the presence of the bridge over the Afon Artro in particular. <u>Size:</u> A small site but highly amenable, the reduction in value of which would not constitute a major impact but would be a significant loss to local residents in particular <u>Reversibility:</u> Irreversible <u>Duration:</u> Ongoing following construction of the bridge over the Afon Artro in particular	Local
Cultural services provided by the natural landscape in the vicinity of the Public Right of Way (PRoW) running along the top of the flood embankment	Local	A decrease in aesthetic value, including presence and setting of natural features and wildlife, due to the presence of the Proposed Improvement cutting across the route	<u>Sign:</u> Negative <u>Extent:</u> Permanent decrease in the aesthetic value and experience of natural resources due to the presence of the bridge over Watercourse 2 in particular <u>Size:</u> A relatively minor route but providing a link to the Wales Coastal Path to the west of the river, the reduction in value of which would not constitute a major impact but would be a significant loss to local residents in particular who may regularly use the path to walk their dogs for example <u>Reversibility:</u> Irreversible <u>Duration:</u> Ongoing following construction of the bridge over Watercourse 2 in particular	Local

Mitigation, Residual Effects and Compensation

- 5.4.365 The following section identifies the measures necessary to mitigate the potential impacts of the Proposed Improvement on each of the important ecological features for which the potential for a significant impact (without mitigation) has been identified. Mitigation includes measures to avoid or reduce the negative impacts of the Proposed Improvement but in this assessment does not include such measures that have become integral to the scheme design, as these are referred to as embedded mitigation and are included in the assessment of the scheme design without mitigation (Tables 5.4.12 and 5.4.13 above). A summary of these embedded mitigation measures has been provided in Table 5.4.11 in the previous section. The mitigation referred to in this section also excludes measures to make up for impacts resulting in the loss of or permanent damage to ecological features (such as habitat creation to make up for habitat lost), as these are referred to as compensation according to the CIEEM (2016) guidelines, and are included in the 'Residual Effects and Compensation' section below.
- 5.4.366 Mitigation measures for impacts arising from both the construction and operation of the Proposed Improvement are included and summarised in Table 5.4.14 below. Any significant effects that would remain with mitigation in place are also included in Table 5.4.14 and described in 'Residual Effects and Compensation' below. Where significant residual effects are anticipated, compensation measures are described.
- 5.4.367 The mitigation measures in this section have generally been described according to important ecological features or groups of similar features, except for those relating to air and water quality impacts, as each of these impacts affect a number of different features. For locations of existing and proposed features associated with the mitigation described below, see Figures 7.1-5: Environmental Master Plan (Volume 1a).

Water quality

Features Mitigated: Pen Llyn a'r Sarnau SAC; Morfa Dyffryn SSSI; Coastal and floodplain grazing marsh; Purple moor grass and rush pastures; Reedbeds; Rivers; Bats (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter; Amphibians; Fish; and Cultural services provided by the river corridor and fluvial floodplain

- 5.4.368 The degradation of fluvial habitats within the scheme corridor through pollution incidents or sedimentation during construction, which could be transferred to protected sites downstream, would be minimised through good environmental site management. In particular, during construction, best practice guidelines including PPG and CIRIA guidance would be followed, particularly when working in or near to watercourses. The mechanism for ensuring the delivery of this mitigation would be through the CEMP (see Chapter 7) and associated Method Statements for the works, to be agreed in advance with NRW. Some examples of pollution prevention measures that would be included are using pre-cast concrete instead of wet mix where possible, no discharge to water of mixer washings or excess concrete, and ensuring the use of spill kits and refuelling in designated areas away from watercourses (see Chapter 5.10: Road Drainage and the Water Environment). In addition, a plan to deal with environmental emergencies would also be put in place.
- 5.4.369 Statutory Consents would be required for works within all of the watercourses that pass through the Proposed Improvement corridor. All mitigation described within these consents would be undertaken, including pollution prevention measures.
- 5.4.370 Additional measures would include no in-channel works within the Afon Artro or Watercourse 2 (unless previously agreed with NRW); the measures described in paragraph 5.4.380 below relating to works within the fluvial floodplain; and periodic monitoring of water quality pre-, during and post-construction to ensure mitigation measures are working successfully.

5.4.371 Construction personnel would also be made aware of the sensitive environment of the works through toolbox talks. These would be provided by a suitably qualified Environmental Manager or Environmental Clerk of Works, as appropriate.

5.4.372 During operation the predicted risk of pollution events affecting the watercourses is not considered significant due to the embedded pollution prevention mitigation including three attenuation areas, and filter strips and filter drains throughout the scheme corridor (see Chapter 5.10: Road Drainage and the Water Environment). A rush pasture and reedbed creation area proposed as compensation for these habitats (see 'Residual Effects and Compensation' section below) would provide additional attenuation at the northern end of the scheme. The agricultural underpasses would be drained in such a manner that does not discharge directly into watercourses *i.e.* filtered through/over adjacent ground or designed to drain away from such features.

Air quality

Features Mitigated: Coedydd Derw a Safleoedd Ystlumod Meirion SAC; Pen Llyn a'r Sarnau SAC, Morfa Dyffryn SSSI, Restored Ancient Woodland Sites (RAWS); Lowland mixed deciduous woodland; and Lichens

5.4.373 The main air quality impacts likely to arise during the construction period are considered to be from dust generated by construction activities, earthworks and trackout. Dust generation and emissions from construction traffic would be controlled during the construction period using standard mitigation measures as described in Chapter 5.1: Air Quality, and include the following as examples:

- Development and implementation of a Dust Management Plan (DMP), which may include measures to control other emissions, to be approved by NRW and SNPA;
- Carry out regular site inspections to monitor compliance with DMP, record inspection results, and make an inspection log available to NRW/SNPA when asked;
- Plan site layout so that machinery and dust causing activities are located away from sensitive receptors as far as is possible;
- Cover, seed or fence stockpiles to prevent wind whipping;
- Ensure all vehicles switch off engines when stationary – no idling vehicles;
- Impose and signpost a maximum speed limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- Use water-assisted sweepers on the access and local roads, to remove, as necessary, any material tracked out of the sites. This may require the sweeper being continuously in use; and
- Ensure vehicles entering or leaving the site are covered to prevent escape of materials during transport.

5.4.374 During operation, there is likely to be a slight improvement in the air quality at the locations of the Coedydd Derw a Safleoedd Ystlumod Meirion SAC, three out of four of the RAWS and two of the mature trees supporting notable lichen species. There is likely to be a slight reduction in the air quality at the location of the mature sycamore within the car parking and picnic area supporting *Schismatomma graphidioides*, a notable lichen species. However, none of these impacts are considered significant and no operational mitigation for air quality is proposed.

Trees and hedgerows

Other Features Mitigated: Lowland mixed deciduous woodland; RAWS; Badger; Polecat; Hedgehog; Breeding birds; Reptiles; Amphibians; and Lichens

- 5.4.375 The 150m of species-rich hedgerow located on the southeast side of Mochras Road between the station and the car park would be translocated to a similar location on the proposed alignment of Mochras Road leading to the proposed junction with the realigned A496. This would retain the mature state of this hedgerow, with associated benefits as a wildlife corridor and sheltered foraging route, along with the diversity of hedgerow species and any ground flora associated with it.
- 5.4.376 A line of mature broad-leaved trees, dominated by sessile oak, and scrub, forming the eastern boundary of the existing A496 at the northern tie-in of the Proposed Improvement, and 160m of which lies within the proposed construction area, would be retained. This boundary includes three of the mature trees supporting notable lichen species within the scheme corridor (Lichen Trees 3 – 5 on Figure 7.1-5: Environmental Master Plan). Lichen Tree 2, a mature sycamore within the car parking / picnic area between the Afon Artro and Mochras Road, would also be retained, along with a mature sessile oak currently located within the old field boundary between the two horse-grazed fields of lowland meadow habitat but would be located at the top of the cutting of the proposed realignment of Mochras Road on the approach to the new junction (Ch. 760). One of the lesser spotted woodpecker records was located at this point and it is possible that this large mature oak is a potential nest site for this species but it is also a significant mature oak with inherent ecological and landscape value. These retained trees may require localised adjustments in the scheme design at the detailed design stage, such as local steepening of the embankment (see Figure 7.1-5: Environmental Master Plan for locations).
- 5.4.377 An arboricultural survey would be undertaken when the detailed design is finalised, of all trees to be retained within or immediately adjacent to the proposed construction area, in order to produce a Method Statement detailing measures required to ensure minimal damage to these trees, according to BS5837:2012.
- 5.4.378 Arboricultural supervision to be provided for all works within the root protection areas of the trees described in paragraph 5.4.376 above, which would be undertaken according to the Method Statement described in paragraph 5.4.377 above.

Coastal and floodplain grazing marsh

Other Features Mitigated: Purple moor grass and rush pastures; Bats including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter; Rivers; Fish; Ecosystem services; Pen Llyn a'r Sarnau SAC; and Morfa Dyffryn SSSI

- 5.4.379 Within the fluvial floodplain between the Afon Artro and Watercourse 2 (see Figure 7.1-5: Environmental Master Plan), all topsoil from the scheme footprint would be removed and stored separately to soil from other areas. This would then be re-used within an area of rush pasture habitat creation proposed as compensation at Chainage 1230 – 1450 (see 'Residual Effects and Compensation' section below) to help establish the rush pasture habitat within this area, as the seed bank would contain species typical of wetter conditions with little agricultural improvement.
- 5.4.380 To minimise damage to the important habitats within the fluvial floodplain and adjacent fluvial habitat, works would be scheduled to avoid periods of tidal or fluvial inundation, as well as periods of prolonged or significant rainfall, leading to waterlogged conditions. Protective boarding and low ground pressure machinery would also be used within this area and there would be no site compound or storage of machinery or materials within the fluvial floodplain.
- 5.4.381 As well as minimising direct physical damage to the floodplain grazing marsh and associated rush pasture habitat within the fluvial floodplain, these measures would slightly reduce the impacts from loss of foraging habitat of bats (including lesser horseshoe) and otters. They would also help to minimise the risk of pollution from siltation of the adjacent fluvial habitat, including the Afon Artro, Watercourse 2 and protected sites downstream. This would obviously minimise potential damage

to fish populations. All these measures would also help to minimise the loss of cultural ecosystem services provided by the natural habitats in the vicinity of the car parking / picnic area and PRoW 1.

Lowland meadow

Other Features Mitigated: Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC)

5.4.382 To reduce the impact from loss of lowland meadow habitat, all topsoil from the scheme footprint within the two fields of lowland meadow in the vicinity of the proposed junction with Mochras Road, would be removed and stored separately to soil from other areas. This would then be re-used within proposed grassed areas in adjacent parts of the Proposed Improvement, such as the covered attenuation area (Attenuation Area to the west of the scheme on Figure 7.1-5: Environmental Master Plan), and the verges, embankment and cutting slopes associated with the realigned section of Mochras Road and proposed junction with the realigned A496. These areas would not be reseeded but left to regenerate naturally from the lowland meadow seedbank that should remain within the soil. Following construction, these areas would need to be managed appropriately to maintain the lowland meadow habitat, which is likely to require the removal of certain weed species during the five year maintenance period and cutting once or twice annually (in early autumn and/or spring), with removal of all arisings.

5.4.383 Works would be scheduled to avoid periods of prolonged or significant rainfall, leading to waterlogged conditions. Protective boarding and low ground pressure machinery would also be used within this area and there would be no site compound or storage of machinery or materials within areas of lowland meadow habitat.

5.4.384 Bats would also benefit from minimising loss of lowland meadow habitat, as it is good foraging habitat for bats, and a number of species were recorded within this area during the baseline bat surveys, including *Myotis*, common and soprano pipistrelle and lesser horseshoe.

Reedbeds

Other Features Mitigated: Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC); Otter (and therefore Pen Llyn a'r Sarnau SAC); Breeding birds; Reptiles; and Amphibians

5.4.385 All reedbed habitat located within the temporary construction areas within Watercourses 2 and 3 would be retained, with measures to prevent access and damage during the construction period. These measures would include demarcation prior to construction in these areas, with signage to prevent access without agreement with the Environmental Clerk of Works. The proposed wide span bridge over Watercourse 2, incorporated as embedded mitigation, would enable all the reedbed habitat within Watercourse 2 to be retained.

5.4.386 This retention of reedbed habitat would also benefit species known to forage within or inhabit this habitat, including bats, otters, breeding birds, reptiles and amphibians. Bat species recorded foraging above this habitat during baseline surveys include noctule, common and soprano pipistrelle, lesser horseshoe, barbastelle and *Myotis* species.

Rivers

Other Features Mitigated: Amphibians; and Migratory fish and brook lamprey; Otters (and therefore Pen Llyn a'r Sarnau SAC); and Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC)

5.4.387 Water quality impacts on the Afon Artro river catchment within and downstream of the Proposed Improvement corridor would be mitigated by the pollution prevention measures described in 'Water quality' above.

- 5.4.388 Disruption to Watercourse 3 due to the permanent culverting of 31m of this watercourse would be reduced by inserting the culvert below the existing channel bed level to allow for natural bed formation within the culvert. This would allow for the natural formation of a low flow channel within the newly accumulated bed material, which should retain sufficient depth of water for aquatic life under most conditions. This watercourse would not be deepened or widened up- or downstream of the proposed culvert and bank reinforcement would be avoided.
- 5.4.389 Further disruption to aquatic species or other species that use the fluvial corridors as foraging or commuting habitat, such as otters and bats, would be mitigated during construction by the avoidance of night-time working, site facilities or construction lighting within 30m of any watercourses.
- 5.4.390 During operation, impacts relating to disruption of commuting or foraging species would be mitigated by a commitment not to significantly increase light levels along the river corridor of the Afon Artro during operation of the Proposed Improvement.

Bats

Other Features Mitigated: Coedydd Derw a Safleoedd Ystlumod Meirion SAC

- 5.4.391 The loss of roosting habitat for lesser horseshoe and brown long-eared bats caused by the demolition of the two small buildings within the builder's yard currently used as transitional roosts by these species would be mitigated by the creation of a new purpose-built mitigation roost building within the area of land owned by Gwynedd Council to the south of Lower Wood and adjacent to the west of Maes Artro (see HRA, Technical Appendix G, Volume 2, for outline design). This new roost would be constructed well in advance of the demolition of the existing builder's yard roosts and would provide roosting habitat for lesser horseshoe and brown long-eared bats as well as a range of crevice-dwelling species throughout the year. This would therefore provide greater roosting potential for a greater number of species than the roost buildings to be removed and would therefore act partly as enhancement.
- 5.4.392 The two buildings within the builder's yard, which are currently used occasionally by low numbers of lesser horseshoe and brown long-eared bats as transitional roosts, would be demolished when bats are absent and only after the mitigation roost structure described above has been completed. This work must be undertaken under a European Protected Species (EPS) license provided by NRW and further surveys may be required to inform the license application. All associated mitigation required as a condition of this license would be undertaken.
- 5.4.393 Loss of potential or actual roosting habitat of tree-roosting species due to loss of trees and woodland would be mitigated by the following measures:
- 5.4.394 A full endoscope survey would be undertaken of all mature trees (and younger trees with any potential roosting features) to be removed prior to their removal, in addition to any such trees located immediately adjacent to or within the proposed construction area. For every tree with bats recorded roosting, or those with significant potential roosting features, three tree bat boxes would be erected within nearby suitable habitat and suitable replacement tree stock planted. Following erection of such suitable alternative roosting habitat, all trees with potential roosting features would be sectionally felled under the Watching Brief of a licensed bat worker. All trees supporting actual bat roosts would require an EPS license for destruction of a bat roost to be obtained from NRW, although further surveys may be required to inform such a license application. All associated mitigation required as a condition of such a license would be undertaken.
- 5.4.395 The loss of bat foraging habitat would be mitigated to some extent by the measures to minimise construction damage to areas of rush pasture, lowland meadow and reedbed, as described above

for each of these habitats, as well as pollution prevention measures for fluvial habitats, as described under 'Water quality' above. However, compensatory measures are proposed that would replace roosting and foraging habitat lost in the long-term (see 'Residual Effects and Compensation' below).

5.4.396 The only significant disturbance of existing roosting habitat likely to occur is that of the lesser horseshoe maternity and hibernation roost located in the former aquarium building within Lower Wood to the west of Maes Artro holiday village. This is only considered to be significant during the construction period as increased lighting and noise levels due to operational traffic are unlikely to significantly affect the roost due to the distance of approximately 50m between the roost and the new road. However, this impact would be reduced by the woodland planting and close board fence along the western and southern boundaries of Maes Artro holiday village and Gwynedd Council owned land bordering this to the west (see paragraph 5.4.399 below).

5.4.397 Mitigation proposed for potential construction disturbance of the former aquarium roost would constitute the avoidance of all works in the immediate vicinity of the roost between June and August (inclusive), when females are more likely to have dependent young; the avoidance of construction lighting between dusk and dawn from April and October (inclusive) when bats are most active; and an EPS license to be obtained from NRW to cover any potential disturbance of the roost, with conditional mitigation likely to include:

- Pre-construction roost surveys;
- No construction activities within 150m of the roost between June and August; and
- No night-time working or artificial lighting and minimal vegetation clearance in the vicinity of the roost.

5.4.398 Lesser horseshoe, *Myotis*, pipistrelle, brown long-eared, greater horseshoe and barbastelle bats would all be at risk from disruption due to severance of foraging and commuting routes during construction of the Proposed Improvement as a result of lighting, noise or loss of connectivity. The following measures would mitigate this impact:

- Connectivity at the locations of the embedded bridges, culvert and underpasses would be maintained by avoiding disturbance due to noise or lighting during the most active periods for bats (dusk to dawn between April and October); removal of physical barriers (such as machinery and materials); and temporarily 'bridging' any gaps created in linear features between dusk and dawn using a temporary linear structure such as willow-hurdling, brash woven into heras fencing or potted plants; and
- All construction works associated with the Afon Artro with the potential to disturb foraging bats would be avoided between dusk and dawn from April to October.

5.4.399 Severance would also continue into the operational period for these species, due to the permanent obstruction of the Proposed Improvement, bisecting foraging and commuting routes. This could also lead to bats flying over the road, creating an increased risk of mortality from traffic collision. Much of the embedded mitigation including the proposed high level widespan bridges over the Artro and Watercourse 2, the 2.6m high underpass to the west of Maes Artro, and the 2.2m box culvert for Watercourse 3, would help to alleviate this impact, providing safe crossing points at three out of four of the potential/confirmed commuting routes identified during baseline surveys, with the remaining corridor removed completely, along with its associated roosts, making it much less likely to be used by bats in the future. However, it is possible that bats could attempt to cross the new road at other locations or fly over the Artro bridge due to the proposed under-bridge lighting of the new footway and Mochras Road. The permanent disruption caused by the presence of the Proposed Improvement and associated traffic noise and lights could also impact foraging habitat used by the big bat species (noctule, Leisler's and serotine) although the severance of commuting routes is unlikely to be a significant impact for these species due to the height at which they tend to fly. The following measures would mitigate these impacts:

- Low level planting in the vicinity of actual and potential bat crossing points including the proposed bridge over the Artro and Watercourse 2, as well as the culvert for Watercourse 3, leading to the area of proposed rush pasture and reedbed creation at the northern end (see 'Residual Effects and Compensation' below), to lead bats into them and underneath the new road;
- Low level planting to screen the river corridor from the proposed lighting of Mochras Road and new footway underneath the proposed Artro bridge;
- Planting to link the existing maternity roost in the former aquarium, the proposed compensation roost (see 'Residual Effects and Compensation' below) and Unit 34 of the Coedydd Derw a Safleoedd Ystlumod Meirion SAC to the proposed underpass to the west of Maes Artro holiday village (Ch. 530), with a close board fence adjacent at least until vegetation establishes. This would also help to screen these roosting and foraging areas from traffic lights and noise;
- Planting to infill existing gaps within the scrub vegetation located within the floodplain to the east of the Proposed Improvement would help to screen foraging/commuting habitat to the east;
- Planting between Plas-y-bryn Farm and the area of retained copse at the western end of the proposed underpass to the west of Maes Artro holiday village (Ch. 530) in order to guide bats towards the underpass;
- Clearance of trees and vegetation that could encourage bats to cross over the new road, including at Ch. 320, Ch.550 and Ch. 700;
- Works to minimise the bat roosting potential of retained buildings within the builder's yard to the west of the Proposed Improvement that could encourage bats to cross over the new road at this location; and
- Appropriate management of all planting described above to ensure its continued functionality as part of the five year soft landscaping aftercare contract and following this, the HEMP.

Otter

Other Features Mitigated: Pen Llyn a'r Sarnau SAC

- 5.4.400 The loss and disturbance of otter resting sites due to activities associated with the construction of the proposed bridge over the Afon Artro would be mitigated by the construction of an artificial otter holt on the north bank of the Afon Artro well in advance of the commencement of construction. Any construction activities in the vicinity of the Afon Artro would need to be undertaken under an EPS license from NRW for the disturbance or destruction of an otter resting site and any mitigation arising as a condition of this license would be undertaken in addition to the mitigation described in this chapter.
- 5.4.401 A pre-construction survey of all watercourses within the scheme corridor would be undertaken to identify the presence of any additional resting sites that could be subject to disturbance/destruction at the time of the proposed works. This survey could be used to inform the application of the otter license discussed above.
- 5.4.402 To further mitigate for disturbance or disruption to the local otter population, all excavations arising as a result of construction activities would be covered overnight, or an egress provided to allow any trapped animals to escape. There would be no night-time working, site facilities or construction lighting within 30m of any watercourse or within 100m of any identified resting sites. Access would be maintained for otters between dusk and dawn along all watercourses within the scheme corridor by removing any physical barriers such as machinery and materials.
- 5.4.403 The loss of foraging habitat would be mitigated slightly by the measures proposed above for rush pasture and reedbed habitat but compensatory measures are also proposed to replace habitat lost

(see 'Residual Effects and Compensation' below). The degradation of foraging habitat would be mitigated by pollution prevention measures described in 'Water pollution' above.

5.4.404 During operation, there could be an increased risk of mortality due to the severance of commuting and foraging routes leading to otters crossing over the road, particularly during spate conditions. Much of the embedded mitigation, including the proposed bridges over the Afon Artro and Watercourse 2, the 2.2m box culvert for Watercourse 3 with dry mammal ledges, 900mm flood alleviation pipes every 2.9m at the base of the proposed embankment throughout the fluvial floodplain and 900mm dry pipe at a higher level within this section, would help to alleviate this impact, providing safe crossing points at all of the likely future crossing points for this species. However, the following measures are proposed to mitigate any residual risk:

- Planting would be provided in the vicinity of the proposed otter underpasses, including the proposed bridges over the Afon Artro and Watercourse 2, and the 2.2m box culvert for Watercourse 3, leading to the area of proposed rush pasture and reedbed creation at the northern end (see 'Residual Effects and Compensation' below), to lead otters into them and underneath the new road;
- Retention of an area of reedbed habitat located within Watercourse 3 and lying within the construction area to the west of the proposed 2.2m box culvert, as well as any other potential otter habitat in the vicinity of proposed otter underpasses where possible;
- Appropriate management of all guidance planting described above to ensure its continued functionality;
- Otter-proof fencing to be provided for an appropriate distance on each side of all proposed otter underpasses, including the two bridges, the dry pipe within the flood embankment and the 2.2m box culvert at the northern end (Ch.1230 – 1250); and
- No significant increase in light levels along the Afon Artro river corridor during operation of the Proposed Improvement.

Badger

5.4.405 The loss of an active annexe badger sett located within the footprint of the Proposed Improvement would be mitigated by the following measures:

5.4.406 An artificial badger sett would be provided nearby at least six months prior to commencement of construction. The sett to be destroyed would be closed under ecological supervision and according to standard guidelines, under a badger derogation license from NRW. The sett closure would need to take place between July and November inclusive (outside the badger breeding season), following at least three weeks' ecological monitoring to ensure that all animals have left. The details of the license would outline the mitigation measures required as part of working close to badger setts.

5.4.407 The potential for mortality, disturbance or disruption to badgers due to construction activities in the vicinity of retained active setts would be mitigated by the following measures:

- A pre-construction survey would be undertaken to identify any additional badger setts requiring licensing or additional mitigation measures;
- As described for otters above, any excavations would be covered or an egress provided;
- All site facilities would be located at least 50m away from any active setts;
- There would be no construction lighting or night-time working within 50m of any active badger setts;
- A badger license would be required from NRW, along with all conditional mitigation, for all works likely to cause significant disturbance or damage to a badger sett, such as use of heavy machinery within 30m of an active sett; use of light machinery within 20m of an active sett; and hand digging or scrub clearance within 10m of an active sett.

5.4.408 The loss of badger foraging habitat is not considered likely to have a significant impact on the local badger population and no mitigation is proposed, although mitigation for construction damage to some of the habitat features, such as lowland meadow, floodplain and grazing marsh and hedgerows would reduce the impact slightly. Compensation measures proposed to replace areas of habitat lost would also compensate for this loss in the long-term (see 'Residual Effects and Compensation' below).

5.4.409 During operation there is likely to be an increased risk of mortality due to the severance of two badger territories leading to badgers crossing over the road where it crosses foraging habitat within a territory. Much of the embedded mitigation, including the proposed bridges over the Afon Artro and Watercourse 2, the 2.2m box culvert for Watercourse 3 with dry mammal ledges, 900mm flood alleviation pipes every 2.9m at the base of the proposed embankment throughout the fluvial floodplain, 900mm dry pipe at a higher level within this section, and two large underpasses at Ch. 530 and Ch. 1180, would help to alleviate this impact, providing safe crossing points at four out of seven of the commuting routes identified in baseline surveys. The following measures are proposed to mitigate any residual risk:

- Provision of badger-proof fencing to guide the animals towards the safe crossing points incorporated as embedded mitigation (and described above);
- Provision of an increased area of good quality foraging habitat to the east of the Proposed Improvement, which is the same side as the retained and proposed setts within the territories to be severed, due to the proposed compensatory planting areas (see 'Residual Effects and Compensation' below), therefore potentially decreasing the need for badgers to cross the Proposed Improvement; and
- Planting proposed in the vicinity of the underpasses to be provided, as described for bats in paragraph 5.4.398 above).

5.4.410 There could also be a risk of disturbance or damage to badger setts due to maintenance works during operation of the Proposed Improvement. Environmental screening would be undertaken for all maintenance works and a badger license obtained for all works likely to cause disturbance or damage to badger populations. All associated conditional mitigation would be undertaken.

Polecat and Hedgehog

5.4.411 Mitigation for construction damage to some of the habitat features, such as lowland meadow, floodplain and grazing marsh and hedgerows would reduce the loss of foraging habitat for polecat and hedgehog slightly. Compensation measures proposed to replace areas of habitat lost would compensate for this loss in the long-term (see 'Residual Effects and Compensation' below).

5.4.412 The increased risk of road mortality due to the presence of the operational Proposed Improvement severing potential foraging habitat is likely to be reduced by the provision of otter/badger-proof fencing in the vicinity of proposed safe crossing points (underpasses, bridges, culvert, flood alleviation pipes and dry pipe) incorporated as embedded mitigation. However, although hedgehogs are unlikely to be able to negotiate this fencing, the majority of polecats would be able to pass through the 5cm mesh. It is possible that the presence of 1m high boundary walls would help to deter polecats from crossing the carriageway to some extent but it is unlikely that they would be unable to climb over this if they tried.

5.4.413 In order to eliminate or further reduce this risk of road mortality remaining for polecats, post-construction monitoring would be undertaken to obtain road casualty data along the Proposed Improvement corridor during operation, as described for polecats. If any polecat road casualties are recorded during this period, NRW and SNPA should be consulted regarding the need for further mitigation, which could include replacement of the standard otter/badger-proof fencing (5cm mesh size) with fencing of a smaller mesh size. Alternatively, or additionally, there may be a requirement for additional underpasses, potentially at the southern end of the Proposed Improvement corridor

where woodland habitat is located immediately adjacent to the east of the road and a polecat road casualty was recorded in 2004. Although this section of the scheme would be online, the speed limit during operation would be faster (50mph) than the current speed limit (30mph), increasing the risk of fatalities.

5.4.414 Planting leading into the proposed safe crossing points would help to guide both of these species towards them and the proposed planting between Plas-y-bryn Farm and the southern copse adjacent to the 2.6m underpass to the west of Maes Artro would help to increase connectivity to this crossing point. Conversely, the removal of vegetation that would otherwise remain immediately adjacent to the Proposed Improvement in areas that could lead animals to cross over the road outside of the safe crossing points, would also help to reduce the risk of road traffic collision.

5.4.415 The compensatory areas of habitat replacement that could also be used as replacement foraging habitat for polecat and hedgehog, would be located on the east side of the Proposed Improvement, where there is currently more suitable habitat for these species, potentially decreasing the need for them to cross the Proposed Improvement.

Brown hare

5.4.416 The embedded safe crossing points and provision of otter/badger-proof fencing would also help to mitigate the increased risk of brown hare road traffic mortality during operation, particularly as the fencing would cover most of the scheme corridor other than the southern tie-in, including areas of more open habitat favoured by hares.

Breeding birds, including Lesser spotted woodpecker, Barn owl and Red kite

5.4.417 To mitigate the potential for destruction or disturbance of active birds' nests during site clearance, all vegetation clearance would be undertaken outside of the main breeding bird season (March to August inclusive) or, should this not be possible, under ecological supervision to confirm the absence of nesting birds immediately before any potential nesting habitat were removed. If the presence of nesting birds were to be confirmed, works would cease and a suitable buffer zone (to be agreed with the ecologist) established until the young had fledged.

5.4.418 A pre-construction survey for nesting lesser spotted woodpeckers and red kites would be undertaken in the April prior to any scheduled works and for barn owls between March and August prior to construction. This would determine the presence of any nest sites within or adjacent to the area of proposed works. Should any active nests be identified, works would be scheduled to avoid disturbance or destruction of the nest site while it is still active. Another survey would be undertaken in the following breeding bird season to assess whether the birds have returned to a nest site or adopted another one in the Proposed Improvement corridor. Construction works would then be programmed accordingly to avoid disturbance or destruction of active nests. Should any nest sites require destruction (following the fledging of all young), it may be necessary to provide alternative nesting habitat as compensation for habitat lost, depending on consultation with NRW and SNPA.

5.4.419 The loss of potential nesting and foraging habitat would be mitigated to some extent by the translocation of the 150m section of hedgerow bordering Mochras Road (see paragraph 5.4.375), retention of 160m of boundary habitat comprising trees and scrub within the construction area, and reconstruction of 200m of dry stone wall that would otherwise be lost (see 'Invertebrates' below). Riparian nest boxes would be provided on the proposed bridge and culvert structures and nest boxes suitable for tree-nesting species would be erected on trees within the area of Lower Wood RAWS within Gwynedd Council ownership to the east. The mitigation for reedbed habitat described above would also help to mitigate for loss of habitat. Compensation for areas of habitat lost (see

'Residual Effects and Compensation' below) would also replace potential nesting and foraging habitat lost to the scheme footprint.

5.4.420 The potential for an increased risk of road mortality for barn owls during operation may be reduced slightly by the provision of 1m high boundary walls at the top of the embankments and 1.4m otter/badger-proof fencing at the top of cutting areas that could help to raise the flight level of barn owls attempting to cross over the new road. The provision of hedgerows proposed at the southern and northern tie-ins as mitigation for landscape impacts could also help to raise the height of any barn owls attempting to fly across the road.

5.4.421 In order to eliminate or further reduce this risk of road mortality remaining for barn owls, post-construction monitoring would be undertaken to obtain road casualty data along the Proposed Improvement corridor during operation. This would comprise a monthly walk-through of the scheme corridor to record any road casualties for a period of 12 months. In addition, Cofnod data would be obtained, to include any road casualties along this section (and adjacent sections) of the A496 before and after construction. If any barn owl road casualties are recorded during this period, NRW and SNPA should be consulted regarding the need for further mitigation, which could include erecting fencing higher than the boundaries currently proposed within high risk areas or increasing the height of the proposed boundary walls.

Reptiles and Amphibians

5.4.422 To minimise injury and mortality of reptiles and amphibians during construction, the hedgerow translocation and removal of dry stone walls, woodland and scrub and topsoil stripping within the fluvial floodplain would be undertaken under a Watching Brief by a suitably qualified ecologist. Any reptiles or amphibians found would be relocated to a nearby receptor site, to be identified by the ecologist. This would be undertaken during the reptile active season (mid-March to mid-October) or, if necessary, into November to December during temperatures greater than 5°C.

5.4.423 The diversion of approximately 45m of Watercourse 0, where palmate newts were recorded during baseline surveys for great crested newts, would be undertaken under an ecological Watching Brief within the newt active season but outside the breeding season (July to October inclusive) or at temperatures above 5°C between November and February. Any newts or other amphibians or reptiles found would be relocated to a nearby receptor site, to be identified by the ecologist.

5.4.424 The potential for increased mortality of amphibians and also potentially reptiles due to becoming trapped within gulley pots within the scheme corridor during operation would be mitigated by minimising the use of gulleypots and by the provision of amphibian-friendly gulley pots wherever gulley pots are required within the Proposed Improvement, along with sympathetic kerb design to allow amphibians and reptiles to easily escape from the carriageway. The design of these features would be finalised at the detailed design stage, in consultation with NRW and SNPA. The use of enviro-kerbs should be avoided if possible.

5.4.425 The loss of potential reptile and amphibian habitat during site clearance is not considered to be a significant impact but mitigation for other receptors including the translocation of 150m of hedgerow, retention of an 160m line of trees and scrub within the construction area and reconstruction of 200m of dry stone wall (see 'Invertebrates' below) would reduce this impact to some extent, as would the compensation provided for loss of important habitats (see 'Residual Effects and Compensation' below).

Migratory fish and brook lamprey

5.4.426 To mitigate for potential injury and mortality of migratory fish and brook lamprey during in-channel construction activities, there would be no in-channel works within the Afon Artro or Watercourse 2

and no in-channel works within the remaining watercourses during the fish spawning season (generally mid-October to mid-April but site specific advice should be obtained from NRW).

5.4.427 Statutory consents would be required for all works within watercourses, and all conditional mitigation associated with these would be undertaken, which may include a requirement for fish rescues.

5.4.428 Disruption or disturbance to migratory fish and brook lamprey during construction would be mitigated by pollution prevention measures described in 'Water quality' above and the avoidance of night-time working, site facilities or construction lighting within 30m of any watercourse.

Invertebrates

5.4.429 The loss of potential foraging habitat for the latticed heath moth and wall mason bee would be reduced by mitigation described above for lowland meadow, coastal and floodplain grazing marsh and purple moor grass and rush pastures, as these areas are either known to or likely to support the forage plants of these species, including clover species and bird's-foot trefoil.

5.4.430 200m of dry stone walls would be removed during site clearance for the construction footprint to the south of Mochras Road, representing loss of potential nesting habitat for the wall mason bee. As mitigation, the stone from these walls would be retained on site separate from other material, and then re-used in the construction of a replacement 200m of dry stone wall along the northern boundary of the realigned Mochras Road to the west of the proposed junction with the realigned A496. This location would provide sunlit conditions suitable for wall mason bee nest sites, as well as for a range of other invertebrate species. The wall would also provide potential habitat for nesting birds, reptiles and amphibians and some of the lichen flora from the existing wall would be retained (see Lichens below).

Sharp rush

5.4.431 All sharp rush in the vicinity of the Proposed Improvement would be retained and all areas of sharp rush located within 50m of the proposed construction corridor would be marked out on the ground prior to any construction activities within the fluvial floodplain or in the vicinity of Watercourse 2, with signage to prevent unauthorised access. Mitigation for construction dust as described in 'Air quality' above would also help to reduce any impact on this species.

Lichens

5.4.432 Lichen Tree 1, supporting the regionally important *Schismatomma graphidioides*, and lying directly within the footprint of the main cutting proposed to the south of the Afon Artro, would be felled during site clearance and the trunk section supporting this species would be relocated to the part of Lower Wood under Gwynedd Council ownership to the east. Prior to felling, the location of the important lichen should be carefully marked out based on the pre-construction survey report, ensuring no damage to the lichen itself. Measures would need to be taken to ensure the retention without damage of the sensitive lichen population on this tree during felling and relocation. The population of *S. graphidioides* on the section of trunk would then be retained in a location providing a similar microclimate to its current location, in the vicinity of suitable receptor trees for this species, such as hornbeam, ash, aspen, oak and wych elm. The habitat selected for the relocation of this species should have the characteristics of woodland edge and should be at least 50m from the construction area to minimise impacts from construction dust. These measures would increase the chances of colonisation of nearby suitable receptor trees with *S.graphidioides* from the colony on the tree to be felled before it dies with its substrate.

5.4.433 Lichen Tree 2, also supporting *Schismatomma graphidioides*, and located within the car parking and picnic area between the Afon Artro and Mochras Road, would be retained with signage to prevent

unauthorised access to the root protection area during construction activities. Lichen Tree 3, supporting the locally important *Gyalecta carneola* and Lichen Trees 4 and 5, supporting *Punctelia reddenda*, also locally important, would be also be retained with similar signage. Lichen Trees 3 - 5 are all located within the mature tree and scrub boundary to the east of the existing A496 at the northern end of the Proposed Improvement.

5.4.434 Tree protection measures described in 'Trees and hedgerows' above, and control of construction dust and emissions described in 'Air quality', would also help to mitigate the risk of damage to these lichen populations during construction. Regular visual inspections should be made to monitor dust levels in the vicinity of Trees 2 - 5 during construction, and particularly during periods of dry or windy weather. If the potential for damage from dust becomes apparent despite the control measures, works in these areas should be postponed until wetter periods or additional mitigation agreed with the Environmental Clerk of Works.

Non-native invasive plant species

5.4.435 Areas of non-native invasive plant species, including *Rhododendron ponticum*, Japanese knotweed, Himalayan balsam and Montbretia, located within 30m of the proposed construction area and any site facilities, would be marked out prior to construction with signage to prevent unauthorised access.

5.4.436 All of the invasive species listed above would be treated with an appropriate herbicide, such as glyphosate, in accordance with guidance from NRW, which may include annual treatment over a number of years, or until no further regrowth occurs.

5.4.437 Any topsoil or plant material removed from the southern bank of the Afon Artro that is likely to be contaminated with Japanese knotweed, Himalayan balsam and Montbretia, to be treated according to NRW guidance. This is likely to include encapsulation within a root barrier membrane and burial at a depth of at least 2m, or burial at a depth of 5m and covered by a root barrier membrane and 5m of inert fill or topsoil. Material removed from the area contaminated with Japanese knotweed at the southern extent of the scheme would also be treated in this way. Topsoil removed from areas contaminated with rhododendron at the northern and southern tie-ins would be re-used in adjacent areas of proposed planting and not moved to another location.

5.4.438 Measures to treat, control and prevent the spread of non-native invasive plant species within the proposed construction footprint would be included in the Construction Environmental Management Plan (CEMP), such as washing down vehicles leaving contaminated areas, and secure segregated storage of material contaminated with these species. Ongoing management of invasive species following the construction period would also be included as part of a five year soft landscaping aftercare contract and also within the HEMP.

Ecosystem services

5.4.439 There would be no mitigation for the loss of cultural services provided by the river corridor in the vicinity of the car park, picnic and fishing area or the natural environment in the vicinity of PRoW 1 during construction due to their short-term closure to the public.

5.4.440 During operation, some of the mitigation proposed for habitat and species features in the vicinity of these two public assets would alleviate the loss of amenity from the natural environment in these areas to some extent. For example, the erection of riparian nest boxes underneath the two bridges proposed, installation of an artificial otter holt downstream of the bridge on the northern river bank and replacement of non-native species with native scrub in the vicinity of the bridge could encourage wildlife interest to the picnic and fishing area, as well as a greater species diversity, increasing the amenity. Similarly, the mitigation to minimise impacts on the floodplain and reedbed

habitats in the vicinity of PRow 1 would reduce the negative impact on the cultural services provided by the natural environment in this area. The planting of low native shrub species such as blackthorn, guelder rose and dog rose proposed along the northern side of the flood embankment between the Proposed Improvement and Llanbedr as landscape screening mitigation (see Chapter 5.3: Landscape) would also add to the biodiversity interest of this route, particularly in terms of bird species nesting or feeding on the berries and invertebrates foraging on the blossom.

5.4.441 During site clearance, there would be a loss of suitable foraging habitat for a range of pollinator species that could lead to a negative impact on pollination services provided to local agriculture. Mitigation proposed for lowland meadow, purple moor grass and rush pastures and coastal floodplain and grazing marsh (described above) would help to reduce this impact. Compensation for areas of habitat lost (see 'Residual Effects and Compensation' below) would replace foraging habitat for pollinators in the long-term that would otherwise be permanently lost.

Method of Delivery

5.4.442 The mechanism for ensuring delivery of construction mitigation would be through sensitive construction programming, the production of a Construction Environmental Management Plan (CEMP) and associated Method Statements, based on an Environmental Commitments Register (ECR) compiling all environmental commitments detailed in the ES. The delivery of these commitments on site would be ensured through toolbox talks to construction personnel together with site supervision, to be provided by an ecologist/Environmental Clerk of Works.

5.4.443 The mechanism for ensuring delivery of operational mitigation would be through the CEMP and subsequent HEMP (Handover Environmental Management Plan), along with ongoing liaison with NRW and SNPA and a five year soft landscaping aftercare contract (see Chapter 7: Environmental Management for further details).

Table 5.4.14: Summary of Residual Effects on Important Ecological Features

Ecological Feature	Description of Impact	Nature (Positive/Negative) and Scale of Significance Without Mitigation	Mitigation Proposed	Nature of Impact (Positive / Negative) and Scale of Significance of Residual Effect	Compensation (if required)
Sites:					
Coedydd Derw a Safleoedd Ystlumod Meirion SAC	Potential for impacts on lesser horseshoe bats likely to represent part of the lesser horseshoe bat population of the SAC (see 'Lesser horseshoe bat' as a separate feature below)	Negative: International	See mitigation proposed for impacts on lesser horseshoe bats below	Negative: Not significant	Not required, but compensation proposed for lesser horseshoe bats below would compensate for effects on the lesser horseshoe bat population of the SAC
	Potential for damage to 'old sessile oakwoods' within Unit 34 of the SAC due to dust arising from trackout during construction	Negative: International	Mitigation for dust during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24) and including (amongst other measures): <ul style="list-style-type: none"> - Development and implementation of a dust management plan - Regular inspections to monitor dust levels on - and off-site - Plan site layout so that machinery and dust causing activities are located away from sensitive receptors where possible - Impose speed limits (10 or 15mph) on site traffic - Use water-assisted dust sweepers on access and local roads 	Negative: Not significant	Not required
Pen Llyn a'r Sarnau SAC	Potential for impacts on otters likely to represent part of the otter	Negative: Not significant	Not required, but see mitigation for otters below	Negative: Not significant	Not required

	feature of the SAC (see 'Otter' as a separate feature below)				
	Potential for damage to otter habitat within the SAC due to dust arising from trackout during construction	Negative: Not significant	Not required but see mitigation for dust during construction as described in Chapter 5.1: Air Quality (Table 5.1.24)	Neutral	Not required
	Potential for damage to otter habitat within the SAC due to siltation and pollution incidents affecting watercourses during construction	Negative: Not significant	<p><u>Construction:</u> Standard pollution prevention measures would be applied prior to and during construction, including the following (see also Chapter 5.10: Road Drainage and the Water Environment):</p> <ul style="list-style-type: none"> • Adherence to Pollution Prevention Guidelines (PPG's) • The use of pre-cast concrete instead of wet mix where possible • The use of concrete would be monitored carefully to ensure no accidental discharge into any stream • Mixer washings and excess concrete would not be discharged to water • All fuel, oils or chemicals stored on site would be located as far as is reasonably possible, and in no case less than 10m from any water body. • Stores would be surrounded by an effective and impervious bund capable of holding the full contents of the store plus 10%. Protocol for the storage of fuel, equipment and construction materials, so as to minimise the risk of water pollution, is provided within PPG2. • Dust suppression measures would be required in order to prevent entry of suspended solids into nearby water bodies, particularly in dry weather conditions. 	Negative: Not significant	Not required

			<ul style="list-style-type: none"> No plant would be used in-stream without prior consent from NRW. Plant operators and contractors would check vehicles and mobile plant on a daily basis for fuel and oil leaks and suitable maintenance would be promptly carried out. Plant and wheel washing facilities would be sited appropriately. <p>Additional measures include:</p> <ul style="list-style-type: none"> No in-channel works within the Afon Artro or Watercourse 2 (unless previously agreed with NRW) Schedule works within the tidal floodplain to avoid periods of highest inundation Restricted access to the fluvial floodplain during wet conditions Use of protective boarding and low ground pressure machinery where possible in temporary construction areas within the fluvial floodplain No site compound, machinery or materials to be stored in the fluvial floodplain Periodic monitoring of water quality pre-, during and post-construction to ensure mitigation measures are working successfully <p><u>Operation:</u></p> <ul style="list-style-type: none"> In addition to the embedded attenuation areas and filter drains, additional attenuation would be provided by the rush pasture and reedbed habitat creation area proposed as compensation for loss of these habitats The agricultural underpasses would be drained in such a manner that does not discharge directly into watercourses <i>i.e.</i> filtered through/over adjacent ground or designed to drain away from such features. 		
Morfa Dyffryn SSSI	Potential for damage to features of the SSSI due to dust arising from	Negative: Not significant	Not required but see mitigation for dust during construction as described in Chapter 5.1: Air Quality (Table 5.1.24)	Neutral	Not required

	trackout during construction				
	Degradation of the SSSI features arising from siltation and pollution incidents affecting watercourses during construction	Negative: National	Pollution prevention mitigation summarised above for the same impact on Pen Llyn a'r Sarnau SAC (and described in full in Chapter 5.10: Road Drainage and the Water Environment)	Negative: Not significant	Not required
Restored Ancient Woodland Sites (25332, 25334, 25336 – Lower Wood and 25306 – Coed Hafod-y-Bryn)	Potential for construction damage to sites located immediately adjacent or within 50m of the construction footprint due to physical damage and/or construction dust	Negative: Not significant	Not required but the following would help to reduce any impacts: <ul style="list-style-type: none"> • Arboricultural survey to be undertaken prior to construction to outline detailed tree protection measures required to prevent damage to trees during construction, according to BS5837:2012 • Mitigation for dust and air quality during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24) 	Negative: Not significant	Not required, but any damage would be compensated by the production and implementation of a management plan to improve the condition of 0.56ha of Lower Wood RAWs (25336) within Gwynedd Council ownership by replacing non-native species with native broad-leaved trees of local provenance
Habitats:					
Trees and hedgerows	Loss/damage to trees and hedgerows during site clearance	Negative: Local	<ul style="list-style-type: none"> • Trees of particular ecological importance (other than Lichen tree 1) to be retained, including Lichen Trees 2 – 5 and mature oak in vicinity of proposed junction with Mochras Road, which may be a lesser spotted woodpecker nesting site • Arboricultural supervision during works within the root protection areas of the trees specified above • Arboricultural survey to be undertaken prior to construction to outline detailed tree protection measures required to prevent damage to trees during construction, according to BS5837:2012 • Mitigation for dust and air quality during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24) 	Negative: Local	1. A total area of 0.65ha would be planted as native broad-leaved woodland, amounting to a greater area than that lost including an area to the north of the proposed northern junction into Llanbedr; Gwynedd Council owned land to the south of Lower Wood; a 3m wide woodland belt (including trees and scrub) along the Maes Artro southern

			<ul style="list-style-type: none"> • Translocation of the 150m section of hedgerow located within the scheme footprint (southern boundary of Mochras Road between car park and railway) • Retention of line of trees and scrub forming eastern boundary of the existing A496 at the northern end of the Proposed Improvement (and including Lichen Trees 3 - 5), 160m of which lies within the construction area 	<p>boundary (as landscape and bat mitigation) and also along the western boundary of the two properties Swyn yr Afon and Lismore to the south of Mochras Road (as landscape mitigation); along the north side of the proposed attenuation pond; and a small area between the Proposed Improvement and the existing road to the east of the builder's yard;</p> <p>2. Additional planting of trees and scrub to fill in existing gaps in lines of trees and scrub within the Arthro floodplain and riverbanks as well as gaps created by construction areas;</p> <p>3. Planting of scrub, low shrubs and trees to the north of the flood embankment located along the north side of Watercourse 2, and an area of scrub on the western embankment at the southern end of the scheme corridor (as landscape mitigation)</p> <p>4. Planting of a line of native broad-leaved trees between the retained copse area and Plas-y-Bryn Farm to be thinned out and managed as three or four standard trees eventually (also mitigation for bats)</p> <p>5. Compensation described for RAWs above.</p>
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Lowland mixed deciduous woodland	Loss of 0.4ha of mature broad-leaved semi-natural woodland during site clearance	Negative: Local	<ul style="list-style-type: none"> • Arboricultural survey to be undertaken prior to construction to outline detailed tree protection measures required to prevent damage to trees during construction, according to BS5837:2012 • Mitigation for dust and air quality during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24) 	Negative: Local	<ol style="list-style-type: none"> 1. A total area of 0.65ha would be planted as native broad-leaved woodland, amounting to a greater area than that lost; 2. Production and implementation of a management plan to improve the condition of 0.56ha of Lower Wood RAWS (25336) within Gwynedd Council ownership
Coastal and floodplain grazing marsh	Permanent loss of approximately 0.63ha of this habitat to the scheme footprint and temporary loss/degradation of approximately 0.43ha during construction	Negative: Local	<ul style="list-style-type: none"> • Topsoil removed from areas to be permanently lost, stored and used in habitat creation (rush pasture compensation) area at chainage 1230 – 1450 • Schedule works within the fluvial/tidal floodplain to avoid periods of highest inundation • Restricted access to the fluvial floodplain during wet conditions • Use of protective boarding/matting and low ground pressure machinery where possible in temporary construction areas within the fluvial floodplain • No site compound, machinery or storage of materials to be located within the fluvial floodplain 	Negative: Local	No compensation proposed
Lowland meadow	Permanent loss of approximately 0.79ha of this habitat to the scheme footprint and temporary loss/degradation of an additional 0.36ha during construction	Negative: County	<ul style="list-style-type: none"> • Topsoil permanently removed from lowland meadow area to be lost (0.79ha) to be stored separately and spread above underground Attenuation Area 2 and all verges, cutting and embankment slopes in this area incorporating re-aligned section of Mochras Road and junction leading to the proposed bypass • These areas not to be reseeded but left to regenerate naturally and managed appropriately during operation to maintain species-richness • Restricted access to lowland meadow habitat during wet conditions 	Negative: Local	<ol style="list-style-type: none"> 1. Pre-construction NVC survey of the fields potentially supporting lowland meadow habitat to be lost to the Proposed Improvement 2. Seeding of verges, embankments and cutting slopes throughout scheme corridor with an appropriate seed mix using species identified during the pre-construction NVC survey to

			<ul style="list-style-type: none"> • Use of protective boarding/matting and low ground pressure machinery where possible within this habitat • No site compound or storage of machinery or materials within lowland meadow habitat 		re-create an additional 2.83ha of lowland meadow habitat (also enhancement) 3. Habitat created to be managed appropriately to maintain species-richness
Purple moor grass and rush pastures	Permanent loss of approximately 0.35ha of this habitat to the scheme footprint and temporary loss/degradation of an additional 0.2ha during construction	Negative: Local	<ul style="list-style-type: none"> • Mitigation described for Coastal and floodplain grazing marsh above 	Negative: Local	<ol style="list-style-type: none"> 1. Creation of approximately 0.54ha rush pasture to the east of the Proposed Improvement at the northern end (Ch. 1230 – 1450) 2. Habitat created to be managed appropriately to maintain habitat type
Reedbeds	Permanent loss of approximately 0.01ha of reedbed habitat during operation; and potential for damage of up to an additional 0.03ha of reedbed during construction	Negative: Not significant	<ul style="list-style-type: none"> • All reedbed habitat within temporary construction areas to be retained • Reedbed habitat to be marked out on the ground prior to construction activities in these areas, with warning signs to prevent access that could cause damage to this habitat during construction • Construction pollution prevention mitigation as described for Pen Llyn a’r Sarnau SAC above and in Chapter 5.10: Road Drainage and the Water Environment 	Negative: Not significant	Not required but the following would compensate for the loss of habitat: Creation of approximately 0.04ha of reedbed within diverted section of Watercourse 3 adjacent to the proposed rush pasture habitat creation area to the east of the Proposed Improvement at the northern end (Ch. 1230 – 1450)
Rivers	Degradation of the Afon Artro catchment within the corridor of the Proposed Improvement arising from siltation and pollution or	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> • Construction pollution prevention mitigation as described for Pen Llyn a’r Sarnau SAC above and in Chapter 5.10: Road Drainage and the Water Environment • Schedule works within the fluvial and tidal floodplains to avoid periods of highest inundation • Restricted access to the fluvial floodplain during wet conditions and no site compound or storage of 	Negative: Not significant	Not required

	disruption during construction and/or operation (including light and noise)		<p>machinery or materials within the fluvial floodplain</p> <ul style="list-style-type: none"> • Culvert for Watercourse 3 to be inserted below existing channel bed level to allow for bed formation within the culvert • Watercourse 3 should not be deepened or widened up or downstream of the culvert • Artificial bank reinforcement should be avoided if possible • No night-time working, site facilities or construction lighting within 30m of any watercourses • Mitigation for dust and air quality during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24) <p><u>Operation:</u></p> <ul style="list-style-type: none"> • No significant increase in light levels along the river corridor of the Afon Artro during operation 		
Species:					
Lesser horseshoe bat	Direct loss of roosting habitat during site clearance, demolition and excavation for the Proposed Improvement footprint	Negative: Local	<ul style="list-style-type: none"> • To mitigate for the removal of two buildings containing lesser horseshoe occasional day roosts within the Builder's Yard a new purpose-built roost would be created within suitable habitat to the south of the Former Aquarium within the Gwynedd Council owned land adjacent to Maes Artro. This new roost would be constructed well in advance of the demolition of the existing roost buildings and would provide suitable habitat for lesser horseshoe bats and other bat species throughout the year. This would provide greater roosting potential for a larger number of bats and species than the roosts to be lost • The two buildings supporting lesser horseshoe bat roosts within the builder's yard would be demolished when bats are absent (and only once the alternative mitigation roost, as described above, has been provided) • A licence from NRW would be obtained to cover demolition of the existing roost buildings. Pre-construction roost surveys are likely to be required to 	Positive: Local	Not required

			inform the license application. All associated mitigation required as a condition of the license would be undertaken		
	Direct and indirect loss of foraging habitat during vegetation clearance and construction of the Proposed Improvement, including permanent loss of 6.1ha	Negative: Not significant	Not required (as not significant) but the following would help to mitigate any impact: <ul style="list-style-type: none"> Mitigation described for Rivers, Coastal floodplain and grazing marsh, Purple moor gass and rush pastures, Reedbeds and Lowland meadow above 	Negative: Not significant	Not required but the compensation for Trees and hedgerows, Purple moor grass and rush pastures, Reedbeds and Lowland meadow would compensate any residual effect
	Disturbance of the maternity / hibernation roost in the former aquarium due to lighting / noise / vibration during construction	Negative: Local	<ul style="list-style-type: none"> Works within 150m of the Former Aquarium maternity roost would be avoided between June and August (when females are likely to have dependent young) The use of additional temporary artificial lighting would be avoided between dusk and dawn from April to October (when bats are most active) A licence from NRW would be obtained to cover any potential disturbance of the roost, with conditional mitigation likely to include pre-construction roost surveys, no construction activities in the vicinity of the roost between June and August; no night-time working or artificial lighting and minimal vegetation clearance in the vicinity of the roost 	Neutral	Not required
	Increased risk of bat mortality during operation of the Proposed Improvement due to permanent severance of commuting routes	Negative: Local	<ul style="list-style-type: none"> Low level planting in the vicinity of actual and potential bat crossing points including the proposed bridges over the Afon Artro and Watercourse 2, as well as the culvert leading to the proposed area of rush pasture and reedbed habitat at the northern end, to lead bats into them and underneath the new road Low level planting to screen the proposed under- 	Negative: Not significant	Not required

			<p>bridge lighting of the road/footway from the river corridor</p> <ul style="list-style-type: none"> • Clearance of trees and vegetation that could encourage bats to cross over the new road, including at Ch. 320, Ch. 550 and Ch. 700 • Works to minimise the bat roosting potential of retained buildings within the builder’s yard to the west of the Proposed Improvement that could encourage bats to cross over the new road at this location • Planting to link the existing maternity/hibernation roost in the former aquarium, the proposed compensation roost and also Unit 34 (Coed Hafod-y-Bryn) of the Coedydd Derw a Safleoedd Ystlumod Meirion SAC to the proposed underpass adjacent to Maes Artro, with a close board fence adjacent at least until vegetation establishes • Planting between Plas-y-bryn Farm and the area of retained copse in order to guide bats to the underpass proposed at Ch. 530 • All guidance planting described above to be managed appropriately to ensure its continued functionality 		
	<p>Disruption / severance of bat commuting routes during construction and operation due to lighting/noise, loss of connectivity, etc.</p>	<p>Negative: Local</p>	<p><u>Construction:</u></p> <ul style="list-style-type: none"> • Connectivity at the new bridge/culvert/underpass locations would be maintained during construction by: avoiding disturbance (by noise or lighting during the most active periods for bats); removing physical barriers (for example, machinery and materials); and temporarily ‘bridging’ any temporary gaps created in linear features between dusk and dawn (using, for example, willow-hurdling or brash woven into Heras fencing) • All construction works associated with the Afon Artro with the potential to disturb foraging bats would be avoided between dusk and dawn from April to October (when bats are most active) <p><u>Operation:</u></p>	<p>Negative: Not significant</p>	<p>Not required</p>

			<ul style="list-style-type: none"> • Mitigation for loss of connectivity as described in 'Increased risk of bat mortality' above • Low level planting to screen the proposed under-bridge lighting of the road/footway from the river corridor • Woodland planting and erection of a close board fence along southwest boundary of Maes Artro holiday village and Gwynedd Council owned land (Ch. 380 - 630) to screen existing and proposed maternity roosts and associated commuting routes within Lower Wood from traffic noise and lights • Planting to infill gaps in the existing scrub within the fluvial floodplain to the east of the Proposed Improvement and additional planting to the north of the flood embankment (Ch. 900 - 1100) would act as screening of foraging habitat and potential commuting routes to the south and east from traffic noise and lights 		
<p><i>Myotis</i>, pipistrelle and brown long-eared bats</p> <p>Greater horseshoe and Barbastelle bats</p>	<p>Direct loss of roosting habitat during site clearance, demolition and excavation for the Proposed Improvement</p>	<p>Negative: Local</p>	<ul style="list-style-type: none"> • To mitigate for the removal of two buildings containing brown long-eared occasional day roosts within the Builder's Yard, a new purpose-built roost would be created within suitable habitat to the south of the Former Aquarium within the Gwynedd Council owned land adjacent to Maes Artro. This new roost would be constructed well in advance of the demolition of the existing roost buildings and would provide suitable habitat for brown long-eared bats and other bat species throughout the year. This would provide greater roosting potential for a larger number of bats and species than the roosts to be lost • The two buildings supporting occasional day roosts for brown long-eared bats within the builder's yard would be demolished when bats are absent (and only once the alternative mitigation roost, as described above, has been provided) • A licence from NRW would be obtained to cover demolition of the existing roost buildings. Pre-construction roost surveys are likely to be required to 	<p>Neutral</p>	<p>Not required but the following would compensate any possible residual effect or act as enhancement: A greater area of woodland and trees would be planted than the area to be lost, which would eventually increase available roosting habitat (see compensation for Trees and hedgerows above)</p>

			<p>inform the license application. All associated mitigation required as a condition of the license would be undertaken</p> <ul style="list-style-type: none"> • Full endoscope survey of all mature trees to be removed prior to their removal and trees immediately adjacent to the proposed works. For each tree with bats or potential for bats recorded, three tree bat boxes to be erected within suitable habitat nearby and suitable replacement tree stock planted • Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker • If actual roosts recorded during endoscope survey, an EPS disturbance licence for bats to be obtained from NRW and associated mitigation undertaken 		
	Direct and indirect loss of foraging habitat during vegetation clearance and construction of the Proposed Improvement, including permanent loss of 4.7ha	Negative: Not significant	Not required but the mitigation proposed for the same impact on lesser horseshoe bats above would help to mitigate this impact on these species	Negative: Not significant	Not required but the compensation described for lesser horseshoe bats above would compensate the impact on these species as well to some extent
	Increased risk of bat mortality during operation of the Proposed Improvement due to permanent severance of commuting routes	Negative: Local	Mitigation as proposed for the same impact on lesser horseshoe bats above	Negative: Not significant	Not required
	Disruption / severance of bat	Negative: Local	Mitigation as proposed for the same impact on lesser horseshoe bats above	Negative: Not significant	Not required

	commuting routes during construction and operation				
'Big bat' species (Noctule, Leisler's and Serotine)	Direct loss of roosting habitat during site clearance, demolition and excavation for the Proposed Improvement	Negative: Local	<ul style="list-style-type: none"> • Full endoscope survey of all mature trees to be removed prior to their removal and trees immediately adjacent to the proposed works. For each tree with bats or potential for bats recorded, three tree bat boxes to be erected within suitable habitat nearby and suitable replacement tree stock planted • Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker • If actual roosts recorded during endoscope survey, an EPS disturbance licence for bats to be obtained from NRW and associated mitigation undertaken • The construction of the new roost building proposed for lesser horseshoe and brown long-eared bats above would also provide habitat with some suitability for the big bat species that have all been found to roost in buildings (although for noctules this is rare) 	Negative: Not significant	Not required but the following would compensate any residual effect: A greater area of woodland and trees would be planted than the area to be lost, which would eventually increase available roosting habitat for these species (see compensation for Trees and hedgerows above)
	Direct and indirect loss of foraging habitat during vegetation clearance and construction of the Proposed Improvement, including permanent loss of 4.7ha	Negative: Not significant	Not required but the mitigation proposed for the same impact on lesser horseshoe bats above would help to mitigate this impact on these species	Negative: Not significant	Not required but the compensation described for lesser horseshoe bats above would compensate the impact on these species as well to some extent
	Permanent disturbance / disruption to species and	Negative: Local	<ul style="list-style-type: none"> • Woodland planting and erection of a close board fence along southwest boundary of Maes Artro holiday village and Gwynedd Council owned land (Ch. 380 - 630) to screen potential roosts, foraging habitat 	Negative: Not significant	Not required

	habitats used by them due to increased traffic noise and lighting in the vicinity of the Proposed Improvement		<p>and commuting routes within Lower Wood from traffic noise and lights</p> <ul style="list-style-type: none"> Planting to infill gaps in the existing scrub within the fluvial floodplain to the east of the Proposed Improvement and additional planting to the north of the flood embankment (Ch. 900 - 1100) would act as screening of foraging habitat and associated commuting routes to the south and east from traffic noise and lights 		
Otter	Loss/disturbance of resting sites and disturbance to otters due to the construction of the Proposed Improvement	Negative: Local	<ul style="list-style-type: none"> Provision of an artificial holt on the northern bank of the Afon Artro well in advance of construction commencement Otter license to be obtained and any associated conditional mitigation undertaken in addition to the mitigation above Pre-construction survey to check for further resting sites/holts and any additional mitigation arising from this Excavations to be covered or an egress provided for trapped animals No night-time working, site facilities or construction lighting within 30m of any watercourses No night-time working, site facilities or construction lighting within 100m of identified resting sites 	Negative: Not significant	Not required
	Severance of commuting / foraging routes due to construction and operation of the Proposed Improvement, including associated increased risk of road fatalities during operation	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> Access to be maintained for otters between dusk and dawn along all watercourses within the scheme corridor by removal of any physical barriers such as machinery and materials No night-time working, site facilities or construction lighting within 30m of any watercourses <p><u>Operation:</u></p> <ul style="list-style-type: none"> Planting in the vicinity of proposed otter underpasses including the proposed bridges over the Afon Artro and Watercourse 2, as well as the culvert leading to a 	Negative: Not significant	Not required

			<p>proposed area of rush pasture and reedbed habitat at the northern end, to lead otters into them and underneath the new road</p> <ul style="list-style-type: none"> Retention of the area of reedbed habitat leading into the proposed 2.2m box culvert for Watercourse 3 and any other existing otter habitat in the vicinity of potential otter underpasses where possible All guidance planting described above to be managed appropriately to ensure its continued functionality Otter-proof fencing to be provided for an appropriate distance on each side of all proposed otter underpasses (according to distances specified in DMRB guidance where possible), including the two bridges, the dry pipe within the flood embankment and the 2.2m box culvert at the northern end (Ch. 1230 – 1250) No significant increase in light levels along the river corridor of the Afon Artro during operation 		
	Temporary loss of 0.41ha of foraging habitat and permanent loss of 0.2ha due to temporary and permanent land take respectively	Negative: Not significant	<p>Not required but the following would mitigate this impact:</p> <ul style="list-style-type: none"> Mitigation described above for Coastal and floodplain grazing marsh and Reedbeds 	Negative: Not significant	<p>Not required but the following would compensate any residual effects:</p> <ol style="list-style-type: none"> Creation of approximately 0.54ha rush pasture and 0.04ha reedbed to the east of the Proposed Improvement at the northern end (Ch. 1240 – 1390) Areas of invasive plant species on the south bank of the river within the scheme footprint, to be replaced with native low scrub species such as gorse to replace potential otter habitat lost
	Potential pollution/siltation of the watercourses	Negative: Local	Construction pollution prevention mitigation as described for Pen Llyn a’r Sarnau SAC above and in Chapter 5.10: Road Drainage and the Water Environment	Negative: Not significant	Not required

	adversely affecting prey populations during construction				
Badger	Loss of badger setts during site clearance / earthworks	Negative: Local	<p>Badger license and associated mitigation, including:</p> <ul style="list-style-type: none"> • Provision of an artificial sett 6 months in advance of sett closure • Sett closure according to standard guidelines, including 3 weeks' monitoring prior to destruction under ecological supervision • Sett destruction and all licensed works within vicinity of active badger setts to be undertaken between July and November inclusive (outside badger breeding season) 	Negative: Not significant	Not required
	Mortality of badgers during construction works and increased mortality rates during operation due to severance and increased traffic speeds	Negative: Local	<p><u>Construction:</u> As above and:</p> <ul style="list-style-type: none"> • Pre-construction survey to check for further active setts • Covering any excavations or providing an egress for trapped animals • Location of site facilities at least 50m away from remaining active setts <p><u>Operation:</u></p> <ul style="list-style-type: none"> • Provision of badger-proof fencing to guide the animals towards the safe crossing points incorporated as embedded mitigation, including a 2.2m box culvert, two bridges, a dry pipe within the fluvial floodplain and two cattle underpasses (see Table 5.4.11) • Provision of an increased area of good quality foraging habitat to the east of the Proposed Improvement (the same side as the retained and proposed setts within the territories to be severed) due to the proposed planting areas to the south of Lower Wood and within other areas to the east, including a total of 0.65ha of woodland planting compared to the 0.4ha to be lost • Planting proposed in the vicinity of the underpasses to 	Negative: Not significant	Not required

			lead animals into them, as described for otters and lesser horseshoe bats above		
	Disturbance to badgers due to construction works and operation of the Proposed Improvement	Negative: Not significant	<p><u>Construction:</u> As above and:</p> <ul style="list-style-type: none"> • No artificial lighting or night-time working within 50m of retained active badger setts • Badger license and associated mitigation, for all works likely to cause significant disturbance/damage to a badger sett, likely to include: <ul style="list-style-type: none"> - Heavy machinery within 30m of an active sett - Light machinery within 20m of an active sett - Hand digging or scrub clearance within 10m of an active sett <p><u>Operation:</u></p> <ul style="list-style-type: none"> • Badger license and associated mitigation for all maintenance works likely to cause significant disturbance/damage to a badger sett 	Negative: Not significant	Not required
	Loss of foraging habitat due to site clearance and severance due to construction	Negative: Not significant	Mitigation for Hedgerows, Lowland meadow and Floodplain and coastal grazing marsh would mitigate this impact to some extent	Negative: Not significant	Not required but the compensation proposed for Trees and hedgerows and Purple moor grass and rush pastures above would compensate for this impact. In addition, the inclusion of crab apple in the species mix used for additional woodland planting in the Lower Wood area would provide an additional food source for badgers
Polecat and Hedgehog	Loss of foraging habitat due to site clearance	Negative: Local	Mitigation for Hedgerows, Lowland meadow, Reedbed and Floodplain and coastal grazing marsh would mitigate this impact to some extent	Negative: Local	Compensation for Trees and hedgerows, Lowland meadow, Purple moor grass and rush pastures and

					Reedbeds would compensate the residual effect
	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting foraging habitat and increased traffic speed compared to the existing A496 through Llanbedr	Negative: Local	<ul style="list-style-type: none"> Provision of otter/badger-proof fencing would guide the animals towards the safe crossing points incorporated as embedded mitigation, including a 2.2m box culvert, two bridges, a dry pipe within the fluvial floodplain and two cattle underpasses (see Table 5.4.11). <p>However, polecats would be able to pass through the 5cm mesh of this fencing but 1m high boundary walls throughout most of the length of the Proposed Improvement, apart from the northern and southern tie-in sections, may help to deter polecats from crossing over the road. See additional mitigation for Polecats below.</p> <ul style="list-style-type: none"> Planting in the vicinity of proposed underpasses including the proposed bridges over the Afon Artro and Watercourse 2, as well, the 2.2m box culvert leading to a proposed area of rush pasture and reedbed habitat at the northern end and the underpass at Ch.530 adjacent to Maes Artro to lead animals into them and underneath the new road Planting between Plas-y-bryn Farm and the area of retained copse in order to guide animals to the underpass proposed at Ch. 530 Clearance of trees and vegetation that could encourage animals to cross over the new road, including at Ch. 320, Ch. 550 and Ch. 700 All guidance planting described above to be managed appropriately to ensure its continued functionality Creation of areas of suitable habitat for these species (woodland, lines of trees and scrub, rush pasture and reedbed) to the east of the Proposed Improvement, where the majority of polecat records have been recorded and the most suitable habitat for hedgehogs exists at present, to reduce the need to cross to the west of the Proposed Improvement 	Negative: Not significant	No compensation proposed

			<p><u>Additional Mitigation for Polecats</u></p> <p>If post-construction monitoring of road casualties (monthly for 12 months) suggests a significant increase in polecat road mortality, further mitigation should be considered that could include:</p> <ul style="list-style-type: none"> - Replacement of otter/badger-proof fencing (5cm mesh) with finer mesh fencing (maximum 3cm mesh) - Provision of additional underpasses, such as at the southern end in the vicinity of the builder's yard where a polecat RTA was recorded in 2004 		
Brown hare	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting foraging habitat and increased traffic speed compared to the existing A496 through Llanbedr	Negative: Local	<ul style="list-style-type: none"> • Provision of otter/badger-proof fencing would help to guide the animals towards the safe crossing points incorporated as embedded mitigation, including a 2.2m box culvert, two bridges, a dry pipe within the fluvial floodplain and two cattle underpasses (see Table 5.4.11). 	Negative: Not significant	Not required
Lesser spotted woodpecker	Destruction of active nests and/or disturbance of nesting birds during site clearance	Negative: Up to Regional	<ul style="list-style-type: none"> • Preconstruction check for lesser spotted woodpecker nests in the vicinity of the proposed works, in the April prior to any scheduled works • If any active lesser spotted woodpecker nests are found that could be disturbed, construction activities to be programmed to avoid the area during the nesting period • Vegetation removal outside breeding bird season or ecologist check for active nests immediately prior to removal • Retention of mature oak in vicinity of proposed junction with Mochras Road, which may be a lesser spotted woodpecker nesting site, and arboricultural supervision during works within the root protection area of this tree 	Neutral	Not required

Barn owl	Destruction of active nests and/or disturbance of nesting birds during site clearance	Negative: Up to County	<ul style="list-style-type: none"> • Preconstruction check for barn owl nests in the vicinity of the proposed works, between March and August prior to any scheduled works • If any active barn owl nests are found that could be disturbed, construction activities to be programmed to avoid the area during the nesting period • Removal of suitable habitat outside the main breeding bird season and ecologist check for active nests immediately prior to removal • Should any active nests be recorded that could be disturbed / destroyed by the proposed works, the erection of barn owl boxes may be required in suitable locations nearby, in agreement with NRW and SNPA 	Neutral	Not required
	Increased risk of road mortality due to the presence of the Proposed Improvement bisecting foraging habitat and increased traffic speed compared to the existing A496 through Llanbedr	Negative: Local to County	<ul style="list-style-type: none"> • 1m high boundary walls at the top of the embankments and 1.4m otter/badger-proof fencing at the top of cutting areas may help to raise the flight level of barn owls attempting to cross over the new road. The hedgerows proposed at the northern and southern tie-ins as landscape mitigation could also help <p><u>Additional Mitigation for Barn owls</u> If any barn owl road casualties are recorded during post-construction monitoring of road casualties (monthly for 12 months), further mitigation should be considered that could include:</p> <ul style="list-style-type: none"> - Erection of fencing higher than the boundaries currently proposed within high risk areas - Increasing the height of the boundary walls in high risk areas such as between the Artro and Watercourse 2 or where no mammal-proof fencing is provided 	Negative: Not significant to Locally significant	No compensation proposed
Red kite	Destruction of active nests and/or disturbance of nesting birds during site clearance	Negative: Up to County	<ul style="list-style-type: none"> • Preconstruction check for red kite nests in the vicinity of the proposed works in April prior to any scheduled works • If any active red kite nests are found that could be disturbed, construction activities to be programmed 	Neutral	Not required

			<p>to avoid the area during the nesting period</p> <ul style="list-style-type: none"> Vegetation removal outside breeding bird season or ecologist check for active nests immediately prior to removal 		
Other breeding birds	Destruction of active nests and/or disturbance of nesting birds during site clearance	Negative: Local	Vegetation removal outside breeding bird season or ecologist check for active nests immediately prior to removal, and works scheduled to avoid disturbance of active nests if any are found	Neutral	Not required
	Loss of potential nesting and foraging habitat	Negative: Not significant	<ul style="list-style-type: none"> Translocation of the 150m section of hedgerow located within the scheme footprint (southern boundary of Mochras Road between car park and railway) Retention of the line of trees and scrub forming the eastern boundary of the existing A496 at the northern end of the Proposed Improvement (160m) Reconstruction of 200m of dry stone wall, as described for Wall mason bee below Provision of riparian nest boxes on proposed bridge and culvert structures Provision of nest boxes suitable for tree-nesting species to be erected within the area of Lower Wood within Gwynedd Council ownership Mitigation for reedbeds described above 	Negative: Not significant	Not required but compensation described above for Trees and hedgerows, Purple moor grass and rush pastures and Reedbeds above would compensate this impact
Reptiles and amphibians	Injury/mortality during site clearance works and during operation	Negative: Up to Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> Ecological Watching Brief during the removal of suitable habitat, including boundary features, damp grassland and rush pasture, woodland and scrub and topsoil stripping in these areas Clearance works described above to be undertaken during the active season (mid-March to mid-October) or at temperatures above 5°C Ecological Watching Brief during the diversion of 45m of Watercourse 0, where palmate newts have been recorded, along the base of the proposed 	Negative: Not significant	Not required

			<p>embankment, to be undertaken between July and October inclusive (within the active season but outside the breeding season) or at temperatures above 5°C between November and February</p> <ul style="list-style-type: none"> • Translocation of any reptiles/amphibians found to a suitable receptor site <p><u>Operation:</u></p> <ul style="list-style-type: none"> • Minimal use of gulley pots but wherever gulley pots are utilised, these are to be amphibian-friendly throughout the Proposed Improvement 		
Migratory fish and brook lamprey	Injury/mortality of fish during in-channel works	Negative: Up to Local	<ul style="list-style-type: none"> • No in-channel works within the Afon Artro or Watercourse 2 (unless previously agreed with NRW) • No in-channel works within any watercourse during the fish spawning season (generally mid-October to mid-April) • Statutory Consents and associated mitigation for working in watercourses, expected to include fish rescues 	Negative: Not significant	Not required
	Disturbance / disruption to fish and their habitats, due to construction activities including pollution risk and mobilisation of suspended solids	Negative: Up to Local	<ul style="list-style-type: none"> • Pollution prevention measures as described for Pen Llyn a'r Sarnau SAC above • No night-time working, site facilities or construction lighting within 30m of any watercourses 	Negative: Not significant	Not required
Latticed Heath moth (<i>Chiasmia clathrata</i>)	Loss of potential habitat during site clearance	Negative: Not significant	<ul style="list-style-type: none"> • Mitigation for Lowland meadow, Coastal floodplain and grazing marsh and Purple moor grass and rush pastures described above 	Negative: Not significant	Not required but the following would compensate for this loss and also constitute enhancement: 1. Creation of 0.54ha of rush pasture proposed to mitigate for the loss of this habitat from within the floodplain, would help to

					<p>compensate for this loss as it would be likely to include some of the species' food plants over time, such as white clover, marsh bedstraw and bird's-foot trefoil.</p> <p>2. White clover and common bird's-foot trefoil would also be incorporated into the seed mix for the verges and cutting slopes throughout the Proposed Improvement, creating an area of suitable foraging habitat greater than that lost</p>
<p>Wall mason bee (<i>Osmia parietina</i>)</p>	<p>Loss of potential nesting and foraging habitat during site clearance</p>	<p>Negative: Not significant</p>	<ul style="list-style-type: none"> • Mitigation for Lowland meadow, Coastal floodplain and grazing marsh and Purple moor grass and rush pastures described above • Approximately 200m of dry stone wall that would be removed during site clearance for the footprint of the construction area, would be reconstructed as a replacement dry stone wall in a sunlit location along the northern boundary of the realigned Mochras Road in the vicinity of the proposed junction with the realigned A496. This would replace potential nesting habitat for this species that would otherwise be lost, that would also be suitable for a range of other invertebrates 	<p>Negative: Not significant</p>	<p>Not required but the following would compensate for this loss:</p> <p>1. Creation of 0.54ha of rush pasture proposed to mitigate for the loss of this habitat from within the floodplain, would help to compensate for this loss as it would be likely to include some common bird's-foot trefoil, the species' only forage plant.</p> <p>2. Common bird's-foot trefoil would also be incorporated into the seed mix for the verges and cutting slopes throughout the Proposed Improvement, creating an area of suitable foraging habitat greater than that lost that would also constitute enhancement</p>

<p>Sharp rush (<i>Juncus acutus</i>)</p>	<p>Potential for damage during construction</p>	<p>Negative: Up to Local</p>	<ul style="list-style-type: none"> All sharp rush to be retained Areas of sharp rush within 50m of the construction area to be marked out on the ground prior to construction activities, with warning signs to prevent access that could cause damage to this species during construction Mitigation for dust during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24) 	<p>Neutral</p>	<p>Not required</p>
<p><i>Schismatomma graphidioides</i> (a lichen)</p>	<p>Loss of a small population during construction and potential for construction damage</p>	<p>Negative: Up to Local</p>	<ul style="list-style-type: none"> Section of Lichen Tree 1 (on Figure 7.1-5: Environmental Master Plan) supporting <i>Schismatomma graphidioides</i> to be relocated to a nearby area with a similar microclimate and suitable receptor trees for potential recolonisation Sycamore supporting this species within the car park / picnic area (Lichen Tree 2) to be retained. This tree to be marked out on the ground prior to construction activities, with warning signs to prevent access that could cause damage during construction. Arboricultural supervision during works within the root protection area of this tree Arboricultural survey to be undertaken prior to construction to outline detailed tree protection measures required to prevent damage to trees during construction, according to BS5837:2012 All mitigation for dust and air emissions impacts during construction (as described in Table 5.1.24 of Chapter 5.1: Air Quality) to be undertaken Regular visual inspections to be undertaken to monitor dust levels in the vicinity of Lichen Tree 2, during works in the vicinity, with works in that area to be postponed until wetter periods or additional mitigation to be agreed, if existing mitigation is not suppressing dust sufficiently 	<p>Negative: Not significant</p>	<p>Planting proposed as compensation for Trees and hedgerows above to include trees suitable as substrate for this species, such as hornbeam, ash, aspen, oak and wych elm, within suitable habitat such as woodland edge</p>
<p><i>Gyalecta carneola</i> and <i>Punctelia</i></p>	<p>Potential for construction damage/loss</p>	<p>Negative: Up to Local</p>	<ul style="list-style-type: none"> Retention of line of trees and scrub forming eastern boundary of the existing A496 at the northern end of the Proposed Improvement (and including Lichen 	<p>Negative: Not significant</p>	<p>Planting proposed as compensation for Trees and hedgerows above to include</p>

<i>reddenda</i> (lichen species)			<p>Trees 3 - 5)</p> <ul style="list-style-type: none"> • Arboricultural supervision during works within the root protection area of these trees • Oaks supporting these species (Lichen Trees 3 - 5) to be marked out on the ground prior to construction activities, with warning signs to prevent access that could cause damage during construction • Arboricultural survey to be undertaken prior to construction to outline detailed tree protection measures required to prevent damage to trees during construction, according to BS5837:2012 • All mitigation for dust and air emissions impacts during construction (as described in Table 5.1.24 of Chapter 5.1: Air Quality) to be undertaken • Regular visual inspections to be undertaken to monitor dust levels in the vicinity of Lichen Trees 3 - 5, during works in the vicinity, with works in that area to be postponed until wetter periods or additional mitigation to be agreed, if existing mitigation is not suppressing dust sufficiently 		trees suitable as substrate for these species, such as ash, willow, rowan and oak, within suitable habitat such as humid, shady areas within woodland
	Potential for improved conditions for retained populations of these species on Lichen Trees 3 and 4 due to a decrease in air pollution	Positive: Up to Local	Not required	Positive: Up to Local	Not required
Non-Native Invasive Plant Species:					
<i>Rhododendron ponticum</i> ; Japanese knotweed; Himalayan balsam; Montbretia	Potential for <i>Rhododendron ponticum</i> , Japanese knotweed, Himalayan balsam and Montbretia to be spread more	Negative: Local	<p><u>Construction:</u></p> <ul style="list-style-type: none"> • All areas of non-native invasive plant species within 30m of the proposed construction area and any site facilities, to be marked out prior to construction activities • Treatment of all invasive species located within the 	Negative: Not significant	Not required, but the following would compensate for loss of invasive plant species acting as potential otter habitat: Areas of invasive plant species on the south bank of the river

	widely in the vicinity of the Proposed Improvement due to construction activities and also maintenance during operation		<p>construction area of the Proposed Improvement with an appropriate herbicide, such as glyphosate, in accordance with guidance from NRW</p> <ul style="list-style-type: none"> Any topsoil or plant material removed from the southern bank of the Afon Artro, contaminated with Japanese knotweed, Himalayan balsam and Montbretia, to be treated according to NRW guidance, likely to include encapsulation within a root barrier membrane and burial at a depth of at least 2m, or burial at a depth of 5m, covered by a root barrier membrane and 5m of inert fill or topsoil Material removed from the area contaminated with Japanese knotweed at the southern extent of the Proposed Improvement, also to be treated in this way Topsoil from wooded areas potentially contaminated with Rhododendron seed (at northern and southern tie-ins) to be re-used in adjacent areas of proposed planting and not moved to another location Measures to treat, control and prevent the spread of non-native invasive plant species within the footprint of the Proposed Improvement to be included in the CEMP, such as washing down vehicles leaving contaminated areas, and secure segregated storage of material contaminated with these species <p><u>Operation:</u></p> <ul style="list-style-type: none"> Ongoing control of invasive species to be included as part of a 5 year soft landscaping aftercare contract 		within the scheme footprint to be replaced with native low scrub species such as gorse to replace potential otter habitat lost
Ecosystem Services:					
Cultural services provided by the natural river corridor in the vicinity of the car park / picnic / fishing area off Mochras	Short-term loss of the picnic / fishing area adjacent to the proposed bridge over the Afon Artro during construction	Negative: Local	No mitigation proposed	Negative: Local	No compensation proposed
	A decrease in the	Negative:	Provision of potential for additional wildlife interest due to:	Negative: Local	The provision of

Road	aesthetic value, including presence of natural features and wildlife, due to the proposed bridge over the Afon Artro	Local	<ul style="list-style-type: none"> Erection of riparian bird nest boxes underneath the bridge Installation of an artificial otter holt downstream on the northern river bank Replacement of non-native invasive species with native scrub 		approximately 290m of additional footway to connect the existing footway along the south bank of the river within the village of Llanbedr to the existing car park / picnic / fishing area. This would provide an additional aesthetically pleasing route, enabling appreciation of the natural river corridor and associated wildlife
Cultural services provided by the natural landscape in the vicinity of the Public Right of Way (PRoW) running along the top of the flood embankment	Short-term closure of PRoW 1 along the flood embankment to the east of the Afon Artro during the construction period	Negative: Local	No mitigation proposed	Negative: Local	No compensation proposed
	A decrease in aesthetic value, including presence of natural features and wildlife, due to the presence of the Proposed Improvement cutting across the route	Negative: Local	<ul style="list-style-type: none"> Retention of natural habitat as much as possible, including reinstatement of habitat within the floodplain Seeding of embankment slopes and verges as species-rich grassland Planting of low native shrub species such as blackthorn, guelder rose and dog rose along the northern edge of the embankment to the east of the proposed bridge over Watercourse 2, which would enhance the biodiversity along this route 	Negative: Local	The provision of an additional section of footpath leading to the Meini Hirion Standing Stones Scheduled Ancient Monument (SAM) to the north of the Afon Artro. This would provide an additional aesthetically pleasing route through semi-natural habitat within the floodplain, including rush pasture, mature native trees and associated wildlife
Services to agriculture provided by pollinators	Permanent loss of habitat used by pollinators due to the footprint of the	Negative: Local	All mitigation proposed for Lowland meadow, Purple moor grass and rush pastures and Coastal floodplain and grazing marsh above	Negative: Local	Compensation proposed for Lowland meadow and Purple moor grass and rush pastures, as described above, would

benefitting from semi-natural habitat within the scheme corridor	Proposed Improvement				compensate for the residual effect on pollination services
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Residual Effects and Compensation

5.4.444 All significant residual effects with mitigation in place (as summarised in Table 5.4.14 above) are described below, with measures to compensate for these effects explained where relevant. Locations of all the compensatory measures are shown on Figures 7.1-5: Environmental Master Plan.

Trees and Woodland

5.4.445 Following completion of the Proposed Improvement, a residual adverse effect would remain on trees and woodland, as mitigation can only avoid or reduce impacts, including retention of important trees, arboricultural protective measures and control of construction dust and emissions. The residual effect arises from the areas of woodland and scattered trees that would be lost to the Proposed Improvement footprint. This area is increased slightly by mitigation for bats involving the removal of trees located immediately adjacent to the scheme corridor in key areas that could lead bats to cross the new road outside the proposed safe crossing points. It is considered that this **negative** residual effect, comprising a total loss of 0.4ha of mature woodland and an additional 14 scattered mature trees would be **locally significant** at most, considering the extensive woodland resource that would remain to the east of the Proposed Improvement corridor and in the wider area.

Compensation

5.4.446 The loss of 0.4ha of woodland habitat would be compensated by planting 0.63ha of native broad-leaved woodland in the following areas:

1. Planting of a woodland belt grading into scrub from east to west on the north side of the northern proposed junction into Llanbedr (Ch. 1240);
2. Woodland planting (including creation of a woodland glade) within the area of land owned by Gwynedd Council to the south of Lower Wood and adjacent to the west of Maes Artro, to include a woodland glade between the former aquarium bat roost, the mitigation roost proposed and the underpass to the southwest (Ch. 430 – 620);
3. Planting of a 3m wide woodland belt running along the northwest and southwest boundaries of the properties Swn yr Afon and Lismore to the south of the Afon Artro (Ch. 690 - 800);
4. Planting of a 3m wide woodland belt running along the southwest boundary of Maes Artro holiday village to link the proposed woodland planting with the existing woodland and SAC to the southeast (Ch. 380 - 440); and
5. Woodland planting along the northern side of the proposed attenuation pond adjacent to the southern proposed junction into Llanbedr (Ch. 380).

5.4.447 The potential for damage to retained woodland areas, including RAWs, either physically due to construction traffic, or due to dust or emissions during construction and operation, would be compensated by management of 0.56ha of woodland within the part of Lower Wood RAWs under Gwynedd Council ownership. As this impact is not considered to be significant, this would also constitute an enhancement measure, and would involve the phased replacement of non-native plant species, including cherry laurel and beech with native broad-leaved trees, including crab apple as a food source for badgers. Details of the management would be included in a Woodland Management Plan to be agreed with SNPA, and could be implemented in collaboration with the Wildlife Trusts.

5.4.448 The loss of any scrub and approximately 14 scattered mature trees would be compensated by the following:

1. The inclusion of at least five standard trees, including sessile oak, within the proposed species-rich hedge along the western boundary of the Proposed Improvement adjacent to the Sewage Works at the northern end;
2. Planting of trees and scrub, such as willow, hazel and alder, to fill in existing gaps in the lines of trees and scrub within the fluvial floodplain between the Afon Artro and Watercourse 2, proposed as landscape screening (see Chapter 5.3: Landscape);

3. Planting of trees and scrub, such as willow, hazel, alder and sessile oak, to fill in existing gaps or gaps created by construction, along both banks of the Afon Artro to the east of the Proposed Improvement;
4. Planting of common gorse on both banks of the Afon Artro on each side of the proposed Artro bridge;
5. Planting of a line of native low-growing shrubs that would achieve a maximum height of 3-4m, such as blackthorn, guelder rose and dog rose, along the north side of the flood embankment leading from Llanbedr towards the bridge over Watercourse 2 as landscape screening (Ch. 1080 - 1090);
6. Planting of common gorse leading into the bridge over Watercourse 2 from the east (Ch. 1070 - 1100);
7. Planting of a small group of at least five larger trees such as alder and willow between the line of shrubs and the gorse to the north of the flood embankment (4 and 5 above);
8. Planting of common gorse between the flood embankment to the west of the bridge over Watercourse 2, along the bottom of the scheme embankment and up to the 2.2m box culvert for Watercourse 3, leaving a gap at the location of the 2.3m livestock underpass (Ch. 1150 - 1240);
9. Planting of gorse scrub to replace any areas of non-native invasive plant species removed in the vicinity of the Afon Artro;
10. Planting of a short hedgerow (with a gate for agricultural access) to bridge the gap between the proposed underpass to the west of Maes Artro and the proposed woodland planting within Gwynedd Council owned land (Ch. 540);
11. Planting of a line of native broad-leaved trees, including sessile oak, between the partly retained copse to the west of the southern underpass and Plas y Bryn Farm further to the west (Ch. 550), to be thinned out at the end of the five year soft landscaping aftercare contract to leave four trees to be protected from stock and managed to ensure their retention and development into large standard trees; and
12. Planting of an area of scrub on the western embankment of the Proposed Improvement at the southern end (Ch. 170 – 200) as landscape screening.

5.4.449 Planting would be comprised of native broad-leaved species of local provenance and wherever conditions are suitable would include tree species that could provide a substrate for the notable lichen species to be retained within the scheme corridor. Suitable species include ash and oak (suitable for all three lichen species); hornbeam, ash, aspen and wych elm (suitable for *S. graphidioides*); and willow and rowan (suitable for *G. carneola* and *P. reddenda*). All planting would be managed to ensure establishment as part of the five year soft landscaping aftercare contract.

5.4.450 Although not considered to be significant, this compensation would also compensate impacts on lesser horseshoe bats (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC) and the other bat species recorded within the scheme corridor by providing more foraging habitat in the long-term than would be lost to the Proposed Improvement. The woodland glade proposed between the former aquarium maternity roost, the proposed mitigation roost and the underpass to be provided at Ch. 530 should provide a sheltered foraging corridor guiding bats from the roosts to the safe underpass. Otters would also benefit from the replacement of potential foraging or resting habitat provided by invasive species such as Japanese knotweed on the southern bank of the river, with native common gorse. Badgers would benefit from the replacement of foraging habitat lost and also the inclusion of crab apple in the species to be planted, a favoured food source of the badger. Polecats, hedgehogs, breeding birds, reptiles, amphibians and lichens would also benefit from the provision of a greater area of native broad-leaved trees, shrubs and woodland than that lost.

Coastal and floodplain grazing marsh

5.4.451A **negative** residual effect would remain for coastal and floodplain grazing marsh as, despite mitigation to minimise the damage to areas of this habitat within temporary construction areas, the

permanent loss of 0.63ha would remain. This is considered to be of **local significance** and no compensation is proposed as the habitat could not be replaced without moving the flood embankment to the north of Watercourse 2 to create another area that would be periodically inundated by fluvial/tidal flooding and this was not considered to be a viable option. However, some compensation for this type of habitat would be provided by the compensation for loss of rush pasture described in paragraph 5.4.456 below.

Lowland meadow

5.4.452 A **negative** residual effect of **local significance** would remain for lowland meadow, as although mitigation is proposed to retain the topsoil and re-use it on the proposed soft estate in the vicinity, which should allow natural regeneration of this habitat in these areas from the seed bank, it would take time and appropriate management to create habitat of the quality of the 0.79ha to be lost.

Compensation

5.4.453 The loss of lowland meadow habitat would be compensated by seeding the soft estate (verges, embankment and cutting slopes) throughout the Proposed Improvement corridor (other than the areas described in paragraph 5.4.452 above which would be allowed to regenerate without seeding), with a species-rich seed mix equivalent to lowland meadow habitat. To achieve an appropriate seed mix, the area of existing lowland meadow within the two horse-grazed fields to be affected by the Proposed Improvement would be NVC surveyed in June/July prior to construction to establish the nature of the community, and species recorded would be included in the seed mix where possible. The areas to be seeded would be left as sub-soil where possible to reduce their fertility and the seed mix would be comprised of locally-occurring fine grasses and wildflower species, including yellow rattle (*Rhinanthus minor*) to increase species diversity due to its parasitism on grasses. The seed mix should be designed to include species flowering throughout the season if possible, to ensure a supply of pollen and nectar for pollinator species throughout the flowering season. This would create an additional area of approximately 2.85ha of habitat equivalent to lowland meadow if managed appropriately, or a total of 3.4ha including the soft estate in the vicinity of the Mochras Road junction to be topsoiled with lowland meadow topsoil. Appropriate management is likely to include control of weed species under the five year soft landscaping contract and cutting once or twice a year (in early autumn and/or early spring) with removal of arisings, which would apply to the seeded areas described above as well as the topsoiled areas described in paragraph 5.4.452 above. As the area to be created would be much larger than the area to be lost, this measure would also constitute enhancement.

5.4.454 In order for this habitat creation to benefit the latticed heath moth, the species mix should include some of the moth's foodplant species, including white clover and common bird's-foot trefoil. The inclusion of common bird's-foot trefoil would also provide the only forage plant of the wall mason bee, which is considered to be the key to management for this species.

Purple moor grass and rush pastures

5.4.455 A **negative** residual effect of **local significance** would remain for purple moor grass and rush pastures, as, despite mitigation to minimise the damage to areas of this habitat within temporary construction areas, the permanent loss of 0.35ha would remain.

Compensation

5.4.456 The loss of 0.35ha of purple moor grass and rush pasture would be compensated by the creation of approximately 0.54ha of rush pasture in an area between the existing road and the Proposed Improvement to the north of the proposed northern junction with Llanbedr. This would be achieved by lowering the ground level within this area, which is already susceptible to surface water flooding, and due to the soil within this area, comprising gravelly clay, and the proximity of ground water about 2.2m below the surface, this is likely to create the damp conditions required for the establishment of this habitat (see Chapter 5.5: Geology and Soils). Topsoil would also be supplied

from the existing area to be permanently lost from the fluvial floodplain between the Afon Artro and Watercourse 2, which is partly composed of purple moor grass and rush pasture. This would therefore include a seed bank comprising suitable species for the establishment for this habitat. Following topsoiling, the area would be left to regenerate naturally, with appropriate management including control of weed species under the five year soft landscaping contract and cutting once or twice a year (in early autumn and/or early spring) with removal of arisings. Once the habitat has become more established, it would be appropriate to introduce a low level of grazing, which could be undertaken by letting the area to a local farmer, under an appropriate Grazing Management Plan.

5.4.457 This habitat creation would also benefit bats including lesser horseshoe, otters, badgers, polecat and hedgehog, brown hare, birds, reptiles, amphibians, latticed heath moth, wall mason bee and other invertebrates by replacing foraging habitat lost. The embedded 2.2m box culvert provided for Watercourse 3, leading into this habitat creation area, would provide safe access for the vertebrate species mentioned above from habitat to the west, including the Afon Artro river corridor. The mammal ledges provided on each side within this culvert would provide safe access to this habitat at times of high flow.

Reedbeds

5.4.458 There is not considered to be a significant impact on reedbeds with or without mitigation but to compensate for any permanent habitat loss (up to 0.01ha) that could occur due to lack of sunlight underneath the proposed bridge over Watercourse 2 during operation, an area of reedbed of approximately 0.04ha would be created within the diverted section of Watercourse 3 along the bottom of the proposed embankment on the east side of the Proposed Improvement adjacent to the rush pasture creation area described above. This would be a significantly greater area than that lost so would be expected to constitute enhancement as well once it is fully established. Reedbed creation would be achieved by following guidance such as 'Bringing Reedbeds to Life: Creating and Managing Reedbeds for Wildlife' (RSPB, 2014), which is likely to include creating appropriate conditions within the diverted section of Watercourse 3 allocated for reedbed creation, and possibly seeding with seed harvested from the existing reedbed within Watercourse 2. Future management of the reedbed habitat created should also follow guidance such as that provided within the RSPB document cited above and management commitments would be included in the HEMP. These details would be agreed with NRW and SNPA at the detailed design stage.

5.4.459 This reedbed creation would also benefit bats including lesser horseshoe, otter, polecat, breeding birds, reptiles, amphibians and invertebrates and the 2.2m box culvert with mammal ledges would provide safe access as described above.

Lesser horseshoe bat

5.4.460 A **positive** residual effect is likely to arise for lesser horseshoe bats with mitigation in place, due to the proposed creation of a mitigation roost that would provide roosting opportunities far exceeding the roosts to be lost within the builder's yard, including potential for use as a maternity and hibernation roost by large numbers of lesser horseshoe bats. This would therefore also be considered as an enhancement, which would be particularly beneficial due to the deterioration of the existing former aquarium roost building, which is likely to become unsuitable for use as a maternity roost for lesser horseshoe bats in the near future.

Polecat and Hedgehog

5.4.461 A **negative** residual effect of **local significance** would remain for polecats and hedgehogs with mitigation in place, as there would be a residual loss of suitable foraging habitat for both these species. However, the compensation proposed for trees and hedgerows, lowland meadow, purple moor grass and rush pastures and reedbeds above would compensate for this effect.

Barn owl

5.4.462 There is potential for a **negative** residual effect to remain for barn owls due to a residual risk of road traffic mortality due to the severance of suitable foraging habitat for this species by the Proposed Improvement. However, it is likely that with the mitigation in place, this risk would be low, particularly as there is only one record for this species within the Cofnod data, and this was located 1.2km to the west in 2005. It is therefore considered that this effect would be of **local** significance at most. No compensation is proposed.

Lichens

5.4.463 A **positive** residual effect is likely for the notable lichen species *Gyalecta carneola* and *Punctelia reddenda* due to the removal of the majority of the traffic flow further away from the trees supporting these species at the northern end of the Proposed Improvement, likely to result in an improvement in air quality. This is likely to be significant at a **local** level at most.

Ecosystem services - cultural

5.4.464 A **negative** residual effect of **local significance** would remain for the cultural services provided by the natural environment in the vicinity of the picnic and fishing area by the car park off Mochras Road and PROW 1, due to their closure to the public during the construction period. No compensation is proposed for this.

5.4.465 A **negative** residual effect of **local** significance is also likely to remain for the services described in paragraph 5.4.464 above during operation due to the degradation of the natural environment in these areas affecting their amenity, particularly visually due to the presence of the Proposed Improvement, including the large bridge structures proposed over the Afon Artro and Watercourse 2 (see Chapter 5.3: Landscape for more detail of visual effects and also Chapter 5.8: All Travellers and Chapter 5.9: Community and Private Assets, for amenity effects).

Compensation

5.4.466 The provision of approximately 290m of additional footway along the southern bank of the Afon Artro, to link the existing footway along Mochras Road to the east with the car park and footway to the station to the west would help to compensate for the loss of amenity of the cultural services provided by the river corridor in the vicinity of the picnic and fishing area due to the proposed bridge.

5.4.467 The provision of an additional section of footpath leading to the Scheduled Ancient Monument (SAM) within the fluvial floodplain, proposed as mitigation for cultural heritage impacts (see Chapter 5.2: Cultural Heritage).

Ecosystem services - pollination

5.4.468 A **negative** residual effect of **local significance** would remain for pollination services in the vicinity of the Proposed Improvement due to the reduction in value of lowland meadow habitat following mitigation, and loss of coastal and floodplain grazing marsh and associated purple moor grass and rush pastures. However, the compensation proposed for Lowland meadow and Purple moor grass and rush pastures above would more than compensate for this effect, particularly in the long-term, and is considered to represent an enhancement for pollinators.

Overall Habitat Loss and Creation

5.4.469 Table 5.4.15 below provides a summary of the total areas of habitat lost and created due to the Proposed Improvement.

Table 5.4.15: Summary of habitat lost and created due to the Proposed Improvement

Habitat	Permanent Loss	Creation
Broad-leaved woodland	0.4ha	0.63ha
Scattered broad-leaved mature trees	c.14 scattered trees	c.20 scattered trees
Species-rich hedgerow	0	530m
Dry stone wall	200m	200m
Coastal and floodplain grazing marsh	0.63ha	0
Purple moor grass and rush pasture	0.35ha	0.54ha
Reedbed	0.01ha	0.04ha
Pond	0	0.11ha
Lowland meadow (species-rich grassland)	0.79ha	3.4ha

Cumulative Effects

5.4.470 Cumulative effects on ecological features in combination with other schemes have been assessed in Chapter 6.0: Assessment of Cumulative Effects. Incremental effects from within the Proposed Improvement on important ecological features are integral to the ecological impact assessment process and have been assessed within this chapter.

Ecological Enhancement

5.4.471 The ecological enhancement proposals detailed in this section do not mitigate impacts of the project, and are not included within the ecological impact assessment as embedded mitigation, mitigation or compensation measures, although some of these do also provide an enhancement overall, as described in the respective sections above. These proposals represent additional measures of benefit to nature conservation that have been included to add value to the biodiversity of the Proposed Improvement corridor.

Additional hedgerow habitat

5.4.472 Species-rich native hedgerows would be planted on the western boundary of the northern tie-in and both boundaries of the southern tie-in, as well as the short length to be provided between the southern underpass and the compensation woodland planting area adjacent to Maes Artro, amounting to an additional 600m of hedgerow habitat compared to the current extent. This would provide additional foraging and commuting habitat and shelter for a range of wildlife including badgers, polecats, hedgehogs, breeding birds, reptiles, amphibians and invertebrates.

Interpretation board

5.4.473 An interpretation board would be provided in the vicinity of the proposed footpath to the Meini Hirion Standing Stones Scheduled Ancient Monument (SAM) within the fluvial floodplain to the north of the Afon Artro. This would provide information to the public about the coastal and floodplain grazing marsh and associated habitats and species, including purple moor grass and rush pastures, reedbeds, brackish ditches, willow scrub, and wildlife including otters, brown hares, bat species, breeding bird species, reptiles and amphibians and a diverse range of invertebrate and plant species. This would complement the interpretation board to be included as mitigation for cultural heritage impacts in relation to the SAM, providing historic information about the standing stones (see Chapter 5.2: Cultural Heritage). This interpretation would also complement and enhance the cultural ecosystem services provided by the natural environment in this location.

Lighting strategy to optimise bat commuting route

5.4.474 A lighting strategy would be devised and implemented to minimise/reduce light spill to the river corridor for the length of the proposed footway between Mochras Road and the Afon Artro. This would be designed to ensure that dark corridors are created or retained where lesser horseshoe bats have been found or are most likely to be commuting between the existing and proposed roosts in Lower Wood to the south and the foraging corridor of the Afon Artro. This would be incorporated at the detailed design stage, and agreed in consultation with NRW and SNPA.

Reptile hibernacula

5.4.475 Two artificial reptile hibernacula would be created within the scheme corridor. One would be constructed within the habitat creation area to the north of the proposed northern junction with Llanbedr (Ch. 1250) on the boundary of the proposed rush pasture area and the adjacent woodland and scrub planting. The other would be constructed within the woodland compensation planting area within Gwynedd Council owned land to the west of Maes Artro (Ch. 600). These structures could be created using waste materials from the Proposed Improvement, such as stones and brash, according to standard guidelines such as those provided in the DMRB. The locations would provide suitable foraging and basking habitat nearby and would also provide suitable habitat for hibernating amphibians.

Control of invasive plant species outside construction area

5.4.476 It is proposed that all non-native invasive plant species occurring on both banks of the Afon Artro between Pont Llanbedr within the village to the east and the northern corner of the triangular plot including the car parking / picnic area owned by Gwynedd Council to the west of the Proposed Improvement would be treated with an appropriate herbicide whilst managing invasive species within the scheme corridor. This area would include all invasive species recorded along the Afon Artro during the baseline Extended Phase 1 Habitat Survey for the Proposed Improvement undertaken in 2014 (and updated in 2015), including Japanese knotweed, Himalayan balsam and Montbretia. This would be incorporated into the CEMP and five year soft landscaping aftercare contract.

Monitoring

5.4.477 Ecological monitoring pre-, during and post-construction is proposed in order to confirm the effectiveness of the mitigation measures described above and extent of any residual effects. For some receptors, the ecological monitoring would be combined with monitoring for landscape reasons (*i.e.* assessing the success of planting). Some monitoring would be required for any species derogation licences obtained for the construction of the scheme. Ecological monitoring associated with the Proposed Improvement should include:

Pre-construction:

- Bat activity surveys to monitor activity at the locations of the proposed safe crossing points and any other confirmed or potential commuting routes that cross the scheme corridor, including in the vicinity of the builder's yard and proposed attenuation pond at Ch.350, throughout the active season;
- Monitoring of the bat population within the former aquarium roost to update the baseline to assess further monitoring against in terms of the effectiveness of construction mitigation;
- Otter survey to confirm the locations of any holts or resting sites within the vicinity of the Proposed Improvement;
- Badger survey to confirm locations of active setts within the corridor of the Proposed Improvement;

- Red kite and lesser spotted woodpecker survey during April and barn owl survey between March and August to check for nest sites in the vicinity of the Proposed Improvement;
- Water quality monitoring;
- Pre-construction baseline survey of the condition and extent of the notable lichens included in the impact assessment; and
- NVC survey of lowland meadow habitat lying within the Proposed Improvement footprint to establish nature and diversity of community and inform the species used in the seed mix throughout.

During construction:

- Bat activity surveys to monitor activity at the locations of the proposed safe crossing points and any other confirmed or potential commuting routes that cross the scheme corridor, including in the vicinity of the builder's yard and proposed attenuation pond at Ch.350, throughout the active season;
- Monitoring of the bat population within the former aquarium roost and the new mitigation roost to assess the effectiveness of construction mitigation and set the results of scheme monitoring in the context of the wider population;
- Monitoring of any bat boxes erected as mitigation for loss of actual or potential roosting habitat in August-October,
- Monitoring of otter activity in the vicinity of the Proposed Improvement quarterly throughout the construction period;
- Monitoring use of the artificial badger sett and other badger activity within the corridor of the Proposed Improvement;
- Water quality monitoring;
- Monitoring of the condition and extent of the notable lichens included in the impact assessment; and
- Regular dust monitoring, particularly in the vicinity of dust-sensitive features identified in this assessment (retained lichen trees, RAWs, Meirionnydd Oakwoods and Bat Sites SAC).

Post-construction:

- Bat activity surveys to monitor activity at the proposed safe crossing points and any other confirmed or potential commuting routes that cross the scheme corridor, including in the vicinity of the builder's yard and proposed attenuation pond at Ch.350, throughout the active season;
- Monitoring of the bat population within the former aquarium roost and the new mitigation roost to assess the effectiveness of operational mitigation and set the results of scheme monitoring in the context of the wider population;
- Monitoring of bat boxes erected as mitigation for loss of actual or potential roosting habitat;
- Twice yearly monitoring of otter activity in the vicinity of the Proposed Improvement, including the artificial otter holt and the safe crossing points provided;
- Twice yearly monitoring of use of the artificial badger sett and other badger activity within the corridor of the Proposed Improvement, and particularly in the vicinity of the safe crossing points provided;
- Monitoring of the otter/badger-proof fencing required as mitigation for the increased risk of road mortality due to the Proposed Improvement, to ensure its continued functionality;
- Monitoring the tree, shrub and hedgerow translocation and planting in parallel with landscaping obligations, to ensure that they continue to fulfil their ecological functions;
- Monthly walk through of the scheme corridor to record any road casualties of any species but particularly those included in the impact assessment;
- Collation of records of road traffic mortality within the corridor of the Proposed Improvement for the duration of the aftercare period to give some indication of the success of the mitigation proposed to reduce this impact;

- Water quality monitoring;
- Monitoring of the condition and extent of the notable lichens included in the impact assessment; and
- Monitoring of habitat creation areas to determine the success of creation and management measures, including NVC survey of rush pasture creation area and lowland meadow creation within the soft estate (from both topsoiling and seeding).

5.4.478 Details of the monitoring required would be established at the detailed design stage in consultation with NRW and SNPA and incorporated into the Construction Environmental Management Plan (CEMP) and Handover Environmental Management Plan (HEMP). Monitoring would be undertaken for a minimum of 12 months, with the results to be included in a report and circulated to relevant statutory consultees for review and to establish the need for any further monitoring and/or additional mitigation.

Summary and Conclusions

5.4.479 Table 5.4.14 above summarises the potential impacts of the Proposed Improvement, proposed mitigation measures, residual impacts and compensation.

5.4.480 With the embedded design mitigation and additional mitigation in place to reduce or avoid potential impacts from construction activities or operation of the Proposed Improvement, there are likely to be locally significant residual negative impacts on important habitats including trees and woodland, coastal and floodplain grazing marsh, lowland meadow and purple moor grass and rush pastures due to permanent habitat loss. Most of these residual effects would be compensated by habitat creation including planting a greater area of native broad-leaved woodland, scattered trees and scrub than that lost; creation of a larger area of rush pasture than the area to be lost; and significantly more species-rich drier grassland, equivalent to lowland meadow, than the area to be lost. In addition, reedbed creation is proposed that would more than mitigate for any loss or damage of reedbed habitat, although this is not considered to be a significant impact. These habitat creation areas would also compensate for a residual loss of foraging habitat that could otherwise be significant for species such as polecats and hedgehogs. As additional compensation for loss or damage to woodland and RAWS, management of part of Lower Wood RAWS is proposed, to replace non-native species with native broad-leaved tree species. The only loss of habitat that would not be compensated would be loss of floodplain grazing marsh but this is considered to be locally significant at most.

5.4.481 Barn owls could also experience a negative residual effect due to the increased risk of road mortality due to severance of suitable foraging habitat during operation. No compensation is proposed for this but it is considered that the risk would be low due to the low number of barn owls recorded in the vicinity, and locally significant at most.

5.4.482 For lesser horseshoe bats, it is considered that there would be a positive residual impact of local significance due to the construction of a large roost structure that would more than mitigate for the loss of two transitional roosts within the builder's yard. This would provide suitable habitat for lesser horseshoes throughout the year, as well as providing roosting habitat for the other bat species recorded within the scheme corridor, that could even include rare species such as greater horseshoe and barbastelle in the future due to increasing temperatures shifting their range further north.

5.4.483 A positive residual effect could also remain for lichens due to the removal of the A496 and its associated traffic flow further away from trees supporting the notable species *Gyalecta carneola* and *Punctelia reddenda*. This should result in a reduction in air pollution from vehicle emissions, which

should improve conditions for the growth of these populations and would be locally significant at most.

5.4.484 Cultural ecosystem services would suffer a locally significant negative residual impact during construction due to the temporary loss of the picnic and fishing area and also the closure of part of PRow 1. This could not be compensated but is only a short-term impact and the degradation of these services during operation due to the presence of the Proposed Improvement would be compensated by the provision of additional footway along Mochras Road and an extra section of footpath leading to the Meini Hirion SAM within the floodplain. With the compensation provided by the provision of a much larger area of lowland meadow habitat than that lost, and replacement of rush pasture habitat, the habitat available as forage for pollinators would be greatly increased by the Proposed Improvement, resulting in a net gain overall for pollinators and the services they provide to local agriculture.

5.4.485 In addition to the compensatory measures described above, enhancement is proposed to create additional features of benefit to local biodiversity, including planting additional hedgerows, provision of an interpretation board about the local habitats and species, a lighting strategy to reduce disruption to bats commuting along the river corridor from the nearby maternity roost, creation of reptile hibernacula and control of invasive plant species along the Afon Artro river corridor.

5.4.486 Overall, it is considered that although there could be locally significant negative residual effects on coastal and floodplain grazing marsh and barn owl in the long-term, there could be long-term benefits to a number of ecological features including lesser horseshoe bats, notable lichen species, lowland meadow habitat and pollinators, and much of the biodiversity provided by the 0.63ha of floodplain grazing marsh would be provided by the 0.54ha of rush pasture habitat to be created at Ch. 1250-1400. The majority of biodiversity value within the scheme corridor would be associated with the important habitats to be lost and created, and these amount to a loss of approximately 2.18ha and a gain of approximately 4.72ha, resulting in a net gain.

Review against policy framework

5.4.487 Policies, plans and legislation relevant to nature conservation have been listed at the start of the chapter. It is considered that through the iterative design process and the identification of appropriate mitigation, compensation and enhancement measures, the Proposed Improvement would be compliant with all relevant legislation and policy.

5.4.488 Specifically, the Proposed Improvement avoids any significant impacts on sites designated for their nature conservation interest, and aims to minimise any impacts on wildlife in the vicinity of the Proposed Improvement, such as mortality, disturbance, severance or loss of habitat. Although some impacts on species and habitats are unavoidable, mitigation and compensation measures have been proposed for these impacts that would ensure that in the long-term there is a net gain for the majority of important ecological features identified as well as for biodiversity as a whole. Where species or sites are protected by European or UK legislation, the appropriate licences would be obtained where necessary and all associated mitigation incorporated into Contract Documents, in order to comply with this legislation (specifically Conservation of Habitats and Species Regulations 2010 and Protection of Badgers Act 1992).

5.4.489 The Proposed Improvement has been subject to Habitats Regulations Assessment, to be determined by the SNPA (as the 'Competent Authority'). See 'A496 Llanbedr Access Improvements: Habitat Regulations Assessment' (YGC, 2017). This assessment concludes that no significant effects are likely on the Natura 2000 sites, with consideration of the measures outlined in the Mitigation and Compensation sections of this chapter.

- 5.4.490 Section 7 species and habitats have all been included in the full assessment process, any impacts mitigated and/or compensated where possible and enhancement measures proposed that would benefit Section 7 species and habitats, including hedgerows, lowland mixed deciduous woodland, lowland meadow, purple moor grass and rush pastures, reedbeds, rivers, barbastelle, noctule, common and soprano pipistrelle, brown long-eared, greater and lesser horseshoe bats, otter, polecat, hedgehog, brown hare, slow worm, common lizard, grass snake, common toad, Atlantic salmon, brown/sea trout, river lamprey, sea lamprey, European eel latticed heath moth, wall mason bee, and three notable lichen species. In this way, all reasonable steps have been taken to maintain and enhance living organisms and habitats listed on Section 7, as required under the Environment (Wales) Act 2016.
- 5.4.491 The mitigation, compensation and enhancement measures proposed, such as planting a greater area of woodland, trees and hedgerows than that lost, replacing rush pasture lost with a greater area, creation of species-rich grassland within the verges, construction of a mitigation bat roost of much greater benefit than those lost, provision of a reptile hibernaculum, lighting strategy to improve conditions for commuting bats, control of invasive species outside the construction area and increased connectivity throughout the scheme corridor, all help to maintain and enhance biodiversity and ensure ecosystem resilience by maintaining and enhancing habitat connectivity and accessibility throughout. This is important at a time of increasing pressure from climate change and habitat fragmentation, and complies with the requirements of Section 6 of the Environment (Wales) Act 2016.
- 5.4.492 There would also be impacts on species and habitats listed in the Eryri LBAP, including coastal and floodplain grazing marsh, lowland meadow, purple moor grass and rush pastures, brown hare, otter, polecat, natterer's, noctule, lesser horseshoe and pipistrelle bats. These have all been included in the assessment, with mitigation and/or compensation proposed where potential impacts have been identified, and enhancement measures incorporated that would benefit many of these ecological features. In this way, many of the BAP actions described in the Baseline Conditions for these features have been met, and the majority of those that have been compromised have been mitigated and/or compensated.
- 5.4.493 The creation of 3.38ha of species-rich grassland equivalent to lowland meadow within the verges of the Proposed Improvement would benefit local pollinator populations and thus contribute to the Wales Action Plan for Pollinators (2013), particularly as the seed mixes used would incorporate species with different flowering seasons spread throughout the spring and summer to ensure a continuous supply of pollen and nectar. The provision of a larger area of native woodland, tree and hedgerow habitat than the area lost would also benefit the pollinator population in the long-term. These benefits to pollinators also constitute a benefit to ecosystem services in terms of their essential role in agriculture in Wales, and therefore support the Resilient Wales' goal of the Well-being of Future Generations (Wales) Act 2015 by supporting social, economic and ecological resilience.
- 5.4.494 The mitigation, compensation and enhancement measures proposed would conform with Outcomes 13 and 17 of the Wales National Transport Strategy, in terms of supporting habitat connectivity and providing mitigatory and compensatory measures where transport has a significant negative effect. They also support Strategic Policy D of the Eryri Local Development Plan, in terms of protecting and enhancing the natural environment.

5.5 Geology and Soils

Introduction

- 5.5.1 This chapter contains information on the geological and hydrogeological setting of the study area, past mining activity, nature of local soils and potentially contaminated land. This chapter should be read in conjunction with Chapters 5.6 (Materials), 5.9 (Community and Private Assets, including consideration of Agricultural Land Classifications affected) and 5.10 (Road Drainage and the Water Environment).

Methodology

- 5.5.2 The Proposed Improvement has been assessed for its impact on geology and soils in accordance with the DMRB, Volume 11, Section 3 and Part 11: Geology and Soils (Highways Agency, 1993). HA205/08 and IAN 125/09(W) have also been taken into consideration in drafting this chapter.
- 5.5.3 A preliminary sources study report (desk study report) was completed in order to obtain and collect information regarding the assessment of impacts on the geology and soils associated with the proposed scheme. This involved a search for geological, hydrogeological and land use information.
- 5.5.4 A site walk over survey was undertaken on the 12th June 2015.
- 5.5.5 A detailed ground investigation comprising 18 boreholes and 8 trial pits was carried out in early 2016.
- 5.5.6 As sources of information were readily found the only consultation undertaken has been with Natural Resources Wales regarding groundwater abstraction.

Assessment Methodology

- 5.5.7 The assessment has used the criteria in Tables 5.5.1 and 5.5.2 to define the value/sensitivity of receptors and predict the magnitude of impact. These are based on the generic scales noted in DMRB Volume 11, Section 2, Part 5 (HA 205/08) (Tables 2.1 and 2.2) with further modification to directly relate to geology, soils, groundwater and contaminated land. Table 2.4 from the same document, reproduced in this document as Table 5.5.3 has been used to derive the Degree of Significance.

Table 5.5.1: Criteria for assessing Value (Sensitivity) in connection with geology, soils, hydrogeology and contamination

Value (Sensitivity)	Criteria
Very High	<ul style="list-style-type: none"> • Geological feature is of international importance • Major aquifer with high quality and abstraction volume.
High	<ul style="list-style-type: none"> • Geological feature is of national importance <i>e.g.</i> SSSI • Major aquifer locally important • A pollution linkage with an incident likely to occur
Medium	<ul style="list-style-type: none"> • Geological feature is of regional importance <i>e.g.</i> RIGS • Aquifer providing water for agricultural or industrial use important locally
Low	<ul style="list-style-type: none"> • Sites of local geological importance • Minor aquifer • A pollution linkage but a low likelihood of occurrence
Negligible	<ul style="list-style-type: none"> • Geological feature is of little or no geological interest. • Non-aquifer • No pollution linkage

Table 5.5.2: Criteria for assessing Magnitude of Effect in connection with geology, soils, hydrogeology and contamination

Impact	Criteria
Major	<ul style="list-style-type: none"> Geological feature or soils at high risk of being destroyed or adversely affected <i>e.g.</i> obscured Damage to human health, watercourse, or ecological system in short term <i>e.g.</i> risk pollution to an aquifer High concentrations of known contaminants
Moderate	<ul style="list-style-type: none"> Partial loss of geological feature/soils (adverse) Greatly increased access to geological feature <i>e.g.</i> new cutting in important formation (beneficial) High risk to human health, watercourse or ecological system Concentrations of contaminants at or exceeding guideline values
Minor	<ul style="list-style-type: none"> Potential partial loss of geological feature/soils (adverse) Low risk to watercourse or ecological system Low concentrations of known contaminants
Negligible	<ul style="list-style-type: none"> No significant effect on geological feature or aquifer Concentrations of contaminants requiring interventions during construction <i>e.g.</i> PPE
No Change	<ul style="list-style-type: none"> No effect on geological feature, aquifer, no contamination risk No change in status quo

Table 5.5.3: Assessment Matrix for Degree of Significance in connection with geology, soils, hydrogeology and contamination

		IMPACT				
		Major	Moderate	Minor	Negligible	No Change
SENSITIVITY	Very High	Very Large	Large	Moderate/Large	Slight	Neutral
	High	Large	Moderate/Large	Slight/Moderate	Slight	Neutral
	Medium	Moderate/Large	Moderate	Slight	Neutral/Slight	Neutral
	Low	Slight/Moderate	Slight	Neutral/Slight	Neutral/Slight	Neutral
	Negligible	Slight	Neutral/Slight	Neutral/Slight	Neutral	Neutral

Study Area

5.5.8 This report utilised a survey/study area of up to 0.5km from the centreline of the proposed scheme.

References and Sources of Information

5.5.9 The following information has been used to inform the Geology and Soils assessment.

Table 5.5.4: Information used for the Geology and Soils assessment

Source	Date viewed/published	Details
Anglesey and Gwynedd Councils	2015	Anglesey and Gwynedd Joint Local Development Plan – Deposit Plan (2015) available at https://www.gwynedd.gov.uk/en/Council/Documents---Council/Strategies-and-policies/Environment-and-planning/Planning-policy/Deposit-Plan/Deposit-Plan-

		2015.pdf
British Geological Survey (BGS)	Viewed November 2016	http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=boreholes Online archive of submitted exploratory hole logs
BGS	Viewed November 2016	http://mapapps.bgs.ac.uk/geologyofbritain/home.html Geology of Britain Viewer
Gwynedd Council	Viewed November 2016	Gwynedd Unitary Development Plan (2001 – 2016) http://www.cartogold.co.uk/gwynedd/
Snowdonia National Park Authority	2011	Eryri Local Development Plan 2007 – 2022 (adopted July 2011)
GeoCon Ltd.	2016	Ground Investigation and Factual report on Land at A496 Llanbedr Access Improvement Road North Wales
UK Radon	Viewed August 2016	http://www.ukradon.org/information/ukmaps/englandwales
YGC	2015	A496 Llanbedr Access Improvement Preliminary Sources Study report

Limitations and Assumptions

5.5.10 No difficulties or limitations were encountered in the collation and assembly of information for the preparation of the Geology and Soils assessment for this ES.

Baseline Conditions

Regulatory Framework

5.5.11 In writing this chapter consideration has been given to the relevant sections of the following legislation and policy documents:

- Environment Act (1995);
- Environmental Protection Act (Part IIa) (1990);
- Contaminated Land (Wales) Regulations (2006 + 2012 amendment);
- Groundwater Regulations (1998);
- Water Environment Regulations (2003);
- Water Act (2003);
- Water Resources Act (1991), and;
- Planning Policy Wales (Ed. 8).

5.5.12 Within the Gwynedd Unitary Development Plan (2001 – 2016) Policy B17: Protecting Regionally Important Geological/Geomorphological Sites states: *“Proposals that are likely to cause significant harm to a Regionally Important Geological/Geomorphological Site (RIGS) will be refused unless the need for the development is more important than the site's value to Earth Science or the landscape”*.

- 5.5.13 In addition the emerging Anglesey and Gwynedd Joint Local Development Plan – Deposit Plan (2015) includes Policy AMG5: Protecting Regionally Important Geological/Geomorphological (RIGS) Sites. This states: *“Proposals that are likely to cause direct or indirect significant harm to ... regionally important geological / geomorphologic sites (RIGS) will be refused, unless it can be proven that there is an overriding social, environmental and/or economic need for the development, and that there is no other suitable site that would avoid having a detrimental impact on sites of nature conservation value and local geological importance. When development is granted, assurance will be required that there are appropriate mitigation measures in place. It will be possible to use planning conditions and/or obligations in order to safeguard the site’s biodiversity and geological importance”*.
- 5.5.14 The National Parks and Access to the Countryside Act 1949 establishes a legal framework for nature conservation including geological conservation. This enables a local planning authority, once notified of a SSSI, to protect it from adverse development under the controls of the planning system. The Wildlife and Countryside Act 1981, and amendments, provides for the notification of geological sites as SSSI’s.
- 5.5.15 The Nature Conservancy Council published a strategy in 1990 which sets out a framework for geological conservation in Britain. The strategy introduced the concept of Regionally Important Geological Sites (RIGS). Although RIGS have no statutory protection, local planning authorities can protect these sites through planning policies. The Countryside and Rights of Way Act 2000 strengthened the legislation relating to the conservation of geology in Britain.
- 5.5.16 The Eryri Local Development Plan (adopted July 2011) also recognises the importance of conserving and enhancing the National Park’s natural resources including geodiversity, particularly within Strategic Policy A (National Park Purposes and Sustainable Development) and Strategic Policy D (Natural Environment).
- 5.5.17 No Regionally Important Geological/Geomorphological Sites (RIGS) or Geological Conservation Reviews (GCRs) have been identified within 0.5km of the proposed scheme. As there are no sites of geological interest affected by the proposed scheme it is concluded that it fits within the local policy context.
- 5.5.18 Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from existing land contamination. Guidance on the implementation of a development scheme is currently provided in the Part IIA Statutory Guidance on Contaminated Land (Welsh Assembly Government, 2006).
- 5.5.19 The regime provides a statutory definition of ‘contaminated land’ based on the risks of significant harm to human health and the environment, or pollution of controlled waters. The definition is as follows:
- (a) significant harm is being caused or there is the significant possibility of such harm being caused;
 - or
 - (b) pollution of controlled waters is being, or is likely to be caused.
- 5.5.20 Ground contamination is also a material consideration for any planning application and would need to be addressed as part of a development scheme. The remediation required would need to address potential risks to both future site use and the surrounding environment. The guidance issued to support the Part IIA legislation is also intended for use by Local Planning Authorities in determining planning applications.
- 5.5.21 Both of the aforementioned regimes are based on the Government’s ‘suitable for use’ approach. This approach recognises that the risks associated with a site ‘affected by ground contamination’ will

vary depending on the use of the site and its environmental setting. The approach consists of three elements:

- Ensuring that the land is suitable for its current use;
- Ensuring that the land is made suitable for any new use, as planning permission is given for that new use, and;
- Limiting requirements for remediation to the works necessary to prevent unacceptable risks to human health or the environment in relation to the current or future use of the land for which planning permission is being sought.

5.5.22 The assessment of potential impacts on groundwater and soils for the proposed scheme has been undertaken with due regard to the principles and guidance associated with the Part IIA regulatory regime of the Environmental Protection Act 1990.

Solid Geology

5.5.23 The solid geology underlying the whole route corridor is described on the BGS Geology of Britain viewer as the Llanbedr Formation - Siltstone and Mudstone, Interbedded. No rock outcrops have been identified within the route corridor

Drift Geology

5.5.24 The geology and geomorphology of the area is predominantly a consequence of glacial and post glacial deposition and is divided into two main areas.

5.5.25 North of the Afon Artro is a flat low-lying area; the result of deposition in a marine or alluvial environment or a combination of both. The drift geology is described on the BGS Geology of Britain viewer (viewed at <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>) as Tidal Flat Deposits - Clay, Silt and Sand.

5.5.26 South of the Afon Artro the drift geology of the route corridor is dominated by glacial deposition in the form of a large drumlin formed by deposition of material by glacial action. The drumlin trends north-south and is likely to have been deposited by the Irish Sea ice sheet. The drift geology south of the Afon Artro is described on the BGS Geology of Britain viewer as till of Devensian age described as Diamicton.

Geomorphology

5.5.27 The geomorphology is a reflection of the drift geology and forms two discreet areas. North of the Afon Artro has been formed in a marine environment but the presence of the Afon Artro means that fluvial processes have also shaped this area. So the geomorphological features are a tidal plain with a fluvial flood plain overlaid on this.

5.5.28 South of Afon Artro the landform is a large relatively steep ridge of land rising up from the banks of the Afon Artro which rises to the south but also falls away to the east and west. This geomorphological feature is noted on the BGS mapping as a drumlin i.e. an elongate hill, streamlined in the direction of ice flow and composed largely of glacial deposits

Soils

5.5.29 The natural soil types also show a north - south split related to the drift geology.

5.5.30 North of the Afon Artro, Soilscape 20 soils (defined under the Soilscape soil classification system viewed at <http://www.landis.org.uk/soilscales/>) are present. Soilscape 20 soils are described as loamy and clayey floodplain soils with naturally high groundwater

5.5.31 South of the Afon Artro Soilscape 6 are present and are described as freely draining slightly acid loamy soils. It is highlighted that the description of these soils as freely draining does not tie in with results of the ground investigation or descriptions elsewhere which suggest that these soils in this locality are relatively impermeable.

Made Ground

5.5.32 Made Ground is present within the site predominantly associated with the existing A496 and Mochras Road county roads. This consists of minor amounts of earthworks materials, most of which are likely to have been locally won, together with unbound granular aggregates (capping and sub-base) and bituminous bound pavement layers.

5.5.33 As the Proposed Improvement is effectively off-line the existing Made Ground will predominantly be left in situ with only very minor amounts re-used within the proposed carriageway construction (see Chapter 5.6: Materials).

Mining and Tunnelling

5.5.34 There is no known history of mining in the route corridor and the topography and drift geology generally precludes this.

Radon

5.5.35 information obtained from Public Health England at <http://www.ukradon.org/information/ukmaps> suggests elevated levels of radon potential are present within the route corridor with a maximum radon potential in the range 3 – 5%.

Unexploded Ordnance (UXO)

5.5.36 Given the rural location, lack of industry and major infrastructure and distance from centres of industry and population and flight paths towards such centres during the 1939 – 1945 period, the risk of UXO from being present in the study area is extremely low.

5.5.37 The Llanbedr Airfield west of the route and the area around Maes Artro Holiday Village were used as RAF establishments in the past however these appear to have been used for flight training rather than anything associated with heavy munitions and it is highly unlikely that any ordnance was stored, placed or dropped within the route corridor.

Hydrogeology

5.5.38 Given the drift geology of tidal flat deposits and coastal location north of the Afon Artro and relatively impermeable glacial till south of the Afon Artro, together with the absence of groundwater indicators on Ordnance Survey mapping it is highly unlikely that any potential aquifers exist within the route corridor.

5.5.39 Aquifer designation maps obtained from NRW for the Llanbedr area show that for most part north of the Afon Artro there is no designation for superficial deposits, presumably due to the proximity to sea water and tidal flooding prevailing in this area, potentially leading to brackish groundwater, whilst to the south of the Afon Artro the superficial aquifer designation is “Unproductive” (see Figure 5.5.1).

5.5.40 For the solid geology the bedrock aquifer designation from the NRW maps is “Secondary (undifferentiated)”. The Hydrogeological Map of England and Wales (Scale 1:625,000) states for the bedrock areas in the vicinity of Llanbedr “These older rocks are indurated. In general they have little or no groundwater except in areas where deep weathering has produced a sub-surface permeable zone in which perched water tables may occur”. Solid geology is likely to be present at a

significant depth below superficial deposits as it is not shown on geological maps within the route corridor and was not encountered during the ground investigation.

Local Groundwater Exploitation

5.5.41 No evidence of local groundwater abstraction in the geological and hydrogeological maps of the region or the NRW database was found. The likelihood of productive superficial and bedrock aquifers being present from various mapping sources also suggests that groundwater exploitation within the study area is impractical. Additionally there appears to be a relative abundance of water from non-groundwater sources available. Therefore, it is considered highly unlikely that any abstraction of local groundwater is presently occurring in the area affected by the Proposed Improvement. See Chapter 5.10 (Road Drainage and the Water Environment) for further information.

Hydrology

5.5.42 The hydrology of the route corridor is dominated by the Afon Artro which is classified by NRW as a Main River and its tributaries. See Chapter 5.10: Road Drainage and the Water Environment for further information about the potential effects on water quality.

5.5.43 The NRW flood risk mapping (viewed at <https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en>) shows the area south of the Afon Artro to have no flood risk and the area to the north of the Afon Artro to be in flood risk zones 2 and 3 suggesting the whole area north of the river is prone to flooding.

Environmentally Sensitive Land Use Areas

5.5.44 The whole of the proposed scheme is within the environmentally sensitive area of the Snowdonia National Park. There are also several other nationally important environmentally sensitive areas of land use directly adjacent to the proposed scheme, including one Site of Special Scientific Interest (SSSI) and one Special Area of Conservation (SAC). These are shown in Table 5.5.5: Environmentally Sensitive Land Use Areas and assessed in further detail within Chapter 5.4: Nature Conservation.

5.5.45 The Environmentally Sensitive Land Use Areas numbered in Table 5.5.1 are situated within the study area of the scheme and are therefore at potential risk of impact.

Table 5.5.5 Environmentally Sensitive Land Use Areas

Site Number	Site Name	NGR	Distance & Direction from Proposed Scheme	Area (m²)	Designation
1	Snowdonia National Park	SH261745 338198	0m	2139330944	National Park
2	Morfa Dyffryn SSSI	SH256436 325435	200m NW	741.29	SSSI - Biological
3	Coedydd Derw A Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods And Bat Sites	SH266011 338608	85m E	1827.24	SAC
4	Penllyn a'r Sarnau SAC	SH 240168 313026	200m NW	146034	SAC

Land Uses Indicative of Potential Contamination

5.5.46 There are no Designated Contaminated Land Sites on the Gwynedd Council Register within 2km of the proposed scheme. In addition, NRW have no records of contaminated land in the vicinity of the proposed scheme. Potentially contaminating land uses assessed by reviewing the historical Ordnance Survey Maps are shown in Table 5.5.4: Historical Potentially Contaminating Land Uses.

Table 5.5.6 Historical Potentially Contaminating Land Uses

Potentially Contaminating Land Use	Location in relation to Proposed Scheme	NGR	Date Mapped
Llanbedr Airfield	700 m W	SH 262050, 339200	1954
Sewage Treatment Plant	0m NW	SH 260997, 338828	Post 1977

Current Land Uses Potentially Indicative of Contamination

5.5.47 There is a waste treatment facility which will be affected by the proposed scheme, the sewage treatment works close to the northern tie in to the existing road and shown on Figure 5.5.1. The site is operated by Dŵr Cymru Welsh Water and the proposed scheme will affect one small part of the site away from the main treatment areas. Discussions with Dwr Cymru in relation to this are ongoing. The only other potentially contaminative land use identified within the study area is farming. The main current land use is farming, which is known to produce potential contaminants such as slurry, sheep dip *etc.* However, it is unlikely that these contaminants have passed into the soils in any significant quantities and they are very unlikely to constitute a source of contamination. See Chapter 5.9: *Community and Private Assets* for further details on agricultural impacts.

Value (Sensitivity) of Resource

5.5.48 The Value (Sensitivity) of Resource has been assessed in accordance with the guidance provided in the DMRB, Volume 11, Section 2, Part 5, HA: 205/08; Determining Significance of Environmental Effects, adapted in respect of as shown in Table 5.5.3 above.

Geology

5.5.49 From the description of the baseline conditions, it is concluded that as there are no geological SSSI's, RIGS or GCR's located within or directly adjacent to the proposed scheme the baseline conditions in terms of the geology, hydrogeology and geomorphology are valued as **Low** and are of local interest only.

Soils

5.5.50 The Soilscales soil type designations are discussed in sections 5.2.28 and 5.2.29. The soils are generally poorly draining and north of the Afon Artro are close to the groundwater table. The Agricultural Land Classification system produced by MAFF classifies the agricultural quality of the land in the immediate vicinity of the proposed scheme as Grade 4 and Grade 5 (poor and very poor respectively). It is therefore concluded that the baseline conditions in terms of soil quality are valued as **Low** and of low importance on a local scale.

Hydrogeology

5.5.51 Although secondary aquifers are shown on the NRW aquifer maps and as shown on drawing number 5.5.1 these all lie within areas subject to tidal flooding and there are no known abstractions associated with these therefore the sensitivity of the hydrogeology is assessed as **Negligible** value.

Contamination

Conceptual Site Model

5.5.52 A Conceptual Site Model (CSM) of the study area was developed based principally on the identification of potentially significant impact (risk) linkages. For a significant potential impact to be identified, all of the following elements must be present:

- A source *i.e.* a substance or activity which is capable of causing pollution or harm;
- A receptor (or target) *i.e.* something which could be adversely affected by the source, and;
- A pathway *i.e.* a route whereby the source can interact with the receptor.

5.5.53 If one of these elements is missing, there can be no significant risk or impact. If all of the elements are present, then there is a potential for an impact. The magnitude of the potential impact is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway. Figure 5.5.2 provides an example of how the CSM is applied.

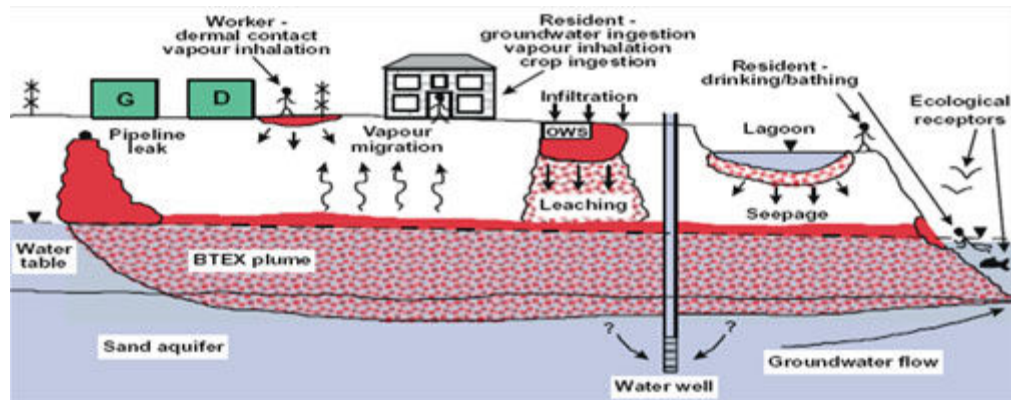


Figure 5.5.2: Example of a Conceptual Site Model

Sources

5.5.54 The historical maps were reviewed to identify possible sources of ground contamination up to 0.5km uphill (*i.e.* to the east) of the proposed scheme that could generate a potential impact during the construction period. The review did not identify any potential contamination sources uphill of the route corridor.

5.5.55 The activities carried out at the sewage treatment works are heavily regulated and unlikely to lead to contamination other than by incidents such as accidental discharges or vandalism, the occurrence and effects of which are unaffected by the proposed scheme.

Table 5.5.7: Summary of Potential Sources of Ground Contamination

Site Number	Potential Source	Potential Contamination	NGR Location (SH)
1	Llanbedr Airfield*	Fuel and lubricating oils Radioactive contamination Chemical warfare agents Explosives Unexploded ordnance Metals Solvents – degreasing agents De-icers Detergents	256955 325980

2	Water Company Sewage: Sewage Treatment Work	Crude Sewage	258161 327525
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* potential contaminants taken from Table 3.1 of Environment Agency Technical Report R & D Technical Report P5-042/TR/01 dated 2001

5.5.56 The potential sources of contamination are all downhill and/or downstream of the proposed scheme.

5.5.57 In addition to the existing potential ground contamination sources, impacts could potentially occur during the construction of the proposed scheme as a result of the spillage of materials, such as hydrocarbon fuels and oils, brought to the site and utilised during the construction works.

Receptors

5.5.58 Based on the information obtained, the principal receptor groups which could be affected as a result of the prevailing ground conditions within the study area during the proposed scheme are:

- human health;
- controlled waters, and;
- sensitive protected sites.

Human Health

5.5.59 Impacts on the health of construction workers, future users of the proposed scheme and occupants of the adjacent land could potentially occur due to the nature and quantity of construction materials that would be used during construction.

Controlled Waters

5.5.60 The Afon Artro and a number of other watercourses shown on Figure 5.5.1 are potentially at risk of impact from contamination arising from the scheme as it is considered to be a receptor. However as no potentially contaminated sites have been identified within the route corridor the risk of contamination, other than from sources arising directly from the construction process *e.g.* siltation, is considered to be very low.

Pathways

5.5.61 Theoretical pathways that could potentially increase the ease with which contaminants reach the receptors identified include:

- Disturbance of the source material leading to increased leaching of any contaminants via surface water, such as the Afon Artro or groundwater and from these primary receptors to various secondary receptors (*e.g.* local residents, construction workers, nearby SSSI's/SAC's *etc.*);
- Disturbance of source material leading to airborne transport of contaminated dust particles, and;
- Disturbance of source material leading to dermal contact with contaminated materials.

5.5.62 As only one of the identified potential sources of contamination listed in Table 5.5.7 (Site Number 2 – the sewage works) (see Figure 5.5.1, Volume 1a) is likely to suffer disturbance as part of the proposed works and this is a site that is already managed by Dwr Cymru to prevent pollution from this source it is unlikely that any new pathways will be created.

Summary of Conceptual Site Model

5.5.63 Potential contamination is only considered to be a plausible possibility where:

- there will be disturbance of any sources of contaminated soils within the area of the proposed scheme, or;

- materials brought on to the site during construction are accidentally released into the environment.

5.5.64 The pathways of primary concern are inhalation of airborne contaminated dust (construction workers, local residents and highway users during the construction period) and direct dermal contact with contaminated materials (construction workers).

5.5.65 Secondary pathways of contamination may also occur if contamination leaches into groundwater upstream or close to groundwater abstraction points.

5.5.66 The main source-pathway-receptor linkages for contamination to potentially cause an adverse impact in the vicinity of the identified sources as a result of the proposed scheme are considered to be:

- Disturbance of contaminated soils giving rise to airborne dust, which may negatively impact on construction workers, local residents and users of the highway.
- Disturbance of contaminated soils leading to dermal exposure of construction workers.
- Disturbance of contaminated soils leading to increased leaching of contamination into local controlled waters (particularly the Morfa Dyffryn SSSI)
- Accidental release of hydrocarbon oils and fuels stored temporarily on site during the construction period.

5.5.67 The only identified source of contamination existing within the works area, and which could be disturbed by site operations the sewage treatment works is currently managed in a controlled way by Dwr Cymru and site operations will be managed to prevent pollution incidents the sensitivity in terms of contamination is assessed as **negligible**.

Magnitude of Impacts and Significance of Effects (Before Mitigation)

Construction Period

Geology

5.5.68 No geological SSSI's, RIGS or GCR's would be affected by the proposed scheme. However, a beneficial impact due to the increased area of drift geology exposed and available for study in the short term is expected; a cutting will be constructed between the Afon Artro in the north and the southern tie in with the existing road. The Magnitude of Impact (before mitigation) on geology during the construction period is therefore considered to be **negligible beneficial** and of **Neutral** significance. An adverse effect on human health due to radon gas may potentially occur if mitigation measures for radon gas are not implemented.

Soils

5.5.69 There will be a temporary loss and disturbance to the affected soils. The Magnitude of Impact (before mitigation) on soils during the construction period is therefore considered to be **moderate adverse** and of **Slight** significance.

Hydrogeology

5.5.70 As no aquifers are present within the study area the sensitivity of the hydrogeology is assessed as **negligible** value and the potential to impact groundwater is **Negligible adverse** the Degree of Significance is **Neutral**.

Contamination

5.5.71 Adverse effects on human health, controlled waters and sensitive protected sites may potentially occur without mitigation measures associated with contaminated land that may lie within or

adjacent to the proposed scheme. However, this is considered unlikely as whilst part of one potentially contaminated source of land identified in Table 5.5.7 is expected to be disturbed or affected by the proposed scheme i.e. the sewage treatment works, this site is already and will continue to be managed in such a way as to minimise the risk of contamination.

5.5.72 It has been assumed that the following contingency measures would be applied as standard good practice throughout the construction period and will be included in the CEMP:

- 1) In order to avoid contamination of the ground by spills or leakages of harmful substances, all precautions will be taken by the Contractor to ensure that this risk is minimised. The Contractor will also be required to have an effective emergency spill response procedure in place. See Chapter 5.10 (Road Drainage and the Water Environment) for further details.
- 2) During the earthworks, vigilance would be maintained with regard to the possible presence of contaminated material. If any suspicious substances were encountered, work would cease and specialist advice would be sought. The potential for the generation of contaminated dust would be minimised by the adoption of appropriate working practices including, if necessary, damping down through mist spraying if the earthworks take place during dry weather (see Chapter 5.1: Air Quality).
- 3) The potential impacts on the health of construction workers (such as possible contact with contaminated soils) would be addressed by the adoption of appropriate health and safety and hygiene practices including the use of PPE (Personal Protective Equipment) as necessary.
- 4) Further investigation would be undertaken at the start of construction to determine the potential sources of contamination within the boundary of the Proposed Improvement in order to:
 - confirm the exact nature of any contamination present;
 - accurately assess any resulting risk posed, and;
 - allow for design/implementation of appropriate design measures.

5.5.73 As the sensitivity in relation to contamination is **negligible** and the potential impacts are likely to be **Minor adverse** the Degree of Significance is classed as **Neutral/Slight**.

Operational Period

Geology

5.5.74 As there would be no significant effect on features of geological interest and there is potential to increase areas of exposed geology, via the main cutting, the magnitude of impact (before mitigation) on geology during the operational period is considered to be **Negligible beneficial** and of **Neutral significance**.

Soils

5.5.75 Whilst topsoil will be stripped from the footprint of the scheme the majority of topsoil excavated will be re-used within the works whilst in some places e.g. verges, soil will not be deposited in order to provide low nutrient soils for the establishment of wildflower seed mixes (see Chapters 5.3 Landscape and 5.4 Nature Conservation) The Magnitude of Impact (before mitigation) on soils during the operational period is considered to be **Minor adverse** due to the loss of areas of soil but the quality of the agricultural land affected is low and of **Slight significance**.

Hydrogeology

5.5.76 As no aquifers are present within the study area the sensitivity of the hydrogeology is assessed as **Low** and it is unlikely that contaminants can enter the groundwater, due to low permeability of soils the likely impact is **Negligible adverse** and the Degree of Significance is assessed as being **Neutral**.

Contamination

5.5.77 During the operational phase there is a very small risk of contamination from traffic using the road e.g. a fuel spill, and this impact is likely to be **Negligible adverse** leading to an assessment of degree of significance as **Neutral**.

Design, Mitigation and Enhancement Measures

Construction Period

5.5.78 **Introduction**

The following mitigation measures would form part of the contractor's Construction Environmental Management Plan (CEMP) (see Chapters 2.5 and 7)

Geology

5.5.79 The only geological mitigation measure is for the risk of potential radon gas during the construction period. As radon gas disperses easily in the open air it is not considered a significant risk to the proposed scheme, but nevertheless it is recommended that all excavations should be left uncovered and open to the atmosphere at all times. Any works in confined or enclosed spaces will require a review of this assessment.

Soils

5.5.80 Mitigation measures that would apply to all areas of disturbed soil are as follows:

- Topsoil and subsoil layers would be identified and clearly defined before being stripped and stored separately under favourable weather conditions so that a proper soil profile could be re-established;
- Soils for reinstatement would be derived from the site if possible. Storage mounds would be located locally in small batches, re-used as close to the original location as possible and would not exceed 2m in height;
- Soil handling would be avoided during wet conditions and would not be compacted by heavy machinery once spread. Soil would be kept free of contamination by invasive plant species, such as Japanese Knotweed.

5.5.81 In order to avoid contamination of the soils by leakages and spills of harmful substances, during the construction period all precautions would be taken by the contractor to ensure that this risk is minimised. The contractor would also be required to have an effective emergency spill response procedure in place. See Chapter 5.10: Road Drainage and the Water Environment and the SIAA for further details.

5.5.82 All areas where no site traffic is permitted during the construction period would be clearly defined in order to reduce the level of compaction of the existing soils.

Groundwater

5.5.83 In order to avoid contamination of the groundwater by leakages and spills of harmful substances, during the construction period all precautions would be taken by the contractor to ensure that this risk is minimised. The contractor would also be required to have an effective emergency spill response procedure in place. See Chapter 5.10: Road Drainage and the Water Environment and the SIAA for further details.

Contamination

5.5.84 During the earthworks, vigilance would be maintained with regard to the possible presence of contaminated material. If any suspicious substances were encountered, work would cease and

specialist advice would be sought. The potential for the generation of contaminated dust would be minimised by the adoption of appropriate working practices including, if necessary, damping down through mist spraying if the earthworks take place during dry weather (see Chapter 5.1: Air Quality).

5.5.85 The potential impacts on the health of construction workers (such as possible contact with contaminated soils) would be mitigated by the adoption of appropriate health and safety and hygiene practices including the use of PPE (Personal Protective Equipment) as necessary.

5.5.86 Further investigation would be undertaken at the start of construction to determine the potential sources of contamination within the boundary of the proposed scheme in order to:

- (i) confirm the exact nature of any contamination present;
- (ii) more accurately assess any resulting risk posed, and;
- (iii) allow for design/implementation of appropriate design and mitigation measures.

Afon Artro (see Chapter 5.10: Road Drainage and the Water Environment)

5.5.87 Potential impacts on this watercourse would be mitigated by the adoption of working practices to minimise the exposure of potentially contaminated soils and to prevent any direct run off into or siltation of watercourses. This would include the phasing of earthworks to minimise the area of soils exposed at any one time. In particular, working practices would also be adopted to minimise leaching from any stockpiles of spoil awaiting off-site disposal.

5.5.88 Any fuel or oil stored on site during construction works would be undertaken in accordance with current good practice and as a minimum, secondary containment would be provided. Care would be exercised during use to prevent spillages.

Waste Management (see Chapter 5.6: Materials)

5.5.89 There is a duty of care with regard to the management and disposal of waste generated during the works to ensure that this is undertaken in an environmentally responsible fashion. If possible, materials would be re-used in the works if this did not present any risk to human health or the wider environmental receptors, such as controlled waters or sensitive protected sites.

5.5.90 Any off-site disposal of surplus soil would be to a suitably-licensed facility. .

Operational Period

Geology and Soils

5.5.91 No mitigation measures are proposed for geology or soils during the operational period because no significant impacts are expected to occur to geological features or beyond the initial loss of soils.

Hydrogeology

5.5.92 As the drainage design for the scheme considers any likelihood of pollution generated during the operational phase entering the surface water and groundwater systems no further mitigation measures are proposed for the operational phase (see Chapter 5.10: Road Drainage and the Water Environment).

Contamination

5.5.93 As any sources of contamination found would be dealt with during the construction phase no mitigation measures for the operational phase are proposed. See Chapter 5.10: Road Drainage and the Water Environment for further details on highway pollution risks during operation.

Magnitude of Impacts and Significance of Effects (After Mitigation)

Construction Period

Geology

5.5.94 No mitigation is considered to be required for geological features, other than the consideration of radon gas during excavation work. The magnitude of impact on geology during the construction period is therefore considered to remain **Negligible beneficial** and of **Neutral significance** due to new areas of drift geological strata being exposed by the proposed cutting in glacial till.

Soils

5.5.95 Due to the proposed mitigation measures during the construction period noted above the magnitude of impact on soils is considered to be **Negligible** and of **Neutral** significance.

Hydrogeology

5.5.96 Due to the proposed mitigation measures during the construction period noted above the magnitude of impact on groundwater is considered to be **Negligible adverse** and of **Neutral** significance.

Contamination

5.5.97 As the source and pathway of any likely contaminants e.g. fuel oils, silt etc. should be managed using standard site practices the magnitude of impact is assessed as being **Negligible adverse** and of **Neutral significance**.

Operational Period

Geology

5.5.98 Due to the low value associated with its importance of geological features and the provision of a new exposure of drift geology within the cutting the magnitude of impact on geology during the operational period is considered to be **Negligible beneficial** and of **Neutral**.

Soils

5.5.99 Due to the mitigation measures proposed to reduce the construction impact on the soils affected, the magnitude of impact (after mitigation) on soils during the operational period is considered to be **Negligible adverse** and of **Neutral** significance as a result of the poor quality of the existing soils and the low impact of the works.

Hydrogeology

5.5.100 As no aquifers are present within the study area the magnitude of impact (after mitigation) is assessed as **Negligible adverse** and of **Neutral** significance.

Contamination

5.5.101 Overall, following the adoption of the outlined mitigation measures, there would not be expected to be a long term significant environmental impact associated with ground contamination as a result of the proposed scheme and the overall impact would be **Negligible adverse** and the Degree of Significance **Neutral**.

The Do Minimum Scenario

5.5.102 The Do Minimum Scenario is based on the current situation remaining the same and the proposed scheme not being implemented. If the Do Minimum Scenario is followed then the current situation

with regard to both Geology, Soils, Groundwater and Contamination would remain unchanged and there would be no impact upon them.

Summary

5.5.103 There are no geological sites such as SSSI's, RIGS or GCR's located within or directly adjacent (within 1km) to the proposed scheme. The baseline conditions in terms of geology and geomorphology are valued as low and generally of local interest and importance.

5.5.104 The Proposed Improvement is considered unlikely to affect hydrogeological water movement, water abstraction, contamination or potential future economic geological exploitation to any significant degree.

5.5.105 Some soil will be lost due to carriageway construction and new access provisions, however the environmental value of the soil lost is low.

5.5.106 One potential source of contamination that will be affected by the works has been identified, a sewage treatment works, but this is already a controlled site and the effect on the site by the project is peripheral.

5.5.107 Monitoring of the residual impacts on Geology and Soils receptors is not considered to be required due to the minimal impact on them.

5.6 Materials

Introduction

5.6.1 This chapter provides an assessment of the potential impacts from the use of material resources and generation of waste associated with the Proposed Improvement, and has been prepared in accordance with Interim Advice Note (IAN) 125/09, 'Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment' (Highways Agency, 2009).

5.6.2 IAN 153/11 'Guidance on the Environmental Assessment of Materials Resources' was produced by the Highways Agency in October 2011. The methodology for this chapter has been based upon the guidance provided within this document.

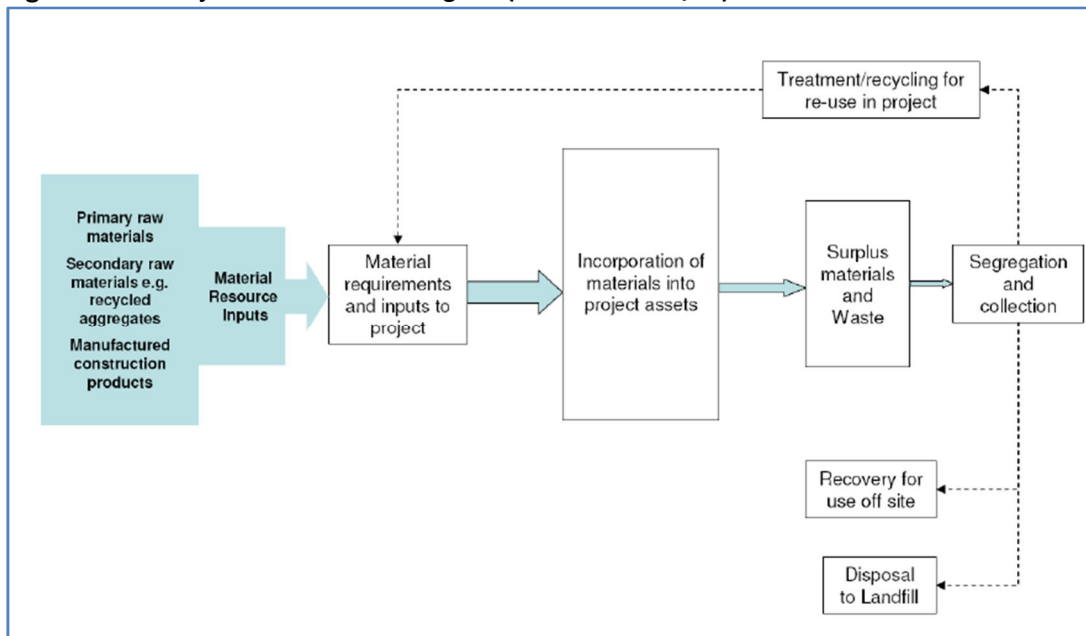
5.6.3 For the purpose of this assessment the term 'material resources' encompasses the materials and products required for the construction of the Proposed Improvement. Material resources include primary raw materials such as aggregates and minerals, and manufactured construction products. Many material resources will originate off site, purchased as construction products, and some will arise on site such as excavated soils or recycled road planings.

5.6.4 Construction waste associated with the Proposed Improvement will be generated from surplus materials which are likely to arise from two sources:

- Existing site materials *e.g.* concrete from demolition of existing structures, excavation of material from earthworks, and;
- Materials brought on to site but not used for the original purpose *e.g.* damages, offcuts

5.6.5 Figure 5.6.1 illustrates how materials and waste are used in the construction process.

Figure 5.6.1: Project Material Flow Diagram (source: IAN153/11)



Methodology

5.6.6 A detailed assessment has been undertaken in accordance with IAN 153/11. The assessment is a quantitative exercise which aims to identify and quantify the effects associated with material use

and waste during the construction of the Proposed Improvement. The guidance in IAN 153/11 is not prescriptive or exhaustive in order to provide a flexible approach, enabling those undertaking the assessment to tailor their approach to the specific characteristics of each scheme.

5.6.7 The assessment of the effects upon materials of constructing the Proposed Improvement considers the extent, method and programme of the proposed earthworks and construction activities required to complete the construction phase. The impacts have been assessed before and after mitigation measures are applied.

5.6.8 This assessment has considered the following parameters:

- **Materials Requirements**
 - materials balance;
 - type of materials;
 - source of materials, and;
 - origin of supply of material
- **Waste Forecasts**
 - volume and types of waste, and;
 - suitability for re-use, reclamation or recycling
- **Construction impacts**
 - movements of materials;
 - storage of materials, and;
 - processing of materials

5.6.9 These parameters are based on the subjects included within IAN 153/11 for detailed assessments and subsequently the reporting mechanisms are based upon the matrices provided within Annex 2 and 3 of that guidance document.

5.6.10 The use of materials, including the management of waste, may also give rise to other impacts, which might include, for example, detrimental impacts on air quality and increased noise. Such impacts may be referenced in this chapter, however more detailed assessment can be found in other chapters of the ES (see Chapter 5.1: *Air Quality* and Chapter 5.7: *Noise*).

Assessment Criteria

5.6.11 Detailed guidance on aspects of assessment, including assigning significance of effects, is not available from IAN 153/11. However, this guidance does suggest that identifying the quantities of materials to be used and waste forecast to be produced provides the basis for assessment of magnitude of change, while permanent impacts are likely to be more significant in terms of their effects.

Study Area

5.6.12 The study area for the assessment corresponds primarily with the site boundary for the works, although if materials are imported or exported to and from site reference is made to the likely origin and destination sites based on current knowledge as described above.

Regulatory/Policy Framework

The EU Waste Framework Directive

5.6.13 The *EU Waste Framework Directive 2008/98/EC* provides the overarching legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste. The overall purpose of the Waste Framework Directive is to lay down measures to protect the environment and human health by preventing or reducing the adverse effects of the generation and

management of waste and by improving the efficiency and reducing the overall impacts of resource use. The Waste Framework Directive requires all Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health or causing harm to the environment.

5.6.14 The Waste Framework Directive sets out 5 steps for dealing with waste, ranked according to environmental impact - the 'waste hierarchy', see Table 5.6.1. Prevention, which offers the best outcomes for the environment, is at the top of the priority order, followed by preparing for re-use, recycling, other recovery and disposal, in descending order of environmental preference.

Table 5.6.1: The waste hierarchy

Prevention	Using less material in design and manufacture, keeping products for longer, re-use, using less hazardous materials
Preparing for re-use	Checking, cleaning, repairing, refurbishing, whole items or spare parts
Recycling	Turning waste into a new substance or product, includes composting if it meets quality protocols
Other recovery	Includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste, some backfilling
Disposal	Landfill and incineration without energy recovery

National Policy

5.6.15 *Towards Zero Waste*, published in 2012, is the Welsh Government's overarching waste strategy document and identifies high level outcomes, policies and targets. It forms part of a suite of documents that comprise the national waste management plan for Wales as required under various EU Directives and the National Waste Strategy for Wales as required under UK legislation. Detailed delivery actions are provided in 'sector plans'.

5.6.16 The following milestones and outcomes have been set in *Towards Zero Waste*:

By 2025, there will be a significant reduction in waste, and we will manage any waste that is produced in a way that makes the most of our valuable resources. This means maximising recycling and minimising the amount of residual waste produced, and achieving as close to zero landfill as possible. This is an intermediate step on the way to our 2025 target of achieving zero waste and 'living within our environmental limits'. This is needed because reducing the impact of waste in Wales to 'One Wales: One Planet' levels will require big changes in the way that products and services are designed, and the actions that consumers and businesses take.

By 2050, we will have reduced the impact of waste in Wales to within our environmental limits. Residual waste will have been eliminated and any waste that is produced will all be recycled. This means that the ecological footprint of waste in Wales will be at 'One Wales: One Planet' levels.

5.6.17 In addition to these key milestones, *Towards Zero Waste* sets out 4 sector specific milestones / targets for the construction and demolition sector:

2015 - The amount of C&D waste disposed of to landfill will be reduced by 50%.

2020 - The amount of C&D waste being prepared for re-use and recycled will have increased to a minimum of 90% by weight for all non-hazardous construction and demolition waste, excluding naturally occurring material defined in category 170504 in the List of Wastes.

2025 - There will be a significant reduction in the generation of C&D waste (23%), thereby reducing the impact of the ecological footprint of C&D waste.

2050 - We will have further reduced the ecological footprint of waste due to a further reduction in the amount of C&D waste generated (61%).

5.6.18 The Welsh Government *Construction and Demolition (C&D) Sector Plan* (November 2012) addresses waste materials which are directly generated by a C&D business conducting construction or demolition activities in Wales, no matter what the source of the waste. It includes all types of construction development and each phase within these developments (demolition, site clearance, sub-structure, super-structure, and fittings). The sector plan also covers wastes generated through the activities of renovation and maintenance of existing building structures.

5.6.19 This sector plan is aimed at all stakeholders who can influence the life cycle of a construction project and is therefore of relevance to anyone who commissions construction projects (whether private or public sector), architects and designers, planning and building control professionals, manufacturers, retailers and suppliers of building materials, construction companies, demolition companies, civil engineering organisations, general building operators of all sizes from sole-trader to large scale companies operating and working across Wales, and the waste management industry who take in C&D waste.

5.6.20 Key areas for action addressed with the sector plan mirror the 'waste hierarchy' discussed above and involve waste prevention, preparing for re-use, recycling, other recovery and disposal.

5.6.21 The sector plan focuses on a number of 'priority materials' – materials within the waste stream of the C&D sector specifically referred to by the *Waste Framework Directive* and/or which have the highest ecological footprint associated with them, and for which appropriate management is of paramount importance. Over 75% of the ecological footprint of C&D waste is attributable to five material groups:

- Wood (26.6%)
- Plastic (17.5%)
- Insulation and gypsum products (12.5%)
- Hazardous waste (10%)
- Metals (9.5%)

5.6.22 *Planning Policy Wales (PPW)* (edition 8, 2016) sets out the land use planning policies of the Welsh Government, translating the government's commitment to sustainable development into the planning system so that it can play an appropriate role in moving towards sustainability. PPW should be taken into account in the preparation of development plans and may be material to decisions on individual planning applications.

5.6.23 Chapter 4 of *PPW* (Planning for Sustainability) lists objectives which reflect the sustainable development outcomes and should be taken into account in the preparation of development plans and in taking decisions on individual planning applications in Wales. One of these objectives included in section 4.4 involves:

Maximising the use of renewable resources, including sustainable materials (recycled and renewable materials and those with a lower embodied energy). Where it is judged necessary to use non-renewable resources they should be used as efficiently as possible. The use of renewable resources and of sustainably produced materials from local sources should be encouraged and recycling and re-use levels arising from demolition and construction maximised and waste minimised

Local Policy

5.6.24 The Eryri Local Development Plan is the policy context for assessing development proposals within Snowdonia National Park, up to 2022. The following strategic and development policies contained

within the plan are applicable to the conservation and sustainable use of material resources, and minimisation of waste:

Strategic Policy A: National Park Purposes and Sustainable Development

The Local Development Plan seeks to ensure that new development promotes the principles of sustainable development in ways which further National Park purposes and duty whilst conserving and enhancing the National Park's 'Special Qualities'. Proposals which compromise National Park purposes will be refused. The following considerations should be taken into account to help deliver sustainable development in Snowdonia:

(vii). Conservation of the quality and quantity of natural resources including water, air, soil and geodiversity.

Development Policy 1: General Development Principles

There are certain broad requirements which all development should meet if it is to be acceptable within the National Park. Proposals must be acceptable in terms of their impact on the landscape, natural environment and cultural heritage, opportunities for understanding and enjoyment, quality and design, sustainable use of resources, amenity, highway safety, flood risk and infrastructure.

Development Policy 1 (xi). The development will not have an unacceptable adverse impact, through increased resource use, discharges or emissions, on public health, surface and ground water (quality, quantity or ecology), air quality, soil and the best and most versatile agricultural land.

Strategic Policy F: Waste

In order to further the goals of sustainability resources and materials must be used wisely and in an efficient and effective manner. Reducing waste is one way of helping to attain these goals. It is vital therefore to examine carefully the whole life-cycle of products and to seek opportunities to minimise the amount of waste produced wherever possible. This can be achieved by re-using, recycling and recovering materials and energy. By adopting these approaches there is potential for significantly reducing the amount of waste produced.

Baseline Conditions

Geology and Contamination

- 5.6.25 A detailed description of the geological conditions and soils within the study area is provided in Chapter 5.5: *Geology and Soils*. A brief description of the type of materials that would be excavated during construction of the Proposed Improvement is provided below.
- 5.6.26 The geology and geomorphology of the area is predominantly a consequence of glacial and post glacial deposition and is divided into two main areas. South of the Afon Artro the drift geology of the route corridor is dominated by glacial deposition in the form of a large drumlin formed by deposition of material by glacial action. The drumlin trends north-south and is likely to have been deposited by the Irish Sea ice sheet. North of the Afon Artro is a flat low-lying area; the result of deposition in a marine or alluvial environment or a combination of both.
- 5.6.27 The Cranfield University Soilscales mapping describes the soil south of the Afon Artro as freely draining slightly acid loamy soils and to the north of the Afon Artro as loamy and clayey floodplain soils with naturally high groundwater.

5.6.28 There are no Designated Contaminated Land Sites on the Gwynedd Council Register within 2km of the proposed scheme. In addition, NRW have no records of contaminated land in the vicinity of the proposed scheme.

5.6.29 The main current land use is farming, which is known to produce potential contaminants such as slurry, sheep dip *etc.* However, it is unlikely that these contaminants have passed into the soils in any significant quantities and they are very unlikely to constitute a source of contamination. See Chapter 5.9: *Community and Private Assets* for further details on agricultural impacts. The only other identified source of contamination existing within the works area which could be disturbed by site operations is the sewage treatment works at the north end of the scheme. The works are currently managed by Dwr Cymru and site operations will be managed to prevent pollution incidents therefore the risks associated with this facility are low. It's not expected that ground contamination from sources beyond the footprint of the scheme would be encountered during the works.

Traffic Movements and HGV Site Access

5.6.30 As described in Chapter 2, the Proposed Improvement involves the construction of a new road approximately 1.5 km long consisting of a single 7.3m wide carriageway between Llanbedr and the Cambrian Coast railway line. The preferred route provides an off-line improvement allowing the existing A496 to function as normal during the construction period.

5.6.31 Connectivity to the proposed site from adjacent sections of the A496 is not optimal due to the alignment of the road and the fact that it passes through various towns and villages to the north and south, though connectivity from the A487 has recently been improved by improvement to Pont Briwet at Penrhyndeudraeth. The distance to the trunk road network to Penrhyndeudraeth in the north and Llanelltyd to the south is 16km and 25km respectively.

5.6.32 It is not currently known where along the scheme the site compound and dedicated materials storage areas would be situated as this will be a matter for the principal contractor to determine, though restrictions will exist for some areas of the scheme due to ecological and/or flooding constraints as described in Chapter 5.4: *Ecology and Nature Conservation* and Chapter 5.10: *Road Drainage and the Water Environment*. It is currently expected that the number of accesses from/onto the A496 will be limited to minimise interface with road traffic, though it's likely that a minimum of two accesses will be required, one either side of the Afon Artro, as well as a potential access to the site from Mochras Road.

Landfill

5.6.33 Table 5.6.2 identifies landfill sites for construction waste within a reasonable proximity of the study area according to the NRW waste permitting interactive mapping service⁴⁹ (non-exhaustive), which could be used as disposal sites for waste material generated during the construction phase of the Proposed Improvement.

Table 5.6.2: Landfill Sites for Construction Waste within Close Proximity to the study area

Name and location of landfill site	Type of waste accepted	Distance from study area (approx.)
Ty Mawr East Quarry	Non-hazardous	40km
Plas Gwernoer	Inesrt	40km

⁴⁹ <http://naturalresources.wales/WastePermitMap?lang=en>

Cae Main Farm	Inert	43km
Pontrug Landfill	Inert	50km
Nant y Garth Landfill Site	Inert	57km

Environmental Effects

Overview

- 5.6.34 The effects associated with material use and generation of waste as a result of the Proposed Improvement are identified and described below and summarized in Table 5.6.5 in accordance with the reporting requirements of IAN 153/11.
- 5.6.35 Material resources encompass the materials and construction products required for the construction of the scheme. The potential environmental impacts are associated with the extraction and transport of primary raw materials, the manufacture of products, and their subsequent transport to, and use on construction sites. Many material resources would originate off site, purchased as construction products and some would arise onsite such as excavated soils or vegetation.
- 5.6.36 For surplus materials and waste, the potential environmental impacts are associated with the production, movement, transport, processing, and disposal of arisings from the construction site. The basis of the assessment of impacts of waste will be to firstly identify the quantities and type of waste, and then try to establish the impacts.

Assumptions and limitations

- 5.6.37 It should be noted that the assessment of impacts upon material resources is only based on the knowledge available at the outline design stage, whereas most decisions regarding material use and management are taken during the detailed design and construction phases of a project. The assessment is therefore based upon current forecasts of material use and knowledge of existing suppliers and haulage options, and the opportunities for resource efficient decisions to be taken during subsequent phases of the project.
- 5.6.38 The construction waste volumes are also based on the current outline design, and at this stage the level of waste resulting from materials which are brought onto the site and not incorporated into the permanent works (*e.g.* offcuts, damaged materials, formwork) has not been considered, as the type and volume of waste generated via this stream is subject to various factors which are currently unknown *e.g.* construction techniques, phasing of works and procurement procedures.
- 5.6.39 The area of construction considered is based upon the land take acquired through statutory procedures. However, it is likely that the principal contractor will seek to obtain further land for temporary compounds and storage areas (see Chapter 2). Whilst it is uncommon for such temporary land take to be identified at this stage, certain assumptions have been made in describing mitigation whereby particularly environmentally sensitive areas are not available for such purposes.

Materials Requirements

Materials Balance

- 5.6.40 An estimate of the current earthworks balance for the Proposed Improvement is provided in Table 5.6.3. This exercise has identified that there is currently a deficit of fill material in the region of 69,427 m³ which will need to be supplemented by imported class 1A granular fill. These figures provide an optimistic estimate for the current outline design, based on the current understanding that all excavated materials would be suitable for re-use within the permanent works.

5.6.41 A balance has been shown in Table 5.6.3 between the topsoil required for the verges and landscaping areas for the Proposed Improvement and what is available as site won material, which has been estimated based on a nominal topsoil depth across the whole of the proposed footprint. The volume of topsoil which will be required during the finishing works for the Proposed Improvement will be subject to the detailed landscaping design and based on an accurate estimate of current depths. The successful contractor will be required to balance soil resource efficiency (i.e. how much soil is needed in different areas of the scheme) and the need to prevent topsoil being taken from site as waste as part of the detailed design work. Therefore, an overall topsoil balance is predicted.

5.6.42 The volume of sub-base and bituminous material required for the proposed road construction are shown in table 5.6.3. It's likely that surfacing material will be removed from the A496 where the proposal ties into the existing road. The volume of material removed will be determined during detailed design and therefore the potential re-use of this material within the new road surface has not been considered within this assessment.

Table 5.6.3: Estimated earthworks and pavement balance for the Proposed Improvement

Material	Total
<i>Earthworks</i>	
Earthworks Fill	121,224 m ³
Earthworks Cut	51,797 m ³
Balance	69,427 m ³
<i>Topsoil (Class 5A material)</i>	
Topsoil Strip*	12,788 m ³
Topsoil Requirement**	12,788 m ³
Balance**	0 m ³
<i>Pavement Construction</i>	
Bituminous Material	4,838 m ³
Sub-base Material	3,870 m ³
* Based on nominal current topsoil depth	
** The principal contractor will propose topsoil depths during detailed design work, based on accurate estimate of soils to be excavated	

Type of Materials

5.6.43 A breakdown of the material requirements currently estimated for the construction of the Proposed Improvement as well as an estimate, where practicable, of the volume or extent of each type of material required is provided in Table 5.6.4.

Table 5.6.4: Estimated materials requirements for the Proposed Improvement

Material	Requirement	Type	Likely Origin	Distance
Earthworks Fill	Approx. 121,224 m ³ of well-graded granular material (51,797 m ³ would be obtained from site excavation)	Naturally occurring, and/or natural secondary aggregate	Site won/Minffordd/ Blaenau Ffestiniog/Arthog	Up to 30km
Road Surfacing	Approx. 4,838 m ³ between all grading layers	Man made using primary aggregate (recycled site won road planings may also be used for base layer)	Minffordd	17km
Sub-base	Approx. 3,870 m ³ of graded aggregate	Natural secondary aggregate (recycled site-won road planings may also be used)	Site won/Minffordd/ Blaenau Ffestiniog/Arthog	Up to 30km
Topsoil	Approx. 12,788 m ³ of soil for use in verges and landscape areas	Naturally occurring	Site won	0km
Concrete	Estimated 2160m ³ for use within the two bridges, agricultural underpass and wildlife underpass structures	Man-made using primary aggregate (recycled aggregate can also be used based on availability)	Minffordd/ Porthmadog	Up to 22km
Steel	Estimated 250T for use within the two bridges, agricultural underpass and wildlife underpass structures	Man-made material using high recycled content (75-100%)	National Supplier	Approx 100km
Walling stone	Estimated 2,000 m ³ for use within proposed 3.3km masonry wall highway boundary	Naturally occurring	Site won/local quarry	Up to 50km
Drainage materials	Combination of plastic (some concrete) pipes and chambers which make up the surface water drainage network across the improvement	Man-made synthetic material	National Supplier	Approx 100km
Drainage Surround	Pipe bedding for the drainage network	Primary or natural secondary aggregate	Minffordd/ Blaenau Ffestiniog/Arthog	Up to 30km
Fencing and Gates	Combination of stock and mammal proof fencing either side of the road for	Man-made using sustainable sourced timber posts and	National Supplier	Approx 100km

	the length of the improvement (approx. 4km)	galvanized steel mesh		
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Source of Materials

5.6.44 Table 5.6.4 contains an estimation of the source of the various materials required for the construction of the Proposed Improvement and shows that it is currently estimated that the majority of the construction materials can be obtained locally. It is likely that the bulk fill material required to supplement what is won on site can be sourced from local working quarries to the north and south of Llanbedr, and carried to the site along the A496. It is likely that material for new pavement construction can be obtained from Minffordd quarry near Penrhyndeudraeth, and ready-mix plants are available at Minffordd and Porthmadog to supply concrete for the various structural works across the Proposed Improvement. It is envisaged that the remaining construction materials will be obtained through the national suppliers and most likely delivered from further afield, possibly along the A55(T) and A487(T) or A470(T).

5.6.45 Considering the location of the Proposed Improvement and the proximity of material suppliers it is envisaged that all construction materials will be transported to the site along the existing A496, with some use of the wider highway network. Potential disturbance upon the flow of traffic along the A496 as a result of importing construction materials would be expected due to the relatively narrow and winding alignment.

Waste Forecasts

Type and Volume of Waste

5.6.46 The type and volume of excavated waste material expected to be generated from construction of the Proposed Improvement is modest. It is currently estimated that the only site-won excavated material which may be surplus to requirements during the construction phase is the existing pavement material which requires removal at the tie-ins; this is likely to be comprised of a combination of bituminous and sub-base material. The recycling of this material within the permanent works will depend upon the principal contractor’s construction programme, and whether phasing of the work will allow opportunities to use this material in suitable parts of the works on its removal. Conversely, such opportunities may have passed by the time this material is removed.

5.6.47 Other material which will be encountered during site clearance and may not be suitable for re-use, therefore requiring removal from site includes: existing stock-proof and post and rail fencing material; hedgerows and trees; timber/steel gates; existing road drainage pipes and redundant road signs.

Suitability for re-use, reclamation or recycling

5.6.48 It is currently estimated that all earthworks material encountered during excavation would be suitable for re-use within the works. Restrictions would be associated with the re-use of soils within that may contain *Rhododendron ponticum*, a non-native invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981, to prevent the possibility for this plant to spread beyond the area described in Chapter 5.4. Other non-native plants such as Japanese knotweed and Himalayan balsam, are also present within the study area and may be encountered by works, which would introduce further limitations regarding re-use of small volumes of soils.

5.6.49 Following testing to confirm acceptability of tar content, the existing surfacing material removed through planing is likely to be suitable for recycling as coarse aggregate required for new pavement construction or as general fill in various areas of the site. Existing gates, fencing materials and redundant road signs encountered during site clearance activities described above may not all be

suitable for re-use within the permanent works and would therefore be removed to offsite waste facilities, with most of the materials suitable for recycling.

Construction Impacts

Movements of materials

5.6.50 It is envisaged that the majority of construction materials will be transported along the existing A496 and surrounding highway network to the north of the site. Potential disturbance upon the flow of traffic as a result of importing construction materials would be expected during periods of material import.

5.6.51 The majority of material excavated from the cutting area to the south of the Afon Artro (circa 35,000m³) would be used to construct the road embankment to the north, and would therefore need to be transported across the site. It is currently expected that this would be achieved by constructing the permanent crossing over the river early in the construction programme, which would reduce potential impacts generated by haulage vehicles travelling along the A496 through Llanbedr.

Storage of materials

5.6.52 The land adjacent to the proposed alignment which is likely to be considered by the contractor for materials storage during construction is made up of agricultural land (see Chapter 5.9: *Community and Private Assets* and Figure 5.9.1, Volume 1a). Restrictions would be placed to prevent storage within or adjacent to ecologically sensitive areas such as areas of lowland meadow and rush pasture within the scheme footprint, and designated nature conservation sites nearby (see Chapter 5.4: *Ecology and Nature Conservation*). Also areas which are susceptible to fluvial or coastal inundation at the north end of the site would not be available for storage of materials unless NRW can be satisfied that the risk of using such areas is acceptable.

5.6.53 It is expected that excavation of the cutting could be programmed to coincide with extensive embankment construction to prevent storage and double handling of bulk fill materials. The need for storage of excavated material to be used within the permanent embankment will therefore largely depend on the contractor's construction programme. Should storage be required it is expected that it would largely occur on land near the area of cutting to the south of the river. Excavated material may need to be segregated into types which are suitable and unsuitable for use within the permanent earthworks, or dehydrated in open air before it can be handled further.

5.6.54 It is assumed that all topsoil would be windrowed in low stockpiles near to the position of excavation prior to incorporation within the permanent works. The re-use of certain topsoil in the correct areas of the scheme would be critical to the delivery of the habitat restoration/creation proposals (see Chapter 5.4: *Ecology and Nature Conservation*).

Processing of materials

5.6.55 The processing of excavated materials prior to their incorporation into the permanent works is predicted to be minimal. Temporary stockpiling of site-won material may be required to reduce its moisture content to a suitable level before it can be placed within the new embankment. Riddling of excavated material may be used to separate stones which are suitable for use within the proposed masonry boundary walls. The processing of existing road surfacing would occur on its removal and further treatment is not expected.

5.6.56 Table 5.6.5 summaries the construction phase environmental effects described above in accordance with the IAN 153/11 reporting matrices. The project activities have been tailored towards the Proposed Improvement and do not include operational or maintenance activities.

Table 5.6.5: Environmental Effects Reporting Matrix (source: IAN 153/11, Annex 2)

Project Activity	Potential impacts associated with material resources/waste arisings	Description of environmental effect
Site Clearance	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Adverse, Permanent, Indirect, Minor Impact
Excavation	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Adverse, Permanent, Indirect, Minor Impact
Construction	Import of materials for construction which reduces natural resources and availability of raw construction materials	Adverse, Permanent, Indirect, Moderate Impact
	Importation of materials could also introduce contaminating substances or invasive species if sourced from negligent supplier	Adverse, Permanent, Direct, Moderate Impact
Movement of materials	Movement of materials to/from the construction site can cause temporary disturbance to traffic flows and increase local air pollution and noise levels.	Adverse, Temporary, Direct, Moderate Impact
	Movement of materials across the site can impact upon the integrity of ecological features and surface water quality, and can also generate dust which can impact environmental and human receptors.	Adverse, Temporary, Direct, Moderate Impact
Storage of materials	Storage of earthworks and construction materials can impact upon sensitive ecological receptors in-directly by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Adverse, Temporary, Indirect, Moderate Impact
Processing of materials	Processing of earthworks can impact upon sensitive ecological receptors in-directly by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Adverse, Temporary, Indirect, Moderate Impact

Mitigation Measures

5.6.57 Decisions and measures to minimise environmental effects generated from the use of materials and generation of waste would mainly be implemented during detailed design and construction of a project. In order to direct the principal contractor and detailed designer towards resource efficient solutions the following series of contractual requirements and best practices design guidance will provide a framework for sustainable decision making.

Site Waste Management Plan

5.6.58 Efficient site waste planning will enable the identification of all potential waste streams associated with a construction project therefore allowing the establishment of measures to minimize the

generation of waste through reduction, recovery and recycling; and also to manage the storage and movement of different types of waste during construction. Part of the duties placed upon the eventual contractor and their designers will be the preparation and early implementation of a Site Waste Management Plan (SWMP), allowing waste management principles to be adopted from the outset, thereby resulting in greater benefits.

Construction Environmental Management Plan

5.6.59 The principal contractor will be required to establish a Construction Environmental Management Plan (CEMP, see Chapter 7), the main purpose of which is to enable management of the construction phase to minimize all potential environmental impacts. With particular regard to the content of this chapter, the CEMP would identify procedures to minimize the impacts associated with the following aspects:

- additional land take selection
- use of temporary working areas
- storage of materials next to watercourses
- nuisance caused by construction traffic
- generation of dust

CEEQUAL

5.6.60 CEEQUAL is an evidence-based sustainability assessment which aims to deliver improved project specification, design and construction of civil engineering works. As is common for major highway improvement projects it is expected that the framework provided by the CEEQUAL assessment manual will be used to integrate the principles of sustainable development into the design and construction of the Proposed Improvement. Application of the CEEQUAL process will guide the detailed design towards the following resource efficiency and waste minimization considerations, all of which will encourage provisions to reduce the overall impacts of the Proposed Improvement further than the measures which can be described for the current outline design stage:

- material resource efficiency planning
- cut and fill optimization
- durability and low maintenance of materials
- soil management
- re-use of site won materials
- use of reclaimed or recycled materials

5.6.61 Through application of the procedures described above a range of mitigation measures can be identified and implemented which will reduce the significance of potential environmental effects described in Table 5.6.5.

5.6.62 The principal contractor and their designers will consider the current estimated earthworks balance and will look to refine the design in order to reduce the volume of nett import required during the construction phase. Reducing the volume of imported material required during construction could provide substantial cost benefits as well as reducing the potential impacts associated with extraction of raw materials and limiting HGV trips.

5.6.63 The recycling of existing pavement construction material from scheme tie-ins within the permanent works will depend upon the principal contractor's construction programme, and appropriate phasing of the work will allow opportunities to use this material in suitable parts of the works on its removal. This material could also be suitable as surfacing for field accesses or agricultural tracks constructed as part of the Proposed Improvement. The geotechnical property of road plainings makes it unlikely that any such surplus material would be disposed of, and would likely be used for construction purposes elsewhere should it not be practicable to recycle on site.

- 5.6.64 Consideration of waste at the detailed design stage through implementation of a SWMP will allow mitigation to be incorporated into the design and for such measures to become part of the scheme; this approach will help to identify opportunities to 'design out' waste prior to construction and allow suitable receptor sites to be identified for surplus waste materials as necessary.
- 5.6.65 Other than excavated earthworks materials the most potentially significant waste streams during site clearance are estimated to be existing fences, gates and hedgerow material, and the principal contractor will be required to develop plans for their treatment based on the waste hierarchy. Some materials could be utilized by adjacent landowners should conditions allow and there are likely to be beneficial re-uses for vegetation material on site *e.g.* as hibernacula for reptiles or as an organic mulch to suppress weed growth along the base of the new hedge line (see Chapters 5.3: *Landscape* and 5.4: *Ecology and Nature Conservation*).
- 5.6.66 Any imported materials required would be from approved sources and the suitability of the material checked. For any imported earthworks materials, appropriate chemical testing would be undertaken to confirm that no contamination is present within the imported materials (see also Chapter 5.5: *Geology and Soils*).
- 5.6.67 Table 5.6.4 suggests that the material requirement consists of fairly conventional construction products, much of which can be provided by site-won material, secondary aggregates, recycled products and certified sustainable sources. The availability of such products will provide the principal contractor with an opportunity to make decisions regarding material sourcing based on sustainability performance, thereby reducing the direct and whole-life impacts of the Proposed Improvement.
- 5.6.68 To mitigate the potential impacts of transporting materials to site, material would be derived from the nearest practicably available source and suitable location to keep HGV journey distances to a minimum.
- 5.6.69 Temporary working areas including compounds, storage areas and haul roads will be positioned to avoid sensitive ecological receptors such as watercourses, retained trees, bat roosts and active badger setts (see Chapter 5.4: *Ecology and Nature Conservation*). The temporary storage of materials will follow best practice guidance measures to prevent the generation of dust (see Chapter 5.1: *Air Quality*) and silt-laden run-off towards existing surface water receptors (see Chapter 5.10: *Road Drainage and the Water Environment*), and would also limit stockpile heights to maintain structure of topsoil during storage (see Chapter 5.5: *Geology and Soils*). With implementation of sensitive working practices in the selection and management of materials storage areas, coupled with the inert nature of the material to be stored, it is not expected that any impacts to the surrounding natural environment or to human health would occur as a result of materials storage or handling.

Residual Environmental Effects

- 5.6.70 Table 5.6.6 summarises the potential impacts associated with material resources/waste arisings from the project, construction phase mitigation measures and the predicted residual magnitude of effects following their implementation, in accordance with the IAN 153/11 reporting matrices.

Table 5.6.6: Mitigation Measures Reporting Matrix (source: IAN 153/11, Annex 3)

Project Activity	Potential impacts associated with material resources/waste arisings	Description of mitigation measures	How the measures will be implemented, measured and monitored	Description of environmental effect after mitigation
Site Clearance	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Early estimation of waste stream and developing of treatment options based on waste hierarchy	Waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Indirect, Negligible Impact
Excavation	Generation of waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities	Early estimation of waste stream and developing of treatment options based on waste hierarchy	Waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Indirect, Negligible Impact
Construction	Import of materials for the construction phase which reduces resource and availability of raw materials	Minimise volume of imported material by allowing re-use of site won material Detailed design to consider opportunities to reduce net import volume Consider use of secondary material where net import remains	Detailed design, waste forecasting, management and monitoring measures to be included in SWMP	Adverse, Permanent, Indirect, Negligible Impact
	Importation of materials could also introduce contaminating substances or invasive species if sourced from negligent supplier	Source material from reputable and certified supplier and obtain chemical testing results	Environmental protection and biosecurity measures and monitoring procedures to be stipulated in CEMP	Adverse, Permanent, Direct, No Change
Movement of materials	Movement of materials to/from the construction site can cause temporary disturbance to traffic	Minimise volume of imported material by allowing re-use of site	Detailed design, waste forecasting, management and monitoring measures to be	Adverse, Temporary, Direct, Minor Impact

	flows and increase local air pollution and noise levels.	won material. Detailed design to consider opportunities to reduce net import volume Identify local suppliers and waste receptor sites to reduce residual traffic-related impacts	included in SWMP	
	Movement of materials across the site can impact upon the integrity of ecological features and surface water quality, and can also generate dust which can impact environmental and human receptors.	Implementation of best practice construction site methods during selection and management of haul routes to prevent impacts on environmental and human receptors	Environmental protection measures and monitoring procedures to be stipulated in CEMP	Adverse, Temporary, Direct, Minor Impact
Storage of materials	Storage of earthworks and construction materials can impact upon sensitive ecological receptors in-directly by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Implementation of best practice construction site methods during selection and management of storage/processing areas to prevent impacts upon environmental and human receptors	Environmental protection measures and monitoring procedures to be stipulated in CEMP	Adverse, Temporary, Direct, Minor Impact
Processing of materials	Processing of earthworks can impact upon sensitive ecological receptors in-directly by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment.	Implementation of best practice construction site methods during selection and management of storage/processing areas to prevent impacts upon environmental and human receptors	Environmental protection measures and monitoring procedures to be stipulated in CEMP	Adverse, Temporary, Direct, Minor Impact

Summary

- 5.6.71 This chapter, prepared in accordance with IAN 125/09 and IAN 153/11, has considered the environmental effects associated with the use of material resources and generation of waste for the Proposed Improvement. A detailed assessment of the effects of constructing the Proposed Improvement on materials has considered the extent, method and programme of the proposed earthworks and construction activities required to complete the construction phase. The impacts have been assessed before and after mitigation measures are applied.
- 5.6.72 The assessment is based on the knowledge available at the outline design stage and has used current forecasts of material use and knowledge of existing suppliers and haulage options, and the opportunities for resource efficient decisions to be taken during subsequent phases of the project.
- 5.6.73 Without mitigation, the key impacts associated with Materials are:
- Generation of waste material to be disposed away from site thereby reducing capacity of local waste management facilities (up to minor adverse);
 - Import of construction materials which reduces resource and availability of raw construction materials and could introduce contaminating substances/invasive species if sourced from negligent supplier (up to moderate adverse);
 - Movement of materials to/from the construction site causing temporary disturbance to traffic flows and increased local air pollution and noise levels (moderate adverse);
 - Movement of materials across the site affecting the integrity of ecological features and surface water quality and generating dust (moderate impact), and;
 - Processing/storage of earthworks and storage of construction materials affecting sensitive ecological receptors in-directly through silt-laden run-off and dust (moderate impact).
- 5.6.74 Decisions and measures to minimise such environmental effects would mainly be implemented during detailed design and construction. In order to direct the principal contractor and detailed designer towards resource efficient solutions the following series of contractual requirements will provide a framework for sustainable decision making:
- Site Waste Management Plan (SWMP): part of the duties placed upon the eventual contractor and their designers will be the preparation and early implementation of a SWMP, allowing waste management principles to be adopted from the outset, resulting in greater benefits, and;
 - Construction Environmental Management Plan (CEMP): the principal contractor will be required to establish a CEMP (see Chapter 7) to enable management of the construction phase to minimize all potential environmental impacts, including those associated with materials resource use and generation of waste.
- 5.6.75 It is also expected that the framework provided by the CEEQUAL assessment manual will be used to integrate the principles of sustainable development into the design and construction of the Proposed Improvement. Application of the CEEQUAL process will guide the detailed design towards resource efficiency and waste minimisation considerations.
- 5.6.76 Through application of the procedures described above a range of mitigation measures can be identified and implemented which will reduce the significance of the identified environmental effects to no more than minor adverse.

5.7 Noise and Vibration

The Noise and Vibration assessment (Arcadis 2017) is found in Volume 2, Technical Appendix F. This includes :

- **Baseline Noise Survey Data (Appendix A)**
- **Modelled Traffic Noise Data (Appendix B)**
- **Construction Noise Predictions (Appendix C)**

References are provided at the end of this chapter, page 352

Introduction

5.7.1 Arcadis has been commissioned to undertake a Noise Assessment to evaluate the potential impacts of a new by-pass in the town of Llanbedr, north Wales. Hereinafter referred to as ‘the Scheme’.

The objectives of this chapter are to:

- Determine the likelihood of any significant impacts, both beneficial and adverse.
- Appraise the impacts against relevant legislative policy & guidance.
- Suggest potential mitigation measures to reduce any potential adverse effects.

Methodology

Study Area

5.7.2 The operational phase study areas used within the scope of the study have been defined in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7, HD 213/11 (HD213/11) (Ref 1.1) by the following process, as presented in Table 5-7-1.

5.7.3 The following protocol has been applied to the assessment in the defining of the operational road traffic noise study area.

Table 5-7-1: Determining Road Traffic Noise Study Area

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) above.
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 one where there is the possibility of a change of 1dB(A) or more between the Do Minimum and Do Something scenarios in the short-term or 3dB(A) or more in the long term.

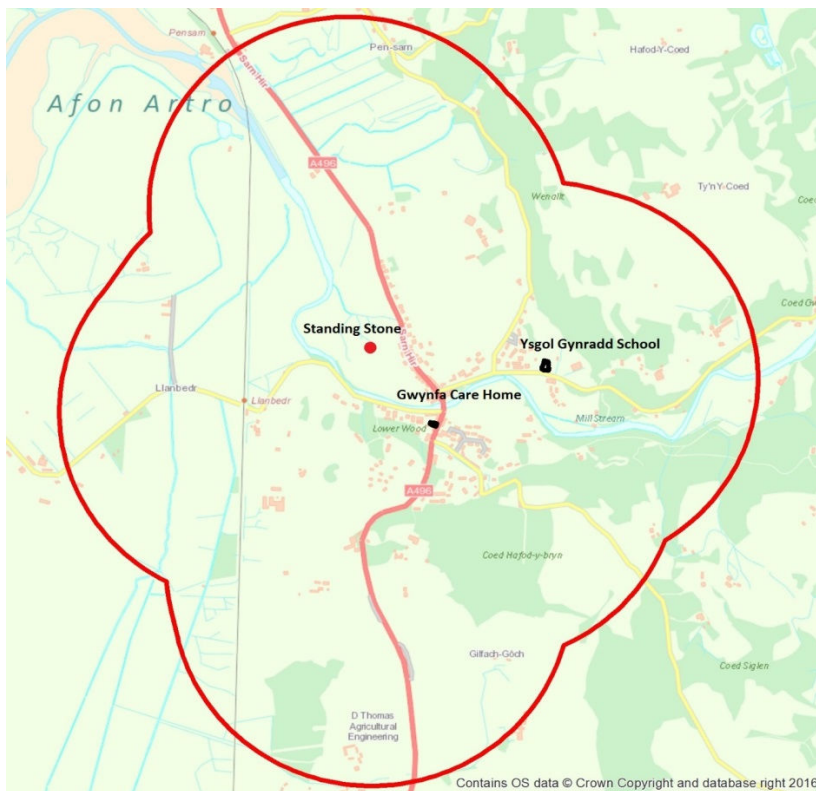
5.7.4 The study area for the noise assessment is shown on Figure 5-7-1 below.

Figure 5-7-1: Llanbedr Scheme Noise Study Area



5.7.5 The study area accounts for a total of 248 residential receptors and 2 other sensitive receptors, which are detailed on Figure 5-7-2.

Figure 5-7-2: Other sensitive receptors



Baseline Assessment

5.7.6 A full suite of baseline noise measurements was taken over a period of 24 hours between 22/06/2016 and 23/06/16. The baseline monitoring locations, as agreed in consultation with the Environmental Health Officer (EHO) at Gwynedd Council, are shown on Figure 5.7.1. The predominant noise source within the study area is road noise, with some noise contributions from agricultural activities. Presented in Table 5-7-2 is a summary of the Baseline results. The full results can be found in Vol 2 Appendix F.

Table 5-7-2: Summary Baseline Noise Data

Location	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
1	59.9	76.0	55.4	42.8
2	62.1	78.8	56.8	35.1
3	52.3	62.3	36.1	47.7
4*	43.3	52.9	30.5	40.1
5	43.3	52.9	30.5	40.1
6	58.5	68.7	37.3	55.1

**Due to vandalism of the equipment and after agreement with the Gwynedd Council EHO, data from Location 5 has been used as representative of Location 4.*

Value of Resource

5.7.7 In accordance with the principles of EIA, the sensitivity of receptors (existing and proposed) to noise impacts during construction, operation or decommissioning phases have been defined in Table 5-7-3. In the absence of specific guidance on the sensitivity of noise receptors, the criteria in Table 5-7-3 have been based on criteria set out in the Technical Advice Note Assessment of Noise (Scottish Government, 2011) (Ref 1.17).

Table 5-7-3: Sensitivity/Value of Receptor

Sensitivity/ Value of Receptor	Description
High	Residential premises, residential properties, educational buildings, medical facilities, care homes concert halls/theatres, specialist commercial premises.
Medium	Places of worship, community facilities, offices.
Low	Other commercial/retail premises.

5.7.8 Predominantly residential dwellings have been considered within the scope of the Route Option comparison assessments, as they are of a high value in terms of noise change.

5.7.9 The study area contains a total of 248 individual dwellings. In addition, there are 2 other sensitive receptors which are also of a high value with reference to noise change (Image 2).

Road Traffic Noise Predictions

5.7.10 As previously detailed, road traffic noise calculations have been undertaken in accordance with the CRTN (Ref 1.12) prediction methodology, which has been used to calculate a dB $L_{A10, 18 \text{ hour}}$ value for road traffic noise contribution at identified sensitive receptors within the Study Area (as defined within Section 1.2). Night time levels have been based on an $L_{A10, 8 \text{ hour}}$ and calculated using TRL Method 2 as defined in in DMRB (Ref 1.1).

5.7.11 Calculations have been undertaken using the commercially available noise modelling software IMMI, which has been validated to follow the prediction procedures set out in CRTN (Ref 1.12). At this stage of the Scheme design a spatially coarse model has been produced which does not account for topography or vertical alignment. However, it is considered that the level of detail within the noise model is sufficient to inform the conclusions relating to the noise impacts of the Scheme Options proposed.

5.7.12 Traffic data used in the assessment has been provided by the Traffic Engineers to the project, and contains the following data. Information has been provided for both the Opening Year (2020) and Future Assessment Year (2035) “Do-minimum” (without Scheme) and “Do-something” (with Scheme) scenarios on the basis of the following.

- 18-hour annual average weekday traffic (AAWT) flow;
- 18-hour average speed (kph); and
- Percentage of Heavy Goods Vehicles (HGV) content of total 18 hour AAWT flow;
- 8-hour Night time traffic flow;
- 8-hour average speed (kph); and
- Percentage HGV content of total 8-hour night time flow.

5.7.13 Residential receptors have been identified using Ordnance Survey postcode point data information, with all buildings within the noise model assumed to be an arbitrary height of 7m. Individual receptor (calculation) points have been assumed to be 4.0m above ground level as required by DMRB for situations where dwellings have a first floor.

5.7.14 All new/altered road surfaces in the opening year of the Scheme have been assumed to have a low noise surface/thin wearing course with a correction of -2.5dB applied (for links with a speed in excess of 75kmph).

Legislation and Policy

Legislation

The Environmental Noise Directive (Ref 1.2)

5.7.15 The Environmental Noise Directive (2002/49/EC) (END) provides the European Union policy context under which policies to manage environmental noise including traffic noise are implemented in Wales.

Control of Pollution Act (Ref 1.3)

5.7.16 Section 60, Part III of the Control of Pollution Act (HMSO, 1974) refers to the control of noise on construction sites. It provides legislation by which local planning authorities can control noise from construction sites to prevent noise disturbance occurring. The Control of Pollution Act provides the local planning authority, in whose area work is going to be undertaken, or is being undertaken,

with the power to serve a notice imposing requirements as to the way in which construction works are to be carried out. This notice can specify, the plant or machinery that is or is not to be used, the hours during which the construction work can be carried out, the level of noise and vibration that can be emitted from the premises in question or at any specified point on these premises or that can be emitted during specified hours, or for any change of circumstances.

5.7.17 Section 61, Part III of the Control of Pollution Act refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. If consent is given, and the stated method and hours of work are complied with, then the local authority cannot take action under Section 60.

5.7.18 Section 71, Part III of the Control of Pollution Act refers to the preparation and approval of codes of practice for minimising noise. The current, June 2014, version of BS 5228 is one such approved code.

5.7.19 Section 72, Part III of the Control of Pollution Act refers to 'best practicable means' (BPM), which is defined as:

'reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'. Whilst 'Means' includes 'the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures.'

5.7.20 If BPM is applied, then it can provide a defence against prosecution by the consenting body.

Environmental Noise (Wales) Regulations 2006 (Ref 1.4)

5.7.21 The Environmental Noise (Wales) Regulations 2006 (National Assembly for Wales, 2006) (Statutory Instrument No. 2629 W.225) implements EU Directive 2002/49/EU, known as the END in Wales. This legislation relates to the assessment and management of environmental noise and its implementation is the responsibility of the Welsh Assembly Government.

5.7.22 The noise action plan for roads in Wales (Welsh Government, 2013) sets out the results of the noise mapping and evaluation of the numbers of people exposed to different levels of noise, noise reduction measures in place at the time of publication and sets out a long-term strategy for reducing noise from road traffic.

Land Compensation Act 1973 (Ref 1.5) and Noise Insulation Regulations 1975 (amended 1988) (Ref 1.6)

5.7.23 The Land Compensation Act 1973 (HMSO, 1973) provide a mechanism for property owners to seek compensation for devaluation of their property. Under Part 1 of the Act, compensation can be claimed by people who own and also occupy property that has been reduced in value by more than £50 by physical factors, including noise, caused by the use of a new or altered road. These claims can be made between one and seven years following the opening of the Scheme and are assessed by the Regulatory Authority.

5.7.24 The highways authority also has a duty under the Noise Insulation Regulations 1975 (amended 1988) (HMSO, 1988) to offer sound insulation for dwellings affected by increased noise from a new road, and discretionary powers in relation to altered roads based upon various conditions.

5.7.25 To qualify for sound insulation, three conditions have to be satisfied:

- The combined highest expected traffic noise level, referred to as the relevant noise level, up to 15-years after the Scheme opens, from the new or altered highway together with other traffic in the vicinity must not be less than 68 dB LA10,18hr;

- The relevant noise level is at least 1.0 dB(A) more than the prevailing noise level, i.e. the total traffic noise level existing before the works to construct or improve the highway were begun; and
- The contribution to the increase in the relevant noise level from the new or altered highway must be at least 1.0 dB(A).
- Under the Noise Insulation Regulations, the highways authority also has discretionary powers to offer insulation against construction noise.

National Policy

5.7.26 This section sets out relevant policy at the national and local level.

National Planning Policy (Ref 1.7)

5.7.27 Planning Policy Wales (PPW) (Welsh Government, 2016) recognises the need to foster sustainable change, in particular making it possible to live with less noise, congestion and traffic pollution, and improving the quality of life.

5.7.28 Section 13 of the PPW states that noise can affect people's health and well-being and have a direct impact on wildlife and local amenity. Noise levels provide an indicator of local environmental quality. The objective of a policy for noise is to minimise emissions and reduce ambient noise levels to an acceptable standard. Noise Action Plans, drawn up by the Welsh Ministers in relation to Wales under the Environmental Noise Directive, and the Wales Regulations¹², aim to prevent and reduce environmental noise where necessary and preserve environmental noise quality where it is good. They are a planning consideration in the use and development of land.

5.7.29 In Section 8.5.7 the PPW states that great care must be taken to minimise the adverse impacts of new transport infrastructure, or improvements to existing infrastructure, on the natural, historic and built environment and on local communities, where neighbourhood severance should especially be avoided. Routes should make the best use of existing landforms and other landscape features to reduce noise and visual effects, subject to safety and other environmental considerations.

5.7.30 The goal of the Transport Strategy for Wales '*One Wales: Connecting the Nation*' is to promote sustainable transport networks that safeguard the environment while strengthening the country's economic and social life. The transport strategy identifies a series of high-level outcomes. Outcome 15 is to 'improve the positive impact of transport on the local environment' (Welsh Assembly Government, 2008). Indicators of success for this outcome, as related to noise, are stated as:

- "Number of targeted noise action plans related to transport"
- "Proportion of noise sensitive areas with noise protection measures" – In the context of road traffic, noise protection measures would include barriers, bunds, speed restrictions, low noise road surfaces etc. These measures, as appropriate, are being considered for the Scheme.

5.7.31 National planning guidance on noise is contained within Technical Advice Note (Wales) 11 (TAN 11) (Welsh Government, 1997) (Ref 1.8). This document does not provide any specific guidance relating to the assessment of noise from new or altered roads but does refer to the Noise Insulation Regulations 1975.

Local Policy

5.7.32 The scheme falls within the administrative areas of Gwynedd Council.

Gwynedd Unitary Development Plan (UDP) adopted July 2009 (Ref 1.9)

- 5.7.33 Policy A1 – Environmental or other impact assessments. Proposals will be refused unless sufficient information is provided with the planning application concerning any significant likely environmental or other impacts.
- 5.7.34 Policy B13 – Protecting the coastline. Outside the Heritage Coast, proposals on open coastal areas included in the Plan area will only be approved if they comply with a set of criteria which includes creating no adverse impact on noise.
- 5.7.35 Policy B23 – Amenities. Proposals that cause significant harm to the amenities of local communities will be refused; developers are required to demonstrate clearly that they will respond positively to a variety of factors. This includes that the development does not increase traffic nor the noise associated with traffic in a way that causes significant harm to local amenities.
- 5.7.36 Policy B33 – Development that creates pollution or nuisance. Proposals that will cause significant harm to the quality of public health, safety or amenities, or to the quality of the built or natural environment as a result of higher levels of air, water, noise, or soil pollution will be refused unless adequate controls can be attained by means of planning conditions and powers of regulatory bodies, and that arrangements can be made to monitor discharges.

Snowdonia National Park Authority (UDP) Eryri Local Development Plan 2007-2022 (Ref 1.10)

- 5.7.37 Snowdonia National Park Authority Eryri Local Development Plan 2007-2022 Written Statement Adopted Version, as adopted 13th July 2011 indicates that a healthy and safe living environment is essential, through good building design, the provision of good public recreational and open space and noise reduction measures and good management, enhancement, promotion and safeguarding of rights of way and access to open country. Development must be compatible with, and must not cause significant harm, to the environment, neighbouring residential amenity or the amenity of the Park by way of noise, dust, vibration, odour, light pollution, hazardous materials or waste production.
- 5.7.38 Snowdonia National Park Authority Supplementary Planning Guidance: General Development Considerations. September 2011 (Ref 1.11) state that a proposal may be undesirable because of its adverse impact on a neighbour or the wider local community. Such a nuisance may relate to excessive noise or odour levels which cannot be reduced by planning condition and therefore would significantly impact on other people's everyday way of life. Consent for noise-generating development will be carefully controlled or refused where the special qualities of the National Park would be affected.

Relevant Guidance

Department of Transport (Welsh Office 1988) CRTN (Ref 1.12)

- 5.7.39 Calculation of Road Traffic Noise (CRTN) (Department of Transport/Welsh Office, 1988) (Ref 1.12) provides the Welsh Government's approved methodology for calculating noise from road traffic. The calculations are based on the traffic flow data and the spatial relationship between the receptor and the road. Noise levels are determined using the L_{A10} index, which is the 10th percentile of the A-weighted sound pressure level. The index is normally determined for the 18-hour day (06.00 - 24.00 hours) based on the annual average weekday traffic. CRTN also provides methodologies for noise surveys.

Design Manual for Roads and Bridges (DMRB) (Ref 1.1)

- 5.7.40 The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 (Highways Agency et al., 2011) Noise and Vibration (HD 213/11) provides guidance on assessing the noise and

vibration impacts from road schemes. This has been updated in places by Interim Advice Note 185/15 (Highways Agency, 2015) (Ref 1.13)

- 5.7.41 The DMRB defines scoping and sets out simple and detailed methods for assessing the impacts of road traffic noise (Highways Agency et al., 2011). Thresholds for significant operational traffic noise effects are a 1 dB(A) change in the short term, assessed for the opening year, and a 3 dB(A) change in the long term, assessed by comparing the change between the opening year and the future assessment year.
- 5.7.42 The 1 dB and 3 dB thresholds being the onset of a 'minor' impact for short term and long term assessments respectively. These scales should also be applied to night-time noise changes. However, a night-time noise assessment is only necessary for dwellings subject to L_{night} , outside levels exceeding 55 dB. This threshold is the interim target for night-time noise in the WHO Night Noise Guidelines for Europe (World Health Organisation, 2009). (Ref 1.14)
- 5.7.43 Given the scale of the scheme, it is considered that a detailed assessment of the noise generated by traffic in the long term is appropriate (see DMRB Chapters 3 and 4 of Volume 11, Section 3, Part 7 (Ref 1-1)). A simple assessment would normally be appropriate where noise and vibration sensitive receptors (NVSRs) are present but neither of the threshold values (i.e. noise and vibration) are expected to be exceeded. A detailed assessment is appropriate in situations where NVSRs are present and either or both of the threshold values are expected to be exceeded, most commonly with an all new road.
- 5.7.44 The baseline and future assessment years for construction and operational effects are defined as follows.
- 5.7.45 For an assessment of temporary noise and vibration impacts (i.e. from construction or maintenance activities), the baseline year is taken as that immediately prior to the start of works. The future assessment year would be a year during the period of construction/maintenance works.
- 5.7.46 For an assessment of permanent noise and vibration impacts, the baseline year is taken as the opening year of the road project. This is considered to be the year which is most representative of the situation immediately before a road project opens to traffic. It is noted that the baseline year used for this assessment could be different to the year used when predicting the Prevailing Noise Level for any calculations undertaken for the relevant Noise Insulation Regulations. The future assessment year for operation is typically the 15th year after the opening year of the road project as that is when traffic flows are generally at their highest but, in some circumstances, this may occur before the 15th year. For this project, it is expected that the greatest traffic flows will generally occur in the 15th year, and this is taken as the future assessment year.
- 5.7.47 The methodology requires CRTN (Calculation of Road Traffic Noise, Department of Transport and the Welsh Office, 1988) (Ref 1.12) noise predictions to be made for dwellings and other NVSRs affected by the Scheme, both with and without the Scheme for the opening year and future year. This enables both the short term and long term changes to be evaluated. The latest version of the DMRB Volume 11, Section 3, Part 7 (Ref 1.1) includes separate classifications of impact magnitude for the short term and long term noise changes.
- 5.7.48 The DMRB sets out the approach to simple and detailed assessments. At the simple stage, the following two comparisons are made in order to determine the impact of the Scheme in the short term, and the long term.
- Do-Minimum (without Scheme) scenario in the baseline year against Do-Something (with Scheme) scenario in the baseline year (short term).

- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

5.7.49 At the detailed stage, the following three comparisons are made in order to better understand the impact of the Scheme.

- Do-minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year.
- Do-minimum scenario in the baseline year against Do-Something scenario in the baseline year.
- Do-minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

5.7.50 The assessment of noise and vibration has been based on the Scheme with permanent acoustic mitigation in place (i.e. as part of the highway engineering design). The mitigation includes provision of low noise surfacing, embankments and placing of the Scheme in a cutting between chainage 550 and chainage 920. In Wales, however, it is a requirement of DMRB Volume 11, Section 3, Part 7 (Ref 1-1), paragraph 3.12, page 3/2 that an assessment of noise and vibration should also be undertaken without mitigation in place. The assessment periods reflect the detail of traffic data available.

5.7.51 For a detailed assessment, Annex 1 of DMRB Volume 11, Section 3, Part 7 provides a methodology for tabulating the noise changes based on the predicted noise levels for the various scenarios. A parallel assessment of change in noise nuisance has also been carried out. This methodology draws upon a number of studies that determined the percentage of people bothered by road traffic noise and are referred to in Annex 6 of the document.

5.7.52 The guidance for assessing temporary construction impacts in DMRB Volume 11, Section 3, Part 7 requires the identification of key construction operations likely to be the most significant; assessment of the extent and duration of such impacts taking account of proposed mitigation and expected restrictions likely to be agreed with the local authorities. Chapter 2 of DMRB Volume 11, Section 3, Part 7 refers to the legal control mechanisms set out in Control of Pollution Act 1974 and the guidance in BS5228 on prediction and mitigation of construction noise (BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1 – Noise (Ref 1.15) and vibration levels (BS 5228: 2009 +A1 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 2 - Vibration (Ref 1.16).

BS5228 Part 1 (Noise) (Ref 1.15) and BS5228 Part 2(Vibration) (Ref 1.16)

5.7.53 Construction noise impacts are assessed in accordance with BS 5228 Part 1 – Noise (Ref 1.15) which also provides recommendations for basic methods of noise control relating to construction and open sites. BS 5228 - Part 1 Noise provides guidance and recommendations on methods for the calculation of construction noise and the consequential assessment of its impact on those exposed to it.

5.7.54 In addition, BS 5228: - Part 1: Noise (Ref 1.15) makes reference to the legislative background regarding noise control on construction sites, and gives recommendations for basic methods of noise control. The Standard provides suitable methods for the calculation of noise from construction activities, including information regarding noise levels from a range of construction equipment.

5.7.55 BS 5228: 2009 +A1 2014 Part 2 - Vibration (Ref 1.16) provides guidance in relation to the effects of construction vibration upon the surroundings.

5.7.56 It is not possible to evaluate the effects of groundborne vibration during the construction phase as there is insufficient information regarding construction methods and propagation pathways to allow and accurate construction vibration assessment to be made according to BS5228-2. It is

recommended therefore that a construction vibration assessment be undertaken by the contractor, and appropriate mitigation measures proposed (if required) prior to works commencing. Any required mitigation measures would form part of the Construction Environmental Management Plan (CEMP)

Magnitude of Impacts

5.7.57 The assessment methodology for the evaluation of the considered Route Options has followed the 'Detailed' assessment methodology outlined in DMRB (Ref 1.1).

5.7.58 At the DMRB 'Detailed' level of assessment, the following two comparisons are required to be made in order to determine the impact of the Scheme in both the short term, and the longer term. These comparisons have been undertaken separately for the Scheme.

- Do-minimum scenario in the opening year (2020) against Do-something scenario in the opening year (2035): short term impact comparison.
- Do-minimum scenario in the opening year (2020) against Do-something scenario in the future assessment year (2035): long term impact comparison.
- Do-minimum scenario in the opening year (2020) against Do-minimum scenario in the future assessment year (2035): long term impact comparison.
- DMRB provides classifications for the magnitude of changes in predicted road traffic noise as outlined below.
- A change in road traffic noise of 1dB(A) (Do-minimum to Do-something in the opening year) is the smallest that is considered perceptible in the short term.
- A change in road traffic noise of 3dB(A) (Do-minimum in the opening year to Do-something in the future assessment year) is considered to be perceptible in the long term.

5.7.59 The magnitudes of impacts in the short and long terms are therefore considered differently within the DMRB methodology. For road traffic noise the classification of magnitude of change is reproduced from DMRB in Table 5-7-4 for both the short and long terms.

Table 5-7-4: Classification of Magnitude for Noise Impacts

Noise change, $L_{A10, 18 \text{ hour}}$	Magnitude of Impact
Short-Term (Opening Year)	
0	No change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5+	Major
Long-Term (Future Year)	
0	No change
0.1 – 2.9	Negligible
3 - 4.9	Minor

5 – 9.9	Moderate
10+	Major

5.7.60 Assessment and consideration of the magnitude and significance of effects in both the short and long terms will be undertaken within the following section in accordance with the DMRB rating scheme presented and discussed within the following sections of this Chapter.

Short Term Do-Something Assessment

5.7.61 The Do Minimum Opening Year noise contour (without the Scheme) is shown on Figure 5.7.2 and the Do Something Opening Year noise contour (with the Scheme) is shown in Figure 5.7.3. In order to assess the short-term impacts in line with DMRB’s detailed assessment a comparison has been made between Do-minimum scenario in the opening year (2020) against Do-something scenario in the opening year (2020): short term impact comparison.

5.7.62 A noise change contour for the Opening Year is shown on Figure 5.7.6.

5.7.63 This enables the consideration of abrupt changes in road traffic noise to be considered immediately following the opening of the Scheme. A summary table of the predicted short term noise changes within the study area are provided in Table 5-7-5 below.

Table 5-7-5: Short Term Noise Impacts

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
Increase in noise level, LA10,18-hour	0.1 - 0.9	27	0
	1.0 - 2.9	26	1
	3 - 4.9	7	0
	>5	9	0
No Change	0.0	3	0
Decrease in noise level, LA10,18-hour	0.1 - 0.9	68	0
	1.0 - 2.9	53	0
	3 - 4.9	23	1
	>5	32	0

5.7.64 The following is concluded with regard to the information presented in Table 5-7-5 above, based on the assumption that all receptors have a high sensitivity in the opening year of the Scheme:

- 3 dwellings and no (0) other sensitive receptors are predicted to experience a 0.0dB change in road traffic noise in the short term as a result of the Scheme. This would result in a short-term impact classification of no change.

- 27 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise of between 0.1dB to 0.9dB as a result of the Scheme. This would result in a short-term impact classification of **negligible adverse**
- 26 dwellings and 1 other sensitive receptor are predicted to experience short term increases in road traffic noise levels of between 1.0dB to 2.9dB as a result of the Scheme. This would result in a short-term impact classification of **minor adverse**. The other sensitive receptor which falls into this banding is Ysgol Gynradd School.
- dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of the Scheme. This would result in a short-term impact classification of **moderate adverse**.
- 9 receptors and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels above 5.0dB as a result of the Scheme, this would be classified as a **major adverse** impact at these receptors.
- 68 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 0.1dB to 0.9dB as a result of the Scheme. This would result in a short-term impact classification of **negligible beneficial**.
- 53 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 1.0dB to 2.9dB as a result of the Scheme. This would result in a short-term impact classification of **minor beneficial**.
- 23 dwellings and 1 other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of the Scheme. This would result in a short-term impact classification of **moderate beneficial**. The other sensitive receptor which falls into this banding is Gwynfa Care Home
- 32 dwelling and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of greater than 5.0dB in the short term as a result of the Scheme. This would result in a short-term impact classification of **major beneficial**.
- In the Opening Year of the Scheme (2020) other sensitive receptors (OSRs) across the Study Area are predicted to experience short term changes in road traffic noise level within the range of -3.5dB to +1.5dB. Ysgol Gynradd School experiences an increase of 1.5 dB(A) in the short term, which is considered **minor adverse**. The Standing Stones experience a decrease in noise of 3.5 dB in the short term, which is considered **moderate beneficial**.
- The change in predicted road traffic noise levels indicate that there would be **42 receptors which would experience a perceptible increase** in short term road traffic noise of greater than 1dB in the opening year with the Scheme. There would **108 residential receptors which would experience a perceptible reduction** in short term road traffic noise levels.

Long Term Do-Something Assessment

- 5.7.65 The Do Minimum Future Year noise contour (with the Scheme in place) is shown on Figure 5.7.4 and the Do Something Future Year noise contour (without the Scheme) is shown on Figure 5.7.5.
- 5.7.66 A noise change contour for the Future Year is shown on Figure 5.7.7.
- 5.7.67 In order to assess the long-term impacts in line with DMRB's detailed assessment a comparison has been made between Do-minimum scenario in the opening year (2020) against Do-something scenario in the assessment year (2035): Long term impact comparison.

5.7.68 This enables the consideration of longer term changes in road traffic noise to be considered associated with the Scheme. A summary table of the predicted long term noise changes within the study area are provided in Table 5-7-6 below.

Table 5-7-6: Long Term Noise Impacts

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
Increase in noise level, LA10,18-hour	0.1 – 2.9	63	0
	3 - 4.9	8	0
	5 - 9.9	8	0
	>10	2	0
No Change	0.0	7	0
Decrease in noise level, LA10,18-hour	0.1 – 2.9	114	1
	3 - 4.9	24	1
	5 - 9.9	22	0
	>10	0	0

5.7.69 The following is concluded with regard to the information presented in Table 5-7-6 above, based on the assumption that all receptors have a high sensitivity in the future year of the Scheme:

- 7 dwellings and 1 other sensitive receptor are predicted to experience a 0.0dB change in road traffic noise in the long term as a result of the Scheme. This would result in a long-term impact classification of no change. The other sensitive receptor which falls into this banding is Ysgol Gynradd School
- 63 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise of between 0.1dB to 2.9dB as a result of the Scheme. This would result in a long-term impact classification of **negligible adverse**.
- 8 dwellings and no other sensitive receptor are predicted to experience long term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of the Scheme. This would result in a long-term impact classification of **minor adverse**.
- 8 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise levels of between 5.0dB to 9.9dB as a result of the Scheme. This would result in a long-term impact classification of **moderate adverse**.
- 2 receptors and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels above 10.0dB as a result of the Scheme, this would be classified as a **major adverse** impact at these receptors.
- 114 dwellings and 1 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 0.1dB to 2.9dB as a result of the Scheme. This would result in a

long-term impact classification of **negligible beneficial**. The other sensitive receptors which falls into this banding is Ysgol Gynradd School

- 24 dwellings and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of the Scheme. This would result in a long-term impact classification of **minor beneficial**. The other sensitive receptors which falls into this banding is Gwynfa Care Home.
- 22 dwellings and 1 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 5.0dB to 9.9dB as a result of the Scheme. This would result in a long-term impact classification of **moderate beneficial**.
- 0 dwellings and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of greater than 10.0dB in the short term as a result of the Scheme.

5.7.70 In the Future Year of the Scheme (2035) other sensitive receptors (OSRs) across the Study Area are predicted to experience long term changes in road traffic noise level within the range of -3.9dB to -0.1dB. All OSRs therefore experience a decrease in noise level in the Future Year (2035) with the Standing Stones experiencing a decrease of 3.1 dB(A) and Gwynfa Care Home a decrease of -3.9 dB(A), which is considered **moderate beneficial**. Ysgol Gynradd School experiences a decrease of 0.1 dB(A) in the long term, which is considered **negligible beneficial**.

5.7.71 The change in predicted road traffic noise levels indicate that there would be **18 receptors which would experience a perceptible increase** in long term road traffic noise of greater than 1dB in the opening year with The Scheme. There would **46 residential receptors which would experience a perceptible reduction** in long term road traffic noise levels.

Long Term Do-Minimum Assessment

5.7.72 In order to assess the long-term impacts in line with DMRB’s detailed assessment a comparison has been made between Do-minimum scenario in the opening year (2020) against Do-Minimum scenario in the assessment year (2032): Long term impact comparison.

5.7.73 This enables the consideration of longer term changes in road traffic noise to be considered associated with the Scheme. A summary table of the predicted long term noise changes within the study area are provided in Table 5-7-7 below.

Table 5-7-7: Long Term Noise Impacts

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
Increase in noise level, LA10,18-hour	0.1 – 2.9	247	2
	3 - 4.9	0	0
	5 - 9.9	0	0
	>10	0	0
No Change	0.0	1	0
Decrease in noise level, LA10,18-hour	0.1 – 2.9	0	0
	3 - 4.9	0	0

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
	5 - 9.9	0	0
	>10	0	0

- 5.7.74 The following is concluded with regard to the information presented in Table 5-7-7 above, based on the assumption that all receptors have a high sensitivity in the future year of the Scheme:
- 5.7.75 In the Long-term Do-minimum comparison most receptors and both OSRs fall into the same band; between +0.1 - 2.9dB, with one receptor experiencing no change in noise level. This results in an overall classification of **negligible adverse**.
- 5.7.76 In the Opening Year of the Scheme (2023), for the Do-Minimum scenario, sensitive receptors across the Study Area are predicted to experience long term changes in road traffic noise level within the range of +0.6dB to +0.9dB.
- 5.7.77 The change in predicted road traffic noise levels indicate that there would be **0 receptors which would experience a perceptible increase** in long term road traffic noise of greater than 1dB in the opening year with The Scheme. There would **0 residential receptors which would experience a perceptible reduction** in long term road traffic noise levels.

Night-time Traffic Assessment

- 5.7.78 As part of a detailed DMRB assessment Night time impacts have been modelled using TRL (Transport Research Laboratory) Method 2. The results of the assessment showed that there are no receptors experiencing night time levels above 55dB, as a result this has not been included in this section of the report; this is in line with DMRB Part 7 HD 213/11 paragraph 3.38 which states that this is within the target level specified in WHO Night Noise Guidelines for Europe (Ref 1.14).

Construction Noise Assessment

- 5.7.79 At this stage, no specific details on the construction activities, programme or number and type of construction plant are available. Additionally the exact location, dimensions and total area which will be used for construction site compounds has not been agreed at the time of this assessment. As such the need for construction site compounds has not been assessed for impacts from construction noise. It should be noted that the appointed works contractor would need to seek and gain planning permission for the siting of construction compounds, which would encompass further environmental assessment and consultation with statutory consultees.
- 5.7.80 Therefore, detailed construction noise predictions at specific receptors have not been completed. Instead, a qualitative assessment has been adopted focussing on the likely noisy construction activities, the guidance in BS 5228:2009 +A1:2014 Code of practice for noise and vibration control on construction and open sites – Part1: Noise (Ref 1.13), and best practice mitigation measures. The assessment focuses on the impact at existing residential properties.
- 5.7.81 Based on the guidance in BS 5228-1 (Ref 1.13) the criterion for the onset of potentially significant effects at high sensitivity receptors is set at 75 dB $L_{Aeq,T}$ for normal daytime operations (08:00-18:00 weekdays and 09:00-13:00 Saturday). Construction works are scheduled to commence at 7:30 and a noise limit of 70dB $L_{Aeq,T}$ would apply between 07:30 and 08:00, If works are required outside the indicated hours then a permit would be applied for, this would be documented in the

Construction Environmental Management Plan (CEMP). The majority of the closest buildings to the proposed Development are residential in nature and are therefore classed as high sensitivity. Generally, the closest buildings to the south east of the site are industrial/commercial in nature and are therefore of medium or low sensitivity.

5.7.82 Part 1, Annex E of the BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1 – Noise (BSI, 2009) (Ref 1.13) gives different methods of guidance on significance of noise effects from construction, and recommends the ABC method to establish construction noise limits. The ABC method involves rounding the existing ambient noise levels to the nearest 5dB for the appropriate time period (night, evening/weekends or day) and then comparing these levels to the total noise level, including construction noise. If the total noise level exceeds the existing rounded value, then a significant effect is deemed to have occurred. This can be seen more clearly in Table 5-7-8.

Table 5-7-8: Threshold of Significant Effect at Dwellings from Construction

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

- Category A is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
- Category B is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.
- Category C is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.

5.7.83 If the existing ambient noise levels are higher than the threshold values presented in Table 5-7-8 then a significant effect is deemed to have occurred if the total L_{Aeq} noise level for the period increases by more than 3dB due to construction activity. The ABC method should only apply to residential receptors.

5.7.84 The main impact during the construction phase of the proposed scheme would be noise from plant and on-site construction traffic. Indicative construction noise levels have been predicted for representative residential receptor locations within the study area for typical phases of construction.

5.7.85 Details of typical plant which could be used by the contractor during the main construction phases are given in Table 5-7-9 together with their typical noise levels when in use at a reference distance

of 10m, as taken from tables within BS 5228. The source sound power level and the percentage of the working day that such plant normally operates enable a noise level to be calculated at an identified receptor. Construction plant would not normally operate continually throughout the working day (other than perhaps the occasional use of pumps and generators). A percentage 'on-time' of 75% has been assumed for all construction plant as this is a high-level usage but more realistic than assuming 100% on-time.

Table 5-7-9 Construction Plant and Associated Noise Level (dB(A))

Plant Description	Table Reference (BS5228)	Continuous L_{Aeq} @ 10m reference distance
Tracked Excavator	Table C2 no.2	77
Dump Truck	Table C6 no.15	90
Small Dump Truck	Table C1 no.11	80
Vibratory Roller	Table C5 no.24	84
Road Roller	Table C5 no.19	80
Compacting Roller	Table C2 no.36	81
Planer	Table C5 no.7	82
Concrete Pump	Table C3 no.25	78
Tracked Bulldozer	Table C5 no.18	80
Rotary Bored Piling Rig	Table C3 no.14	83
Mobile Crane	Table C4 no.43	70
Telescopic Crane	Table C4 no.39	77
Asphalt Paver and Tipper Lorry	Table C5 no.32	84
Breaker Mounted on Excavator	Table C1 no.9	77
Crawler Rig	Table C3 no.22	83
Tipper Lorry	Table C2 no.34	80
Transporters	Table C6 no.19	76
3 T Swivel Dumper	Table C4 no. 3	76
Wheeled Loader	Table C2 no 28	76
Articulated Low Loader	Table C2 no 26	80
Flat Bed Lorry 12 T	Table C5 no.21	80
Sheet Piling Rig	Table C12 no 2	100

Plant Description	Table Reference (BS5228)	Continuous L_{Aeq} @ 10m reference distance
Water Jet Compressor	Table C7 no.17	62
Generator for Tower Lighting	Table C4 no. 86	65
Tracked Excavator	Table C2 no.2	77

- 5.7.86 Predicted daytime noise levels (free-field) for the selected residential receptors have been calculated based on the above information. The predictions of indicative construction noise levels have followed a cautious approach in that, where assumptions are required to be made, the worst-case assumption has been applied each time.
- 5.7.87 The phases of construction cover wide areas along which the plant would be moving variably close to and further away from the different receptors. For the purposes of assessment, it has been assumed that each item of plant would be at the closest point to each receptor throughout the construction period for a worst-case scenario. In reality this would not be the case, and for a large proportion of the time the actual noise levels would be lower than those predicted.
- 5.7.88 In calculating the noise levels it has been assumed that the ground would be hard, and no attenuation has been included. Although much of the area is soft ground and some absorption could be expected some of the time, during periods of hard frost or very hot weather the ground would be hard. Hard ground has therefore been assumed for the calculations.
- 5.7.89 Predicted maximum noise levels represent worst case short duration impacts during the construction phase. In practice, noise levels are likely to be lower for much of the time.
- 5.7.90 Construction noise impacts will depend on the distance of works from receptor locations, therefore noise impacts have been predicted at distances of 50m, 100m, 200m and 500m from the works. A possible worst case has been presented by considering propagation across hard ground and by not considering screening afforded by topographical features, buildings or other structures. The predicted construction noise impacts associated with the various items of plant, with distance from source, are shown in see Vol 2 Appendix F, Assessment Appendix C.
- 5.7.91 The construction noise impacts predicted in Appendix C indicate that unmitigated noise levels will be significant (ranging from slight to substantial) within 200m of the works, with the highest noise levels experienced closer to source. The predicted noise levels are based on a possible worst case scenario, and it should be noted that construction noise tends to fluctuate and is usually of fairly short duration.
- 5.7.92 The construction noise impacts can however be mitigated, as described in section 5.7.100. The mitigation measures to be implemented would be selected to suit the specific circumstances at each construction area, considering the nature of the works, the plant to be used and the distance and position of the receptor locations in relation to the works. Fixed plant would for example be easier to screen, while screening would not be practical for mobile plant.
- 5.7.93 The effectiveness of the screening would depend on the properties of the screening material, the location of the acoustic screen in relation to the source, the height of the acoustic screen and the height of the receptor in relation to the noise source. As a rule of thumb, when there is no clear line of sight between noise source and receptor, a 10-dB reduction in noise level can be expected.
- 5.7.94 Beyond 200m from the works, construction noise impacts are expected to be negligible.

Mitigation

Vibration Mitigation

5.7.95 It is not possible to evaluate the effects of groundborne vibration during the construction phase as there is insufficient information regarding construction methods and propagation pathways to allow an accurate construction vibration assessment to be made according to BS5228-2. It is recommended therefore that a construction vibration assessment be undertaken by the contractor, and appropriate mitigation measures proposed (if required) prior to works commencing. Any required mitigation measures would form part of the Construction Environmental Management Plan (CEMP)

Road Traffic Noise Mitigation

5.7.97 The assessment of noise and vibration has been based on the Scheme with permanent acoustic mitigation in place (i.e. as part of the highway engineering design). The mitigation includes provision of low noise surfacing, embankments and placing of the Scheme in a cutting chainage 550 and chainage 920.

5.7.98 It may be possible to mitigate against some of the worst affected areas. At this point it has not been decided if any mitigation is to be put in place. Additional mitigation options include, but may not be limited to bunding and acoustic screening.

5.7.99 The Noise Insulation Regulation 1975 (amended 1988) (HMSO, 1988) (Ref 1.7) are designed in part to offer compensation to dwellings affected by adverse effects. In this case, there are no dwellings with levels above the 68dB threshold and as a result it's not mandatory to include compensation or triple glazing as part of the scheme.

Construction Noise Mitigation

5.7.100 Detailed measures to mitigate against construction noise impacts would be developed once a detailed construction programme and inventory of plant to be used is available, and would be agreed with relevant Stakeholders as part of each contractor's CEMP.

5.7.101 General construction management measures that would be put in place to limit environmental impacts. The CEMP for the proposed Development would include general measures to minimise noise impacts from the construction phase, including:

5.7.102 Best Practicable Means (BPM) (as outlined in Section 72 of the Control of Pollution Act 1974) would be employed in order to minimise noise and vibration levels throughout the period of the works.

- Recommendations and good practice as shown BS 5228 would be adopted.
- The measures set out in BS 5228 will include the following as appropriate:
- Construction works would be confined to the normal working hours as prescribed by Medway Council;
 - Careful selection of plant, construction methods and programming. Only plant conforming with relevant national or international standards, directives and recommendations on noise and vibration emissions would be used;
 - Construction plant will be located, as far as is reasonably practicable, away from adjacent occupied buildings or as close as possible to noise barriers or site hoardings where these are located between the plant and the buildings;
 - Static and semi-static plant/equipment would be fitted with suitable enclosures where practicable;

- Personnel would be instructed on BPM to reduce noise and vibration as part of their induction training and as required prior to specific work activities;
- When plant is not being used, it would be shut down and not left to idle;
- Vehicles would not wait with engines running;
- Where practicable, all audible warning systems and alarms would be designed to minimise noise. Broadband reverse alarms would be fitted to all vehicles;
- Local residents would be consulted in advance of the works commencing;
- Localised mobile screening would be used where reasonably practicable to reduce the noise levels from handheld tools such as breakers and saws.

Conclusion

5.7.103 The assessment shows that in the opening year of the scheme there are more receptors that will experience perceptible noise decreases than increases. In the future year, a greater number of properties will experience perceptible noise decreases than increases. As shown in Table 5.7.5, a total of 69 properties show an increase in noise level in the short term as opposed to 176 properties that present a decrease in noise level. Of these properties, 9 experience an increase of 5 dB or more while 32 properties experience a decrease of 5 dB or more. In the long term, as shown in Table 5.7.6, 81 properties present an increase in noise level while 160 properties experience a decrease in noise level.

5.7.104 In the Future Do-minimum assessment, where all receptors experience an increase due to natural traffic growth, however this increase is below the 3dB perceptible threshold.

5.7.105 During the construction of the proposed scheme, there may be potential for the ambient noise level at sensitive receptors to be exceeded. In the absence of mitigation, the effects of the construction activity on the nearby receptors are likely to range from negligible to major dependent upon their distance from the proposed scheme. However, these effects would be temporary and should be reduced to negligible with the implementation of the suggested mitigation measures.

Summary

5.7.106 Table 5-7-10 below summarises the finding of the report, the numbers represent the number of dwelling experiencing perceptible changes in the relevant scenario; in the future year, this is greater than 3dB and in the opening, it's greater than 1dB.

5.7.107 In the short-term, 42 receptors will experience an increase of more than 1 dB and 108 receptors will experience a decrease in noise levels of more than 1 dB. Nine (9) receptors would experience an increase of more than 5 dB, which is considered **major** in the short-term. Thirty-two (32) receptors would however experience a decrease of more than 5dB in the short-term.

5.7.108 In the long term, with the Scheme in place, 46 receptors would experience a perceptible decrease in noise level of 3 dB or more, while 18 receptors would experience a perceptible increase in noise level. Two (2) receptors would experience an increase of 10dB or more in the long term, which would be considered a **major** impact in terms of the noise change criteria in DMRB. The noise change would be expected in this instance where a new road link is provided.

5.7.109 It is however noted that at the two receptors experiencing an increase of 10dB or more, the predicted noise levels at the properties are 53.4 dB(A) and 34.1 dB(A) respectively. The lowest measured ambient noise levels as reported in Table 5-7-2 is 43.3 dB(A). At one receptor, the predicted noise levels will be below the lowest measured ambient noise levels.

Table 5-7-10: Summary of Effects

Short term Perceptible Decrease	Short term Perceptible Increase	Long term Do- Something Perceptible Decrease	Long term Do- Something Perceptible increase	Long term Do- Minimum Perceptible decrease	Long term Do- Minimum perceptible increase
108	42	46	18	0	0

Noise Chapter References

Ref 1.1 DMRB Volume 11, section 3, Part 7, 2011, Highways England

Ref 1.2 Environmental Noise Directive, 2002, European Commission

Ref 1.3 Control of Pollution Act 1974, 1974, HMSO

Ref 1.4 The Environmental Noise (Wales) Regulations, 2006, National Assembly for Wales

Ref 1.5 Land Compensation Act 1973, 1973, HMSO

Ref 1.6 The Noise Insulation Regulations 1975 (Amendment 1988), 1988, HMSO

Ref 1.7 Planning Policy Wales (Welsh Government, 2014)

Ref 1.8 Technical Advice Note (TAN11) Noise (Welsh Government, 1997)

Ref 1.9 Gwynedd Unitary Development Plan, 2009, Gwynedd Council

Ref 1.10 Snowdonia National Park Authority Eryri Local Development Plan 2007-2022 Written Statement Adopted Version, as adopted 13th July 2011

Ref 1.11 Snowdonia National Park Authority Supplementary Planning Guidance: General Development Considerations. September 2011

Ref 1.12 Calculation of Road Traffic Noise (CRTN), 1988, Department for Transport and Welsh Office

Ref 1-13 Interim Advice Note 185/15 (Highways Agency, 2015)

Ref 1.14 WHO Night Noise Guidelines for Europe, 2009, World Health Organisation

Ref 1.15 BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, 2014, British Standards Institution- Part 1 Noise

Ref 1.16 BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, 2014, British Standards Institution- Part 1 Noise

Ref 1-17 Technical Advice Note. Assessment of Noise (Scottish Government, 2011)

5.8 Effect on All Travellers

Introduction

- 5.8.1 This assessment considers the likely effects (both adverse and beneficial) of the Proposed Improvement on All Travellers. For the purpose of this assessment, travellers have been categorised into two groups; Non-Motorised Users (NMUs, which include pedestrians, cyclists and equestrians) and Vehicle Travellers.
- 5.8.2 As no specific DMRB guidance currently exists for the new topic Effects on All Travellers, this assessment combines two separate DMRB guidance notes as recommended by 125/09(W) 'Supplementary guidance for users of DMRB Volume 11, Environmental Assessment' (Highways Agency, October 2009):
- DMRB Volume 11, Section 3, Part 8 (June 1993) - Pedestrians, Cyclists, Equestrians and Community Effects; and
 - DMRB Volume 11, Section 3, Part 9 (June 1993) - Vehicle Travellers.
- 5.8.3 The assignment of the receptor value/importance, magnitude of impact and significance of effect was based on the guidance provided in the DMRB, Volume 11, Section 2, Part 5: HA205/08 (see Chapter 4.3 of this ES for further details).
- 5.8.4 The scope of the Effects on All Travellers assessment included the current and future users of the A496 and the network of roads (including public and private vehicle users) and NMU routes within the study corridor (see Figure 5.8.1, Volume 1a; NMU Context Plan) that could be directly affected during the construction or operational phases of the Proposed Improvement. It is not considered that any limitations were associated with the assessment which could influence the outcome.

Assessment Methodology and Criteria

Non-Motorised Users

Methodology

- 5.8.5 In accordance with the DMRB, Volume 11, Section 3, Part 8, the assessment of impacts on non-motorised users encompassed:
- Changes in NMUs' journey length (both journey distance and time taken);
 - Changes in NMUs' journey amenity (*i.e.* the relative pleasantness of a journey);
- 5.8.6 The method used to undertake the assessment, based on the aforementioned DMRB guidance, is therefore reported under the following headings in comparison with the 'Do Minimum' scenario:
- changes to NMU journey distance and journey times for community and strategic routes,
 - severance of PRow and other key NMU routes;
 - changes to journey amenity (*i.e.* journey pleasantness, journey difficulty, journey safety).

Further consideration of potential impacts upon the community is discussed in Chapter 5.9: *Community and Private Assets*.

- 5.8.7 The assessment began with a desk study, which included the analysis of maps and plans that covered the study area, including local OS maps.

5.8.8 Information was gathered regarding movements of pedestrians within the study corridor through consideration of trip generators and desire lines, and information available regarding apparent usage of local PRowS. Traffic monitoring carried out on the A496 both north and south of Llanbedr, and on Mochras Road from June 2015 to June 2016 provided an indication of the movements of cyclists within the study corridor.

5.8.9 The following were contacted with regard to the use of the study area by NMUs:

- Clwb Seiclo Madog (CSM) – CSM is a local cycling club based in Porthmadog
- Meirionnydd Ramblers – Ramblers Cymru is a charity that promotes walking and ensures that there are plenty of places to go for a walk; the Meirionnydd Ramblers group is one of 40 Ramblers Cymru groups.
- Gwynedd Council’s PRow Officer - As a local highway authority Gwynedd Council has statutory duties to record and keep public rights of way open.
- Snowdonia National Park Authority Access and Warden Services
- Sustrans Cymru - Sustrans, the cycling charity, creates public cycling access and provides information on cycle routes. They work directly with people to bring about behavioural change, therefore influencing government policy.
- Cadw - Welsh Government’s historic environment service were consulted regarding potential impacts upon the Meini Hirion SAM, and suggested improved pedestrian access towards this site as part of the works.

5.8.10 Consultation responses were received from Sustrans and Gwynedd Council, and are discussed in the Baseline Conditions section of this chapter.

Assessment Criteria

Sensitivity of Receptors

5.8.11 Table 5.8.1 describes NMU receptor sensitivity, which is based on the criteria in DMRB Volume 11, Section 3, Part 8.

Table 5.8.1: NMU Receptor sensitivity

Value/Sensitivity	Description
Very High	<i>Pedestrian, cyclist or equestrian routes that are used by vulnerable groups (the elderly, wheelchair users and children) to reach key community facilities</i>
High	<i>Pedestrian, cyclist or equestrian routes which provide frequently used community links, or routes that have high usage as a registered Public Right of Way or as part of a popular recreational trail.</i>
Medium	<i>Pedestrian, cyclist or equestrian routes which are available as links to community facilities but used infrequently, or routes that are moderately used as a registered Public Right of Way or as part of a recreational trail.</i>
Low	<i>Pedestrian, cyclist or equestrian routes that are used on an infrequent basis, have low amenity value and do not provide connection with community facilities</i>

Magnitude of Impacts

5.8.12 Table 5.8.2 describes the magnitudes of impact for the effects of improvements to NMU routes due to introduction of removal of severance, changes to journey distance, time, user safety and/or amenity as a result of the Proposed Improvement, based on the DMRB guidance.

Table 5.8.2: Impact magnitude for improvements to NMU routes

Magnitude of Impact	Description
Major	<i>Proposed Improvement is expected to substantially increase/decrease travel by active modes due to changes to journey distance, time, user safety and/or amenity.</i>
Moderate	<i>Proposed Improvement is expected to perceptibly increase/decrease travel by active modes</i>
Minor	<i>Proposed Improvement is expected to slightly increase/decrease travel by active modes</i>
Negligible	<i>Proposed Improvement is not expected to noticeably increase/decrease travel by active modes</i>

Significance of effects

5.8.13 The significance of an effect upon NMU routes (adverse or beneficial) is assigned by combining the value (or sensitivity) of the receptor (Table 5.8.1) with the magnitude of impact (degree of change) affecting it as a result of the Proposed Improvement. The matrix used for defining the potential outcomes of significance is shown in Table 5.8.3.

Table 5.8.3: Arriving at the Significance of Effect categories

		Magnitude of Impact (Degree of Change)				
		<i>No Change</i>	<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Environmental Value (Sensitivity)	<i>Very High</i>	Neutral	Slight	Moderate or large	Large or very large	Very large
	<i>High</i>	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	<i>Medium</i>	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	<i>Low</i>	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	<i>Negligible</i>	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight
		Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Vehicle Travellers

Methodology - View from the Road

- 5.8.14 The DMRB method requires the assessment of two types of impacts on vehicle travellers, namely; 'View from the Road' and 'Driver Stress', which are described in DMRB Volume 11, Section 3, Part 9, Chapter 2 and Chapter 4 respectively.
- 5.8.15 View from the road is defined as the extent to which travellers, including drivers, are exposed to the different types of scenery through which a route passes. The following aspects are taken into consideration:
- Types of scenery;
 - Extent to which travellers may be able to view the scene;
 - Quality of the landscape, and;
 - Prominence of view or Interesting Features.
- 5.8.16 For the purpose of this study the north and southbound journeys have been considered separately, as have journeys along Mochras Road. The assessment of the Proposed Improvement has been based on the current landscape proposals as shown in Volume 1a, Figures 5.3.18 – 5.3.21.
- 5.8.17 The driver's ability to view the surrounding landscape has been assessed at design year 15, unless otherwise stated, when replacement planting would have reached sufficient maturity to meet its environmental function. It has been assumed that by this design year the replacement hedgerows would have become established (see Chapter 5.3: *Landscape* for more details on the landscaping mitigation approach). The ability to see the surrounding landscape has been based on a driver's eye level of 1.2m.

Assessment Criteria - View from the Road

- 5.8.18 The impact assessment is based on the perceived change in views of the surrounding landscape between the 'Do Minimum' and the 'Do Something' scenarios at design year 15.

Sensitivity of Receptors

- 5.8.19 Four categories have been used in the assessment of vehicle travellers' ability to see the surrounding landscape (as set out in DMRB Vol. 11, Section 3, Part 9, Chapter 2) and are used to define the value/sensitivity of views from the road in Table 5.8.4 below:

Table 5.8.4: Value/sensitivity of views from the road

Value/Sensitivity	Description
Very High	<i>Open view – view extending over many miles</i>
High	<i>Intermittent view – shallow cuttings and barriers at intervals</i>
Medium	<i>Restricted view – frequent cuttings or structures blocking view</i>
Low	<i>No view – e.g. road in deep cutting or surrounded by other structures</i>

Magnitude of Impacts

- 5.8.20 Table 5.8.5 describes the magnitude of impacts of changes in views from the road as a result of the Proposed Improvement.

Significance of effects

5.8.21 The significance of an effect upon views from the road (adverse or beneficial) is assigned by combining the value (or sensitivity) of the receptor (Table 5.8.4) with the magnitude of impact (degree of change) affecting it as a result of the Proposed Improvement. The matrix used for defining the potential outcomes of significance is shown in Table 5.8.3.

Table 5.8.5: Magnitude of impacts associated with change in views from the road

<i>Magnitude of impacts</i>	<i>Description</i>
Major	<i>Major change in vehicle travellers' ability to see the surrounding landscape</i>
Moderate	<i>Moderate change in vehicle travellers' ability to see the surrounding landscape</i>
Minor	<i>Minor change in vehicle travellers' ability to see the surrounding landscape</i>
Negligible	<i>Negligible change in vehicle travellers' ability to see the surrounding landscape</i>
Neutral	<i>No changes in views from the road</i>

Methodology - Driver Stress

5.8.22 For the purposes of this assessment, Driver Stress is defined as the adverse mental and physiological effects experienced when traversing a road network, which has three main components:

- Frustration;
- Fear of potential accidents, and;
- Uncertainty relating to the route being followed.

5.8.23 Frustration can arise when the driver is unable to drive at the speed they wish. This can result from high traffic flows, congestion, intersections, road works or being unable to overtake slow-moving vehicles.

5.8.24 The presence of other vehicles, inadequate stopping sight distances, inadequate lighting, narrow roads, road works, poorly maintained road surfaces and the likelihood of pedestrians stepping into the road are all contributing factors that can exacerbate the fear of accidents.

5.8.25 Route uncertainty can be caused by inadequate signing for an individual's direction of travel or poor route preparation and/or planning.

Assessment Criteria - Driver Stress

5.8.26 The impact assessment is based on the estimated change in driver stress throughout the study corridor of the Proposed Improvement between the 'Do Minimum' and the 'Do Something' scenarios at design year 15.

Sensitivity of Receptors

5.8.27 The DMRB guidance in relation to Vehicle Travellers (Volume 11, Section 3, Part 9, Chapter 4) states that there have been no reliable correlations established between physical factors and driver stress. However, guidance is given on the appropriate category of stress for use in environmental assessments; providing the speeds and flows exist during peak hour flows for at least one kilometre of the route (refer to Table 5.8.6 for dual carriageways). The guidance states that the assessment should be made for the worst year in the first fifteen after opening.

5.8.28 Indicative values/sensitivity of driver stress levels based on the categories of stress are also provided in Table 5.8.6; where a high level of driver stress corresponds to a low value/sensitivity of receptor (and vice versa).

Table 5.8.6: Appropriate category of driver stress (and value/sensitivity) for use in environmental assessment (DMRB Volume 11, Section 3, Part 9, Chapter 4, Table 3 – single-carriageway roads)

Average peak hourly flow per lane, in flow Units / 1 hour	Average Journey Speed km/hr		
	Under 50	50 - 70	Over 70
Under 600	High <i>(low value/sensitivity)</i>	Moderate <i>(medium value/sensitivity)</i>	Low <i>(high value/sensitivity)</i>
600 – 800	High <i>(low value/sensitivity)</i>	Moderate <i>(medium value/sensitivity)</i>	Moderate <i>(medium value/sensitivity)</i>
Over 800	High <i>(low value/sensitivity)</i>	High <i>(low value/sensitivity)</i>	High <i>(low value/sensitivity)</i>

Magnitude of Impacts

5.8.29 Table 5.8.7 describes the magnitude of impacts of changes in driver stress levels as a result of the Proposed Improvement.

Table 5.8.7: Magnitude of impacts associated with change in driver stress levels

Magnitude of impacts	Description
Major	<i>Proposed Improvement results in significant changes in driver stress levels</i>
Moderate	<i>Proposed Improvement results in moderate changes in driver stress levels</i>
Minor	<i>Proposed Improvement results in slight changes in driver stress levels</i>
Negligible	<i>Proposed Improvement results in negligible changes in driver stress levels</i>
Neutral	<i>No changes in driver stress levels</i>

Significance of effects

5.8.30 The significance of an effect upon driver stress (adverse or beneficial) is assigned by combining the value (or sensitivity) of the receptor (Table 5.8.6) with the magnitude of impact (degree of change) affecting it as a result of the proposed improvement. The matrix used for defining the potential outcomes of significance is shown in Table 5.8.3.

Baseline Conditions

Regulatory / Policy Framework

5.8.31 There is legislation and several planning policies which have relevance to the assessment of 'Effects on All Travellers' and many of these have already been introduced in Chapter 2 of this ES. However, those outlined in this section are considered to be particularly pertinent to the

assessment on travellers, and are mainly focussed on the impacts and opportunities for NMUs from new developments.

The Wales Transport Strategy (One Wales: Connecting the Nation)

5.8.32 The Wales Transport Strategy (One Wales: Connecting the Nation) places high emphasis on the promotion of sustainable transport networks that safeguard the environment while strengthening the country's economic and social quality of life. Promotion of walking and cycling is key to reducing greenhouse gas emissions and other environmental impacts, which is one of the priorities of the Strategy. Improving access between key settlements and sites, integrating local transport, enhancing international connectivity and increasing safety and security are also priorities of the Strategy, which relate to all travellers.

The Active Travel (Wales) Act 2013

5.8.33 The purpose of the Act is to require local authorities to continuously improve facilities and routes for pedestrians and cyclists and to prepare maps identifying current and potential future routes for their use. In relation to the Proposed Improvement, the Act specifically makes provision for: '*requiring the Welsh Ministers and local authorities, in constructing and improving highways, to have regard to the desirability of enhancing the provision made for walking and cycling*'.

The Walking and Cycling Action Plan for Wales 2009 – 2013

5.8.34 This Act is of particular importance to this chapter as it is designed to encourage more people to walk and cycle more safely and more frequently. The objectives and actions are set out in Section 3 of the Action Plan.

Trafnidiaeth Canolbarth Cymru (TraCC) Regional Transport Plan, 2009

5.8.35 This Local Transport Plan has been jointly prepared by the three Local Authorities for mid Wales, namely Powys, Ceredigion and Gwynedd (Meirionnydd) and has been overseen by TraCC as a Joint Committee of the local authorities for transport. The three local authorities are working together to facilitate economic development, ensure access for all to services and opportunities, sustain and improve the quality of community life, and make an active contribution to the management of carbon and the quality of the environment by delivering in partnership an integrated and affordable transport system in the region.

5.8.36 The Plan covers a detailed programme from 2015-2020 and a framework for schemes until 2030. Llanbedr Airfield Access improvement scheme is identified in the LTP as a Higher Level Intervention scheme to improve accessibility to employment and services that is of National significance.

Gwynedd Rights of Way Improvement Plan 2007 – 2017

5.8.37 The Rights of Way Improvement Plan provides a ten-year challenge and opportunity for the council to adapt and review the network to meet modern day needs and so to help deliver wider benefits for both Gwynedd's residents and its visitors. The following all have relevance to NMU's.

- Development proposals will be refused if they create an unacceptable increase in traffic on Rural Lanes where walkers, cyclists or horse riders are expected to be the main users.
- One of the main responsibilities of the Rights of Way Section is to advise in the planning process on the effect of proposed development on Public Rights of Way and assist in the processing of applications to create, divert or extinguish Public Rights of Way to suit the needs of developers, including through public inquiry and beyond if necessary.

- Cyclists want the existing rights of way networks to be better integrated with planned cycle routes and those currently found on the highway network, in addition to linking towns and villages with the countryside.

Snowdonia National Park Authority LDP 2007 - 2022

5.8.38 The National Park Authority is committed to improving access to local facilities and reduces the need to travel especially by private car. Within the National Park walking and cycling, improved access to public transport and provision of facilities will be encouraged.

Development will be supported where:

- The provision of services is located so as to minimise the need to travel.
- There is convenient access via footpaths, cycle paths and public transport, thereby encouraging the use of these modes of travel for local journeys, reducing the need to travel by private car and improving the accessibility of services to those with poor availability of transport.
- There is an improvement in accessibility for all, in particular disabled people.
- Changes to the road network do not damage or cause detrimental effects to PRoW. Where possible, these improvements to the road network will feature provision for segregated pedestrian and cycling uses.
- It will reduce or remove vehicle traffic from within town centres and where possible from rural areas.
- The natural environment of the park is not adversely affected.
- Secure cycle parking facilities are provided where appropriate. The National Park Authority will continue to support appropriate sustainable transport and community transport initiatives. The recreational routes identified on the proposals map will be safeguarded from development which would prevent their use as recreational routes.

Non-Motorised Users

Trip generators

5.8.39 Trip generators are considered as places of employment, education, retail, recreation or community facilities that the public might travel to on foot or by bicycle; and may be located either within or near to the study area. The locations of trip generators identified within the study area are shown on the NMU context plan (see 5.8.1, Volume 1a).

Residential Areas:

- Bryn Deiliog
- Coed Artro
- Ystad y Wenallt
- Mochras Road
- Riverside Bungalows
- Along the A496 through Llanbedr
- Other residential properties

Education:

- Ysgol Gynradd Llanbedr
- Ysgol Feithrin Llanbedr

Employment:

- Llanbedr Aerospace Centre and Enterprise Zone
- Various retail/commercial units in the village and on outskirts
- Shell Island campsite

Commercial / Retail:

- Village stores
- Cycle sales/hire
- Hair salon
- Hotel / Public house / B & B's
- Commercial / retail units at Llanbedr Enterprise Zone

Community Facilities:

- Bus stops
- Train Holt/Station
- Playing field
- Village hall
- Places of worship (St. Peter's Church)
- Village Post Office

Desire lines

5.8.40 Desire lines are routes that people travelling on foot or by bicycle are likely to take in order to access any trip generators identified. The desire lines were identified by mapping the trip generators listed above on a detailed map of Llanbedr and noting all the available routes likely to be used. The desire lines identified within the study area are listed in Table 5.8.8 along with a value/sensitivity rating according to the criteria provided in Table 5.8.1. The location of starting points and destinations included in Table 5.8.8 are shown on the NMU context plan (see Figure 5.8.1, Volume 1a).

Table 5.8.8: Desire lines through the study area

To	From	Route	Value / Sensitivity
Nursery, Primary School and Village Hall on Cwm Nantcol Road	Coed Artro, Bryn Deiliog, Maes Artro and properties along A496 south of Llanbedr bridge.	North on A496 over Pont Llanbedr and east along Cwm Nantcol road. Segregated footway over Pont Mochras and north side of Cwm Nantcol road.	High
	Mochras Road properties	East on footway along Mochras Road and over Pont Llanbedr on A496 and east on footway along Cwm Nantcol Road	High
	Properties on A496 north of Llanbedr	South on A496 (no footway) and east on footway along Cwm Nantcol Road.	High

Post Office, Village Stores, Public House and Bus Stops	Coed Artro, Bryn Deiliog, Maes Artro and properties along A496 south of Llanbedr bridge.	North on A496 over Pont Llanbedr. Segregated footway over Pont Mochras only.	High
	Mochras Road properties and Shell Island	East on segregated/ discontinuous footway along Mochras Road and over Pont Llanbedr on A496	High
	Properties on A496 north of Llanbedr	South on A496 (no footway)	High
	Ystad y Wenallt, Riverside Bungalows and other properties on Cwm Nantcol road	West along footway on Cwm Nantcol Road	High
Railway Holt, Llanbedr, Cycle sales/hire, Aviation Centre and Enterprise Park	Coed Artro, Bryn Deiliog and properties along A496 south of Llanbedr bridge.	North on A496 to Pont Llanbedr and west along Mochras Road. Discontinuous footways on Mochras Road.	Medium
	Properties on A496 north of Llanbedr	South on A496 (no footway) over Pont Llanbedr and west along Mochras Road. Discontinuous footway on Mochras Road	Medium
	Ystad y Wenallt, Riverside Bungalows and other properties on Cwm Nantcol road	West along footway on Cwm Nantcol Road, over Pont Llanbedr and west along Mochras Road. Discontinuous footways on Mochras Road.	Medium
St Peters Church	Coed Artro, Bryn Deiliog and properties along A496 south of Llanbedr bridge.	North on A496 over Pont Llanbedr. Segregated footway on Pont Llanbedr.	Medium
	Properties on A496 north of Llanbedr	North/south on A496 (no footway)	Medium
	Ystad y Wenallt, Riverside Bungalows and other properties on Cwm Nantcol road	West along footway on Cwm Nantcol Road and north along A496. No footway on A496.	Medium
	Mochras Road properties	East on segregated/ discontinuous footway	Medium

		along Mochras Road and north over Pont Llanbedr on A496. Apart from footway over Pont Llanbedr, no footway on A496.	
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Footpaths

5.8.41 As the residential centre of the study area, pedestrian movements are mainly expected to occur within Llanbedr village. However a network of facilities for pedestrians exists within the wider surroundings of the village. The eight Public Rights of Way (PRoW) identified through a desktop study as being located within the zone of influence of the Proposed Improvement are described in Table 5.8.10 and are shown in the PRoW plan (see Figure 5.8.2a, Volume 1a) with the value/sensitivity for individual PRoW's categorized according to the criteria described in Table 5.8.1. The Wales Coastal Path follows the network of PRoWs to the west of Llanbedr between Coronation Bridge and Mochras Road before following the road towards the coastline. The overall value/sensitivity of pedestrian provisions within the study area are considered as **High**.

5.8.42 Footpath value/sensitivity rating has been partly informed by a PRoW categorisation system used by Gwynedd Council in order to prioritise footpath maintenance works; this system is based on levels of apparent footpath usage as well as current or potential utility, with ratings assigned following consultation with community representatives. No permissive routes were identified during the desktop search.

Cycleways

5.8.43 The National Cycle Network Route (NCR) 8, which is part of the Lôn Las Cymru connecting Holyhead to Cardiff, passes the eastern side of Llanbedr. From the north NCR8 enters the centre of the village along the north side of the Afon Artro from the class 3 road which emerges by the Ty Mawr Hostel; the route crosses the river over Pont Llanbedr and follows the A496 for a short distance before joining the class 3 road which climbs to the south east from Llanbedr on the south side of Bryn Deiliog estate.

5.8.44 Mochras Road is recognised as a Local Cycle Route on the Sustrans Wales website which links Pont Llanbedr (and therefore NCR8) to the coast via Shell Island. The local highway network within the study area, the A496 in particular, is also considered to be widely used by cyclists. Details of designated cycle routes and routes used by cyclists are included in Table 5.8.10 and are shown in the NMU context plan (see Figure 5.8.1, Volume 1a).

5.8.45 Information regarding movements of cyclists within the study area has been collected using fixed point monitoring stations at various locations across the highway network over a 12 month period between 2015 and 2016. The position of the various traffic monitoring locations are shown in the traffic/NMU monitoring plan (see Figure 5.8.2b, Volume 1a). Table 5.8.9 below provides a summary of the results obtained from this survey as mean annual daily flows. The survey data provided in Table 5.8.9 has partly informed the value/sensitivity ratings for the cycle routes within the study area. The overall value/sensitivity of cycle routes within the study area are considered as **High**.

Table 5.8.9: Cyclist survey data collected within the study area (2015/16)

Monitoring Location	Flow (cyclist/day)
A496 North of Llanbedr	6
A496 Pont Llanbedr	7
Ffordd Mochras	2

Equestrians

5.8.46 Two designated bridleways are known to exist in the area surrounding Llanbedr according to a desktop study. PRoW 43 runs north from the A496 south of Llanbedr between Plas y Bryn farm and the railway, emerging near the railway crossing on Mochras Road. PRoW 42 starts from the class 3 road which follows the north side of the Afon Artro to the east of Llanbedr, approximately 500m from the village centre, and provides an alternative route in front of Plas Gwynfryn for approximately 500m before re-emerging further east; see the PRoW plan (see Figure 5.8.2a, Volume 1a). It is assumed that equestrians also make use of the class 3 road network in order to access the designated bridleways within the study area. Both of these routes are assigned a **Medium** sensitivity/ value rating.

Table 5.8.10: Designated NMU routes identified within the study area - refer to NMU context plan and PRoW plan (Figures 5.8.1 and 5.8.2a, Volume 1a)

Number	Right of way type	Location and description	Value / Sensitivity
Wales Coastal Path	Footpath/ Class 3 road	The Wales Coastal Path follows PRoWs Nos 87 and 1 the west of Llanbedr to link a section of the path which runs adjacent to the A496 to the north of the village towards Mochras Road. The path then follows Mochras Road over the railway towards the coastline.	High
PRoW Llanbedr No.1	Footpath	From the A496 this path follows the flood defence bank on the east side of the Artro before crossing Coronation Bridge and returning to Mochras Road on the west bank of the river. Forms a circular walk from Llanbedr village and a section of this path is also part of the Wales Coastal Path (between PRoW 56 Llanfair and Mochras Road).	High
PRoW Llanbedr No.4	Footpath	From the A496 north of Llanbedr, the PRoW follows a track to the east up past the properties of Bryn, The Barn and Mor Awelon before skirting around Cae Nest Hotel. Forms a link between Llanbedr village and a network of PRoWs on higher ground to the east.	Medium
PRoW Llanbedr No.41	Footpath	From the south-eastern side of Pont Llanbedr, the PRoW skirts around the village playing field and the property of Tyddyn y Pandy before joining an unclassified county road further east. Also forms a link between Llanbedr village and a network of PRoWs on higher ground to the east.	High

PRoW Llanbedr No.42	Bridleway	Starts from the class 3 road which follows the north side of the Afon Artro to the east of Llanbedr, approximately 500m from the village centre, and provides an alternative route in front of Plas Gwynfryn for approximately 500m before re-emerging further east	Medium
PRoW Llanbedr No.43	Bridleway	From the A496 to the south of Llanbedr, the PRoW passes the properties of Plas y Bryn farm and Talwrn Bach before joining Mochras Road near the railway crossing.	Medium
PRoW Llanbedr No.73	Footpath	From the A496 to the south of Llanbedr, the PRoW follows an easterly direction past the properties of Bryn Heulog and Hen Efail, eventually joining the class 3 road which climbs to the south east from Llanbedr.	Medium
PRoW 87 Llanbedr	Footpath	From the A496 to the north of Llanbedr, this path follows the access of the Welsh Water Treatment Facilities towards the Coronation Bridge over the Afon Artro, therefore providing a short link for the the Wales Coastal Path between PRoW 56 Llanfair and PRoW 1 Llanbedr.	High
PRoW 30 Llanfair	Footpath	This path connects the A496 at the point of access to the Welsh Water Treatment Facilities towards the network of Class 3 roads on higher ground directly to the east.	Medium
NCN Route 8 (Lôn Las Cymru)	Class 3 road	National Cycle Route 8 forms the Holyhead to Cardiff cycle route, known as Lôn Las Cymru. The official route utilises the country lanes to the east of Llanbedr;	High
Mochras Road Local Cycleway	Class 3 road	A local cycling route that runs from Llanbedr towards the coast along Mochras Road.	High
A496 through Llanbedr	Class 1 road	Anecdotal evidence and traffic survey suggest that cyclist use the A496 through Llanbedr.	High

5.8.47 For the 'Do Minimum' option it is expected that the existing NMU routes identified within the study area would remain on their existing alignments and would be maintained by the local highway authority to allow continual use throughout the year. Maintenance works on PRoW are expected to consist of cutting back vegetation to allow access in spring and summer as well as replacement of gates and stiles as necessary. Maintenance works along the cycle routes are expected to involve cutting back roadside vegetation to allow forward visibility for both motorists and NMUs.

Vehicle Travellers

View from the Road - A496

5.8.48 Due to local changes in setting and topography the views offered for travellers using the existing A496 vary significantly across the study area. For this reason the description of the baseline conditions considers both north and southbound views from three sections of the existing A496: south of Llanbedr, north of Llanbedr and also within Llanbedr village. Table 5.8.11 (a and b) describe the views from the existing A496 and assigns value/sensitivity based on the criteria described in Table 5.8.4.

Table 5.8.11a Views from the existing A496 for northbound travellers

A496 (northbound)	Description	Description and Value / Sensitivity
South of Llanbedr	<p>The A496 at this location is in an elevated position in relation to the land north and west of the carriageway and provides far reaching views in these directions. The views northwards are predominantly of Tremadog Bay and the high ground of Moel Ddu, Moel Hebog and Garnedd Goch beyond</p> <p>Looking west there is a prominent view of Llanbedr Airfield, Morfa Dyffryn sand dunes and the campsite at Shell Island, with Tremadog Bay and the coast of Penrhyn Llŷn providing the backdrop.</p> <p>The views to the north and west are open with only small amount of features restricting the view. The ground on the eastern side of the A496 slopes upward and therefore there is essentially no view to the side of the road at this location.</p> <p>The features of particular interest within the view of the road travelling in a northbound direction are the sea of Tremadog Bay, the coast of Pen Llŷn and the Mountains of Snowdonia.</p>	<p>Intermittent view</p> <p>High Value/Sensitivity</p>
Through Llanbedr	<p>Northwards of Tan-y-Bryn Lodge, the view in all directions become restricted by frequent trees and hedgerows, cloddiau and high stone walls; there is essentially no view along the section between Tan-y-Bryn Lodge and the northern end of Llanbedr. The view within the village of Llanbedr is restricted due to the built up nature and continuous line of buildings along both side of the A496.</p>	<p>No view</p> <p>Low Value/Sensitivity</p>
North of	Departing Llanbedr to the north, passing the	Restricted view

Llanbedr	<p>properties of Maes-y-Llan (new residential properties); the view from the A496 opens up and provides an open view of adjacent fields to the north and west and then becomes obstructed towards the most northern end of the study area by more frequent trees and hedgerows along the highway boundary. Due to the vegetation screening offered by the railway embankment, the views to the west do not extend beyond the agricultural land directly adjacent to the A496 carriageway.</p> <p>The views to the east remains to be predominantly of residential property or heavily vegetated hillside; though a wide expanse of grazing fields and an immediate backdrop of higher ground become visible on leaving the village, obstructed only by roadside vegetation.</p>	Medium Value/Sensitivity
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Table 5.8.11b Views from the existing A496 for southbound travellers

A496 (southbound)	Description	Value / Sensitivity
North of Llanbedr	<p>Approaching Llanbedr from the north there is an open view from the A496 of adjacent fields to the south and west which is obstructed in places by roadside vegetation and restricted by the vegetation screening growing alongside the adjacent railway embankment. The elevated ground near Plas y Bryn farm can be seen above the stands of woodland either side of the Afon Artro.</p> <p>Views to the south and east before entering the village are largely restricted by a more continuous line of roadside vegetation and the dense vegetation which surround the properties at Mor Awelon and Bryn Amlwg.</p>	Restricted view Medium Value/Sensitivity
Through Llanbedr	The view within the village of Llanbedr is restricted in all direction due to the continuous line of buildings along both side of the A496.	No view Low Value/Sensitivity
South of Llanbedr	The views from the road to the south side of Llanbedr are essentially restricted in all directions up to the Tan y Bryn Lodge. From this point far reaching views open up to the west of a wide expanse of pastoral land with the dunes of Morfa Dyffryn in the background. Views to the south are generally limited by the rising	Restricted view Medium Value/Sensitivity

	elevation of the road; similarly views to the east expose a narrow strip of agricultural land, beyond which a continuous elevated woodland block restricts extended views.	
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5.8.49 Overall therefore the value/sensitivity of views for current travellers along the A496 within the study area has been assigned as **Medium**.

View from the Road - Mochras Road

5.8.50 The assessment of the view for vehicle travellers along Mochras road has been divided into two sections; travelling east between the railway crossing and the car park, and travelling west from the A496 junction to the car park. Table 5.8.12 describes the current views from Mochras Road and assigns value/sensitivity based on the criteria described in Table 5.8.4.

5.8.51 There would be no change in the view when travelling in the opposite directions along these sections, therefore these travellers will not be considered further. Views of the study area from Mochras Road to the west of the railway are largely screened by vegetation alongside the railway to the north of the Afon Artro, and by the elevated ground contours to the south of the river.

Table 5.8.12 Views from Mochras Road either side of the Proposed Improvement

Travel Direction	Description	Value / Sensitivity
East of Mochras Road car park (westbound)	There are largely obstructed views from the road when travelling in a westerly direction along Mochras Road between the A496 junction and Mochras Road car park. This is due to the continuous line of trees growing along the banks of the Afon Artro to the north, and the line of properties with heavily wooded gardens abutting to road to the south. Rising pastoral fields offer little views to the south on approaching the location of the car park.	No view Low Value/Sensitivity
West of Mochras Road car park (eastbound)	Open views across a wide expanse of lowland pasture are offered from the road to the north and east when travelling from the railway crossing; wooded higher ground above Llanbedr and Llanfair provide a backdrop though immediate views are broken up by tree-lined field boundaries. To the south views are limited by a thick roadside hedge line, beyond which the ground rises steeply from the road obstructing views beyond the immediate area.	Restricted view Medium Value/Sensitivity

5.8.52 Overall therefore the value/sensitivity of views for current travellers along Mochras Road within the study area has been assigned as **Low**.

Driver Stress

- 5.8.53 Driver stress is caused by various factors including road layout and geometry, road surface characteristics, junction frequency, speed and traffic flow per lane. These cause drivers to experience discomfort, annoyance, frustration or fear resulting in varying degree of tension. As traffic movements within the study area along both the existing A496 and Mochras Road are restricted by a 30mph speed limit, the criteria provided in Table 5.8.6 to determine driver stress levels is not applicable for the baseline situation.
- 5.8.54 Current driver stress within the study area is largely caused by congestion along the A496 and Mochras Road when traffic volumes are highest during summer months. The narrow bridge in combination with two busy junctions either side of the bridge and parked cars along Mochras Road, cause significant amount of congestion, particularly during peak tourist season, increasing travelling time which is likely to increase driver stress. This situation is exacerbated by larger vehicles wishing to enter or exit Mochras Road, as these vehicles are likely to face difficulty manoeuvring due to the tight radii currently provided.
- 5.8.55 Also, parked cars on the A496, to the south of the bridge and junction limit visibility to the right (south) for vehicles emerging from Mochras Road, forcing drivers to move over the give way line for better line of sight. The view north, over the bridge when exiting Mochras Road is poor, due to the height of the parapet wall on the bridge and the angle at which the A496 approaches the junction (reflex angle). Poor visibility at the junction possibly increases the drivers discomfort in negotiating the junction and increases driver stress.
- 5.8.56 There are commercial and residential properties on both sides of the A496 within the study area with frontage, driveways and entrances emerging directly onto the road. People/pedestrians and/or vehicles emerging from these properties/driveways or entrances are likely to emerge without any prior notice to travellers.
- 5.8.57 Road side footways within the study area are intermittent and narrow and do mean that pedestrians are forced to step onto the road at some sections. Users of mobility equipment would also find it difficult to negotiate the footways, and are therefore likely to use the road instead. When pedestrians are using the road, vehicular travellers may have to stop in order to allow oncoming traffic to pass before they can pull out to the opposite lane to negotiate around the pedestrians on the road. This is likely to cause some congestion, increase journey times and also increase driver discomfort as there is an inherent increase in risk of collision between both pedestrians and oncoming vehicles.
- 5.8.58 In spite of the factors described above, as the high traffic levels and associated congestion problems within the village are mainly limited to the months which coincide with peak holiday season, the base line value for driver stress has been assigned a value of moderate and therefore a **Medium** sensitivity/value rating.

Magnitude of Impacts and Significant Effects

- 5.8.59 This section considers the magnitude of impacts and significance of effects in conjunction with established good practice and embedded design measures, which are expected to be applied during the construction and operational phases respectively. As a result of these, no further specific mitigation measures are proposed and the magnitude of impact and significance of effect is not expected to change from what is reported in this section.
- 5.8.60 It is expected that good site working practices during the construction phase including clear signage and consideration of the effects on all travellers when designing traffic management measures during construction would reduce the severity of any temporary impacts caused by severance or disruption to existing routes. However, adverse effects from temporary delays

leading to longer journey times would remain until the completion of the works and this is discussed in the following section.

- 5.8.61 One of the main aims of the Proposed Improvement is to address congestion within the centre of Llanbedr which should reduce stress levels for vehicular travellers within the study area whilst also improving conditions for NMUs within and around the village. Additional design measures are also described which have been developed to enhance the network of facilities within the study area for all travellers.

Non-Motorised Users - Construction Period

Pedestrians

- 5.8.62 It is not expected that traffic volumes within the centre of Llanbedr would reduce significantly during construction of the Proposed Improvement as the new alignment is almost exclusively offline, though traffic management on the tie-ins at each end of the scheme may result in vehicles passing through the village in waves rather than being naturally dispersed. However the impacts upon pedestrians travelling along the desire lines described previously are generally expected to be minimal during construction. Mochras Road would be re-aligned to allow a tie-in with the Proposed Improvement and also crossed by a proposed overbridge near the location of the car park, and therefore any pedestrians travelling along the road are likely to be re-routed along a temporary diversion away from construction activities.
- 5.8.63 The main impact upon the designated pedestrian network is expected to occur due to the realignment of a 200m section of Mochras Road which incorporates the Wales Coastal Path between the west flood bank of the Afon Artro and the railway, see Detailed Proposals (Figures 2.3 – 2.5, Volume 1a). It is expected that users of the path would be accommodated during the construction phase however they are likely to be re-routed along a diversion route for certain periods of the works, and would almost certainly encounter the site to some degree; though the level of disturbance depends upon the principal contractors works programme and temporary arrangements.
- 5.8.64 Also the Proposed Improvement crosses over the line of the PRoW No 1 where the flood defence bank currently turns north to follow the east bank of the Afon Artro, see Detailed Proposals (Figures 2.3 – 2.5, Volume 1a). It is likely that PRoW No 1 between the existing A496 and Coronation Bridge would be closed for a period during construction stage until it is possible to direct pedestrians through the permanent diversion route (see below), again the timing and length of such a closure depends upon the principal contractors works programme.
- 5.8.65 The Proposed Improvement also extends to the starting points of various footways which currently either commence from the A496 or Mochras Road, these include: PRoW 43 footpath as it emerges onto Mochras Road near the railway line; PRoW 87 Llanbedr and PRoW 30 Llanfair as they emerge onto the A496 near the water treatment facilities near the very northern tie-in. The interface with these footpaths is less severe and it is expected that access should remain unaffected for the duration of the works.
- 5.8.66 Overall it is considered that with good planning and site management the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon pedestrians in the study area, resulting in a **moderate** significant effect.

Cyclists

- 5.8.67 Cyclists using NCN Route 8 (Lôn Las Cymru) should not be impacted noticeably by the Proposed Improvement during the construction stage as the short section which follows the A496 through Llanbedr village is away from the scheme alignment and therefore would not be impacted directly;

also the traffic levels within Llanbedr are not expected to increase noticeably during construction. The flow of cyclists which decide to follow the A496 rather than NCN Route 8 to the north and south of Llanbedr could be interrupted by traffic management measures where the Proposed Improvement ties into the existing road, though the extent and duration of this disruption would depend upon the principal contractor's programme of works.

5.8.68 The main impact upon cyclists is expected to occur due to the realignment of a 200m section of Mochras Road, Local Cycleway between the railway crossing and the proposed bridge over Mochras Road and the Afon Artro, see Detailed Proposals (Figures 2.3 – 2.5, Volume 1a). It is expected that cyclists would be accommodated during the construction phase however they are likely to be re-routed along a diversion route for certain periods of the works, and would almost certainly encounter the site to some degree; though the level of disturbance depends upon the principal contractors works programme and temporary arrangements.

5.8.69 Overall it is considered that with good planning and site management the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon cyclists in the study area, resulting in a **moderate** significant effect.

Equestrians

5.8.70 The main impact upon equestrians during construction of the Proposed Improvement is also expected to centre on the realignment of a section of Mochras Road which leads directly towards the start/end of bridleway PRow 43 near the railway crossing, see Detailed Proposals (Figures 2.3 – 2.5, Volume 1a). Access towards PRow 43 would be expected to remain open for the majority of the construction period however equestrians approaching PRow 43 along Mochras Road are likely to be disturbed and most likely re-routed for a duration due to construction activities.

5.8.71 Overall it is considered that with good planning and site management the construction phase for the Proposed Improvement would generate a **minor adverse** temporary impact upon equestrians in the study area, resulting in a **slight** significant effect.

Vehicle Travellers - Construction Period

View from the road

5.8.72 As the Proposed Improvement is largely off-line it is expected that users of the A496 would follow the current route for the majority of the construction phase. It has been established that views of the surroundings are mainly afforded when looking west from the north side of Llanbedr and most prominently looking north and west from higher ground to the south of the village, which also offers views across Tremadog Bay and a mountainous skyline further afield. It is expected that there would be a temporary adverse visual impact on views from the existing A496 towards areas to the west of the road due to the presence of construction plant and activities immediately adjacent to the route, mainly affecting views from the areas described above.

5.8.73 Views to the north and south along Mochras Road are largely obstructed by adjacent properties and road/riverside vegetation and are therefore expected to be largely unaffected during construction. On approaching the position of the proposed bridge over Mochras Road and the Afon Artro however views of immediate construction activities would become unavoidable and vegetation removal would likely open up views of the wider site, particularly to the north.

5.8.74 Overall it is considered that with good site management including tidy working and storage areas, and good upkeep of temporary boundary features, the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon views from the road, resulting in a **moderate** significant effect.

Driver Stress

- 5.8.75 During construction the flow of traffic along the existing A496 is likely to be interrupted by traffic management measures where the Proposed Improvement ties into the existing road and where temporary site accesses are likely to be required. Similarly the flow of traffic along Mochras Road would be disturbed by site activities such as construction of the proposed bridge over the road and also realignment of a length of the road between the proposed bridge and the railway; subsequently traffic management and temporary diversions are likely to be in place for vehicular traffic along Mochras Road during long periods of the construction phase.
- 5.8.76 The extent and duration of this disruption to users of the A496 and Mochras Road would depend upon the principal contractor's programme of works, though any disruption would exacerbate current stress levels currently experienced towards the centre of Llanbedr and the junction between the A496 and Mochras Road, particularly during periods of heavy traffic.
- 5.8.77 Overall it is considered that with good site management the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon views from the road, resulting in a **moderate** significant effect.

Non-Motorised Users – Operational Phase

Design Measures

- 5.8.78 It is considered that the measures embedded within the outline design would mitigate for the potential impacts associated with the Proposed Improvement and could also improve safety and accessibility for NMUs within the study corridor therefore resulting in overall benefits during the operational phase. Proposed changes to the NMU network were identified following a formal review of current NMU movements within the study area and potential conflict points introduced by the Proposed Improvement. These changes are listed below and displayed in the Detailed Proposals (Figures 2.3 – 2.5, Volume 1a).
- NMU provisions along the length of Mochras Road affected by the Proposed Improvement would be enhanced by provision of a 2m wide segregated route between the Mochras Road car park and the railway crossing;
 - The potential interface between users of PRow 1 and the traffic along the new road where the Proposed Improvement crosses the existing flood bank would be removed by diverting pedestrians beneath the new road through a proposed underpass approximately 50m to the north of this intersection;
 - Further enhancements would be introduced for NMUs along the length of Mochras Road between Llanbedr and the tie-in with the Proposed Improvement; these are likely to consist of traffic calming measures, an extended footway and improved lighting;
 - Pedestrian access towards the Meini Hirion Standing Stones (Scheduled Ancient Monument) would be improved, possibly as a spur from PRow 1 near its intersection with the current A496;
 - The use of traffic calming measures in Llanbedr village would be assessed after completion of the works i.e. once the effects of the reduction in traffic levels is known

Pedestrians

- 5.8.79 The main impact of the Proposed Improvement upon pedestrians would be increased safety and reduced severance within Llanbedr village and along Mochras Road due to the removal of a significant volume of traffic from these areas. Table 2.2.1 in Chapter 2.2 compares the expected

traffic patterns for the 'do-minimum' and 'do-something' scenarios on completion of the Proposed Improvement during the opening year of 2020, and shows a significant 90% decrease in traffic volume flowing through Llanbedr village (from 2909 to 310 vpd at Pont Llanbedr), as well as the section of Mochras Road between Llanbedr and the route of the Proposed Improvement (from 710 to 71 vpd).

- 5.8.80 This estimated level of traffic reduction would result in a major benefit for pedestrians in and around the village making every day journeys towards the trip generators identified within the study area. The estimated change in traffic volumes would also serve as a benefit for recreational users of the various PRow which start or finish on the existing A496; including PRow 1, 4 and 41 in particular. Traffic calming measures within Llanbedr and along Mochras Road would be considered on completion of the proposed works to act in combination with an expected reduction in traffic volume.
- 5.8.81 Changes to the alignment of PRow 1 where it meets the Proposed Improvement, and the length of the diversion in particular, are not expected to increase journey times or to compromise safety or enjoyment for users of this footpath. Also the extension of this footpath to take in the Meini Hirion Standing Stones would provide another benefit for pedestrians. This measure was identified following consultation with Cadw regarding potential impacts upon the Meini Hirion SAM as a result of the Proposed Improvement, during which it was suggested that improved access would enhance experience of this site for visitors and passers-by (see Chapter 5.2: *Cultural Heritage*).
- 5.8.82 Overall the changes described above are expected to increase the use of PRow within the study area by making the centre of Llanbedr more accessible and network of footpaths safer and better integrated through improvements to Mochras Road; thereby generating a **moderate beneficial** impact of **moderate** significance.

Cyclists

- 5.8.83 Likewise the main impact of the Proposed Improvement upon cyclists would be increased safety and reduced severance within Llanbedr village and along Mochras Road due to the removal of a significant volume of traffic from these areas, thereby making the area surrounding Llanbedr far more attractive for cyclists. These benefits would extend to users of NCR 8, the designated Local Cycleway along Mochras Road and also cyclists which choose to use the route of the existing A496 through Llanbedr. Though no specific provisions are included for cyclists within the Proposed Improvement it is considered that the standard width and alignment of the route would provide a suitable route for road cyclists.
- 5.8.84 Overall the changes described above could be expected to increase the number of cyclists within the study area, principally by providing a reduced interface with road traffic, and thereby generating a **moderate beneficial** impact of **moderate** significance.

Equestrians

- 5.8.85 Similar to the expected benefits for cyclists it is considered that the Proposed Improvement would provide a more suitable environment for equestrians by removing traffic from the centre of Llanbedr and Mochras Road and thereby increasing connectivity of the various roads and lanes which are connected to the centre of the village. In particular access towards bridleway PRow 43 from the direction of Mochras Road would be enhanced by a reduction in traffic volumes along the majority of this route and additional traffic calming measures.

5.8.86 Overall the changes described above could be expected to increase the number of equestrians within the study area by providing a reduced interface with road traffic and thereby generating a **slight beneficial** impact of **slight** significance.

Vehicle Travellers – Operational Phase

View from the road – A496

5.8.87 Due to the marked change in topography either side of the Afon Artro, the assessment of views from the new road at design year 15 has been considered separately for the northern and southern sections of the Proposed Improvement. Table 5.8.13 (a & b) describe the views from the Proposed Improvement in accordance with the criteria described in Table 5.8.4.

5.8.88 For context the alignment of the Proposed Improvement and changes to Mochras Road are shown on the Detailed Proposals (Figures 2.3 – 2.5, Volume 1a) and the outline landscaping strategy is shown in the Landscape Mitigation plans (Figure 5.3.18 - 5.3.21, Volume 1A).

Table 5.8.13a Views from the proposed A496 for northbound travellers

Proposed A496 (northbound)	Description	Description and Value / Sensitivity
Southern section (0-800m)	<p>The most southern section (0 - 500m) of the A496 would be elevated as per the existing road and would provide open views to the north towards Tremadog Bay. Views to the east would be restricted by rising topography, new hedge planting and blocks of existing woodland while views towards lower ground to the west would be partly obstructed by a proposed new 1m high masonry boundary wall.</p> <p>Following an elevated section between ch. 400 – 550 views would become more restricted on entering the earthworks cutting at ch. 600, with only views of grassed side slopes offered until the proposed Mochras Road junction. The loss of elevation for road users travelling northwards through the cutting means that views to the north would become less notable by the midway point of the scheme.</p>	<p>Restricted view</p> <p>Medium Value</p>
Northern section (800 - 1600m)	<p>Having crossed the Afon Artro the Proposed Improvement sits on a raised embankment above surrounding agricultural land which drops gradually towards the northern tie-in to the existing road.</p> <p>This elevated section would provide open views to the east and west, partly obstructed by a 1m high boundary wall on both sides of the road. For the most part the views to the east would be of Llanbedr village with the higher ground</p>	<p>Intermittent view</p> <p>High Value</p>

	<p>leading up to the Rhinog range as a backdrop. Linear stands of vegetation along the railway embankment to the west would limit the extent of the view available towards the coastline.</p> <p>Towards the northern tie-in new hedgerow and tree planting would be provided on each side of the carriageway, offering screening for adjacent properties instead of vegetation lost during the construction phase.</p>	
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Table 5.8.13b Views from the proposed A496 for southbound travellers

A496 (southbound)	Description	Value / Sensitivity
Southern section (0-800m)	<p>Approaching the Proposed Improvement from the north the views to the south would be restricted by elevated ground near Plas y Bryn farm and stands of woodland either side of the Afon Artro.</p> <p>Views would open up to the east and west beyond the planting introduced either side of the new alignment at the northern end of the scheme, only partly obstructed by a proposed 1m high boundary wall at the back of the new verge. To the east views of Llanbedr village with the higher ground leading up to the Rhinog range would be offered, particularly as the Proposed Improvement moves away from the existing road. Views to the west towards the coastline would be partly obstructed by adjacent vegetation, but would become more far reaching on approaching the Afon Artro due to a gain in elevation towards the proposed bridge.</p>	<p>Restricted view</p> <p>Medium Value</p>
Northern section (800 - 1600m)	<p>Having crossed the Afon Artro the climb through the earthwork cutting would provide no views beyond the adjacent grassed slopes. South of the cutting the views from the road would begin to open up, and though topography would limit the extent of views to the south and east, there would be wide views across low lying land to the west between the railway alignment and the shoreline, albeit slightly restricted by a proposed 1m high masonry wall on the highway boundary.</p>	<p>Intermittent view</p> <p>High value</p>

5.8.89 Overall the value of views for travellers along the Proposed Improvement within the study area has been assigned as medium and a **minor improvement** of **slight** significance in vehicle travellers' ability the surrounding landscape is expected.

View from the road – Mochras Road

5.8.90 The assessment of the view for vehicle travellers along Mochras road has been divided into two sections; travelling east between the railway crossing and the car park, and travelling west from the A496 junction to the car park. Table 5.8.14 describes the views from Mochras Road at design year 15 in accordance with the criteria described in Table 5.8.4.

Table 5.8.14 Views from Mochras Road either side of the Proposed Improvement

Travel Direction	Description	Value / Sensitivity
East of Mochras Road car park (westbound)	Obstructed views from the road would remain when travelling in a westerly direction along Mochras Road between the Llanbedr junction and Mochras Road car park, as this section is largely unaffected by the proposal. This is due to the continuous line of trees growing along the banks of the Afon Atrto to the north, and the line of properties with heavily wooded gardens abutting to road to the south. Rising pastoral fields offer little views to the south on approaching the location of the car park.	No view Low value
West of Mochras Road car park (eastbound)	The current open views from the road across the lowland pasture to the north and east when travelling from the railway crossing would be interrupted by the proposed embankment. The views from the realigned section of Mochras Road towards the existing car park would be restricted by planting introduced to replace existing hedge lines lost to the scheme.	Restricted view Medium Value

5.8.91 Overall the value of views for travellers expected along Mochras Road within the study area has been assigned as low and a **negligible deterioration** of **slight** significance in vehicle travellers' ability the surrounding landscape is expected.

Driver Stress

5.8.92 One of the main aims of the Proposed Improvement is to reduce traffic congestion within Llanbedr village which is largely caused by the configuration of the bridge in the centre of the village and the A496/Mochras Road junction, and also as a result of reduced carriageway widths through the village due to current car parking arrangements. The traffic volume within the village, and also traffic using the existing junction between the current A496 and Mochras Road, as a result of the Proposed Improvement would reduce significantly, which would subsequently reduce congestion and also driver stress levels for road users within Llanbedr.

5.8.93 Due to the standard widths and alignment provided the route of the Proposed Improvement is expected to result in an unimpeded north-south traffic flow on completion of the works. Using the criteria provided in Table 5.8.6 the driver stress levels for road users along the proposed route are

expected to be at a low level. Similarly due to the improved junction from the proposed alignment onto Mochras Road, the flow of traffic to and from this direction is expected to improve significantly from the current situation in the centre of Llanbedr which should coincide with a significant reduction in driver stress levels for drivers travelling to or from the direction of Shell Island and Llanbedr Airfield.

- 5.8.94 Overall the Proposed Improvement could be expected to significantly reduce driver stress levels in the study area by removing traffic from the centre of Llanbedr, particularly in periods of increased traffic levels, and thereby generating a **major beneficial** impact of **large** significance.

Summary

- 5.8.95 As the residential centre of the study area, pedestrian movements are mainly expected to occur within Llanbedr village however a network of facilities for pedestrians exists within the wider surroundings of the village. The study area also contains designated routes for cyclists and equestrians.
- 5.8.96 It is expected that the conditions for NMUs through Llanbedr would improve significantly on completion of the Proposed Improvement due to the substantial reduction in traffic levels within the village (circa 90% of current levels) creating safer and more ambient surroundings. Where potential conflict points exist between the Proposed Improvement and existing NMU routes along PRoW 1 and Mochras Road, measures would be applied to allow continued NMU movements beneath the new road. Additionally enhancements for NMUs would be carried out as part of the works and would include pedestrian provisions along Mochras Road between Llanbedr and the railway crossing, extension to PRoW 1 to allow access towards the Meini Hirion SAM and traffic calming measures within Llanbedr village.
- 5.8.97 Some disruption to NMUs would be expected during the construction phase and temporary diversions of designated routes would be likely during certain periods. Also it is expected that PRoW 1 would be closed temporarily to the east of the Afon Artro where it meets the line of the Proposed Improvement. The level of disturbance during construction depends upon the principal contractors works programme and would be limited by temporary arrangements.
- 5.8.98 The extent of views afforded to drivers along the existing A496 varies along the study area; little views are provided through Llanbedr due to the built up setting either side of the existing road, however intermittent views towards the coast are available either side of the village. Open views to the north and west exist from for northbound travellers to the south of Llanbedr before the existing road falls towards the village. Limited views are currently available for road users along Mochras Road between Llanbedr and the railway crossing.
- 5.8.99 By removing traffic from Llanbedr the Proposed Improvement would generally offer more open views of the surrounding landscape for road users. The current open views from the elevated position to the south of the village near the proposed tie-in would still be available, and the new road would provide the benefit of views towards higher ground leading up towards the Rhinog range to the east of Llanbedr. Proposed boundary features and roadside planting are expected to slightly restrict the extent of views available for road users, though the earthworks cutting to the south of the Afon Artro will not allow views to the east or west for a section of approximately 200m.
- 5.8.100 Current driver stress within the study area is largely caused by congestion along the A496 as a result of the road width and configuration with adjoining road junctions in the centre of Llanbedr,

particularly when traffic volumes are highest during summer months. The current situation also has the effect of stagnating traffic flows and causing driver stress along Mochras Road.

5.8.101 One of the main aims of the Proposed Improvement is to reduce traffic congestion within Llanbedr and along Mochras Road, and with the reduction expected in vehicles travelling through the village the current congestion problems and associated driver stress are expected to decrease significantly. Due to the standard widths and alignment provided the route of the Proposed Improvement is expected to result in an unimpeded north-south traffic flow on completion of the works.

5.8.102 During construction the flow of traffic along the existing A496 and Mochras Road is likely to be interrupted by traffic management measures where the Proposed Improvement ties into the existing roads and where temporary site accesses are likely to be required.

5.9 Community and Private Assets

Introduction

5.9.1 This chapter addresses impacts in relation to Community and Private Assets associated with the Proposed Improvement. 'Community and Private Assets' was introduced as a new topic under IAN 125/09(W). At present the Environmental Assessment Techniques section of the DMRB Volume 11 is being revised and there is no specific methodology developed for 'Community and Private Assets'. IAN 125/09(W) therefore advises that existing DMRB assessment guidance is followed:

- DMRB Volume 11, Section 3, Part 6 (June 1993) - Land Use
- DMRB Volume 11, Section 3, Part 8 (June 1993) - Community Effects

5.9.2 Following review of the respective DMRB assessment guidance chapters and an initial desktop study of the land surrounding the Proposed Improvement it was considered that the following sections should be scoped out of the Community and Private Assets chapter:

- Effects on development land - no impacts upon development land (as defined) due to the Proposed Improvement identified;
- Community severance – community severance is defined as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows. Community severance has not been considered within this assessment as the Proposed Improvement aims to remove traffic from the centre of the village thereby making community facilities more accessible. Also potential severance issues have been avoided by keeping Mochras Road open to traffic and thereby making the centre of the village accessible for properties to the west of the railway and holiday makers at Shell Island campsite. The construction phase would be managed to limit impacts upon vehicle traffic flows on the A496, Mochras Road and surrounding property accesses as discussed in section 2.5: *Construction, Operation and Long Term Management*. Community effects are discussed further in the context of effects upon travellers in Chapter 5.8: *Effects on All Travellers*.

5.9.3 The first part of this chapter - 'Private property, associated land-take and land used by the community' - assesses the effects of the Scheme on private and community assets, including:

- Private property and associated land take e.g. demolition of houses, loss of gardens
- Land used by the community e.g common land, town and village greens, allotments and public open space

5.9.4 This chapter also refers to Chapter 5.8: *Effects on All Travellers*, which considers the impact of the Scheme on access by all travellers to the following services which are relevant to this chapter:

- Schools
- Services – i.e. community centres, libraries
- Places of worship
- Leisure – i.e. parks, play areas, sports centres and other recreational areas

5.9.5 The second part of this chapter – 'Effects on agricultural land' – is concerned specifically with the effect of the Scheme on land used for agricultural purposes.

Part 1 - Private property, associated land-take and land used by the community

Methodology

Private property and associated land take

- 5.9.6 Demolition of private property and associated land-take will be assessed using the method described in DMRB Volume 11 Section 3, Part 6.
- 5.9.7 The number of residential, commercial, industrial and other properties at risk of demolition or land-take to accommodate the Proposed Improvement is estimated. For business premises which may be affected, the assessment covers the number of people employed at the site, the likely impact of the scheme and the probable effect on the business's future viability. The assessment also covers the effects of land-take from private properties such as the loss of gardens, garages and other parking space in part or in whole.
- 5.9.8 DMRB Volume 11, Section 3, Part 6 does not specify a study area for the assessment of effects due to demolition of private property and land-take. As the assessment focuses private property or land directly affected, other than agricultural land, the study area does not extend beyond the land take of the proposed improvement.

Land used by the community

- 5.9.9 Loss of land used by the community will be assessed using the following method, as described in DMRB Volume 11 Section 3, Part 6.
- 5.9.10 Where land-take would be likely to occur, information is obtained about the number of users and a desk-top study is undertaken to determine any cultural associations of the land in question. Where Public Open Space is to be taken, land in the vicinity which could be offered as exchange land is identified. The assessment sets out the scheme's impact on land used by the public, taking account where relevant of exchange land to be provided in mitigation.
- 5.9.11 DMRB Volume 11, Section 3, Part 6 does not specify a study area for the assessment of effects on communities and community resources. As the assessment focuses solely on loss of land the study area does not extend beyond the land take of the proposed improvement.

Data collection and sources of information used

- 5.9.12 In terms of land use and ownership, a combination of desk based research, site surveys and meetings with affected parties have been undertaken to identify baseline conditions.

The following data sources have been utilised during the desk based study:

- Ordnance Survey (OS) mapping
- OS MasterMap Address Layer data
- OS Points of Interest data
- Land ownership information available from the Land Registry
- Review of Snowdonia National Park Local Development Plan (LDP) (Interactive Map) <http://www.eryri-npa.gov.uk>

5.9.13 Furthermore site visits were arranged to ‘ground truth’ the Ordnance Survey data, identifying commercial and residential properties from OS MasterMap and features mapped from other desk top sources. From this work, a detailed knowledge of land ownership interests affected by the scheme has been collated.

Limitations of the Assessment

5.9.14 The assessment of effects on private property presents the ‘worst case scenario’ as the detailed impacts on residents or businesses are the subject of commercial confidentiality and private discussions between Gwynedd Council and the owners or occupiers of premises affected by the Scheme.

Assessment Criteria

5.9.15 A qualitative assessment of impacts on community and private assets based on professional judgement has been undertaken to indicate the significance of effects on identified receptors, based on the value or sensitivity of the receptor and the magnitude of the predicted impact.

Receptor Sensitivity

5.9.16 The receptors relevant to this assessment comprise the private property and land, as well as land and facilities used by the community which may be affected by the proposed improvement. The value or sensitivity of these receptors relates to the importance of the resource or facility together with its sensitivity to change. The community and private assets assessment uses the categories of sensitivity/value described in Table 5.9.1 below.

Table 5.9.1: Receptor sensitivity - Private property and land used by the community

Value/Sensitivity	Description
Very High	<i>Very high importance and rarity, international scale and very limited potential for substitution.</i>
High	<i>High importance and rarity, national scale, and limited potential for substitution.</i>
Medium	<i>High or medium importance and rarity, regional scale, limited potential for substitution.</i>
Low	<i>Low or medium importance and rarity, local scale.</i>
Negligible	<i>Very low importance and rarity, local scale.</i>

Magnitude of Impact

5.9.17 The magnitude of change (adverse or beneficial) on community and private asset receptors has been described using the levels of impact set out in Tables 5.8.2 below.

Table 5.8.2: Impact magnitude - Private property and land used by the community

Magnitude of Impact	Description
Major	<i>Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse)</i>
	<i>Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial)</i>
Moderate	<i>Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).</i>

	<i>Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).</i>
Minor	<i>Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).</i>
	<i>Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).</i>
Negligible	<i>Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).</i>
	<i>Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).</i>
No change	<i>No loss or alteration of characteristics, features or elements; no observable impact in either direction.</i>

Significance of Effect

5.9.18 The significance of an effect on community and private assets is a function of the value or sensitivity of the resource or receptor and the magnitude of the impact (taking into account the timescale involved - permanent or temporary). The criteria for assessing the significance of environmental effects on community and private assets take account of the guidance that is provided on this topic in the DMRB Volume 11, Section 2, Part 5 (HA 205/08), as set out in Table 5.9.3 below.

Table 5.9.3: Arriving at the Significance of Effect categories

		Magnitude of Impact (Degree of Change)				
		<i>No Change</i>	<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>
Environmental Value (Sensitivity)	<i>Very High</i>	Neutral	Slight	Moderate or large	Large or very large	Very large
	<i>High</i>	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	<i>Medium</i>	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	<i>Low</i>	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	<i>Negligible</i>	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Baseline Environment (Value/sensitivity to change)

Regulatory/Policy Framework National Policy

5.9.19 The following national policy is relevant to the community and private assets assessment.

- Planning Policy Wales (Edition 8) (Welsh Government, 2016). Planning Policy Wales sets out the objectives for Community and Private Assets in Chapters 4, 5 and 11;
- Technical Advice Note (TAN) 6: Planning for Sustainable Rural Communities (Welsh Assembly Government, 2010a);
- Technical Advice Note (TAN) 16: Sport, Recreation and Open Space (Welsh Assembly Government, 2009).

Local Policy

5.9.20 The Eryri Local Development Plan (LDP) provides the policy context for assessing development proposals within Snowdonia National Park up to 2022. The LDP includes strategic policies and development policies which will deliver the long term spatial vision for the future of Snowdonia National Park. The following policies are relevant to community and private assets and are therefore regarded as part of the assessment process.

Strategic Policy A: National Park Purposes and Sustainable Development

5.9.21 *The following considerations should be taken into account to help deliver sustainable development in Snowdonia:*

iii. Safeguarding and improvement of the health, safety, economic and social well-being of local communities.

Development Policy 1: General Development Principles

5.9.22 *To conserve and enhance the 'Special Qualities' and purposes of the National Park development will only be permitted where all the following apply:*

xiii. The development will not have an unacceptable adverse impact on the quiet enjoyment of the area by the public.

xiv. The development will not have an unacceptable adverse impact on public rights of way, other recreational routes or open country.

Development Policy 5: Open space and Green Wedges

5.9.23 *Areas of public or private open space within or adjacent to the main built up area of settlements, which contribute to the amenity of residents, the character of Conservation Areas or the setting of historic buildings, will be protected from development.*

Inappropriate development will not be permitted within areas designated as green wedges in order to retain openness and prevent the coalescence of settlements.

Strategic Policy Nq: Community Services and Facilities

5.9.24 *The provision of new health, sport, education and other community facilities will be supported:*

i. Where they are located within the main built up area of a local service centres, service settlements and secondary settlements.

ii. In other locations where there are no suitable sites in the local service centres, service settlements and secondary settlements and where the development will provide an essential facility to support the local community.

The change of use from a community service or facility will be refused unless it can be shown that the potential for continued use of the facility is un-viable, or unsuitable.

Study Area

5.9.25 The Proposed Improvement is situated to the west of the Llanbedr village in a rural setting which is mainly comprised of improved agricultural grazing land and associated holdings (as considered in Part 2 of this assessment) . The only interfaces with land which is not used for agriculture occur at the proposed tie-ins with the existing A496 at the northern and southern ends of the scheme either side of Llanbedr, and also where the proposed alignment crosses over and also ties into Mochras Road, the class 3 road which connects Llanbedr to the coastline.

Private properties

5.9.26 The following properties are either situated adjacent to the existing A496 at either end of the Proposed Improvement, or along Mochras Road, and would be within the temporary or permanent land take for the scheme:

- Welsh Water Treatment Facilities at the very northern limit of the proposal at the tie-in with the existing A496;
- Bydwynn Industrial Units are located on the west side of the existing A496 where at the southern tie-in point. These units are currently occupied by Knightmovers Removals and Storage and Cambrian Clearance second hand goods outlet;
- On the opposite side of the existing road to the Bydwynn units, and within the land take for the Proposed Improvement, are the grounds and access towards Hafod y Bryn property;
- Hafod y Bryn Lodge is situated approximately 10m from the mouth of the existing access and is therefore more vulnerable to roadside alterations;
- Llyn y Pin is directly to the south of Hafod y Bryn and has a garden and existing access which abut the A496 currently;
- Talwrn Bach and Tal Artro are located on the northern side of Mochras Road, directly to the east of the railway crossing.

5.9.27 The value/sensitivity has been assigned as **High** for all private properties which could be affected by the Proposed Improvement, in accordance with the criteria provided in Table 5.9.1.

Land used by the community

5.9.28 No designated Public Open Spaces are included within the Snowdonia National Park LDP which would be subject to land take or disturbance as a result of the Proposed Improvement. Footpaths, cycle ways and equestrian routes used by the community which would be affected by the Proposed Improvement, as well as any changes to journeys towards community facilities are discussed in Chapter 5.8: *Effects on All Travellers*.

5.9.29 The only land used by the community which is likely to be affected by the Proposed Improvement is a public car park situated on Mochras Road, which serves the nearby railway halt, ramblers using the surrounding footpath network (including the Wales Coastal Path) and anglers along the Afon Artro. The car park is situated a section of Mochras Road which would be locally realigned, and also is directly to the west of the proposed bridge which would carry the Proposed Improvement over Mochras Road and the Afon Artro. The value/sensitivity of the Mochras Road car park, in accordance with the criteria provided in Table 5.9.1 has been assigned as **Medium**.

Predicted Environment Effects

5.9.30 The environmental effects upon private properties and land used by the community as a result of the Proposed Improvement are summarised in Table 5.9.4 below.

Private properties - Construction Phase

- 5.9.31 The Proposed Improvement would not require the demolition of residential properties, but would result in the permanent loss of garden from the grounds of Hafod y Bryn, Hafod y Bryn Lodge and Llyn y Pin. The land take is expected to be limited to the existing A496 boundary wall and garden area directly behind the line of the wall, and would include vegetation removal within this area. It is also expected that access to/from the properties could be impeded during the construction phase while the new access from the realigned A496 is constructed. Permanent and temporary land take figures are shown in Table 5.9.4.
- 5.9.32 Some land loss is expected to occur within the grounds of the Bydwynn Industrial Units due to the re-alignment of the A496, permanent losses are mainly expected to occur to the wooded northern corner of the site and would amount to approximately 1150m² in area. It is also expected that two existing outbuildings would be lost as a consequence of the road re-alignment in this area (see Chapter 5.3: *Nature Conservation*), though these buildings are dilapidated and therefore are not currently used by the companies which occupy the site. It is expected that access to/from these facilities could be impeded during the construction phase while the new access from the realigned A496 is constructed.
- 5.9.33 Temporary land take is expected for Talwrn Bach and Tal Artro. The tie-in works along Mochras Road would interfere with the private access towards Tal Artro for periods of construction while temporary land take would extend to the garden of Talwrn Bach and may require existing boundary features to be removed. Some disruption upon the road which provides access towards Talwrn Bach and Plas y Bryn Farm could also be expected for short periods during tie-in works at the location of the junction with Mochras Road.
- 5.9.34 Additionally the Proposed Improvement would result in loss of land within the Welsh Water treatment facilities at the northern tie-in. The land take is expected to be limited the roadside edge of the existing site and would result in loss of vegetation which currently provides screening from the road, however it is not expected that processing plant would be affected by the Proposed Improvement. It is expected that access to/from the facilities could be impeded during the construction phase while the new access from the A496 is constructed.
- 5.9.35 Construction phase impacts upon private properties are expected to be of **moderate** magnitude resulting in an adverse environmental effect of **moderate** significance.

Land used by the community - Construction Phase

- 5.9.36 No physical alterations are expected to the Mochras Road car park as a consequence of the Proposed Improvement; however the section of Mochras Road either side of the car park would be realigned for a length of approximately 200m to facilitate a tie-in towards the A496. Also a new bridge would be constructed to carry the Proposed Improvement over the Afon Artro/Mochras Road nearby. These works are likely to be facilitated by traffic management and a temporary diversion of Mochras Road from its current alignment, and subsequently the car park is likely to be closed for periods of the construction phase. It is however expected that PRow No. 1 (Llanbedr) and the length of Mochras Road which incorporates the Wales Coastal Path from the car park would remain open throughout construction (see Chapter 5.8: *Effects on All Travellers*).
- 5.9.37 The timing and duration of a closure would depend upon the programme of the principal contractor. It's likely that the car park would be available for the principal contractor during periods of closure for storage or facilities, and a potential impact may occur from damage caused to the site, including the surrounding tree canopy, as a result of such activities.

5.9.38 Construction phase impacts upon land used by the community are expected to be of **moderate** magnitude resulting in an adverse environmental effect of **moderate** significance.

Private properties - Operational Phase

5.9.39 On completion of construction all temporary land acquired for the construction of the Proposed Improvement would be returned to the existing landowner, so the area of permanent land take required is significantly less than the temporary estimate, as is shown in Table 5.9.4 below. Also on completion of the works new and improved accesses towards Hafod y Bryn and Bydwynn Industrial Units would be provided. The permanent loss of land at the northern end of the grounds surrounding Bydwynn Industrial Units is unlikely to generate a substantial impact for the businesses which operate from this site as it is not considered that the wooded area within the scheme footprint, including the two outbuildings to be demolished, is used for business purposes.

5.9.40 The main residual impact on completion of the works would be associated with degradation of temporary working areas, loss of vegetation which currently provides screening for these properties and also loss of existing boundary features, this is particularly pertinent for the Hafod y Bryn for which the current access is served by a tall stone wall and decorative masonry pillars.

5.9.41 Operational phase impacts upon private properties and associated land are expected to be **moderate** in magnitude resulting in an adverse environmental effect of **moderate** significance.

Land used by the community - Operational Phase

5.9.42 No physical alterations are expected to the Mochras Road car park as a consequence of the Proposed Improvement. The main impacts are expected to be associated with a change in setting due to the proximity of the A496 and the bridge over the Afon Artro/Mochras Road on completion of the works. The new bridge would be approximately 30m from the position of the car park and it's likely that presence of the road would affect the tranquillity for users, particularly users which decide to use the picnicking facilities.

5.9.43 As no permanent loss of land is expected the operational phase impacts upon land used by the community are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance.

Table 5.9.4: Summary of impacts upon private properties and associated land and also land used by the community as a result of the Proposed Improvement before mitigation

Receptor	Temporary Impact	Magnitude	Permanent Impact	Magnitude
Private Properties				
Welsh Water treatment facilities	1312m ² of temporary land take during construction	Moderate	958m ² of permanent land take during operation	Moderate
Hafod y Bryn	58m ² of temporary land take during construction	Moderate	None	Negligible
Hafod y Bryn Lodge	145m ² of temporary land take during construction	Moderate	158m ² of permanent land take during operation	Moderate
Llyn y Pin	1715m ² of temporary land take during construction	Moderate	1021m ² of permanent land take during operation	Moderate

Bydwynn Industrial Units	1158m ² of temporary land take during construction	Moderate	1125m ² of permanent land take during operation	Moderate
Talwrn Bach	290m ² of temporary land take during construction	Moderate	None	Negligible
Tal Artro	45m ² of temporary land take during construction	Moderate	None	Negligible
Land used by the community				
Mochras Road car park	Temporary closure during construction phase	Moderate	Adverse impact upon the setting due to proximity of proposed road alignment	Minor

Mitigation Measures and Residual Effects

Private properties

- 5.9.44 Any areas subject to temporary land take would be carefully managed during the construction phase to prevent unnecessary damage to private property, and would be reinstated to the satisfaction of the property owner on completion of the works. Financial compensation would be provided to private property owners where land associated with the property is taken or negatively affected by the Proposed Improvement. Where accesses to private properties are affected by the works, temporary access would be provided throughout the duration of construction.
- 5.9.45 The loss of vegetation which currently provides visual screening for private properties would be replaced as part of the soft landscaping works associated with the Proposed Improvement. The landscape mitigation strategy is discussed in more detail in Chapter 5.3: *Landscape Effects*.
- 5.9.46 With implementation of the mitigation measures described above construction phase impacts upon private properties are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance. Operational phase impacts upon private properties and associated land are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance.

Land used by the community

- 5.9.47 The principal contractor would be encouraged to keep the Mochras Road car park open and accessible for as long as practicable during the construction phase, however when periods of closure are planned the contractor will notify the public in advance and will also consider opportunities for temporary alternative facilities nearby. Should the contractor choose to use the existing car park for storage or similar during periods of closure, care would be applied to prevent damage to surrounding trees and the facilities would be fully reinstated prior to re-opening.
- 5.9.48 With implementation of the mitigation measures described above construction phase impacts upon land used by the community are expected to be minor in magnitude resulting in an adverse environmental effect of slight significance. As no permanent loss of land is expected the

operational phase impacts upon land used by the community are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance.

Summary

- 5.9.49 No land allocated for housing, employment or retail development under the Snowdonia National Park LDP would be acquired for the scheme. There would be community severance as a result of the Proposed Improvement.
- 5.9.50 The Proposed Improvement is situated in a rural setting which is mainly comprised of improved agricultural grazing land and associated holdings. The only interfaces with land which is not used for agriculture occur at the proposed tie-ins with the existing A496 and also where the proposed alignment crosses over and also ties into Mochras Road.
- 5.9.51 Seven properties are situated adjacent to the existing A496 at either end of the Proposed Improvement and would be within the temporary and permanent land take for the scheme. Impacts upon these properties would be mitigated by financial compensation for loss of land, careful undertaking of construction activities and reinstatement of temporary land take.
- 5.9.52 No designated Public Open Spaces included within the Snowdonia National Park LDP would be subject to land take. The only land used by the community which is likely to be affected by the Proposed Improvement is a public car park situated on Mochras Road. This car park is likely to be closed during periods of the construction phase to allow for re-alignment of Mochras Road. On completion of the works there would be deterioration in the setting of the car park for users due to the proximity of the proposed alignment of the A496 and the bridge over the Afon Artro nearby.

Receptor	Approximate Temporary Land loss	Approximate Permanent Land loss	Access Affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to owner/occupier agreement)	Magnitude of Impact	Significance
Private Properties						
Welsh Water treatment facilities	1312m ²	950m ²	Y	<p>Impacts: Loss of land, loss of screening from roadside vegetation, potential degradation of temporary land take, disruption to vehicular accesses</p> <p>Mitigation: Financial compensation, reinstatement of temporary land, introduction of roadside vegetation as screening</p> <p>Accommodation works to be agreed during detailed design</p>	Minor	Slight
Hafod y Bryn	58m ²	None	Y	<p>Impacts: Loss of land, loss of screening from roadside vegetation, potential degradation of temporary land take, disruption to vehicular accesses</p>	Negligible	Slight
Hafod y Bryn Lodge	145m ²	158m ²	Y		Minor	Slight
Llyn y Pin	1715m ²	1021m ²	Y	<p>Mitigation: Financial compensation, improved access, reinstatement of temporary land, introduction of roadside vegetation as screening</p> <p>Accommodation works to be agreed during detailed design</p>	Minor	Slight
Bydwynn Industrial Units	1158m ²	1125m ²	Y	Loss of land, loss of screening from roadside vegetation, potential degradation of temporary	Minor	Slight

				land take, disruption to vehicular accesses Mitigation: Financial compensation, improved access, reinstatement of temporary land, introduction of roadside vegetation as screening Accommodation works to be agreed during detailed design		
Talwrn Bach	290m ²	None	Y	Impacts: Loss of land, potential degradation of temporary land take, disruption to vehicular accesses Mitigation: Financial compensation, reinstatement of temporary land Accommodation works to be agreed during detailed design	Negligible	Slight
Tal Artro	45m ²	None	Y		Negligible	Slight
Land used by the community						
Mochras Road car park	N/A	N/A	Y	Change in setting, potential disturbance during construction stage	Minor	Slight

Table 5.9.5: Summary of Magnitude and Significance of Effects upon private properties and associated land and also land used by the community during scheme operation

Part 2 - Agricultural Assessment

Introduction

- 5.9.53 An agriculture assessment has been carried out in accordance with the guidance in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 6: Land Use (Highways Agency, 2001)⁵⁰. As recommended by the DMRB the scope of the agricultural assessment covers:
- the type of husbandry currently employed;
 - the value and amount of agricultural land that the scheme is likely to take.
 - the likely impacts of severance arising from a scheme;
 - the likely impacts of major accommodation works for access, drainage and water supply.

Methodology

Data Collection

Agricultural Land Quality

- 5.9.54 The Welsh Assembly Government's Agriculture Department and the Department for Environment Food and Rural Affairs (DEFRA) have adopted a system of classifying agricultural land known as the Agricultural Land Classification System of England and Wales (ALC). The ALC system classifies land into five grades numbered 1 to 5, Grade 1 land being the highest quality and Grade 5 the lowest quality land. Grade 3 is further divided into two Sub-Grades (3a and 3b). The principal physical factors influencing land quality are climate, site and soil. These factors, together with interactions between them, form the basis for classifying agricultural land into one of the five main grades.
- 5.9.55 The agricultural land quality of the study area was mapped using the Provisional Land Classification Maps, which are available as a digital 1:250,000 scale map.

Farm Businesses

- 5.9.56 Affected landowners operating an agricultural business were visited and details were collected about their farming business including the farm tenure, size, type of husbandry employed and main use of affected land. Discussions with affected agricultural landowners were conducted between February and September 2016. At the same time the proposals were discussed with them and potential effects discussed and recorded for evaluation against the detailed drawings.
- 5.9.57 From the drawings produced by the project engineers, an assessment was carried out to determine the effect of land-take, severance/fragmentation and the impact of proposed accommodation and mitigation works in line with the recommendations of the DMRB.
- 5.9.58 A number of terms are used which have specific definitions in the context of this assessment that may differ from those in general use. A glossary of agricultural terms is provided at the end of this chapter.

Significance Criteria

- 5.9.59 The assessment considers the predicted physical impacts on the agricultural land quality and farm businesses. This includes assessing the temporary land taken during the construction phase, the area of land severed or fragmented, area to be restored to agriculture and the resulting residual permanent land loss to each farm holding. The significance of effect is then determined based on

⁵⁰ Highways Agency, (2001). Design Manual for Roads and Bridges. Volume 11, Section 3, Part 6: Land Use-Amendment No 1.

the magnitude of the impact and the sensitivity of the affected receptor as set out in the significance criteria below.

Agricultural Land Quality

- 5.9.60 The 'best and most versatile' agricultural land falls into Grades 1, 2 and Sub-Grade 3a. Grade 1 land is excellent quality agricultural land, with few limitations on cropping. Grade 2 land is very good quality agricultural land with minor limitations which affect crop yield, cultivations or harvesting; a wide range of agricultural and horticultural crops can usually be grown. Land in Sub-Grade 3a is good quality agricultural land capable of consistently producing moderate to high yields of a narrow range of arable crops.
- 5.9.61 Land in Sub-Grade 3b is of moderate quality capable of producing moderate yields of a narrow range of crops. Poor quality agricultural land is assessed as Grade 4. Grade 5 land is very poor quality agricultural land. Land that is not agricultural cannot usefully be classified. Such land is referred to as 'other' in the text. Its full description is 'other land not primarily in agricultural use' and includes roads, houses and woodland.
- 5.9.62 PPW seeks to conserve 'best and most versatile' agricultural land and steer development to areas of lower agricultural quality. Agricultural land of Grades 1, 2 and 3a is therefore considered a sensitive receptor to development. The sensitivity assigned to each grade however may vary depending on the availability of 'best and most versatile' land within the region. Gwynedd only contains a small percentage of land classed as 'best and most versatile' and therefore Grades 1 – 3a are considered to be of high sensitivity as shown in Table 5.9.6 below.

Table 5.9.6: Sensitivity of Receptor

Sensitivity	Characteristics
High	Grades 1, 2 and 3a (best and most versatile agricultural land)
Medium	Sub-Grade 3b
Low	Grades 4, 5

- 5.9.63 The magnitude of impact on agricultural land will depend on the amount to be lost due to the Scheme. There is little current guidance on what area of loss is considered significant, however, 20 ha is the threshold adopted in Town and Country Planning (General Development Procedure) Order 1995 (GDPO) (S.I .No 1995/419) for Local Planning Authorities to consult WAG before granting any planning permission which would involve the loss of Grades 1, 2 or 3a agricultural land. This threshold is taken into consideration in the assessment of the magnitude of impacts as shown in Table 5.9.7 below. The significance of effect is then determined by considering the magnitude of effect against the sensitivity of the receptor as shown in Table 5.9.8 below. Effects above moderate level of significance are considered to be significant.

Table 5.9.7: Magnitude of Impact

Magnitude	Area of Effect
High	≥ 50 ha
Medium	20 – < 50 ha
Low	5 – < 20 ha
Negligible	< 5 ha

Table 5.9.8: Matrix for Determining Significance

Magnitude of Impact	Sensitivity of Receptor		
	High	Medium	Low

High	Very Large	Large	Moderate
Medium	Large	Moderate	Slight
Low	Moderate	Slight	Neutral
Negligible	Slight	Neutral	Neutral

Farm Businesses

5.9.64 The sensitivity of a farm holding to change depends on a number of factors such as size and nature of the holding. Larger farm holdings are likely to have a greater capacity to change enterprise mix and scale, and therefore absorb impacts, which smaller farm holdings would be less able to do. Farm types which have some degree over flexibility of operations, such as combinable arable enterprises and grazing livestock farms, are likely to be less sensitive than those where the operation of the enterprise is dependent on the relationship with key infrastructure, such as dairying (where access to fields and dairy parlour must be maintained), field-scale horticulture and irrigated arable cropping, intensive livestock or horticultural production. In addition, the type of tenancy held would also affect the sensitivity of the farm. A business with a long-term agricultural tenancy is likely to be more sensitive than where land is contract farmed or farmed without a tenancy arrangement and no long-term security. Owner-occupied farm businesses may gain financially from the sale of land.

Table 5.9.9: Sensitivity of Receptor

Sensitivity	Characteristics
High	Small farm size < 50 ha Dependent relationship with key infrastructure Long-term Agricultural Holdings Act tenant
Medium	Average farm size > 50 ha < 100 ha Some flexibility over operations Mixed business farming some owned land and some medium- or short-term rented land
Low	Large farm size > 100 ha Large degree of flexibility Short-term tenancy/licence or owner-occupied

5.9.65 Road schemes can impact on farms by affecting the scale and efficiency at which current enterprises can be practised, usually by reducing the land area available to the business or severing land from the main block of land or buildings. These would ultimately manifest themselves in an increased cost or a lower return to the business. Therefore the effect of such a scheme on a farm can be assessed largely, though not exclusively, from the financial impact on the business.

5.9.66 In cases where agricultural land is occupied by people who do not derive their livelihood from it, the impact is assessed by considering the effect the scheme would have on the capability of the land. Principally this is achieved by considering the loss of high quality land, the loss of fixed equipment and other factors.

5.9.67 The magnitude of effects have been classified into three categories; 'slight', 'moderate' and 'severe' is shown in Table 5.9.10. The significance of effect is then determined by considering the magnitude of effect against the sensitivity of the receptor as shown in Table 6 below.

Table 5.9.10: Magnitude of Impact

Magnitude	Characteristics
Severe	The viability of the business is threatened and strategic management of the farm business requires a major shift in enterprise mix.

Moderate	The viability of the business is not threatened, but significant changes in the day to day management are required which may significantly affect the size and scale of the enterprises.
Slight	The viability of the business is not threatened. Only minor changes would be required to the enterprises and the type and range of enterprises is unaffected.

Table 5.9.11: Matrix for Determining Significance

Magnitude of Impact	Sensitivity of Receptor		
	High	Medium	Low
Severe	Very Large	Large	Moderate
Moderate	Large	Moderate	Slight
Slight	Moderate	Slight	Neutral

5.9.68 When assessing effects, the 'severe' classification can only be attributable to agricultural businesses that were viable at the time of the survey. Where a business loses land that is held on an unsecured arrangement it is considered, due to the lack of long-term security of this land, that the effect of this loss cannot be classified as severe. However, if the farm is not viable but provides the main source of income, the effect can be classified as severe.

Limitations and Assumptions

5.9.69 A limitation of the Provisional Land Classification Maps is that the scale does not allow detailed grading for small parcels of land and does not provide the sub-division into Sub-Grades 3a and 3b. The Provisional Maps were produced in the 1970s and there has been no national update to the maps since this time.

5.9.70 The impact assessment of farm businesses has been carried out based on development plans last provided in November 2016. Should the proposals change, the impact assessments should be carried out again, to revisit the impact the proposals might have on farm businesses.

Baseline Conditions

Policy Context

5.9.71 Planning Policy Wales (PPW)⁵¹ outlines the land use planning policies of the Welsh Government. PPW states Grades 1, 2 and 3a agricultural land, which constitutes the best and most versatile land, should be conserved as a finite resource for the future. Land within these grades should only be developed if there is an overriding need for the development, there is no alternative lower quality land or the lower quality land has other environmental value. If best and most versatile land needs to be development, this should be directed to the lowest grade.

5.9.72 Technical Advice Note 6 (TAN 6) 'Planning for Sustainable Rural Communities'⁵² reinforces the requirement to consider the quality of agricultural land when considering planning applications. TAN 6 also refers to the other agricultural factors that should be considered when assessing impacts

⁵¹ Welsh Government, (2016). Planning Policy Wales. Edition 8 January 2016.

⁵² Welsh Assembly Government, (2010). Technical Advice Note 6: Planning for Sustainable Rural Communities.

on farming such as land take, severance and fragmentation, effects on use of buildings, equipment and capital investments and drainage systems.

- 5.9.73 In addition, TAN 6 refers to the requirement of Article 10(1) of the Town and Country Planning (General Development Procedure) Order 1995 (GDPO) (S.I. No 1995/419) for Local Planning Authorities to consult the Welsh Assembly Government before granting any planning permission which is not in accordance with the development plan, and would involve the loss of 20ha or more of grade 1, 2 or 3a agricultural land, individually or cumulatively.
- 5.9.74 The Gwynedd Unitary Development Plan 2001-2016⁵³ recognises the value of agricultural land and Policy C28 seeks to protect best and most versatile land from development.

POLICY C28 - SAFEGUARDING AGRICULTURAL LAND

Proposals that will lead to the loss of grade 1, 2 or 3a agricultural land will be refused unless there is an overriding need for the development and it can be demonstrated that:

- 1. there is no previously developed land available; and*
- 2. there is no land of lower agricultural grades available, other than land that has an environmental value recognised by a landscape, wildlife, historic or archaeological designation which outweighs agricultural considerations.*

- 5.9.75 The requirement to safeguard agricultural land is also taken forward in the Joint Local Development Plan Anglesey & Gwynedd (2011 - 2026), Deposit Plan⁵⁴. Policy PCYFF1 states that planning permission should be refused where there is an unacceptable adverse impact on the best and most versatile land.

Agricultural Land Quality

- 5.9.76 Based on the Soil Survey of England and Wales⁵⁵ the northern part of the study area is mapped as soils belonging to the Conway Association. The association consists of mainly deep stoneless fine silty soils and are generally found along major valley floors. Flooding and high groundwater table limits arable cropping and most of the association is under permanent grass. This corresponds with TAN 15 Development and Flood Risk Development Advice Map which records this area as partly Zone C1 (areas of floodplain served by infrastructure including flood defences) and partly C2 (without flood defences).
- 5.9.77 In the southern part of the study area soils are mapped as belonging to the Rivington 2 Association. This association is dominated by the Rivington series, typical brown earths, and the Withnell series, typical brown podzolic soils. They are coarse loamy well drained and overlie hard sandstone. Most of the land within this association is under grass and used for livestock rearing.
- 5.9.78 The UDP notes that *“The quality of agricultural land within the Plan area is extremely variable. However, only a small part is within the ‘best and most versatile’ category.”* This is reflected by the agricultural land which the proposed route crosses.
- 5.9.79 The agricultural land quality of the study area was mapped using the Provisional Land Classification Maps and is shown in Figure 5.9.1 (Volume 1A). Figure 5.9.1 indicates that the route crosses Grade 4 agricultural land (poor quality) and Grade 5 agricultural land (very poor quality). Grade 4 and Grade 5 agricultural land is considered to be of **low** sensitivity in accordance with the descriptions

⁵³ Gwynedd Council, (2009). Gwynedd Unitary Development Plan 2001-2016.

⁵⁴ The Isle of Anglesey County Council and Gwynedd Council, (2015). Joint Local Development Plan Anglesey & Gwynedd (2011 - 2026). Deposit Plan (2015) Written Statement.

⁵⁵ Soil Survey of England and Wales, Map Sheet 2 Wales. Soils and Their Use in Wales. 1984.

provided in Table 5.9.6. Based on the Provisional Land Classification Maps there is no 'best and most versatile' land within the study area.

Farm Businesses

- 5.9.80 The land use in the study area is grassland. There is a mixture of flatter, productive pastures and meadows as well as land that is wet and rushy in nature. The tide impacts on the land in the locality.
- 5.9.81 The line of the proposed route crosses three land holdings which is shown in Figure 5.9.2 (Volume 1A). These are:
- Gwern Carnyddion;
 - Haulfryn; and,
 - Plas y Bryn Farm.
- 5.9.82 The extent of farm ownership within the study area is shown in Table 5.9.12 and is derived from Gwynedd Council data. The study area covers those land parcels that are bisected by the scheme. The areas within the study area have been measured using GIS.
- 5.9.83 An agricultural business may be defined as carrying out agricultural activities for the purposes of profit or gain. Though the keeping of horses is not strictly considered to be agricultural, one of the land holdings was identified as being rented out for grazing of horses and this land is included within the assessment upon farm businesses. Further information on each farm holding and their corresponding sensitivity is provided in Table 5.9.13 below.

Table 5.9.12: Farm Ownership

Landowner	Farm	Total Area of Land Holding (ha)	Approx. Area of Land Holding within Study Area (ha)
IP O'Rourke	Haulfryn	3.67	3.67
RJ & M Evans	Gwern Carnyddion	117	12.60
E Bailey	Plas y Bryn Farm	56 (plus 1,200 at Corsygedol)	19.75

Table 5.9.13: Description of the Farm Holdings

Farm	Description of the Business	Cropping	Stocking	Access	Sensitivity
Haulfryn	<p>Approximately 3.67 ha. The land is owned by Mr Ivan O'Rourke but rented out for horse grazing. The land is in two blocks, both blocks have stables and a tack room. The block of land to the south of Mochras Road has four stables and a tack room. This unit is let out and Mr O'Rourke's income is derived from the rent. The block to the north of the road is not currently let out due to some issues with drainage responsibility. This is considered to be a viable business.</p>	This is an all grass business	The land is grazed by four horses.	There are two points of access onto Mochras Road from both blocks of land.	High
Gwern Carnyddion	<p>The farm business extends to approximately 117 ha. Of this area approximately 100 ha is owner occupied. The rest of the land is taken on three different informal/seasonal agreements. Approximately 6.8 ha is taken on an 11 month grazing licence, 7.2 ha is taken on an informal grass keep and 3.2 ha of silage land is taken as a standing crop. The suckler herd is made up of Pedigree Welsh Blacks. Heifers are sold for breeding, steers are sold to a local butcher. The cross bred ewes start lambing in March, the ewes and twin lambs graze on the best land which is near the Llanbedr sewage works. The block of land that is part of the study area which extends to 12.60 ha is of particular significance to the viability of the business. The farm business is short of flat, productive land. This block includes land that is flat and intensively managed to optimise productivity. This block is where most of the silage is made, where ewe</p>	<p>Silage is made on 10 ha of grassland. 3.2 ha of silage is bought as a standing crop. 97 ha of land is permanent grassland in a long term ley. 6 ha is on a short term ley.</p>	<p>27 Pedigree Welsh Black suckler cows 8 calves 8 youngstock 17 cattle aged 12 months + 300 Welsh ewes 180 cross bred ewes</p>	Access to the land is from the existing A496 and Mochras Road.	Medium

Farm	Description of the Business	Cropping	Stocking	Access	Sensitivity
	<p>lambs are out wintered and where cross-bred lambs are fattened.</p> <p>Tir Gofal lapsed in 2014.</p> <p>This is considered to be a viable holding.</p>				
<p>Plas y Bryn Farm</p>	<p>The farm business comprises a large hill farm at Corsygedol (1,200 ha) and the small coastal farm at Plas y Bryn (56 ha). The land is owner occupied.</p> <p>The Plas y Bryn farmland is the most productive land that the business owns.</p> <p>The livestock enterprises are best described as hill cattle and sheep.</p> <p>The sheep flock is based on Cheviot cross ewes and the cattle enterprise based on a suckler cow herd, producing 15-16 month old store cattle.</p> <p>The farm is subject to Glastir Advanced. However, none of the grassland at Plas y Bryn is subject to management prescriptions.</p> <p>The Plas y Bryn farm extends either side of the railway line. The lower lying land around the railway line is wet by nature and the land to the east is drier freely draining loams.</p> <p>The block of land within the study area extends to 19.75 ha. This block of land is of particular significance to the farm business because it is some of the most productive land, being used for wintering ewe lambs, producing silage and fattening livestock. The farm has a shortage of flat productive ground.</p> <p>This is considered to be a viable holding.</p>	<p>1,112 ha of permanent grassland.</p> <p>Silage is made on 20 ha of grassland at Plas y Bran</p> <p>Additional silage is made on 24 ha at Corsygedol.</p> <p>22 ha of ploughable land across both sites.</p> <p>6 ha of forage crop, currently grown at Corsygedol.</p> <p>60 ha farm woodland.</p> <p>Areas of rushy, wet grassland make up the rest of the area at Plas y Bran.</p>	<p>94 suckler cows 40 calves 40 youngstock 80 cattle aged 12 months + 40 rams 1,500 ewes 1 horse</p>	<p>The main access to the farm buildings is from Mochras Road. Access to farm land is from the A496.</p>	<p>Low</p>

Predicted Environmental Effects

5.9.84 Operational impacts are largely synonymous with the permanent land take which will occur during the construction phase and are therefore discussed together.

Agricultural Land Quality

5.9.85 The Proposed Road Improvement would result in both permanent and temporary land take. Temporary land take would occur during the construction phase, and consist of land required for the construction compound, storage and construction access. This would be a short term temporary impact. Permanent land take would include the new road and associated embankments/cuttings. This would also occur during the construction phase and this effect would continue throughout the operational phase.

5.9.86 The Proposed Road Improvement would result in the loss of the following approximate areas of agricultural land based on Gwynedd Council data (see Table 5.9.14).

Table 5.9.14: Summary of Agricultural Land Area to be Lost by ALC Grade*

ALC Grade	Approximate Temporary Agricultural Land Take (ha)	Approximate Permanent Agricultural Land Take (ha)
Grade 1	0	0
Grade 2	0	0
Grade 3a	0	0
Grade 3b	0	0
Grade 4	1.98	5.25
Grade 5	0.51	0.75
Total	2.49	6.00

* The figures within Table 5.9.14 are likely to be a slight overestimate of ALC land lost as the Provisional Land Classification Maps may predate some land use changes.

5.9.87 The permanent loss of 5.25 ha of Grade 4 and 0.75 ha of Grade 5 is considered to be of low magnitude, and together with the low sensitivity of these grades of agricultural land, the permanent loss of agricultural land is considered to be of neutral significance. The temporary loss of 1.98 ha of Grade 4 and 0.51 ha of Grade 5 is considered to be of negligible magnitude and of neutral significance. No significant effects are therefore predicted on the agricultural land quality and no further consideration is made within this assessment.

Farm Businesses

5.9.88 In line with the guidance in the DMRB, Vol 11, section 3, Part 6, the assessment considers the effects of land-take, severance and major accommodation works for access, drainage and water supply. This is considered in the context of the farm business.

5.9.89 The assessment has been carried out by interviewing affected parties. By doing this, it is possible to identify differences between businesses in terms of performance such as livestock output, grassland production and cropping yields. This helps to understand how different businesses will be affected by proposals. However, interviewees are often not willing to give out financial details and therefore, where farm specific figures were not available, standard industry figures have been used based on the type of farm enterprise described by the interviewees.

5.9.90 The scheme would result in one equestrian business using agricultural land and two agricultural holdings being individually affected by the scheme as follows in Table 5.9.15.

Table 5.9.15: Summary of Agricultural Land Area to be Lost by Land Holding

Landowner	Total Area of Land Holding (ha)	Area of Land Holding within Study Area (ha)	Approximate Temporary Agricultural Land Take (ha)	Approximate Permanent Agricultural Land Take (ha)
IP O'Rourke (Haulfryn)	3.67	3.67	0.27	0.79
RJ & M Evans (Gwern Carnyddion)	117	12.60	0.86	2.65
E Bailey (Plas y Bryn Farm)	56 (Plas y Bryn Farm) 1,200 (Corsygedol)	19.75	1.36	2.56

5.9.91 Land values can vary significantly. In order to establish a value for the land affected by the route, consultation with local agents should be undertaken, which is then verified by the Welsh Government's appointed valuer.

Haulfryn

Land Take

5.9.92 Approximately 0.79 ha (1.95 ac) of the holding would be permanently taken by the proposed scheme. This represents 21.5% of the total land area of this business.

5.9.93 It is understood that a further 0.27 ha (0.67 ac) of land would be required on a temporary basis during the construction period. This entails land either side of the new road which would be used for construction vehicles, plant and storage. Temporary land use for construction may be subject to changes in soil structure due to compaction by heavy plant and vehicles. The temporary and permanent land take on the block of land that rises from Mochras Road to the south appears to take in the stables. The loss of facilities, disturbance from construction works, reduction in grass area and loss of access may mean that the livestock have to be removed during construction.

Severance

5.9.94 The existing road already severs the two blocks of land owned by Mr O'Rourke. The proposed works would widen and slightly change the alignment of this road but would not change severance of the two blocks of land.

Access

5.9.95 Access onto the land is currently from Mochras Road. There are four access points which would be affected. The block of land to the north of Mochras Road is not currently used, although there is a stable block here and so restrictions to and loss of access to this block during construction is unlikely to have a detrimental effect on land use. Restrictions to and loss of access to the block south of Mochras Road would have a detrimental impact on the use of the land during construction and after.

5.9.96 Should access be restricted during construction, or if construction was deemed to cause too much of a disturbance, the users may be forced to move the horses to another site. This would have a significant detrimental impact on the viability of the business.

Services and Infrastructure

- 5.9.97 Four stables and a tack room on the land to the south of Mochras Road, which are integral to the operation of the business appear to be within the area of temporary and permanent land take and are likely to be lost.
- 5.9.98 Loss of these facilities would have a significant impact on the ability of the business to operate. Again, should the loss of infrastructure result in the horses being removed, the viability of the business would be severely impacted.
- 5.9.99 The proposed scheme's permanent land take would also include the current water trough location. If the land is to continue to have grazing livestock on it, the water troughs would need to be replaced.
- 5.9.100 Plans suggest that the development would not impact on the arterial ditches on the land to the north of Mochras Road, although construction work may have a detrimental impact on the function of the ditches at the very southern tip of this block of land. The presence of field drains in the land to the south of Mochras Road is not known. However, it is not expected that this block of land is drained because of the slope to the road.
- 5.9.101 The land to the north of Mochras Road has a stone wall alongside the road. Some of its length would be removed during construction. The block of land to the south of Mochras Road has a mature hedge along the roadside, a significant amount of this boundary would be lost. In addition, a section of trees that divides the block into two would also be lost.

Farm Business

- 5.9.102 The land take and loss of key infrastructure during construction and post development, means this business is unlikely to remain viable as it is Unlikely that Mr O'Rourke would be able to let the land out for horse grazing.
- 5.9.103 At present only the southern block of land is used and this is the block which is most impacted by land take. The northern block of land is not suitable for horse grazing because it is too wet. The area of temporary and permanent land take results in a block of approximately 0.6 ha, and although some of this is temporary land take, the area would be too small to continue to be used for the number of horses currently grazing the land and for replacement of the infrastructure. Industry figures suggest that the average stocking rates are 0.8 ha for the first horse and 0.4 ha for subsequent horses⁵⁶, although in practice this is flexible especially if there are stables so the horses are not out in the fields all the time.
- 5.9.104 Grass livery, where a landowner provides, grazing, shelter, water supply and a secure area to keep tack and store feed can typically generate income of between £30-£100 per horse, per week⁵⁷. At £50/wk per horse for the four horses he has on the land, this could generate income of £10,400 per annum.
- 5.9.104 The residual land may be let out for grazing of sheep, however, the rent that could be charged for sheep grazing would be considerably less than for horses and there would likely be a significant loss of income.
- 5.9.105 Sheep have less of a physical impact on grassland than horses do and so it may be possible to graze sheep on the northern land as well as the southern block. Sheep grazing would potentially attract

⁵⁶ John Nix Farm Management Pocketbook 2016 46th edition

⁵⁷ As above

between £0.45-0.70⁵⁸ per head per week. Grazing licences do not usually last a full 12 months. At a stocking rate of 9 ewes to the hectare on 2.88 ha (the resultant area of land), for 11 months of the year, sheep grazing at £0.60/hd/wk would generate income in the region of £684 per annum.

5.9.106 Prior to mitigation, the magnitude of impacts is considered to be **severe** and based on a **high sensitivity** receptor, the significance of effects is **very large adverse**.

Gwern Carnyddion

Land Take

5.9.107 Approximately 2.65 ha (6.54 ac) of the holding would be permanently taken by the proposed scheme. This represents 2.4% of the total land area of this business. The permanent land take includes some of the best land and also some rushy areas. The permanent loss would result in fewer sheep being kept and a reduction in the area of grassland cut for silage. The finished embankment slopes would be offered back to the landowner on completion of the works and after a grassed sward has become established, however these slopes have been included in the permanent footprint for the purposes of this assessment.

5.9.108 There would be an area of land (approximately 0.4 ha) which would be severed by the slip road that joins the existing A496 to Llanbedr. It is understood that this area will be used to mitigate habitat loss and therefore has been considered as permanent land take, although it is likely to be offered back to the current landowner for controlled grazing on completion of the works and following reinstatement.

5.9.109 It is understood that a further approximately 0.86 ha (2.13 ac) of land would be required on a temporary basis during the construction period, forming a strip of land either side of the new road. Temporary land use for construction may be subject to changes in soil structure due to compaction by heavy plant and vehicles.

5.9.110 The land required during temporary construction, either side of the new road includes some of the best and most productive land used for silage making, fattening lambs and also overwintering ewes, therefore loss could result in a need to change the size and scale of the business, temporarily. The temporary land take may also be ineligible for the Basic Payment Scheme.

5.9.111 Permanent land take could have a detrimental impact on the farm business because it also includes some of the best land used for silage making, fattening lambs and also overwintering ewes. There would also be a loss of grazing land which is a damp and rushy. Therefore loss due to land take could result in a need to significantly change the size and scale of the business.

Severance

5.9.112 The proposal splits the block of land into two. Approximately 2.26 ha (1.32 ha of the best quality land and 0.94 ha of poorer rush grassland) to the west of the proposed alignment would not be accessible during the temporary construction works, and may not be accessible on operation of the road without provision of access.

5.9.113 Access to this land from the west is not possible because the boundary of the land is the river. The new road could therefore cut off best quality silage land and also rush pasture. It is perceived by the landowner that good quality land is in short supply in the area, which limits his opportunities to re-locate those elements of the business to alternative land.

⁵⁸ As above

5.9.114 The severance of the land to the west of the new road could therefore have a detrimental impact on the farm business because it includes some of the best land used for silage making, fattening lambs and also overwintering ewes. There would also be a loss of grazing land which is damp and rushy. Therefore loss due to severance could result in a need to significantly change the size and scale of the business.

Access

5.9.115 The existing access points onto the agricultural land are from the A496 within the Llanbedr village and are unaffected by the proposals.

Services and Infrastructure

5.9.116 Land drains, thought to be clay pipes are present in the northern part of the block. These drains run to a ditch which runs through the field. Damage to these clay pipes would impact on field drainage, resulting in the field becoming wetter, which would reduce the quality of the land, although it is likely that such issues can be avoided through sensitive design and construction methods.

5.9.117 Several ditches are likely to be affected by the proposed development. These ditches take water off the land and so change or damage to them would change the way water travels across the fields. As with the land drains, damage to the surface drains may result in the field becoming wetter, which would reduce the quality of the land.

Farm Business

5.9.118 The impact of land take and severance on the farm business has been considered above but is further explored here in business terms. If no access was provided during construction, the severed land and the temporary land take west of the development would be lost. The output losses and additional costs would be incurred annually.

5.9.119 The permanent land take would result in a need to buy in an estimated 1.7 ha of silage which would cost in the region of £1088 per annum (based on 32 bales/ha⁵⁹ and a silage cost at £20/bale).

5.9.120 Sheep numbers would need to reduce to accommodate the reduction in grazing area and also possibly fewer cross bred lambs would be finished. Assuming the grassland stocking rate is 8 ewes/ha, the reduction in land areas of 1.7 ha would result in 14 fewer ewes being kept. The sheep enterprise gross margin could potentially reduce by £417 (based on an average lowland ewe gross margin of £29.80/ewe⁶⁰). In addition, there would be the loss of grazing poorer land (approximately 0.81 ha) which could reduce sheep enterprise gross margin by a further £145 (assuming the poorer land only carries 6 ewes/ha).

5.9.121 The loss of access to severed land and temporary land take (3 ha) could cost the enterprises in the region of £1158 per annum in increased silage costs and £691 per annum in reduced output (sheep).

5.9.122 Temporary and permanent land take (3.51 ha) could affect the area of land which the landowner could claim Basic Payment Scheme on. The value of the claim is based on the farmer's entitlement value and will change, annually until 2019. Estimated figures for 2016 are between £237-97/ha. Loss of land area at £237/ha would mean the Basic Payment receipt was reduced by £832 in one year. Payments are expected to continue until 2020. The amount would vary because the value of entitlement varies and it is not clear what the impact of leaving the EU will have on farm receipts.

⁵⁹ Yields provided by the farmer

⁶⁰ Lowland Spring lambing per ewe (average performance) data John Nix Farm Management Pocketbook 46th edition 2016

- 5.9.123 The total annual financial cost as outlined above would reduce output by £2085 (loss of sheep output from permanent land take, temporary land take and severance plus loss of Basic Payment) and increase costs by £2246 (increased silage costs on permanent, temporary land loss and severance) and this would be felt by the farm business annually, although the figures would change based on livestock markets, subsidy receipts and input costs.
- 5.9.124 The loss of land permanently, temporary and through severance could result in the need to make a significant change in farm enterprises, perhaps reducing the number of sheep and cattle to reflect the loss of silage land and good quality grazing land. However, the loss would be unlikely to threaten the viability of the farm business.
- 5.9.125 Prior to mitigation, the magnitude of impacts is considered to be **moderate** and based on a **medium sensitivity** receptor, the significance of effects is **moderate adverse**.
- 5.9.126 The impact of the proposals on the farm business has been considered only at an enterprise level, rather than looking in detail at whole farm costs too. The farmer interview did not identify areas where there would be an impact on elements of fixed costs such as increases or decreases in costs of labour or machinery and fuel costs. Therefore it has been assumed that the fixed or whole farm costs remain the same, and so reduction in output of a farm enterprise and increased costs will have the effect of reducing net profit assuming the enterprises affected make a positive contribution to the total gross margin of the farm business.

Plas y Bryn Farm
Land Take

- 5.9.127 Approximately 2.56 ha (6.33 ac) of the holding would be permanently taken by the proposed scheme. This represents less than 0.2% of the total land area of this business.
- 5.9.128 The permanent land take includes some of the best land within the farm holding. The permanent loss would result in fewer sheep being kept, a reduction in the area of grassland cut for silage, a reduction in grassland for fattening livestock and loss of the Basic Payment Scheme. Overall the permanent loss would be unlikely to significantly affect the size and scale of the enterprises, although due to the lack of availability of flat productive land in the area changes in the day to day management would be required.
- 5.9.129 It is understood that a further approximately 1.36 ha (3.36 ac) of land would be required on a temporary basis during the construction period, forming a strip of land either side of the new road. Temporary land use for construction may be subject to changes in soil structure due to compaction by heavy plant and vehicles. The compaction could be removed with re-instatement of any drainage affected and restoration of the site.
- 5.9.130 The land required during temporary construction, either side of the new road includes some of the best and most productive land used for silage making, fattening lambs and also overwintering ewes, therefore this loss could result in a need to change the size and scale of the business, temporarily. The temporary land take may also be ineligible for the Basic Payment Scheme.

Severance

- 5.9.131 The proposal splits the block of land in the study area into two. Approximately 1.23 ha of land (0.26 ha of the best quality land and 0.97 ha of grazing land) to the east of the proposed alignment would not be accessible during the temporary construction works, and may not be accessible on operation of the road without provision of access.

5.9.132 The severance of the land to the east of the new road could have a detrimental impact on the farm business because it includes some of the best land used for silage making, fattening lambs and also overwintering ewes. This loss due to severance could result in a need to change the size and scale of the business but due to the size of the farm business there is likely to be a degree of flexibility available, which would not be the case on a smaller farm.

Access

5.9.133 The existing access points to Plas y Bryn Hall and the farm from the existing A496 will be affected by the proposal during the construction works. It is understood that a new access is to be included off the new road in a similar position to the existing accesses.

Services and Infrastructure

5.9.134 An open gutter/ditch with a culvert under the existing A496 road would be affected by the proposals as it is inside the working area for construction and the line of the new road. Additional surface flow of water from the road could flow down the trackway towards the farmstead if adequate road drainage is not installed.

5.9.135 There is no access to water for livestock grazing land which is severed from the rest of the farm. A new water supply will therefore be required. Two water mains and a sewer are within the working and operational area of the development, in addition to an underground telephone line and two overhead power lines, which are present on farmland at Plas y Bryn.

5.9.136 A number of boundary walls, which have been restored using funding from Glastir would be affected by proposals as they appear to be within the working area of the scheme. Two woodland copses, which have been fenced off under the Glastir scheme fall within or are adjacent to the proposal and are therefore likely to be lost or partly lost.

Farm Business

5.9.137 The impact of land take and severance on the farm business has been considered above but is further explored here in business terms. The output losses and additional costs would be incurred annually.

5.9.138 Reduction in the grassland area from the permanent and temporary land take by approximately 3.92 ha (9.69 ac) means fewer sheep can be kept. Using a grassland stocking rate of just under 10 ewes/ha⁶¹, the reduction in land areas of 3.92 ha would result in approximately 39 fewer ewes being kept. The sheep enterprise gross margin could potentially reduce by £1368.08 per annum (based on an average gross margin of £34.90/ewe⁶²).

5.9.139 In addition, the temporary and permanent land take includes approximately 1.51 ha of silage land. At 30 bales/ha⁶³, this would be a reduction in silage crop of 45 bales, which to replace would cost around £20/bale, resulting in an additional cost of £906 per annum. This land is also used to overwinter ewe lambs. Assuming the grassland is currently used for 16 weeks, this would equate to a potential cost (of finding alternative land) of £72.48 per annum (5 lambs/ha at 0.60p/hd/week for 16 weeks).

5.9.140 In addition to the land take for the development and during construction, some land to the east of the proposed alignment will become severed from the farm during construction and operation,

⁶¹ Stocking density figure provided during farmer interview

⁶² Upland spring lambing per ewe (high performance) John Nix Farm Management Pocketbook 46th edition 2016

⁶³ Yield data provided during farmer interview

unless new access is provided. It may not be possible to provide access to one of the severed areas of land and so this may need to be considered to be permanent land take.

- 5.9.141 The area of land severed is 1.23 ha, reduction in sheep numbers - assuming the grassland stocking rate is just under 10 ewes/ha, would result in approximately 12 fewer ewes being kept. The sheep enterprise gross margin could potentially reduce by £429 per annum (based on an average gross margin of £34.90/ewe⁶⁴).
- 5.9.142 Of this area of land severed, approximately 0.26 ha is silage land, therefore there is a loss in silage production, incurring a cost of £156 to buy in silage. The cost of overwintering ewe lambs will also be incurred due to this severance of land, incurring a cost of £12. Overall, the impact of the proposals has a financial impact of £ 2943 per annum in terms of increased cost and loss of output, including the loss of severed land.
- 5.9.143 The loss of land permanently, temporary and through severance could result in the need to make a significant change in farm enterprises, perhaps reducing the number of sheep and cattle to reflect the loss of silage land and good quality grazing land. However, the loss would be unlikely to threaten the viability of the farm business and the impact could be mitigated through financial compensation.
- 5.9.144 Temporary and permanent land take (3.92 ha) could affect the area of land which the landowner could claim Basic Payment Scheme on. The value of the claim is based on the farmer's entitlement value and will change, annually until 2019. Estimated figures for 2016 are between £237-97/ha. Loss of land area at £237/ha would mean the Basic Payment receipt was reduced by £929 in one year. Payments are expected to continue until 2020. The amount would vary because the value of entitlement varies and it is not clear what the impact of leaving the EU will have on farm receipts. Reduction in support payment could be mitigated through financial compensation.
- 5.9.145 The farm's Glastir scheme would be affected by the proposals, both in terms of the payment received and also possibly the need to re-pay works completed, such as fencing off copses which would be affected by the development. The financial impact could be reduced by ensuring access to severed land is provided during construction and operation and ensuring land taken temporarily was re-instated to current productive capacity. Financial compensation could be provided to offset increase in cost and loss of output, but the lack of productive land in the area means that the scale of the sheep enterprise is likely to be reduced permanently. Any loss in Glastir payment and need to repay money already received could be compensated financially.
- 5.9.146 The impact of the proposals on the farm business has been considered only at an enterprise level, rather than looking at whole farm costs too. The farmer interview did not identify areas where there would be an impact on elements of fixed costs such as increases or decreases in costs of labour or machinery and fuel costs. Therefore it has been assumed that the fixed or whole farm costs remain the same, and so reduction in output and increase in costs of a farm enterprise will have the effect of reducing net profit assuming the enterprises affected make a positive contribution to the total gross margin of the farm business.
- 5.9.147 Prior to mitigation, the magnitude of impacts is considered to be **moderate** and based on a **low sensitivity** receptor, the significance of effects is **slight adverse**.

⁶⁴ Upland spring lambing per ewe (high performance) John Nix Farm Management Pocketbook 46th edition 2016

Proposed Mitigation

5.9.148 As no significant effects are predicted on agricultural land quality no specific mitigation is proposed. However in accordance with best practice, the correct specification as to soils stripping, storage and replacement would be carried out to ensure that land utilised temporarily during the construction phase can be restored back to its current land quality.

Assumptions about Mitigation

5.9.149 While it is possible to identify the principal works of mitigation in advance of construction, it is not possible to itemise them all at this stage as mitigation works to limit the deleterious effects of proposal on a farm form part of the farmer's claim for compensation; as such they must be agreed with an independent valuer appointed by the Welsh Government before they can be offered as firm commitments.

5.9.150 The following general works would normally be provided or paid for by way of compensation. However, such works would have to be agreed with the landowner/occupier beforehand and are not firm commitments as part of the scheme. Special attention would normally be paid to maintaining exiting services currently serving the land. Typical examples are the maintenance of access, water supplies and drainage.

Returning Land used for Temporary Construction to the Owner

5.9.151 In some locations, where land acquired for construction is returned, it is often a design policy to keep the gradients below 1:10 unless the field itself is at a steeper gradient, in which case the original contours are maintained. Where land is in permanent pasture (as is the case here), gradients may be increased to 1:5. In this way the amount of land which is permanently lost to agriculture can be minimised.

5.9.152 The quality of land restoration has improved considerably over years and with the correct specification as to soils stripping, storage and replacement, there is no reason why the land cannot be restored close to its former productive capacity in the medium term. The assessment has been made on the assumption that restoration would be carried out to a high standard and that compensation would be paid for loss of profits as a result of the scheme.

5.9.153 During the period when land is in aftercare, any shortfall in production can be made up through the payment of compensation. The business would therefore not be disadvantaged in the short term.

Reorganisation of Field Boundaries

5.9.154 Appropriate access to the affected fields would be provided where required and any farm boundaries such as hedgerows, fences and walls affected during construction would be reinstated to maintain the boundary and restore landscape and ecology features. Farms boundaries would generally be reinstated like for like.

Construction Mitigation

Haulfryn

5.9.155 Any land required on a temporary basis during construction period would be returned to the landowner on completion of the work.

5.9.156 Lack of continual access and temporary land take for construction could result in the owners of the horses removing them from the land, impacting on the landowner's income. This could be mitigated through financial compensation. Should this plot remain occupied during construction replacement facilities would be required prior to demolition of the stables and tack room.

5.9.157 Water troughs would be moved and re-located to an agreed alternative location before work begins if stock is to remain grazing the land. Fencing of the construction area would be erected if livestock are to remain on the land during construction.

Gwern Carnyddion

5.9.158 Any land required on a temporary basis during construction period would be returned to the landowner on completion of the work. Additionally the finished embankment slopes would be offered back to the landowner on completion of the works.

5.9.159 The loss of land temporarily for construction and following severance from the rest of the farm would impact on the day to day management and also potentially the ability to claim Basic Payment Scheme. The impact could be mitigated through financial compensation.

5.9.160 Land and surface drainage affected by the construction works would be reinstated and land restored to a functional state. Any damage to the land or surface drains would be made good.

Plas y Bryn Farm

5.9.161 Any land required on a temporary basis during construction period would be returned to the landowner on completion of the work.

5.9.162 The loss of land temporarily for construction and following severance from the rest of the farm would impact on the day to day management and also potentially the ability to claim Basic Payment Scheme. The impact would be mitigated through financial compensation.

5.9.163 Land and surface drainage affected by the construction works would be reinstated and land restored to a functional state. Any damage to the land or surface drains or other infrastructure would be made good.

Operational Mitigation

Haulfryn

5.9.164 The stables, fencing, water and access provided as mitigation during construction would be retained post-construction in order that the business is able to continue operating. Field boundaries such as stone walls and hedgerows would be re-built or replanted. Permanent land take would be financially compensated.

Gwern Carnyddion

5.9.165 Permanent land take would be financially compensated. Crossing the new road with farm machinery and livestock is perceived to be dangerous and may not be feasible depending on the slope of the embankments. The proposals include for a new underpass to enable movement of livestock between land either side of the new road. Field gates would be provided to contain livestock where necessary.

Plan y Bryn

5.9.166 Permanent land take would be financially compensated. Provision of new access to the farm and safe access to be able to continue to use the grassland to the east of the development is required. The proposals include for a new underpass to enable movement of livestock between land either side of the new road. Field gates would be provided to contain livestock where necessary. Provision of water supply for severed land. Installation of adequate road drainage to ensure there is no increase in surface water flows.

Residual Environmental Effects (following mitigation)

Haulfryn

- 5.9.167 The 0.27 ha land take required on a temporary basis during the construction period would be restored and returned to the landowner. The residual permanent land loss would be 0.79 ha.
- 5.9.168 The inclusion of mitigation in the form of replacement/reinstatement of access, infrastructure, water, land, fencing, boundaries and services would reduce impacts, however the magnitude of impact on the business remains **severe** because the viability of the business would be threatened as the land may not be able to be rented out for horse grazing. The significance of effect would be **very large adverse**.

Gwern Carnyddion

- 5.9.169 The 0.86 ha land required on a temporary basis during the construction period would be restored and returned to the landowner. The residual permanent land loss would be 2.65 ha.
- 5.9.170 Although it is proposed to include an underpass to allow access to the severed land to the west of the new road during the operation period, it may not be possible to provide access during the construction period. During the construction period the lack of access to the western block of best quality land would require a change in strategic management of the farm business because winter fodder would need to be brought in, there would be less land to fatten lambs on and the ewes would not have anywhere to graze overwinter. The combination of these factors plus a lack of good quality land for rent in the area could impact on the viability of the farm but are unlikely to threaten it because not all of the best land would become severed.
- 5.9.171 The areas of temporary and permanent land take are not significant but failure to access the cut off best land would result in a moderate impact during the construction period. This would be a short term temporary impact.
- 5.9.172 Mitigation in the form of access to the western block of land during operation, restoration of temporary construction land to pre-development levels and financial compensation would maintain the viability of the farm. However the magnitude of impact on the business remains as **moderate** because significant changes in day to day management would still be required. The significance of effect would be **moderate adverse**.

Plan y Bryn

- 5.9.173 The 1.36 ha land take required on a temporary basis during construction period would be restored and returned to the landowner. The residual permanent land loss would be 2.56 ha.
- 5.9.174 As with Gwern Carnyddion above, a new underpass is proposed to maintain access during the operation of the new road, but it may not be possible to maintain access during the construction period. This would be a short-term temporary impact. Loss of good quality land and severance during the construction period would require a change in strategic management of the farm business, because the most productive land would be affected by proposals. The lack of good quality land in the area means that there is little opportunity to take alternative land on, of the same productive capacity. Therefore the farm enterprises, particularly the sheep enterprise needs to be changed to carry fewer stock and the cattle enterprise need to be more reliant on bought in silage, rather than that grown on farm. These impacts affect both farm viability and farm management. The land at Plas y Bryn is part of a much bigger holding which absorbs some of these impacts. For instance, the farm business currently has approximately 22 ha of ploughable land, an indication of quality in terms of being able to grow fodder crops or more productive re-seeded grassland swards. Loss of some of the good land at Plas y Bryn is therefore partly offset and

absorbed by the rest of the larger holding. This ability to absorb impacts is why this business is described as being of low sensitivity.

5.9.175 Mitigation in the form of provision of water and access to the eastern areas of the farm during operation, restoration of temporary construction land to pre-development levels and financial compensation would reduce the impacts on the farm business but the magnitude of impact would still be considered **moderate**, because significant changes in day to day management would still be required. The significance of effect would be **slight adverse**.

Summary and Conclusions

5.9.176 The land use within the study area is grassland. The agricultural land affected is a mixture of Grade 4 (poor quality) and Grade 5 (very poor quality). The development would result in the permanent loss of around 5.25 ha of Grade 4 land and around 0.75 ha of Grade 5 land. The loss of poor and very poor quality land is considered to be of neutral significance.

5.9.177 The scheme would result in one equestrian business using agricultural land and two agricultural holdings being individually affected by the scheme. The magnitude of the development's impacts on agriculture and the land based business in the study area ranges from severe to moderate adverse and the significance of effect from very large to slight adverse. Post mitigation, the magnitude of impacts range from severe to moderate adverse and the significance from very large to slight adverse depending on the sensitivity of the farm.

Table 5.9.16: Summary of Magnitude and Significance of Effects on Agriculture

Farm	Approx Temporary Land loss (ha)	Approx Permanent Land loss (ha)	Approx Temporary Severance (ha)	Access Affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of Impact	Significance
Haulfryn	0.74 (9.8% land)	0.79 (21.5% land)	0	Yes – southern block of land unlikely to be useable during construction	<p>Loss of infrastructure (stables, access and water) during construction and post development.</p> <p>Temporary and permanent land take.</p> <p>Mitigation: Financial compensation.</p> <p>Provision of new infrastructure (stables, access, water) and additional fencing to prevent grazing animals from reaching the construction area would be provided prior to commencement of construction works.</p> <p>Any land required on a temporary basis during construction period would be restored and returned to the landowner on completion of the work.</p> <p>On completion of the scheme any field land drains/ditches or other services disturbed would be reinstated.</p> <p>On completion of the scheme field boundaries would be reinstated.</p>	<p>Pre-mitigation - Severe</p> <p>Post mitigation - Severe</p>	<p>Pre-mitigation - Very large</p> <p>Post mitigation - Very large</p>
Gwern	0.86 (0.7%)	2.65 (2.3%)	2.26	No	Temporary and permanent land take.	Pre-	Pre-mitigation

Farm	Approx Temporary Land loss (ha)	Approx Permanent Land loss (ha)	Approx Temporary Severance (ha)	Access Affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of Impact	Significance
Carnyddion	land)	land)			<p>Loss of access to western block of plot during construction and post development.</p> <p>Approximately 2.94 ha of 12.6 ha severed including best land and rushy pasture of less agricultural value.</p> <p>Potential damage to field drainage during construction.</p> <p>Mitigation: Financial compensation.</p> <p>Provision of access to the western block of land post development would be provided.</p> <p>Any land required on a temporary basis during construction period would be restored and returned to the landowner on completion of the work.</p> <p>On completion of the scheme any field land drains/ditches or other services disturbed would be reinstated.</p>	<p>mitigation – Moderate</p> <p>Post mitigation - Moderate</p>	<p>– Moderate</p> <p>Post mitigation - Moderate</p>
Plas y Bryn Farm	1.36 (0.1% of total land)	2.56 (0.2% of total land)	1.23	Yes – new permanent	Loss of silage land, loss of best quality grazing land, severance during	Pre-mitigation –	Pre-mitigation – Slight

Farm	Approx Temporary Land loss (ha)	Approx Permanent Land loss (ha)	Approx Temporary Severance (ha)	Access Affected	Description of Impacts and Proposed Design, Mitigation Measures and Accommodation Works (subject to landowner/occupier agreement)	Magnitude of Impact	Significance
				access to the holding proposed	<p>construction and post development.</p> <p>Access to holding affected during construction period</p> <p>Severed land – no water supply.</p> <p>Impact of surface water on already wet land adjacent to railway. Potential damage to field drainage during construction.</p> <p>Mitigation: Financial compensation.</p> <p>Provision of access to the eastern block of land post development would be provided. Provision of water supply. Adequate drainage.</p> <p>Any land required on a temporary basis during construction period would be restored and returned to the landowner on completion of the work.</p> <p>On completion of the scheme any field land drains/ditches or other services disturbed would be reinstated.</p>	<p>Moderate</p> <p>Post mitigation - Moderate</p>	<p>Post mitigation - Slight</p>

Agricultural Terms

Agriculture

5.9.178 For the purposes of this assessment, the definition used in Section 336 (1) of the Town and Country Planning Act 1990 has been adopted.

5.9.179 Agriculture 'includes horticulture, fruit growing, seed growing, dairy farming, the breeding and keeping of livestock (including any creature kept for the production of food, wool, skins or fur, or for the purpose of its use in the farming of land), the use of land as grazing land, meadow land, osier land, market gardens and nursery grounds, and the use of land for woodlands where that use is ancillary to the farming of land for other agricultural purposes, and 'agricultural' shall be construed accordingly'.

Agricultural Business

5.9.180 This is defined as carrying out agricultural activities for the purposes of profit or gain.

Horses

5.9.181 The breeding and keeping of horses and ponies, including stabling and livery, are not considered to be agriculture as statutorily defined. These activities have generally been defined as non-agricultural/equestrian.

Fixed Equipment

5.9.182 This is statutorily defined in Section 96 of the Agricultural Holdings Act 1986. For the purposes of this assessment the term fixed equipment is used to include agricultural buildings, structures, roads, tracks, reservoirs, water supply pipes and apparatus, irrigation pipes and apparatus, electricity, gas and telephone services, gates and gateways, fences, hedges, shelter belts and farm woodlands.

Gross margin

5.9.183 The gross margin of a farm enterprise is the excess of the income from the sale of a product over the variable costs. Variable costs are those costs which can be readily allocated to an enterprise and vary in approximately direct proportion to the scale of the enterprise. For example seeds, fertiliser and sprays.

5.9.184 The gross margin is not a profit because it does not include costs such as labour, rent and insurance, which cannot be attributed to an enterprise.

Viability

5.9.185 Net farm income is taken as the basis for assessing farm viability. For a farm to be viable it has been assumed that the net farm income and return on capital provided by the unit should be sufficiently high to sustain the business in the long-term. In short, the farm should provide the farmer with a wage equivalent to the minimum agricultural hourly rate for the hours worked on the unit.

Land Tenure

5.9.186 Most agricultural land affected by such improvement proposals is either owner occupied or occupied from a landlord with security of tenure granted under Agricultural Holdings legislation. This is referred to as secure land with long-term security. Certain areas of land are, however, occupied by some agricultural businesses under a variety of methods that grant the occupier only limited security of tenure. The occupier could be required to vacate the land within a short period, and this is referred to as unsecured land without long-term security. Tenancies let under the

Agricultural Tenancies Act or on Farm Business Tenancies have fixed term security. These grant secure occupation to the tenant but only for the period of the agreement. This can be any period from a few months to many years. For the purposes of this assessment it is assumed that the secured period of occupation will not extend beyond the fixed term.

Agricultural Land Quality

5.9.187 The Welsh and The Department for the Environment, Food and Rural Affairs (DEFRA) have adopted a system of classifying agricultural land known as the Agricultural Land Classification System of England and Wales (ALC). This system classifies land into five basic grades numbered 1 - 5, although land in Grade 3 is further sub-divided into Sub-Grades 3a and 3b.

5.10 Road Drainage and the Water Environment

Introduction

- 5.10.1 This chapter provides an assessment of the water environment related to the Llanbedr Proposed Improvement- Snowdonia Enterprise Zone. The assessment methodology followed is in accordance with the guidance provided in the Design Manual for Roads and Bridges (DMRB) HD 45/09.
- 5.10.2 This chapter considers the existing water environment conditions for the Proposed Improvement and the legislative context. It investigates the likely effects of the Proposed Improvement on the quality of surface water, groundwater and flood risk. Generic and specific effects on the water environment during the construction phase and the operational phase are identified and assessed. Implications relating to abstraction and existing discharge of water have also been assessed.
- 5.10.3 Reference is also made to a Flood Consequence Assessment (FCA) a Water Framework Directive (WFD) report, a Drainage Strategy report and water quality tests undertaken using the Highway Agency Water Risk Assessment Tool (HAWRAT).
- 5.10.4 The objective of this chapter is to identify, and where possible quantify the potential impacts during the construction and operational phases of the Llanbedr Proposed Improvement on the existing road drainage and the water environment. Where impacts are predicted, measures to be incorporated into the Proposed Improvement design to mitigate, or reduce the significance of these effects are described. Finally, a summary of the assessment is presented.
- 5.10.5 A summary of the findings of the WFD assessment and FCA is provided as follows:

WFD Assessment Summary

- 5.10.6 Water quality samples collected in 2015 indicated that the water quality of the streams hydrocarbons within the waters was generally below the toxicity threshold and therefore it can be assumed that the current level of pollution to the streams is not considered significant. The assessment concluded that the development of the road is likely to increase traffic volumes and types, therefore there is potential for increased pollution to the watercourses. Suitable mitigation will be incorporated into the design to ensure no adverse impacts to the water quality status post construction. The construction phase risk of pollution would be managed using best working practices and ensuring that all works within watercourses have supporting mitigation measures.

Flood Consequence Assessment (FCA) Summary

- 5.10.7 The FCA, prepared in accordance with TAN15, outlined those areas that are currently at risk of flooding and those areas that would be at risk of flooding post construction of the scheme. It was essential to establish if there were any areas identified with increased flood risk post works. Through the construction of bridges and inclusion of culverts there is significant potential for increased flood risk to the area. Bridges can cause restrictions within the watercourse through reducing the width of the channel with piers or large debris becoming lodge under the bridge causing water to build-up, up stream of the blockage. Bridges and culverts incorporated into the design have been designed and sized in exceedance of the 1 in 100 year (1% AEP) +CC flow. It is essential that any works within watercourses or near them does not increase cumulative risks elsewhere within the

catchment. The Proposed Improvement would pass through the fluvial and tidal floodplain which has the potential to alter the natural storage and flow within the floodplains. To mitigate the loss of active floodplain, the incorporation of culverts through the road structure which crosses the active floodplain to allow the natural flow of water into and from the fluvial and tidal floodplain. The culverts will be of 900mm diameter with 2.9m spacing. Hydraulic Models have been created to illustrate the pre and post construction flood risks and changes within the catchment. A number of return periods have been incorporated within the model to illustrate the flow of water pre and post works. The assessment illustrated the Proposed Improvement and drainage design combined with mitigation measures does not increase flood risk to the area. Most notably there is no increased flood risk post development to residential or commercial properties within the area.

5.10.8 There is potential for considerable overlap with the other chapters within the impact assessment process and reference to any other appropriate chapters is therefore made where required.

Methodology

5.10.9 The water quality assessment has been based on the methodology detailed in the DMRB Volume 11, Section 3, Part 10, HD45/09 Road Drainage and the Water Environment, and is described below.

5.10.11 The significance of potential effects on the water environment has been determined by assessing:

1. Importance of the water receptors;
2. Magnitude of the impacts of the Proposed Improvement; and
3. Influence of mitigation measures.

Data Sources

5.10.12 Ongoing correspondence and consultation with NRW and GC have been a key part of defining the scope of work for investigating water quality, drainage and hydrology, as well as guiding the production of the FCA and WFD assessments. Data sources are detailed in Table 5.10.1.

Table 5.10.1: Datasets used within assessment

Source	Dataset/ information	Date on dataset	Description
Natural Resources Wales	Data request for the Afon Artro	2015	Data on the Afon Artro and for flood histories for Llanbedr.
Environment Agency	West of Wales River Basin Management Plan	2015	West of Wales River Basin Management Plan
Gwynedd Council	Traffic Flow Pollution incidents	2015 2015	Traffic count and vehicle types Pollution types and location

Flood Estimation Handbook (FEH) CD ROM version 3.0 (now online)	Catchment size and description	2015	Rainfall data and catchment size
UK Soil Observatory	Information on the soil types within the area	2016	Identification of the soil types and characteristics within the area
British Geological Survey (BGS)	Maps on the geology and rock types within the area.	2016	Identification of the rock types and characteristics within the area
Ordnance Survey Maps	Maps to identify topography and features within the area	2016	Identification of the properties, watercourses, forested areas, roads and other features.

Prediction and evaluation of effects

5.10.13 Prediction and evaluation of the effects of the Proposed Improvement follows the requirements and detailed assessment methods as set out in HD 45/09. The methods are outlined in Table 5.10.2. The results of the FCA, outlined under the assessment criteria, have been taken into account when determining the significance of effects.

Table 5.10.2: Methods used within the water environment assessment

Method	Description
Method A	<p>This method focuses on the dilution of routine runoff and pollutants. This method is a simple assessment and includes the use of HAWRAT considering dilution of indicator metals (dissolved zinc and dissolved copper). The HAWRAT tool is designed to make an assessment of the short-term risks related to the intermittent nature of road-run off as well as the long-term risks.</p> <p>All discharges have been tested using HAWRAT. The methodology for routine runoff involves tests to predict future concentrations of zinc and copper in receiving watercourses with addition of discharge from the Proposed Improvement Proposed Improvement. This is based on Annual Average Daily Traffic flows (AADT), catchment size for the road, dilution flows (Q95) and current water quality (hardness) for each receiving watercourse.</p>
Method B	<p>In the event that, following the assessment using method, application of mitigation still fails against Environmental Quality Standards (EQS), method B should be applied. This is a rare occurrence. Method B assesses the bioavailability of the soluble fraction of pollutants (dissolved zinc and copper).</p>
Method C	<p>This method focuses on groundwater effects. This is the standard method for assessing the impact of a Proposed Improvement Proposed Improvement on ground water quality. Typically this considers the risk of pollution to groundwater of</p>

	discharges from a Proposed Improvement Proposed Improvement.
Method D	This method focuses on the probability of a serious spillage risk occurring that would affect the water environment. The method provides the return period of a serious accident based on road length, road characteristics (e.g. presence of junctions, roundabouts and crossroads) AADT, percentage of Heavy Goods Vehicles (HGVs), spillage risk factors and emergency services response time (based on site environment- e.g. urban/rural). An assessment has been undertaken for each outfall to test whether the probability of an accidental spillage causing a pollution incident represents an unacceptable risk.
Method E	Hydrological Assessment of Design Floods. This gives generic guidance to estimation of flood events for catchments.
Method F	Hydraulic Assessment- This gives direction as to what is required in a FCA and the process of hydraulic modelling to determine flood risk.

5.10.14 The specific requirements or thresholds to protect the surface water environment are shown in Table 5.10.3. For method A, the thresholds are Environmental Quality Standards (EQS) which are outlined in legislation and must not be exceeded. Runoff Specific Thresholds (RST's) also provide an assessment of the short term impacts of the Proposed Improvement for a range of pollutants, including soluble metals. For method D, the threshold is expressed as the minimum return period of an accident or spillage occurring and is set as a standard within HD45/09.

Table 5.10.3: Water quality thresholds

Method	Test	Limit
Method A RST	Range of pollutants including metals	Range if thresholds (pass/fail)
Method A EQS	Downstream dissolved zinc concentrations	7.8 µg/l
Method A EQS	Downstream dissolved copper concentrations*	1 µg/l for <50mg/l CaCO ₃ 6 µg/l for >50–100 mg/l CaCO ₃ 10 µg/l for 100–250 mg/l CaCO ₃ 28 µg/l for >250 mg/l CaCO ₃
Method D	Risk of serious spillage	<200 years

Key: EQS= Environmental Quality Standards; RST= Run-off Specific Threshold; * the maximum, limit for dissolved copper is dependent on hardness of the receiving water. Source HD45/09. Table A1.

Assessment criteria

5.10.15 The DMRB methodology firstly identifies the importance of the environmental attributes within the Proposed Improvement area. The magnitude of impact of the Proposed Improvement on the attribute is then determined using historical records, calculations and

tests from the DMRB, taking into consideration the influence of mitigation measures. The combination of the importance of an attribute and the magnitude of impact on that attribute gives a significance of potential effects on the water environment.

5.10.16 The assessment of the importance of attributes, the magnitude of impacts and the significance of effects are outlined below. Potential impacts of both the construction phase and operation phase have been investigated in accordance with HD 45/09.

5.10.17 The assessment criteria used for this Proposed Improvement follows those set out in HD45/09. Tables adapted from those in HD45/09 are shown in Tables 5.10.4 to 5.10.6. Examples for evaluating the importance of water attributes are shown in Table 5.10.4. A matrix for determining significance of effects is shown in Table 5.10.6.

Table 5.10.4: Evaluating the importance of water environment attributes

Value	Criteria	Typical examples
Very high	Attribute has a high quality and rarity on regional or national scale	<p>Surface Water</p> <ul style="list-style-type: none"> • European Community (EC) Designated Salmonid/ Cyprinid fishery • WFD Class High • Site protected/ designated under ED or UK wildlife legislation (SAC, SPA, SSSI, WPZ, Ramsar Site, salmonid water)/ species protected by EC legislation <p>Groundwater</p> <ul style="list-style-type: none"> • Principal aquifer providing a regionally important resource or supporting site protected under EC and UK Habitat legislation. • SPZ 1 <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain or defence protecting more than 100 residential properties from flooding • Existing likelihood of fluvial flooding affecting property* • Existing likelihood of pluvial flooding affecting properties based on topography
High	Attribute has a high quality and rarity on a local scale	<p>Surface water</p> <ul style="list-style-type: none"> • WFD Class Good • Major Cyprinid Fishery. Species protected under EU or UK habitat legislation. <p>Groundwater</p> <ul style="list-style-type: none"> • Principal aquifer providing locally important resource or supporting river ecosystem • SPZ 2 <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding • Flooding of key infrastructure during a 1 in 30 year event
Medium	Attribute has a medium quality and rarity on a local scale	<p>Surface water</p> <ul style="list-style-type: none"> • WFD Class Moderate <p>Groundwater</p> <ul style="list-style-type: none"> • Aquifer providing water for agricultural or industrial use with limited connection to surface water • SPZ 3 <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain or defence protecting 10 or fewer industrial properties from flooding • Likelihood of pluvial flooding of infrastructure based on

		topography
Low	Attribute has a low quality and rarity on a local scale	<p>Surface water</p> <ul style="list-style-type: none"> • WFD Class Poor <p>Groundwater</p> <ul style="list-style-type: none"> • Unproductive strata <p>Flood Risk</p> <ul style="list-style-type: none"> • Floodplain with limited constraints and a low probability of flooding residential and industrial properties

Key: SAC= Special Area of Conservation; SPA= Special Protection Area; SPZ= Special Protection Zone; SSSI= Site of Special Scientific Interest; WPZ= Water Protection Zone. Source Adapted from HD45/09 Table A4.3

Table 5.10.5: Assessing the magnitude of impact on water environment attributes

Magnitude	Criteria	Typical example
Major adverse	Results in loss of attribute and/ or quality and integrity of the attribute	<p>Surface water</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HAWRAT (method A) and compliance failure with EQS values (method B). • Calculated risk of pollution from accidental spillage >2% annually (method D) • Loss or extensive change to a fishery • Loss or extensive change to a designated nature conservation site. <p>Groundwater</p> <ul style="list-style-type: none"> • Loss of or extensive change to an aquifer • Risk score >250 (method C) • Calculated risk from spillages >2% annually (method D) • Loss or extensive change to groundwater designated wetland. <p>Flood Risk</p> <ul style="list-style-type: none"> • Increase in peak flood level of (1% annual probability) >100mm (methods E and F).
Moderate adverse	Results in effect on integrity of attribute or loss of part of attribute	<p>Surface Water</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HAWRAT (method A) but compliance with EQS values (method B) • Calculated risk of pollution from accidental spillages >1% annually and <2% annually (method D) • Partial loss in productivity of a fishery <p>Groundwater</p> <ul style="list-style-type: none"> • Loss of or extensive change to an aquifer • Risk score >250 (method C) • Calculated risk from spillages >2% annually (method D) • Loss or extensive change to groundwater designated wetland <p>Flood Risk</p> <ul style="list-style-type: none"> • Increase in peak flood level of (1% annual probability) >50mm
Minor adverse	Results in some measurable change in attributes quality	<p>Surface water</p> <ul style="list-style-type: none"> • Failure of either soluble or sediment-bound pollutants in HAWRAT • Calculated risk of pollution from accidental spillages >0.5% annually and <1% annually (method D).

	or vulnerability	<p>Groundwater</p> <ul style="list-style-type: none"> • Risk score <150 (method C) • Calculated risk of pollution from accidental spillages >0.5% annually and <1% annually (method D). • Minor effects on groundwater supported wetlands <p>Flood Risk</p> <ul style="list-style-type: none"> • Change in flood peak (1% annual probability) <10mm
Negligible	Results in effect on attribute but of insufficient magnitude to affect the use or integrity	<p>The Proposed Improvement Proposed Improvement is unlikely to affect the integrity of the water environment.</p> <p>Surface water</p> <ul style="list-style-type: none"> • No risk identified by HAWRAT and risk of pollution from accidental spillages <0.5% <p>Groundwater</p> <ul style="list-style-type: none"> • No measurable impact upon an aquifer and risk of pollution from accidental spillages <0.5% <p>Flood Risk</p> <ul style="list-style-type: none"> • Change in flood peak (1% annual probability) < +/- 10mm
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	<p>Surface water</p> <ul style="list-style-type: none"> • HAWRAT assessment of either soluble or sediment-bound pollutants becomes Pass from existing site where the baseline was a Fail condition • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually) (method D) <p>Groundwater</p> <ul style="list-style-type: none"> • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually) (method D) <p>Flood Risk</p> <ul style="list-style-type: none"> • Reduction in peak flood levels (1% annual probability) >50mm
Moderate beneficial	Results in moderate improvement on attribute quality	<p>Surface water</p> <ul style="list-style-type: none"> • HAWRAT assessment of either both soluble or sediment-bound pollutants becomes Pass from existing site where the baseline was a Fail condition • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk >1% annually) <p>Flood Risk</p> <ul style="list-style-type: none"> • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually) <p>Flood Risk</p> <ul style="list-style-type: none"> • Reduction in peak flood levels (1% annual probability) >50mm
Major Beneficial	Results in major improvement of attribute quality	<p>Surface water</p> <ul style="list-style-type: none"> • Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse <p>Groundwater</p> <ul style="list-style-type: none"> • Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring • Recharge of an aquifer <p>Flood Risk</p> <ul style="list-style-type: none"> • Reduction in peak flood levels (1% annual probability) >100mm

Adapted from Source: Adapted from HD45/09 Table A4.4

Table 5.10.6: Determining the significance of effect on water environment attributes

Importance of attribute	Magnitude of impact			
	Negligible	Minor	Moderate	Major
Very High	Neutral	Moderate/ large	Large/ very large	Very large
High	Neutral	Slight/ moderate	Moderate/ large	Large/ very large
Medium	Neutral	Slight	Moderate	Large
Low	Neutral	Neutral	Slight	Slight/ moderate

Limitations

5.10.18 There was limited information regarding the low flows for the watercourses within the study area. Assumptions have been made based on site information, topographical information and rainfall data by NRW to provide an estimated flow for the Afon Artro. For the purpose of the Highways Agency Water Risk Assessment Tool (HAWRAT) the assumed Q95 flow of 2.51m³/s has therefore been allocated to the Afon Artro (as provided following a data request to NRW). There is no further flow data available for the remaining watercourses.

Flood Consequence Assessment (FCA)

5.10.19 An FCA has been produced in accordance with TAN15 and following consultation with NRW. The methodology is summarised below and the full FCA can be found in Technical Appendix D. The summary is provided within this chapter. The approach for the FCA was developed in accordance with the methodology set out in HD45/09 Annex I, Method E. The parameters used were agreed in principle with NRW and liaison continued as the scheme design developed and progressed. A full hydraulic model was developed (by YGC and Ardent Consulting Engineers) for the area to illustrate the pre and post Scheme flood risk to the properties within the area under joint probability scenarios for both fluvial and tidal events. The full assessment can be found within the full FCA report.

5.10.20 Sources of flood risk considered in the FCA are:

- Fluvial
- Tidal (including the tidally influenced lower reaches of the Afon Artro)
- Pluvial (direct surface runoff)
- Increased Surface Water Runoff from the new road development
- Groundwater

5.10.21 The following stakeholders have been consulted in relation to flood risk (records of consultation are held by YGC- see table 5.10.7 for a summary):

- NRW- as the lead authority of the Internal Drainage District (IDD) within the area

Table 5.10.7 Consultation carried out to date

Name and organisation	Subjects Discussed	Key issues raised	Date
NRW (specify names at a later date)	Flood Risk	Compensatory floodplain. Hydraulic modelling specification. Tidal return periods for hydraulic modelling.	2016/17- ongoing
Community engagement	Route options	Visual impact to the area. Flood risk	2015- ongoing

5.10.22 The watercourses which were considered as part of the FCA are:

- Watercourse 1- Afon Artro- main river (Grid Ref: 258088 327080)
- Watercourse 2- Un-named tributary of Afon Artro- main river (Grid Ref: 258231 327156)
- Watercourse 3- ordinary watercourse (Grid Ref:258264 327361)
- Watercourse 4- ordinary watercourse (Grid Ref: 258256 327478)
- Watercourse 5- main river (Grid Ref: 258143 327642)

5.10.23 The fluvial and tidal floodplain was also considered within the FCA.

Water Framework Directive (WFD) compliance assessment

5.10.24 In agreement with NRW, a supplementary WFD compliance assessment (see Technical Appendix D, Volume 2) has been undertaken. The assessment is based on the methodology in Environment Agency draft guidance as agreed with NRW and considers whether the Proposed Improvement could potentially impact on water bodies within the locality of the affected streams or downstream areas.

5.10.25 The WFD compliance assessment considers hydromorphological, biological (aquatic ecological) and groundwater quality impacts. The environmental objectives used to assess WFD compliance are based on internal Environment Agency guidance. These are as follows:

1. The Proposed Improvement would not cause deterioration in any element of water body classification
2. The Proposed Improvement would not prevent the WFD status objectives from being reached within the water body or other downstream water bodies
3. The Proposed Improvement would not negatively impact critical or sensitive habitats within the water body
4. The Proposed Improvement would contribute to the delivery of the Western Wales River Basin Management Plan (RBMP). Where required by the RBMP, if an affected water body is at less than Good ecological status/ potential, and examination of whether pre-determined mitigation measures could be incorporated into the Proposed Improvement should be considered.

5.10.26 The WFD compliance assessment is based on the current Scheme design as described and assessed in this Environmental Statement. Changes to the design at the detailed design stage may require an updated WFD detailed compliance assessment to be produced.

5.10.27 The WFD compliance assessment can be found in full in Technical Appendix D, Volume 2.

Policy Context

5.10.28 European legislation is implemented in the UK through specific sets of Regulations. The Welsh Government is responsible for all aspects of water policy in Wales. The aim of water policy in Wales is to protect both public health and the environment by maintaining and improving the quality of natural waters. These include surface water bodies (e.g. rivers, streams, lakes and ponds) and groundwater. Management and enforcement of water policy is the responsibility of NRW. The protection of specific water resources, water quality and related policy relevant to the Proposed Improvement is set out in the following:

- The Water Framework Directive (2000/60/EC)
- The Urban Waste Water Treatment Directive (91/271/EEC)
- The Habitats Directive (92/43/EEC)
- Priority Substance Directive (2013/39/EU)
- Protection of Groundwater Directive (2006/18/EC)
- Groundwater Regulations (2009)
- River Basin Management Plans (Western Wales)
- Local Flood Risk Management Strategy (Gwynedd (2013))

5.10.29 The following national legislation is also relevant to the Proposed Improvement:

- Environmental Protection Act (1990)
- Water Industry Act (1991)
- Environmental Act (1995)
- Water Act (2003)
- Water Environment (Water Framework Directive) (England and Wales) Regulations (2003)
- Environmental Damage (Prevention and Remediation) Regulations (2009)
- Flood Risk Regulations (2009)
- Water Resources Act (1991) (Amendment (England and Wales) Regulations (2009)
- Environmental Permitting Regulations (England and Wales) (2010)
- Flood and Water Management Act (2010)

Wales Transport Strategy (WTS)

5.10.30 The Wales Transport Strategy, published by the Welsh Government in April 2008, identifies the importance of adapting to climate change in Wales. The WTS outlines various outcomes aimed at achieving a sustainable transport strategy for Wales. Outcome 13 requires transport networks to adapt to cope with the impact of climate change and support increased resilience; an indicator of this is the proportion of the transport network protected against future flood risk.

Planning Policy Wales and Technical Advice Notes

5.10.31 The context for Planning Policy Wales is set out within the Planning Policy Wales document referencing European and national legislation and supplemented by a series of Technical Advice Notes (TAN) and Policy Clarification Letters.

5.10.32 TANs provide local authorities with guidance when considering the effects of new developments. The TANs identified below can be useful to refer to when assessing road developments on the water environment:

- TAN 5: Nature Conservation and Planning gives advice as to the consideration of impacts on designated sites in relation to the water environment.
- TAN 15: Development and Flood Risk (2004), provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding.

5.10.33 The general approach of Planning Policy Wales (Edition 8, January 2016), supported by TAN 15, is to advise caution in respect of new development in areas at high risk of flooding by setting out a precautionary framework to guide planning decisions.

Water Legislation

5.10.34 Water resources in England and Wales are protected by law under the Water Resources Act 1991, a consolidation of the Water Act 1989, and the Environmental Protection Act 1990 (as amended by the Environment Act 1995). The Water Resources Act 1991 is the principal legislation relating to water resources in England and Wales.

Water Framework Directive (WFD)

5.10.35 In October 2000, the WFD was adopted and came into force in December 2000. The purpose of the Directive, in relation to surface waters, is to establish a framework for the protection of inland surface waters (rivers and lakes). The Directive aims to ensure that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands meet 'good status' by 2015. The WFD's requirements are being implemented through The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.

5.10.36 The WFD updates, and replaced the Groundwater Directive (80/68/EEC) requirements to prevent or limit the introduction of pollutants into groundwater. The WFD established a framework for management of water resources throughout the European Union.

5.10.37 The main aims and objectives of the framework are to:

1. Prevent deterioration, enhance and restore bodies of surface water, achieve good chemical and ecological status of such waters and reduce pollution from discharges and emissions of hazardous substances.
2. Protect, enhance and restore all bodies of groundwater, achieve good chemical and quantitative status of groundwater, prevent the pollution and deterioration of groundwater, and ensure balance between groundwater abstraction and replenishment.
3. Preserve protected areas (TAN15 for Wales).

5.10.38 NRW's monitoring programmes will allow the classification of surface water bodies into one of five WFD ecological status classes (high, good, moderate, poor, bad) and one of two chemical status classes (pass/ fail). One of the main goals of the WFD is to aim for at least 'good' ecological status and 'good' chemical status for surface waters and groundwater by 2015.

Flood and Water Management Act 2010

5.10.39 Following the floods of 2006/ 2007 the government commissioned Sir Michael Pitt to undertake a review of all the issues and actions associated with this flood event. His report in December 2008 produced 92 recommendations, 15 of which the government acted upon report and the first draft of the Flood and Water Bill was produced. Part of the concept of the Bill was that a 'Lead Local Flood Authority' would be set up to coordinate all local flood related activities.

5.10.40 The term Lead Local Flood Authority (LLFA) refers to a County council or Unitary Authority, hence Gwynedd Council (GC). The main directive of the Bill/ framework is the requirement to produce a Preliminary Flood Risk Assessment (PFRA).

5.10.41 The Flood and Water Management Act came into force on the 1st of October 2010. The Act pulls together many of the Pitt recommendations, and will require the Council to undertake new duties to deal with local flood risk. In brief the main new duties for LLFA will be to develop, maintain, apply and monitor a local flood risk management strategy in its area which covers flood risk from surface run-off, groundwater, and ordinary watercourses.

Groundwater Legislation

5.10.41 Historically, the main European legislation related to groundwater protection is the Groundwater Directive (80/68/EEC), which is transposed by the Groundwater Regulations 1998 (as amended). The WFD has integrated the majority of the Groundwater Directive.

5.10.42 Other legislation related to groundwater includes the Water Resources Act 1991, the Control of Pollution Act 1974, the Environmental Protection Act 1990 and the Town and Country Planning Acts.

5.10.43 The vulnerability of groundwater to diffuse pollutants depends on the presence and nature of the overlying soil, the presence and nature of drift, the nature of the strata and the depth of the unsaturated zone. The Soil Survey and Land Research Centre have developed three soil vulnerability classes for the Environment Agency based on physical soil properties. These are:

- soils of high leaching potential (H1, H2, H3)
- soils of intermediate leaching potential (I1, I2)
- soils of low leaching potential (L).

5.10.44 Principles for groundwater protection are detailed in 'Groundwater Protection: Principles and Practice' (GP3).

Land Drainage Legislation

5.10.45 Under the Land Drainage Act 1991 Section 23 it is stated that *'No person shall: a) erect any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or b) erect any culvert that would be likely to affect the flow of any ordinary watercourse or alter any culvert in a manner that would be likely to affect any such flow, without the consenting in writing of the drainage board concerned.'* (Land Drainage Act, 1991, Chapter 59).

5.10.46 Any works that are within or likely to affect Ordinary Watercourses will require consent from the LLFA and must meet the requirements of the Flood and Water Management Act. The LLFA must consider the benefits of the work will outweigh the harmful consequences to natural heritage, preservation of cultural heritage, or people's enjoyment of the environment or of cultural heritage before any consent would be made.

5.10.47 Any works that are within or likely to affect Main Rivers (including culverting or discharging upstream); will require consent and permission from Natural Resources Wales.

Local Authority Guidance

5.10.48 Gwynedd Council and the Isle of Anglesey County Council are preparing a Joint Local Development Plan for the Gwynedd and Anglesey Local Planning Authority Area. The JLDP, expected to be formally adopted in spring 2017, is a land use development strategy for a period of 15 years which concentrates on sustainable development. It will aim to achieve the following:

- Guide the development of housing, retail, employment and other uses;
- Include policies which will aid the Local Planning Authority's decision with regard to planning applications, and;
- Protect areas to ensure the maintenance and enrichment of the natural and built environment.

5.10.49 The current development plan framework for Gwynedd comprises the Gwynedd Unitary Development Plan 2001-2016 (adopted July 2009). The plan establishes a policy framework and makes provision for development needs for the period up to 2016.

Policy B32 provides guidance on Increasing Surface Water. This states that *"proposals that do not include flood minimisation or mitigation measures that will reduce the volume and rate at which runoff reaches rivers and other watercourses will be refused. When a development is approved planning conditions or agreements will be used to ensure that the necessary flood minimisation or mitigation measures are implemented, in accordance with submitted details which were approved"*.

Policy B33 provides guidance on Development that Creates Pollution or Nuisance. This states that *"proposals that will cause significant harm to the quality of public health, safety or amenities, or to the quality of the built or natural environment as a result of higher levels of air, water, noise or soil pollution will be refused unless adequate controls can be attained by means of planning conditions and powers of regulatory bodies, and that arrangements can be made for monitoring discharges. In addition, proposals located adjacent to an existing source of pollution or nuisance will be refused unless the Local Planning Authority is satisfied that there will be no risk to the health or safety of the local community or potential occupants of the new development that cannot be satisfactorily overcome"*.

Policy C29 provides guidance on Safeguarding Water Resources. This states that “*proposals that will cause significant harm which cannot be mitigated or managed effectively, on surface water, ground water sources or freshwater ecosystems will be refused*”.

Eryri Local Development Plan (2007 – 2022) (Snowdonia National Park Authority, 2011)

5.10.50 As the Proposed Improvement is situated within the Snowdonia National Park, local planning policy is directed by the Eryri Local Development Plan (LDP). The Eryri LDP provides a development strategy for sustainable development and conservation needs for the Snowdonia National Park until 2022. It is concerned mostly with the use and development of land, but will also have effects on the local economy.

Nature Conservation designations

5.10.51 The study area is within the Snowdonia National Park and also within the Arduwy Landscape of Outstanding Historic Interest (LOHI). Within the Arduwy LOHI, there are smaller landscape areas which have been classified through a process called Historic Landscape Classification. Of these, the study area overlaps with areas 11 (Royal Aerospace Establishment, Llanbedr), 14 (Coastal plain behind RAE Llanbedr), 15 (Fieldscape, mid-hill slopes, Cae'r Meddyg) and 18 (Llanbedr village).

5.10.52 The study area lies within the Arduwy Marsh Internal Drainage District (IDD), which stretches from Llandanwg to the north of Llanbedr, follows the western side of the A496 carriageway towards Llanbedr, then follows the western side of the railway line to Llaneddwyn. This is one of 11 such areas in north-west Wales which are administered by Natural Resources Wales (NRW) to manage drainage in areas which have special drainage requirements.

5.10.53 Special Areas of Conservation (SAC):

- Pen Llyn a'r Sarnau (200m to northwest) – along the shoreline west of Llanbedr airfield;
- Morfa Harlech a Morfa Dyffryn (1.2km to west) – within the tidal range along the shoreline west of Llanbedr airfield;
- Coedydd Derw a Safleoedd Ystlumod Meirion (85m to east) – Several components of the site are located on the eastern side of the A496:
- Coed Hafod Bryn – immediately south of Llanbedr;
- Coedydd Aberartro - approximately 1km east of Llanbedr, and;
- Coed Lletywalter – 1.3km north east of Llanbedr.
- Afon Eden (12.3km) – Cors Goch Trawsfynydd
- Afon Gwyrfai a Llyn Cwellyn (24.9km to north)
- Glynllifon (26.1km to north)

5.10.54 Sites of Special Scientific Interest (SSSI):

- Morfa Dyffryn SSSI – along the western boundary of Llanbedr airfield;
- Caeau Bwlch SSSI – 560m south east of Llanbedr;
- Coed Aberartro SSSI – 1km east of Llanbedr, and;
- Coed Lletywalter SSSI – 1.3km north east of Llanbedr.

5.10.55 Other nature conservation designations:

- Morfa Dyffryn National Nature Reserve (NNR) – along the shore and up to the western boundary of Llanbedr airfield
- Ancient Semi-Natural Woodlands – several woodlands to the east of Llanbedr (490m NE, 520m SE, 1km E and 1.3km NE).

5.10.56 The various habitats present include improved grassland, dune grassland, dense saltmarsh, open dunes, coniferous woodland, semi-natural broadleaved woodland and river corridor. Please refer to chapter 5.4 (Nature Conservation) for further details about these and other nature conservation designations.

Surface Water

5.10.57 Watercourses within the study area fall within the Western Wales River Basin District as set out within the West of Wales River Basin Management Plan (RBMP). The current WFD status is 'Good' for watercourse 1 (Afon Artro) and watercourse 2. No further information is held on the remaining watercourses within the study area.

5.10.58 Consideration of hydromorphological and aquatic effects of the Proposed Improvement are not defined within the DMRB but are considered within the Water Framework Directive Initial Compliance Assessment. Associated flood risk with the Proposed Improvement will be assessed and defined within the Flood Consequence Assessment. Please refer to Volume 2, Technical Appendix D.

5.10.59 Within the footprint of the Proposed Improvement there are a total of 5 watercourses that may be affected by the new proposed development. These watercourses include both main rivers and ordinary watercourses. The flows seen within each of the watercourses are significantly varied with a number of the watercourses seen to be generally seasonally wet. The design of the road will include two major bridge structures to cross over watercourse 1 and 2 with a culverts incorporated at watercourse 3 to link in the highway drainage. Assessments will be carried out to ensure that flood risk is not increased within the area or elsewhere within the catchment as a direct result of the works.

5.10.60 All watercourses that require culverting for access will be designed to the 1 in 100 year +CC and subject to flood activities permit.

5.10.61 There is limited data held on the watercourses within the study area.

Water Quality Sampling

5.10.62 As part of the Environmental Statement and establishing baseline conditions, water samples were collected in late 2015. The water quality data used as part of this assessment are shown in Table 5.10.8.

Consultation with NRW

5.10.63 The stretch of the Afon Artro within the study area is monitored under the EA's General Quality Assessment (GQA) programme. In 2007 this stretch was graded as A (Very Good) for chemical quality, B (Good) for biological quality and 1 (Very Low) for levels of nitrates and phosphates. Its River Quality Objectives (RQOs) were assessed as class RE1 (River Ecology) in

2007 based upon the river ecology; described by the EA (2008) as “*rivers of very good quality, suitable for all fish species*”. The WFD status objective is Good ecological potential by 2027.

Water Sampling

5.10.64 The water samples tested in 2015 were based on the parameters requested by NRW to be tested for as a minimum; pH, conductivity, chloride, solids, turbidity, zinc, hydrocarbons and oil (visibility test). The parameters of particular concern are the level and type of hydrocarbons present within the watercourses. High levels of hydrocarbons within the watercourses would indicate high pollution levels from the road resulting in poor pollution control on the drainage outlets.

5.10.65 Water sampling was carried out on the 10/12/15 and 17/12/15.

5.10.66 The WFD assessment report (Technical Appendix D, Volume 2) describes the potential pollution and effects on the waterbodies affected by the Proposed Improvement. From the results of the water samples it was indicative that the water quality status has remained unchanged and is still of good status. The level of pollution recorded indicates that the watercourses are currently not receiving high levels of pollution from the surrounding land or road.

pH

5.10.67 Watercourses usually have a pH of 6 - 8 depending on the surrounding soil and bedrock. High pH levels can damage gills and skin of aquatic organisms.

5.10.68 The water sample results indicate that the pH of the waterbodies is within the indicative threshold for freshwater.

Turbidity

5.10.69 Turbidity is the measure of the relative clarity of a liquid. It is an optical characteristic of water and is an expression of the amount of light that is scattered by the material in the water. The higher the intensity of scattered light, higher the turbidity. In England and Wales the maximum value of turbidity is 4.

5.10.70 The water sample results are indicative of waterbodies with low turbidity.

Extractable Hydrocarbons

5.10.71 The most common hydrocarbons within watercourses near highways are from diesel or petrol combustion engines, oil spills and lubricants.

5.10.72 The results indicate that the watercourses are not receiving high levels of hydrocarbons throughout the year. Increased hydrocarbons within the sample results are indicative of the close proximity of watercourse 3 to the existing road. The low flows within the watercourse result in temporary influxes of increased hydrocarbon concentrations due to build up during dry channel followed by rapid flow of water following a rainfall event. Low flows can increase concentration readings as there is not enough water to dilute the pollutant.

Total Suspended Solids (TSS)

5.10.73 Dissolved solids consist of calcium, chlorides, nitrate, phosphorus, iron, sulphur and other ion particles. The concentration of TSS affects the water balance in the cells of aquatic organisms. Higher concentrations of TSS can serve as carriers for toxins such as dissolved metals and pathogens.

5.10.74 The sample results illustrate generally low levels of total suspended solids.

Zinc

5.10.75 Ecotoxicological tests attributed a 50 µg/L Predicted No Effect Concentration (PNEC) value to dissolved zinc. This means total concentrations of 150-200 µg/L of zinc in water. This PNEC value represents the maximum concentration where no environmental effect occurs.

5.10.76 It is clear from the results that the watercourses do not receive elevated levels of zinc throughout the year. The higher concentrations found in sample set 1 points 1 and 2, and sample set 2 point 2 are indicative of the location of the watercourse within agricultural fields and close proximity to the existing road.

Chloride (Cl)

5.10.77 Almost all natural waters contain chloride. Their concentrations vary considerably according to the mineral content of the earth in any given area. In small amounts they are considered not significant.

5.10.78 Chloride may get into surface water from several sources including:

- Wastewater from industries and municipalities
- Wastewater from water softening
- Road salting
- Agricultural runoff
- Produced water from gas and oil wells

5.10.79 The maximum concentration limit of chloride in natural waters is 250mg/l.

5.10.80 The sample results illustrate generally low concentrations of Chlorine.

5.10.81 The 2015 sample results indicate that that the watercourses within the study area currently do not receive high levels of pollution from the surrounding agricultural land or from the road. Sample point 1 and 2 indicate the close proximity of the watercourse to the A496. It was also noted that these watercourses do not have a continuous flow throughout the year and that during drier summer months are often dry which would indicate seasonal increases in sediment and higher concentration of pollutants following initial rainfall.

Table 5.10.8 Summary of water quality samples

Sample Point Number	Type	Zinc (Total as Zn) Mg/l	pH	Turbidity (NTU)	Chloride as Cl	Total Suspended Solids (mg/l)	EH >C6 - C40 µg/l	EH >C6 - C8 µg/l	EH >C8 - C10 µg/l	EH >C16 - C24 µg/l	EH >C24 - C40 µg/l	EH >C10 - C16 µg/l
10/12/2015												
1	Surface water	57.8	5.7	313	242	58	<40	<40	<40	<40	<40	<40
2	Surface Water	24	7	6.12	40.6	6	<40	<40	<40	<40	<40	<40
3	Surface Water	56.3	6.1	7.24	25.4	14	<10	<10	<10	<10	<10	<10
4	Surface Water	35.1	6	2.21	20.3	4	16	<10	<10	<10	16	<10
17/12/2015												
1	Surface water	23.7	7.2	10.2	53.2	12	11	<10	<10	<10	11	<10
2	Surface water	67.4	7.1	54	53.9	87	61	<10	<10	<10	61	<10
3	Surface water	<18	6.9	<1.4	17.6	3	<10	<10	<10	<10	<10	<10
4	Surface water	24.6	6.9	<1.4	25.9	4	<10	<10	<10	<10	<10	<10

Groundwater

5.10.82 Groundwater Source Protection Zones are defined by NRW to identify and protect groundwater sources that supply water to potable or equivalent standards. Information supplied by NRW indicates the study area to be outside any defined Zones.

5.10.83 The catchment study area is volume driven, as opposed to groundwater driven, and the response to rainfall is expected to be fast with peak flows being reached in the river network soon after the rainfall event due to the underlying geology and catchment topography.

5.10.84 A study of the groundwater vulnerability and aquifer maps indicate that there is a Secondary A aquifer within the Proposed bypass area.

5.10.85 Secondary Aquifer includes a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:

- **Secondary A** have permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers;
- **Secondary B** are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
- **Unproductive Strata** for the drift deposits / superficial have low permeability that have negligible significance for water supply or river base flow – these are generally shallow / thin deposits.

5.10.86 It has been concluded that there are no geological SSSI's, RIGS or GCR's located within or directly adjacent to the proposed scheme the baseline conditions in terms of the geology, hydrogeology and geomorphology are valued as **Low** and are of local interest only.

Abstractions and discharges

5.10.87 NRW have no records of abstraction licences or discharge consents within 500m of the Proposed Improvement.

Existing Road Drainage

5.10.88 Minor watercourses which drain west into the Afon Artro (watercourse 1) are culverted under the existing A496. Drainage from the existing A496 is collected by roadside gutters and falls into existing watercourses at some locations, and at others run directly off the road surface on to the adjacent land. Silt traps, oil receptors or other treatment measures do not appear to be present.

5.10.89 Many of the existing outfalls do not meet the standards required for county road. Many are in poor condition, are not designed to permit the movement of mammals such as otters, and may impair hydrological conductivity during high flow conditions.

Recorded Pollution Incidents to Controlled Waters

5.10.90 There have been three documented pollution incidents within the area.

Table 5.10.9 Recorded Pollution Incidents

Date	Location	Pollution Incident
11/09/2013	Ymlwch (Grid Ref: 257850 327888)	Yacht at local club leaking fuel into watercourse
31/03/2014	Hafod y Bryn (Grid Ref: 258530	Watercourse discoloured (white) with

	326810)	an oily sheen
18/07/2014	Sarn Hir (Grid Ref: 258521 326824)	Road traffic accident between two cars resulted in one car in the watercourse and visible oil/ fuel seen around the car.

Flood Risk

5.10.91 TAN15 advises caution in respect of new developments in areas at high risk of flooding. The Development Advice Maps (DAMs) produced in conjunction with TAN15 illustrate those areas at high risk of flooding. From analysis of these DAMs, the study area falls into Zone B, C1 and C2.

5.10.92 Zone C1 and C2 are based on Environment Agency Extreme flood outlines $\geq 0.1\%$ AEP (river, coastal or tidal).

5.10.93 The area also lies within the fluvial and tidal floodplains. It is noted that Llanbedr is currently defended by an earth bund that is managed and maintained by NRW. The bund provides protection to the village and the agricultural fields from flooding from the Afon Artro and from coastal flooding. There are known times of infrequent flooding to the fields as a result of a breach of the earth bund. One of the main issues with the area is the high water table that results in reduced storage capacity of land. During times of inundation the water pools on the surface for an extended period of time as there is limited drainage within the fields and through the bund. Although the bund provides protection, during inundation, there is no direct drainage route for the water to return to the river and therefore further exacerbates the flooding to the area.

5.10.94 Any reduction in the active floodplain area will require subsequent compensatory area. Where works are within the active floodplain the associated risks will need to be understood and water should not be restricted within this area. Any changes to the floodplain will require sensitive mitigation and is discussed in later sections within this chapter.

5.10.95 Currently there are no commercial or residential properties at direct risk of flooding. It is therefore essential that the Proposed Improvement does not adversely affect this flood risk. Any increase in flood risk associated with the development will require suitable mitigation measures to be implemented during both construction and operation.

Pre- Mitigation Measures

Magnitude of Impacts and Significance of Effects

5.10.96 This section considers the potential impacts of the Proposed Improvement road on the water environment during both construction and operation **without mitigation measures in place**. Table 5.10.14 and Table 5.10.15 below summarise the significance of potential effects pre and post suggested mitigation measures during construction and operation respectively.

Proposed Drainage Design

5.10.97 The proposed drainage design is explained in Chapter 2, section 2.3, but specific issues relating to watercourses crossed by the Proposed Improvement, and therefore considered in this assessment are summarised as follows:

- Water pollution

- Hydromorphological and hydrogeomorphological impacts
- Increased surface water
- Loss of floodplain area
- Increased flood risk

The watercourses have been defined as follows:

- Watercourse 1- Afon Artro (main river)
- Watercourse 2- main tributary of the Afon Artro (ordinary watercourse)
- Watercourse 3- un-named watercourse (ordinary watercourse)
- Watercourse 4- un-named watercourse (ordinary watercourse)
- Watercourse 5- un-named watercourse (main river)

5.10.98 The Proposed Improvement road will span the length of 1.53km and will be of single carriage for both directions.

5.10.99 The Proposed Improvement will join the existing A496 to the north of Llanbedr (Grid Ref: 258430 327020).

5.10.100 The crossing of two watercourses and the Mochras Road will require the construction of two bridges.

5.10.101 The two bridges will be of concrete construction, the first, and largest, spanning the Afon Artro (watercourse 1) and the Mochras road (links the airfield from the village centre), would be a double span bridge, allowing approximate headroom above the river of at least 5.8m. The second bridge will span the tributary of the Afon Artro (watercourse 2), to the north of the Afon Artro crossing. The construction of this bridge will allow for the safe passage of livestock and wildlife underneath. The bridge will be single span (approximately 16m between abutments) with approximate headroom above the water level of 3.3m).

5.10.102 Watercourses 3 to the north of the Proposed Improvement will be partially culverted to allow the road to cross over the watercourse and to link the existing road drainage with the new proposed drainage. The proposed 2.2m x 2.2m box culvert would take into consideration the safe passage of marine life and the safe movement of mammals. This culvert would include 400mm mammal ledges on each side, with 600mm head room and sufficient height above the water level to remain dry in a 1 in 100 year flood event. In-river works would be restricted to times allowed and agreed by NRW, most significantly no in river works would occur during fish spawning and migrating seasons. Any in channel works would require consultation with NRW.

5.10.103 The surface water drainage system would comprise kerb gullies routed to carrier drains, as well as filter drains being utilised. Kerbside roads would be drained by gullies or combined kerb gully systems where applicable.

5.10.104 Within the design of the Proposed Improvement, three main areas of attenuation incorporated to ensure that discharge into the watercourses is restricted to Greenfield rates seen pre development. The attenuation areas will have the dual purpose of sediment settlement and pollution removal prior to discharge. The areas will incorporate vegetative bays as further pollution reduction methods. The four attenuation areas will allow for a multi stage drainage train, ensuring that the final discharge into the watercourses does not contain elevated levels of pollution or sediment. In summary there will be one attenuation pond, two attenuation areas consisting of underground

oversized pipes for increased storage and a further attenuation to the north of the Proposed Improvement within a new proposed reed bed area.

5.10.105 The total required area required for attenuation is:

- Attenuation pond 1 :approximately 1700m²* (area available >1500m²)
- Attenuation site 2+3 : approximately 2300m²*(area available > 4500m²)
- Attenuation area 4 (reed beds): approximately 2000m²* (area available >2800m²)

**final size of attenuation areas to be confirmed at detailed design stage. Exact size of required attenuation will vary in accordance with required depths of the water for safety. The above figures outline the minimum space required for sufficient storage of the runoff.*

5.10.106 The outflows from all drainage networks would be restricted as agreed with NRW on behalf of the LLFA prior to discharging to watercourses.

Levels of Service

5.10.107The fence line and cutting drainage would be designed to accommodate the 1.33% (1 in 75) annual chance flood event (although land drainage culverts are designed to the 1% (1 in 100) annual chance event including climate change allowance).

5.10.108Flow down the faces of cuttings would be captured by the drainage system. Flow down earthwork embankments would be intercepted by V ditch toe drains connecting with the nearest watercourse. If possible these would be designed as swales in flatter areas, providing an element of SuDS.

5.10.109 The full drainage design can be found in the Drainage Strategy Report in Volume 2, Technical Appendix D

Sustainable Drainage Systems (SuDS)

5.10.110 The use of SuDS within the Proposed Improvement has been considered and assessed. As the need to minimise land take limits the scope for the implementation of further SuDS, the use of over-sized pipes has been included for temporary storage of surface water runoff. Filter strips, filter drains, swales and attenuation ponds and attenuation areas have been incorporated into the proposed design.

5.10.111 The attenuation areas would be used as settling bays for the surface water runoff to allow for sediment separation and removal of hydrocarbons and other pollutants. During the detailed design stage, additional SuDS would be considered and implemented where possible.

5.10.112Treatment and management of runoff would be carried out as closely as possible to the source of the runoff to eliminate pollution entering the watercourses.

Construction Period

5.10.113 The construction works for the Proposed Improvement have the potential to impact water quality in any of the receiving surface or groundwater receptors; this may be due to excavation, the deposition of soils, sediment, or other construction materials, spillage of fuels or other contaminating liquids, the mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site runoff.

Surface Water

5.10.114 There is potential for the Proposed Improvement to have adverse effect on surface waters within the study area during the construction period through spillages of chemicals, cement and fuels into the streams. Increased siltation can occur during in-stream works that can disrupt the natural environment of the watercourses.

5.10.115 Pollution entering the watercourses as a result could have implications for water quality.

5.10.116 The effect of in-stream works (e.g. construction of culverts) relates to the potential for disturbance of in-stream habitats and associated communities due to the clearance of in-stream and bankside vegetation. Culverting can also affect flow rates, which could in turn affect the ecological composition of the specific stream.

5.10.117 The WFD assessment report (see Technical Appendix D, Volume 2) describes the potential pollution and effects on the waterbodies affected by the Proposed Improvement. From the current WFD status (Good).

5.10.118 The level of pollution recorded indicates that the streams are currently generally not receiving significant levels of pollution from the surrounding land or road. The increased impermeable surface and increased drainage would require proper regulation and design to ensure that increased levels of pollution, especially hydrocarbons, do not enter the watercourses.

5.10.119 The proposed design of the Proposed Improvement has the potential to have an adverse effect on the watercourses within the area without suitable mitigation measures in place.

Stockpiles

5.10.120 Stockpiles would be kept clear of existing trees and watercourses. The location of stockpiles in relation to watercourses would take account of any possible pollution and flooding risk during periods of spate.

Hydromorphology and Hydrogeomorphology

5.10.121 Hydromorphology is a term used in river basin management to describe the hydrological (e.g. water flow, energy) and geomorphological (surface features) processes and attributes of rivers, lakes, estuaries and coastal waters. The Water Framework Directive (WFD) dictates that the ecology of surface waters is protected by correctly managing their hydrology and geomorphology. Changes to hydromorphology and hydrogeomorphology from road projects can be significant, with loss of drainage channels to culverting and increases in flow rates. Impacts on flow regime and physical habitat, which may result in a waterbody's deterioration of status under the Water Framework Directive or a failure to achieve the waterbody's objectives, have therefore been considered.

5.10.122 During the construction period there is potential for changes to occur to the flow rates and capacity of the affected streams, which could have an adverse impact upon their natural hydromorphology and hydrogeomorphology. Any in-river works have the potential to change the hydromorphology of the streams and subsequently increase in erosion.

Groundwater

5.10.123 Although there remains a potential for construction works to impact on the groundwater through storage of materials or accidental spillages, it has been confirmed by NRW that the secondary undifferentiated (bedrock) aquifer that lies below the Scheme area; the Secondary A (Superficial) aquifer that lies to the north of the area and the unproductive aquifer to the southern end of the Proposed Improvement is not at risk of pollution from the works. Furthermore, any pollutants that do infiltrate the groundwater resource are considered likely to diminish over time through natural attenuation processes.

5.10.124 Best practice techniques, as outlined in the Environment Agency's Pollution Prevention Guidelines would be employed throughout the construction process as best practice to minimise the risk of spillages. Appropriate phasing and scheduling of construction activities would play a key role in mitigating potential impacts. With best practice techniques employed, the potential for contamination of groundwater would be minimised. Measures to avoid the contamination of groundwater during both construction and operation would be agreed with NRW prior to the commencement of works.

5.10.125 Pollution prevention measures would be used as best practice to ensure that no land contamination will occur. The high water table of the area may be at risk of pollution if no prevention measures are followed.

Fluvial flood risk

5.10.126 If work is undertaken within the floodplain and materials are stored in the floodplain this could increase flood risk. During high rainfall events the watercourses would become inundated with increased volumes of water which would increase flood risk to the area during construction.

5.10.127 A full hydrological assessment has been carried out with the Flood Consequence Assessment (FCA) and can be found in Technical Report D, Volume 2.

Afon Artro

5.10.128 The river is tidally influenced in the lower reaches to just below the footbridge (Grid Ref: 258060 327532), which is within the study area. The tidal influence on the river will increase the risk of flooding, as there is a joint probability potential for peak fluvial flow to coincide with peak tide.

5.10.129 The area of Llanbedr has a history of flooding from the Afon Artro. The history of flood events to the area is poorly documented. The village of Llanbedr is protected by flood defences managed by NRW. Information provided by the Environment Agency and NRW on the recorded past flood events are listed in Table 5.10.10.

Table 5.10.10 Documented flood events in Llanbedr

Event Date	Event Details
Unknown	High flows within the Afon Artro at Pont Llanbedr
Unknown	High flows within the Afon Artro downstream of Glanffrwd Hall
1995	Surface water flows running towards the Victoria Inn, Llanbedr. Overtopping of agricultural defences downstream of Llanbedr village and the A496.
2014	Coastal and surface water flooding of Llanbedr village due to severe storm, breaching sea defences, 100 people evacuated.

TAN15

5.10.130 From analysis of the Development Advice Maps (DAMs) which follow TAN15, it is indicated that Llanbedr is at risk of fluvial flooding from the Afon Artro combined with tidal flooding from the sea (*important to note that the DAMs do not take into consideration the existing flood defences or an area*).

5.10.131 The areas of the Proposed Improvement that are potentially at risk of fluvial flooding from the Afon Artro are:

1. The western road joining to the Airfield.
2. Northern section north of the Afon Artro crossing (south of the Afon Artro the Proposed Improvement is not at risk of fluvial flooding)

Pluvial flood risk

5.10.132 During intense and heavy rainfall events, surface runoff may be significantly increased with the risk of flooding potential significantly increased. Increased impermeable surfaces will increase surface runoff volumes and rates. Additional impermeable areas from site compounds or access roads has the potential to have a temporary, short term impact locally downstream from these areas by increasing surface water runoff.

5.10.133 Based on NRW Surface Water Flood Maps and site observations of local topography, several locations have been identified to be at risk of pluvial flooding. Those are:

1. Maes Artro, south of the Afon Artro to the east of the Proposed Improvement
2. Maes y Llan, north of the Afon Artro to the east of the Proposed Improvement
3. The northern section of the Proposed Improvement immediately north of the crossing of the Afon Artro

5.10.134 There is also anecdotal evidence of surface water flow paths down the road leading to Maes Artro (Grid Ref: approx. 258503 326689).

5.10.135 It is considered that there is a high importance associated with existing pluvial flood risk to the village of Llanbedr.

Groundwater flood risk

5.10.136 The water table within the study area is naturally high and will be considered as a potential flood risk during times of heavy rainfall as there will be limited storage capacity within the soil. Any deep excavations will require consideration of the high water table within the area.

5.10.137 During construction, discharge of collected groundwater could impact on fluvial flood risk if discharged to watercourses without attenuation. Without permitted dewatering there is potential for a minor adverse magnitude of impact to some sections of the Proposed Improvement during construction.

Tidal/ Coastal Flood risk

5.10.138 There is significant potential for the construction works to be at risk of tidal flooding. Timings of the construction works will be specifically highlighted prior to construction.

Abstractions and Discharges

5.10.139 There are no abstraction licences held for the Afon Artro therefore no further assessment is necessary for abstractions.

5.10.140 There are two known discharge points within the Proposed Improvement into the Afon Artro (watercourse 1) and watercourse 3. These discharge points are managed by Welsh Water Dŵr Cymru.

- Storm overflow into the Afon Artro (Watercourse 1) from water treatment works- Grid Ref: 258115 327466
- Emergency overflow into Watercourse 3 from water treatment works- Grid Ref: 258211 327516.

Lakes and other waterbodies

5.10.141 Analysis of maps and GIS information it has been established that there are no lakes or other water features present within the study area, therefore there is no associated flood risk.

Table 5.10.11 Water Receptors at risk of water pollution from schedule of construction works pre mitigation measures

Water feature	National Grid Reference (NGR)	Potential impact	Importance	Potential magnitude of impact during construction pre mitigation
Construction of new bridge(s)				
Watercourse 1 (Afon Artro)	258205 326958	-increase in silt -spillage to watercourse	High	Major Adverse
Watercourse 2 (tributary of Afon Artro)	258231 327151	-disruption to main channel and river bed -negative impact on water quality status		
Floodplain		-loss of storage -pollution from spillages -land contamination from construction materials	High	Major Adverse
New culvert				
Watercourse 3	258264 327361	-increased flow rates -increased siltation during works -disruption to natural river bed. -negative impact to water quality	High	Moderate Adverse

Operational Impacts

Drainage Hierarchy

5.10.142 During operation road drainage can impact the water environment through discharge of sediments, pollutants and volume of water. The impact of road drainage on the water environment is partly determined by the way in which water is discharged from a road to the water environment. Ideally the pathway of water from the road to the environment should reflect natural hydrological processes. HD 45/09 refers to the process as a preferred drainage hierarchy and suggests that this typically should consider discharge of road drainage by infiltration to ground before discharge to a surface stream or sewer.

5.10.143 Based on ground investigations reported in the Geotechnical Report, it is considered that:

- The catchment is underlain by mixed bedrock geology of mudstones, sandstones and siltstones of the Barmouth formation, Hafotty formation, Rhinog formation and Llanbedr formation.
- The superficial geology of the catchment is perennially wet and seasonally waterlogged with wet peaty surface horizons with the exception of the river terrace deposits.

5.10.144 Therefore, it has been considered that full infiltration to the ground is not a viable option for the Proposed Improvement. Further investigation has considered that outfalls would discharge to attenuation sites before discharging to the watercourses. Further consideration of drainage for each of these outfalls can be found in the Drainage Strategy, Technical Appendix D, Volume 2.

5.10.145 The route of the Proposed Improvement has been assessed in terms of 1 drainage catchment based on the alignment of the Proposed Improvement. All outfalls are proposed to eventually discharge to watercourses, with attenuation areas and ponds to provide water attenuation and settlement.

Hydromorphology and Hydrogeomorphology

5.10.146 During operation it is considered that the Proposed Improvement has the potential to impact upon the hydromorphology and hydrogeomorphology of the watercourses within the study area. Suitable mitigation measures incorporated into the design will ensure that no negative impacts result from the operational phase of the development.

Flood Risk

5.10.147 During operation there is a known level of flood risk associated with the Proposed Improvement. Hydraulic modelling has been carried out to identify hotspots of pooling of water pre and post construction of the Proposed Improvement. The modelling is able to identify those areas that would have a change in flood depths pre and post works. It is essential that if areas see an increase in flood depth post works have suitable mitigation measures considered and implemented. The Flood Consequence Assessment (see Technical Report D, Volume 2) outlines the potential changes to flood risk for the area surrounding the Proposed Improvement.

Fluvial Flood Risk

5.10.148 The Proposed Improvement is at significant risk of fluvial flooding without mitigation as there will be loss of active floodplain. The associated risk arise with out of bank flow from the watercourses, namely watercourse 1 and 2. The fluvial flood risk is not increased during operation.

Pluvial Flood Risk

5.10.149 It is considered that during operation the Proposed Improvement is not at significant risk of pluvial flooding as the development will be built upon an embankment higher than that of the

surrounding ground levels. To ensure pluvial flood risk does not affect the road, culverted watercourses will be designed up to and including the 1 in 100 year +CC event and the use of SuDS will be considered and implemented.

Groundwater Flood Risk

5.10.150 During operation there will be no direct discharge of water to groundwater sources and therefore the risk of ground water is not considered to be increased during operation. Due to the construction of the road on an embankment the road itself is considered not at risk of flooding from groundwater.

Flood Risk and Agricultural Land

5.10.151 There is a known level of flood risk associated with the agricultural fields within the area. It is considered that the risk of flooding is increased during operation of the road on some agricultural land.

Increased Surface Runoff

5.10.152 There is significant potential for increased surface runoff from the development of Proposed Improvement. The use of suitable drainage methods and SuDS will ensure that the increased surface runoff does not increase flood risk to the road and area.

5.10.153 Further detail regarding the drainage of the road structure is included within the Drainage Strategy in Technical Appendix D, Volume 2.

Effects of Routine Runoff on Surface Water Quality

5.10.154 During the operational phase of the Proposed Improvement, the two lane highway would result in an increased area of approximately 1.53km² of hard surface.

5.10.155 An increase in the area of impermeable surfaces within an area is likely to affect the volumes of surface runoff. Surface runoff from impermeable surfaces such as roads may be contaminated by hydrocarbons, silt and other substances such as trace metals. Road-associated contaminants considered to have the greatest potential impact on receiving waters include suspended solids, Polycyclic Aromatic Hydrocarbons (PAHs), metals, pesticides, herbicides, de-icing agents and nutrients.

5.10.156 From the water quality sample results it can be concluded that the concentration of hydrocarbons and zinc within the streams are overall below the toxicity threshold. As the Proposed Improvement will improve traffic flow and movement of vehicles it is expected that traffic volumes to the area are likely to increase. The increase in traffic volume is estimated to not be a significant increase in volumes. The proposed location of the Proposed Improvement is to cut through agricultural land which currently has no traffic movement, therefore traffic volumes at this location will be increased. The inclusion of attenuation areas and the use of SuDS as pollution prevention will allow the sediment and pollutants to be removed from the road drainage before out-falling into the watercourses (See Water Framework Directive assessment for further information, Technical Appendix D, Volume 2).

5.10.157 Drainage systems have the potential to create effective pathways for the transport of pollutant to watercourses. The attenuation areas will have the dual purpose of reducing discharge rates to the watercourses and for effective removal of pollution through settlement and vegetative treatment systems.

5.10.158 Detailed calculations (Method A- HAWRAT assessment) have, however, shown that there is a low probability of an adverse impact upon the water features during the operation of the Proposed Improvement, as the change to predicted levels of dissolved copper or total zinc in the receiving

streams is below the relevant thresholds. As a result no additional pollution control measures are required for routine runoff. However where possible, surface water would be filtered and managed as close to source as possible to ensure that potential pollution is removed as quickly and efficiently as possible. The attenuation areas and filter strips would also allow pollution to be removed from the surface runoff before discharging to watercourses.

5.10.159 Table 5.10.12 summarises the results of the Method A (Pollution Impacts from routine runoff to surface waters) and Method D (Pollution impacts from Spillages) calculations, based on HD45/09. The full calculations of these assessments are provided in Technical Appendix D, Volume 2.

Table 5.10.12 Results of Method A Assessment of Effects of Routine Runoff (before mitigation)

Outfall number	Receiving watercourse	RST no mitigation		EQS limit (µg/l) no mitigation		SS test (Tier 1) no mitigation
		HAWRAT copper	HAWRAT zinc	HAWRAT copper concentration	HAWRAT zinc concentration	
1	Artro (watercourse 1)	PASS	PASS	0.00	0.01	N/A
2	Un-named Tributary (watercourse 2)	PASS	PASS	0.00	0.00	N/A
3	Existing Drainage ditches (watercourses 3,4 & 5)	PASS	PASS	0.00	0.01	N/A

Effects of Routine Runoff on Groundwater Quality

5.10.160 As there would be no discharges to groundwater within the drainage design of the Proposed Improvement, there is no requirement to undertake further assessments of routine runoff on groundwater as prescribed in DMRB HD45/09.

Pollution from Accidental Spillages

5.10.161 Pollution from accidental spillages during the operation of the Proposed Improvement is potentially the most damaging form of pollution to both surface and groundwater. The significance of the impact on water quality would depend on the nature of the spill, concentration of contaminants released into the water and the speed at which the spillage enters the watercourse. A combination of dilution, dispersion, settlement and attenuation of contaminants determines the area affected by either routine discharge or accidental spillage.

5.10.162 The risk of a pollution incident from accidental spillages has been calculated as <0.5% and is therefore below the acceptable risk threshold recommended by HD45/09 for sensitive waters (100 years). As a result, there is no direct requirement for pollution mitigation measures to be incorporated into the Proposed Improvement design, although these would be provided to ensure that there is no negative impact to the water quality of the area, particularly considering the sensitivity of the downstream protected sites. Where possible to ensure that potential pollution is removed as quickly and efficiently as possible, the use of the pollution containment locations, attenuation areas, swales and filter strips would allow pollution to be removed from the surface runoff water before discharging to the watercourses.

5.10.163 Table 5.10.13 summaries the results from the Method D assessment of pollution impacts from spillages. See Technical Appendix D, Volume 2 for the full calculation of potential pollution impacts from accidental spillages.

Table 5.10.13 Results from Method D Assessment of Pollution Impacts from Spillages

Watercourse	Probability of a spillage	Predicted annual probability of a serious incident	Spillage Prevention Required (none required if probability is <1%)
Afon Artro (watercourse 1)	<1% (0.00000918675)	<1% (0.00000918675)	None required
Watercourse 2	<1% (0.00001694660)	<1% (0.00001270995)	None required
Watercourse 3	<1% (0.00001523290)	<1% (0.00001142468)	None required

Mitigation and Design Measures

Construction Phase

Generic Mitigation Measures

5.10.164 Prior to construction a Construction Environmental Management Plan (CEMP) would be compiled to provide targeted guidance throughout the construction period. This would detail both generic and specific instructions to enable construction to be undertaken with minimal impact on the water environment and ensure appropriate consents are obtained prior to works commencing.

5.10.165 Consultation with NRW and Gwynedd Council as LLFA would also occur prior to undertaking any works with the potential to adversely affect water attributes.

5.10.166 In addition to best practice guidance, effects of construction have been assessed for particular construction activities.

5.10.167 The risk of pollution during construction can be reduced by the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidelines (PPGs) (2011-2016) and the CIRIA Pollution Prevention guidelines.

The key guidelines are:

- PPG 1 Understanding your environmental responsibilities- good environmental practice
- PPG 2 Above ground oil storage tanks
- PPG 3 Use and design of oil separators in surface water drainage systems
- PPG 4 Treatment and disposal of sewage where no foul sewer is available
- PPG 5 Works and maintenance in or near water
- PPG 6 Working at Demolition and Construction Sites
- PPG 22 Dealing with spills

- Control of pollution from highway drainage discharges (CIRIA report 142)
- Control of water pollution from construction sites (CIRIA C532)
- Containment systems for the prevention of pollution (CIRIA C736)

5.10.168 Additional good working practice has been collated from DMRB Volume 11 Section 3 Part 10, the Construction Industry Research and Information Association (CIRIA). Generic mitigation measures that would be applied prior to and during construction include the following:

- Provision of adequate temporary storage to contain surface runoff during the construction period, particularly when there are large areas of exposed earthworks or cutting, as these lead to substantial increases in surface flows during intense rainfall and can carry silt through to receiving watercourses.
- On-site availability of oil spill clean-up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak.
- Use of drip trays under mobile plant.
- Sediment- trapping matting installed downstream of any construction activities adjacent to or over watercourses.
- Preparation of incident response plans, prior to construction, and present on site throughout construction to inform sub-contractors of required actions in the event of a pollution incident.
- Timing of works close to watercourses so that they do not interfere with spawning fish.
- The use of construction materials on site free from contaminated material, so as to avoid any potential contamination of the watercourses.
- Ensuring that wet cement does not come into contact with river or groundwater.
- Testing of made soils and soils that have been reworked to identify any soil contamination.
- No storage of site compound, machinery or materials within the active floodplain.
- No in-stream works, without prior agreement from NRW.
- Use of pre-cast concrete where practical to limit use of wet mix concrete.

5.10.169 Sediment and erosion control measures would be implemented, following consultation with NRW, to ensure that increased siltation and erosion does not occur during construction.

5.10.170 During construction an incident response plan would be in place to deal with any issues as soon as they occur for a particular site and to ensure that works are undertaken with the utmost care where they have potential to lead to contamination of any watercourse. Emergency action planning would include measures to be taken to prevent pollution caused by severe weather.

5.10.171 Wherever practicable, grey water systems would be used at site compounds to reduce runoff from site, improve water efficiency and lessen the potential for polluting discharges to surface watercourses.

Surface Water

5.10.172 Good working practices would include so far as is practicable, the implementation of the PPGs and CIRIA Pollution Prevention Guidelines (as mentioned above). Measures to avoid the contamination of surface waters during construction would be incorporated into the construction programme and

method statements, and would be agreed with NRW prior to commencement of works. The need to prepare and enforce appropriate working practices during construction would be included in the CEMP. This would include requirement for appropriate training of site staff on water environment issues. An agreed contingency plan to deal with emergencies would also be established.

5.10.173 By employing best practice techniques listed below, the risks of pollutants reaching surface water features would be minimised to a level where any events that did occur would be contained and limited in scale:

- Use of pre-cast concrete where practical
- The use of concrete would be monitored carefully to ensure no accidental discharge into any watercourse
- Mixer washings and excess concrete would not be discharged to water
- All fuel, oils or chemicals stored on site would be located as far as is reasonably possible, and in no case less than 10m from any water body.
- Stores would be surrounded by an effective and impervious bund capable of holding the full contents of the store plus 10%. Protocol for the storage of fuel, equipment and construction materials, so as to minimise the risk of water pollution, is provided within PPG2.
- No materials, vehicles or site compound to be stored within the active floodplain.
- Dust suppression measures would be required in order to prevent entry of suspended solids into nearby water bodies, particularly in dry weather conditions.
- No plant would be used in-stream without prior consent from NRW. Plant operators and contractors would check vehicles and mobile plant on a daily basis for fuel and oil leaks and suitable maintenance would be promptly carried out.
- Plant and wheel washing facilities would be sited appropriately. To prevent indiscriminate washing out of the mobile plant, designated wash-out bays would be employed on site. This would avoid cementitious materials from being washed out directly onto the ground.
- A pumping/ de-watering plan will be implemented prior to the start of construction works

5.10.174 Regular monitoring of the surface water quality will also be carried out throughout the construction period to check for any changes to the water quality.

5.10.175 Where works are within close proximity to the watercourses specific mitigation measures will be implemented. The use of sheet piles will be implemented for the construction of the abutments of the bridges to prevent any contamination into the nearby watercourses and to reduce the fluvial flood risk to the construction of the structures. This will have the dual purpose of ensuring water quality is not affected and that the works are protected from flooding.

5.10.176 During construction there will be no in-channel works. Any requirements at detailed design stage for in-channel works will require consultation and agreement with NRW. These will be restricted to outside of fish spawning season if required.

5.10.177 Table 5.10.14 and table 5.10.15 below summarise the significance of potential effects pre and post suggested mitigation measures during construction and operation respectively.

Groundwater

5.10.178 Although there would be no direct discharges of surface water runoff to ground, precautionary mitigation would be taken during construction to minimise the potential for contaminants to reach any perched groundwater that may be present.

5.10.179 Best practice techniques, as outlined in the PPGs, would be employed throughout the construction process to minimise the risk of spillages. Appropriate phasing and scheduling of construction activities would play a key role in mitigating potential impacts. With best practice techniques employed, the potential for contamination of any underlying groundwater would be minimised. Measures to avoid the contamination of groundwater during both construction and operation would be agreed with NRW prior to the commencement of works.

5.10.180 During construction the implementation of a pumping plan and strategy will be adopted to ensure that groundwater does not increase flood risk.

Hydromorphology and Hydrogeomorphology

5.10.181 During construction there is potential for changes to occur to the natural flow rates and capacity of the watercourses, which could have adverse impact upon their natural hydromorphology and hydrogeomorphology. Any in-river works have the potential to change the hydromorphology of the streams and subsequently increase erosion. This risk will be reduced using best working practices and reducing in-stream works. In-stream works will also not be permitted under high flow conditions. Due to the nature of the construction there will be no requirement for in-stream works. If the need for in-stream works arises, agreement with NRW will be sought prior to the works.

Flood Risk

5.10.182 To ensure that flood risk is not increased during construction, suitable mitigation measures will be adopted. Storage of materials and vehicles will not be within the floodplain or within areas known to have flooded in the past. In-stream works will not occur during times of increased rainfall and high flows. Increased runoff caused by compound or site areas will be restricted and attenuated to reduce increased runoff from increased impermeable surfaces into the watercourses. Further detail can be found in the Flood Consequence Assessment in Technical Appendix D.

Tidal/ Coastal flood risk

5.10.183 The lower reaches of the Afon Artro are tidally influenced and therefore will be considered during the construction works. Timings of the works will be specifically outlined prior to the start-up of the works. Works will not be permitted during spring tides or during storm surge conditions.

5.10.184 For sections of the Proposed Improvement (approx. 200m) within the floodplain; a minimum of 900mm diameter pipes every 2.9m at base of embankment to allow flow of water onto the tidal and fluvial floodplain. During construction the pipes will be constructed as to ensure that the active floodplain is not compromised. The staging of the works will allow continuous movement of water as required.

Operational Mitigation

Surface water

5.10.185 Mitigation measures for drainage and the water environment during operation are required for several reasons:

- To treat contaminants in normal runoff
- To deal with any accidental spillages occurring on the carriageway
- To attenuate flows from additional impermeable areas of road
- To prevent any increase to flood risk in the area

- To protect and enhance wildlife corridors near watercourses

5.10.186 Attenuation ponds provide surface attenuation of storm water runoff to aid in the control of surface water discharge. Ponds also allow for water quality treatment, primarily settlement of solids and uptake of heavy metals through plants. In total there are four attenuation areas within the Proposed Improvement project, one pond, two attenuation areas and attenuation within a new reed bed to the north of the project.

5.10.187 In terms of spillage risk, Method D tests undertaken show that all proposed discharges have a lower serious spillage risk than the threshold of 1 in 200 years. Separate oil interceptors are therefore not proposed. However, although the pollution risk is below the applicable threshold for requiring pollution control measures are to be provided through the use of swales and filter strips.

5.10.188 Surface water runoff from the highway would be managed by the drainage network. The use of SuDS in the form of filter drains, filter strips and attenuation ponds/areas would be combined with over-sized pipes to allow efficient removal of excess water from the carriageway.

5.10.189 The agricultural underpasses would be drained in such a manner that does not discharge directly into watercourses *i.e.* filtered through/over adjacent ground or designed to drain away from such features.

5.10.190 Downstream of the Proposed Improvement are a number of protected/ designated sites. These sensitive locations must not receive increased levels of pollution as a result of the operational phase of the Proposed Improvement. As mentioned above the tests undertaken indicate that all proposed discharges have a lower than serious risk than the threshold, therefore the downstream protected/ designated sites are not expected to be recipient of any increased pollution as a result of the operational phase of the Proposed Improvement.

5.10.191 Pollution control measures will be agreed with NRW prior to completion of detailed design.

Hydromorphology and Hydrogeomorphology

5.10.192 During operation there is no expected change to hydromorphology or hydrogeomorphology of the watercourses. The use of clean span bridges, spanning the width of the watercourses, will ensure that the watercourses are not altered from their natural state.

5.10.193 Discharge to watercourses will be reduced to the pre development Greenfield rates.

Winter maintenance

5.10.194 During operation of the Proposed Improvement it would be ensured that the maintenance contractors comply with current Environment Agency and NRW guidance and specifications as detailed in PPG10: Guidelines for storage of salt. It would be ensured that the use of de-icing salts would follow accepted practice and methodologies.

5.10.195 DMRB Volume 4, Section 2, Part 1 HA 103/06 recommends where the use of de-icing salt is likely to be very frequent and the dilution of runoff by receiving waters is low, flow should be diverted to infiltration facilities with groundwater protection or ponds.

Flood Risk

Fluvial Flood Risk

5.10.196 All new culverts, together with existing which are to be retained, have been assessed to ensure that each would pass a 1% (1 in 100) chance flow including 30% climate change. Checks have been made to ensure no adverse impact on flood risk up to a 0.1% (1 in 1000) chance event.

5.10.197 Measures to manage the risk of blockages of culverts have been incorporated into the Proposed Improvement. Further mitigation will be provided through the use of 900mm diameter culverts with 2.9 spacing to allow for both fluvial and tidal flow through onto and from the floodplain.

Pluvial Flood Risk

5.10.198 Attenuation facilities would be provided in the design to ensure that increased surface water runoff from the highway is restricted to greenfield runoff rates. Storage would be provided to contain the volume of a 1% (1 in 100) flood event plus an allowance of 30% for climate change.

5.10.199 Runoff from the highway would be restricted using controls such as hydro-breaks, orifice plates, and balancing would be provided by ponds. Oversized pipes may be considered for storage in specific situations where space does not facilitate the use of ponds. Suitable access provision would be provided to all balancing facilities to allow for future maintenance. Further details can be found in the Flood Consequence Assessment in Technical Report E, Volume 2.

Groundwater flood risk

5.10.200 During operation there is no direct discharge to groundwater sources. All surface water will be filtered, attenuated with settlement before discharging to the watercourse. During operation the risk of pollution to groundwater is therefore seen as low.

Tidal/ Coastal Flood Risk

5.10.201 The risk of tidal/ coastal flooding to the Proposed Improvement has been assessed and mitigated through the incorporation of the 900mm pipes through the floodplain. As the Proposed Improvement will be built on an embankment the risk of tidal/ coastal flooding is seen as low during more frequent return periods.

5.10.202 The majority of the Proposed Improvement is above the 1 in 1000 year +CC sea level and would therefore remain flood free up to this event. Approximately 0.1km of the northern section of the development is at risk of tidal flooding during this event.

Proposed Water Framework Directive (WFD) compliance mitigation and enhancement measures

5.10.203 Compliance against the WFD has been considered within this Environmental Impact Assessment (EIA). A number of mitigation and enhancement measures have been considered for each element and are summarised below. Enhancement within WFD compliance assessments can be used as a form of mitigation to offset adverse impacts. Liaison with NRW has been undertaken as part of the Proposed Improvement design process, and agreement is required on which measures are essential to include within the Proposed Improvement to ensure compliance with the WFD.

- If Japanese Knotweed is present it should be prevented from spreading during the construction works.
- To lessen the impact to the hydromorphology and aquatic ecology, box culverts instead of pipe culverts should be proposed (if necessary).
- At appropriate locations mammal passes would be installed to ensure connectivity, structures would incorporate a raised mammal ledge.
- All culverts would have erosion control measures up and downstream of the structures. The exact design at the transition points between the natural and artificial channels would need to be managed with respect to the WFD throughout the detailed design process of the Proposed Improvement.

5.10.204 Pollution containment will be included at specific locations to ensure no pollution enters the watercourses which connect to the sensitive downstream receptors.

Residual Environmental Effects (following mitigation)

Construction Impacts

5.10.205 Providing adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency PPGs (as best practice), the magnitude of impact during construction would be negligible, with neutral significance.

Operational Impacts

5.10.206 Water quality tests have been undertaken for each watercourse within the study area. The tests show that all discharges would comply with the EQS (environmental quality standards) for both copper and zinc and would meet and pass the Runoff Specific Thresholds for both copper and zinc.

5.10.207 Discharge from the drainage design following mitigation would pass the Tier 1 test from Method A Assessment of Pollution Impacts from Routine Runoff to Surface Waters. However, pollution control measures would be provided at downstream outfalls to protect the sensitive downstream areas in the event of an accidental spillage on the highway.

Table 5.10.14 Summary of potential impacts and significance to the waterbodies within the area of the Proposed Improvement during construction (pre and post mitigation)

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
Water Quality	Watercourse 1 (Afon Artro)	Biodiversity	Good	High	Negligible	Neutral	No in channel works. Use of clear span bridges. Use of pre-cast concrete where practical.	Negligible	Neutral
	Watercourse 2	Biodiversity	Good	High	Negligible	Neutral	No in channel works. Use of clear span bridges. Use of pre-cast concrete where practical.	Negligible	Neutral
	Watercourse 3	Biodiversity	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	No in channel works.. Use of pre-cast concrete where practical.	Negligible	Neutral
	Watercourse 4	Biodiversity	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	No in channel works. Use of clear span bridges. Use of pre-cast concrete where practical.	Negligible	Neutral
	Watercourse 5	Biodiversity	Un-Known (estimated to be good)	High/ Medium	Negligible	Neutral	No in channel works. Use of pre-cast concrete where practical.	Negligible	Neutral
Flooding	Floodplain	Conveyance of flow	N/A	High	Major Adverse	Large	Ensure no storage of material or site compound within the floodplain. No works within the floodplain during spring tides.	Minor Adverse	Slight/ Moderate

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
	Floodplain	Conveyance of flow	N/A	High	Major Adverse	Large	Ensure no storage of material or site compound within the floodplain. No works within the floodplain during spring tides.	Minor Adverse	Slight/ Moderate
	Watercourse 1 (Afon Artro)	Conveyance of flow	Good	High	Negligible	Neutral	Controlled discharge rates into watercourse through the use of flow control measures. Discharge rates reduced to pre development greenfield runoff rates.	Negligible	Neutral
	Watercourse 2	Conveyance of flow	Good	High	Negligible	Neutral	Controlled discharge rates into watercourse through the use of flow control measures. Discharge rates reduced to pre development greenfield runoff rates.	Negligible	Neutral
Flooding due to culverting	Watercourse 3	Conveyance of flow	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	Ensure culvert capacity is fit for purpose including an allowance for climate change estimations.	Negligible	Slight/ Moderate
Flooding from increased	All watercourses	Conveyance of flow	Good	High	Moderate Adverse	Moderate	Use of SuDS drainage systems and attenuation ponds/ sites	Negligible	Neutral

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
surface runoff from hard surface									
Water Quality	Groundwater	Biodiversity	Good	High	Negligible	Neutral	No drainage to groundwater through infiltration at any time.	Negligible	Neutral
Culverting	Watercourse 3	Conveyance of flow and hydromorphology	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	Use of natural channel bed to replicate channel bed within structure.	Negligible	Neutral

Table 5.10.15 Summary of potential impacts and significance to the waterbodies within the area of the Proposed Improvement during operation (pre and post mitigation)

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
Water Quality	Watercourse 1 (Afon Artro)	Biodiversity	Good	High	Negligible	Neutral	3 step drainage train with the use of attenuation ponds with vegetative treatment combined with the use of swales, filter strips to remove any pollution or sediment before discharge.	Negligible	Neutral
	Watercourse 2	Biodiversity	Good	High	Negligible	Neutral	3 step drainage train with the use of attenuation ponds with vegetative treatment combined with the use of swales, filter strips to remove any pollution or sediment before discharge.	Negligible	Neutral
	Watercourse 3	Biodiversity	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	3 step drainage train with the use of attenuation ponds with vegetative treatment combined with the use of swales, filter strips to remove any pollution or sediment before discharge.	Negligible	Neutral
	Watercourse 4	Biodiversity	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	3 step drainage train with the use of attenuation ponds with vegetative treatment combined with the use of swales, filter	Negligible	Neutral

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
							strips to remove any pollution or sediment before discharge.		
	Watercourse 5	Biodiversity	Un-Known (estimated to be good)	High/ Medium	Negligible	Neutral	3 step drainage train with the use of attenuation ponds with vegetative treatment combined with the use of swales, filter strips to remove any pollution or sediment before discharge.	Negligible	Neutral
	Groundwater	Biodiversity	Good	High	Negligible	Neutral	No drainage to groundwater through infiltration.	Negligible	Neutral
Flooding	Floodplain	Conveyance of flow	N/A	High	Major Adverse	Large	Compensatory floodplain area for lost floodplain to project. Use of upsized pipes within the road structure to allow flow of water through the structure as required. Use of SuDS drainage systems to remove increased surface runoff from road.	Minor Adverse	Slight/ Moderate
	Watercourse 1 (Afon Artro)	Conveyance of flow	Good	High	Negligible	Neutral	Controlled discharge rates into watercourse through the use of flow control measures.	Negligible	Neutral

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
							Discharge rates reduced to pre development greenfield runoff rates.		
	Watercourse 2	Conveyance of flow	Good	High	Negligible	Neutral	Controlled discharge rates into watercourse through the use of flow control measures. Discharge rates reduced to pre development greenfield runoff rates.	Negligible	Neutral
Flooding due to culverting	Watercourse 3	Conveyance of flow	Un-known (estimated to be good)	High/ Medium	Negligible	Neutral	Ensure that culvert capacity is sufficient for the flows including allowance for climate change estimations. Replicate channel roughness and include energy dissipation measures to reduce flow rates if necessary.	Negligible	Slight/ Moderate
Flooding from increased surface runoff from hard surface	All watercourses	Conveyance of flow	Good	High	Moderate Adverse	Moderate	Use of SuDS drainage systems and attenuation ponds/ sites	Negligible	Neutral

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude Pre-Mitigation	Significance Pre-Mitigation	Mitigation	Magnitude Post Mitigation	Significance Post Mitigation
Culverting	Watercourse 3	Conveyance of flow and hydromorphology	Un-known (estimated to be good)	High/Medium	Negligible	Neutral	Base of culvert to represent natural channel bed. Culvert will allow for mammal passage.	Negligible	Neutral

Summary

5.10.208 Using the DMRB guidance HD45/09, the assessment has followed the steps required to ensure that all possible incidences and parameters are assessed for risk to the water environment. The assessment techniques follow the associated effects of discharges to waterbodies from the development or improvement of trunk roads and motorways, and can be applied wherever surface water or groundwater resources are affected by road runoff.

5.10.209 The current ecological and chemical status of the streams has been established and is estimated to remain the same during and post works. The assessment of the water environment within the study area has ensured that all factors of pollution sources have been taken into consideration and suitable mitigation measures recommended.

5.10.210 The assessment findings illustrate that:

- Accidental spillages during construction and operation have been assessed and the probability of such accidents polluting the streams is low.
- Increased pollution to the streams and waterbodies within the area would not occur during the construction phase with the use of best practice guidance and specific pollution prevention controls.
- WFD status would not be degraded throughout construction of the Proposed Improvement or during its operation.
- The downstream sensitive receptors (protected/ designated sites) will not be adversely affected due to the construction or operational works.
- Increased flood risk to property within the area would not be increased post development.
- Discharge of surface water to streams would be reduced to pre-Proposed Improvement flow rates using flow control devices and attenuation areas.
- Compensatory floodplain area has been incorporated into the design through the use of culverts through the road structure spanning the length of the active floodplain being crossed by the development.
- The hydraulic model highlights the pre and post development flood risk and these are suitably mitigated within the design of the Proposed Improvement.
- It has been estimated that the road structure would, in the majority, remain flood free up to the 1 in 1000 year +CC event. It has been estimated and calculated that approximately 0.1km of the northern section of the development would be at risk of flooding during this event. The risk of flooding is accepted and is in line with guidance set out in TAN15.

Chapter 6.0: Assessment of Cumulative Effects

This chapter summarises the assessment of cumulative effects associated with the Proposed Improvement.

Methodology

- 6.1 Cumulative impacts result from multiple actions on receptors and resources 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 projects together with the Proposed Improvement⁶⁵.
- 6.2 There can be a considerable level of uncertainty associated with the prediction of cumulative effects and professional judgment is required when considering the influence of other projects on particular receptors and the associated likelihood of significant cumulative effects occurring. However, the method explained in the following section has been adopted in order to reduce such uncertainty and provide objectivity and clarity to the assessment of the potential significant cumulative effects associated with the Proposed Improvement.
- 6.3 Cumulative effects have been considered using the guidance provided in the DMRB, Volume 11, Section 2, Part 5, HA205/08 and Part 6, HD48/08. In accordance with this guidance cumulative effects upon single resources/receptors as a result of the Proposed Improvement and multiple effects from other projects in the vicinity have been considered.
- 6.4 In terms of which types of project should be assessed, the HA205/08 guidance refers to the term 'reasonably foreseeable', and interprets this to include other projects that are 'committed'. These should include (but not necessarily be limited to):
- Trunk road and motorway projects which have been confirmed (*i.e.* gone through the statutory processes).
 - Development projects with valid planning permissions as granted by the Local Planning Authority, and for which formal EIA is a requirement or for which non-statutory environmental impact assessment has been undertaken.
- 6.5 The HA205/08 guidance recognises that there are principally two types of cumulative impact to consider in environmental impact assessment. These are:
- Incremental impacts from a single project (*i.e.* the combined action of a number of environmental topic-specific impacts upon a single receptor/resource), and;
 - Multiple impacts from different projects (in combination with the project being assessed). These have therefore been considered within this assessment.
- 6.6 The study area for the cumulative effects assessment varies depending on each environmental topic. Incremental impacts are those occurring within the zone of influence of the Proposed Improvement. Multiple impacts from other projects relate to the Proposed Improvement and other projects within North-west Wales considered to have potential to generate significant cumulative environmental effects particularly developments located along the A496 corridor and A470, A494, A458.
- 6.7 The HA205/08 guidance explains that other projects to be considered in the assessment of cumulative effects should be determined in consultation with the Local Planning Authority and other statutory bodies and confirmed with the Overseeing Organisation on a project-by-project basis.

⁶⁵ Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interaction, European Commission, May 1999.

6.8 The following organisations were consulted with regard to their knowledge of potential projects/Proposed Improvements that are either committed or likely to be developed in the future and could generate cumulative impacts in combination with the Proposed Improvement:

- Snowdonia National Park Authority (SNPA)
- Gwynedd Council, Planning, Economic Development and Transportation depts.
- Natural Resources Wales (NRW),
- Dwr Cymru
- North and Mid Wales Trunk Road Agent (NMWTRA)

6.9 Responses were received from SNPA, Gwynedd Council and NMWTRA and were used to inform this assessment. The Proposed Improvements and projects raised were:

- Bungalow Development , Mochras Road
- A470 Dolgellau junction improvements (A493, A494)
- A487 Caernarfon – Bontnewydd bypass.

6.10 In accordance with HA205/08 the following factors have been considered in determining the significance of cumulative effects:

- Which receptors/resources are affected?
- How will the activity or activities affect the condition of the receptor/resource?
- What are the probabilities of such effects occurring?
- What ability does the receptor/resource have to absorb further effects before change becomes irreversible?

6.11 The magnitude of cumulative impacts is based on their corresponding magnitude in the relevant topic assessment chapters. The significance of cumulative effects, following mitigation, has been determined using the guidance provided in Table 6.1 (taken from Table 2.6: HA205/08) and professional judgement.

Table 6.1: Assigning significance of cumulative effects

Significance	Criteria
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issues.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

Cumulative (incremental) impacts from a single project

- 6.12 Incremental cumulative impacts associated with the Proposed Improvement have been assessed in consideration of the guidance provided in HA205/08 and are presented in Table 6.2. This approach enables the quantification of various environmental impacts upon a single receptor.
- 6.13 The assessment of incremental effects considers receptors within topic chapters assessing impact alone such as Chapters 5.1 Air Quality, 5.3 Landscape and 5.7 Noise and Vibration. The remaining chapters, including 5.2 Cultural Heritage, 5.4 Nature Conservation, 5.5 Geology and Soils, 5.8 All Travellers and 5.9 Community and Private Assets, already consider different types of impact on a specific set of receptors and therefore incremental effects from multiple impact sources are inherently considered whilst undertaking these impact assessments. Subsequently the main focus of the cumulative impact assessment is local residents, which could be subject to a number of different impact types but not subject to an exclusive topic chapter assessment. Table 6.2 below therefore summarises the incremental cumulative effects of different aspects of the Proposed Improvement on the local residents.
- 6.14 It's not considered that impacts with negligible value or below could have a significant cumulative effect. For local residents during construction, there would be no significant cumulative effect resulting from impacts from air, noise and landscape/visual impact because noise and air impacts after mitigation were considered to be negligible, and only landscape/visual impacts were considered to be major adverse.
- 6.15 During operation of the Proposed Improvement, there could be a cumulative effect from noise and visual impacts which could increase the significance of adverse effect upon residential properties reported in Chapters 5.3 and 5.7 respectively. It is considered likely to have an increased adverse significance of effect on some receptors than the impacts experienced in isolation. The scale of the cumulative impacts and change in significance of effect depends upon the exposure of individual properties to the two separate impacts which has not been determined in detail at this stage. However there does not appear to be a correlation between the areas where noise and visual impacts as a result of the Proposed Improvement are most prevalent and therefore the significance of the cumulative effect is not expected to be higher than moderate as described in Table 6.2.

Table 6.2: Summary of Predicted Incremental Cumulative Effects within the Proposed Improvement

Transportation Impact of Proposed Improvement	Incremental Cumulative Impact	Spatial Extent	Magnitude of Impact	Timing/Duration	Mitigation/Enhancement	Certainty	Significance of Cumulative Effect (based on Table 2.6: HA205/08)
Local residents (see Chapters 5.1, 5.3, 5.6 & 5.7)							
Generation of dust and PM ₁₀ resulting in loss of amenity and/or adverse impacts on human health at nearby sensitive locations.	Construction activities contributing to nuisance at affected residential and amenity receptors	Local	Negligible	Temporary (short term) during construction period	Employment of construction best practice in accordance with IAQM guidance, delivered via the CEMP	Low	There would be no significant cumulative effect resulting from construction impacts from air, noise and visual impact. Noise and air impacts after mitigation were considered to be negligible, and only visual impacts were considered to be major adverse. This is addressed in ES Section 5.3.
Construction noise and vibration.		Local	Negligible	Temporary (short term) during construction period	The contractor would be required to prepare a CEMP, for agreement with the Local Authority Environmental Officers, which would include measures to manage construction noise and vibration	Low	
Visual Impact of construction area/ works, site clearance.		Local	Major adverse for residential viewpoints A, B,C,D	Temporary (short – medium term) during construction period and while replacement landscape features establish	In selected locations, retention of existing mature trees and translocation of existing hedgerows.	Low	

Operational noise and vibration.	Operational activities contributing to nuisance at affected residential receptors.	Local	<p>114 dwellings and Ysgol Gynradd School negligible beneficial.</p> <p>24 dwellings minor beneficial</p> <p>22 dwellings moderate beneficial</p> <p>7 dwellings no change</p> <p>63 dwellings negligible adverse</p> <p>8 dwellings minor adverse</p> <p>8 dwellings moderate adverse</p> <p>2 dwellings major adverse</p>	Long term – opening year of Proposed Improvement plus 15 years	Low noise surfacing	Low	Moderate
Visual Impact of Proposed Improvement		Local	<p>By design year 15 (summer), magnitude of impact for residential view points:</p> <p>Viewpoint B would have a minor adverse</p> <p>Viewpoint C would experience a moderate adverse</p> <p>Viewpoints A, E would experience a minor adverse</p>	Long term – opening year of Proposed Improvement plus 15 years	<p>Landscape and visual impact mitigation includes visual screening planting, landscape integration block planting and offsite planting to reduce the impact on views of the proposed Improvement.</p> <p>Sensitive cladding of Highway structures including stone walls.</p> <p>Changes to powerlines repositioned underground</p>	Low	

Cumulative (multiple) impacts from different projects

Trunk Road and Motorway Projects which have been confirmed

- 6.16 Planned trunk road projects in North Wales are included in the Welsh Government's National Transport Finance Plan 2015. Such projects that are currently identified in statutory plans and/or are undergoing some form of environmental assessment and considered potentially likely to result in significant cumulative effects with the Proposed Improvement are identified in Table 6.3.
- 6.17 Of these projects, the Proposed Improvements listed below in Table 6.3 have currently progressed sufficiently through the statutory processes (*i.e.* publication of draft Orders and ES) to be considered as a 'confirmed project' (subject to statutory approvals), as defined by the HA205/08 guidance; the potential significant cumulative effects with this project have therefore been considered in this chapter.

Table 6.3: Planned trunk road and major infrastructure projects in North Wales

Project/plan	Draft programme	Distance from Proposed Improvement	Transport/development plan reference
A487 Caernarfon – Bontnewydd bypass	Public Inquiry June 2017.	47.9 Km	National Transport Finance Plan. Proposed Improvement (ref. R17).
A470 Dolgellau junction (A493, A494)	A494 completed in 2106, A493 commenced February 2017	28 Km	

A487 Caernarfon – Bontnewydd bypass

- 6.18 The Welsh Government is proposing to build a bypass from the Goat roundabout on the A499/A487 junction to the Plas Menai roundabout, around Llanwnda, Dinas, Bontnewydd and Caernarfon in Gwynedd⁶⁶. A Public Inquiry is expected to start in June and the scheme is currently expected to commence in 2018 and would therefore overlap with the construction of the Proposed Improvement, which is located approximately 28 Km south.
- 6.19 The Scheme is being developed to meet 5 objectives:
- reduce journey times between Llanwnda and Plas Menai;
 - reduce journey times between Llanwnda and Caernarfon;
 - reduce the number of vehicles passing through residential communities including Llanwnda, Dinas, Bontnewydd and Caernarfon;
 - reduce accidents on the A487, and;
 - improve the resilience of the network by increasing the amount and/or capacity of alternative routes.
- 6.20 It is proposed to build 9.8km of 2+1 carriageway (2 lanes in one direction, 1 in the other, switching from one side to another) between the Goat roundabout and Plas Menai roundabout. The Scheme will also involve constructing 22 structures including culverts and 7 bridges and improving the existing A487 to improve existing junctions.

⁶⁶ <http://gov.wales/topics/transport/roads/schemes/a487/caernarfon-bontnewydd-bypass/?lang=en>

- 6.21 An Environmental Impact Assessment and a Statement to Inform Appropriate Assessment (SIAA) have been completed for this project and the findings published in an Environmental Statement and a HRA in August 2016. These assessments have been used to determine whether significant cumulative effects with the Proposed Improvement are likely.
- 6.22 Given the distance of 48 Km between the two Proposed Improvements, there is no potential for cumulative impacts on the local populations of any of the species considered within Chapter 5.4 Nature conservation due to the distance between the schemes.
- 6.23 Although the two Proposed Improvements are both within 30km of the Meirionnydd Oakwoods and Bat sites SAC, there is no potential cumulative effect as the Caernarfon to Bontnewydd SIAA concludes that there is no residual effect on any of the features of the SAC.
- A470 – Dolgellau junction improvements (A493, A494 junctions)**
- 6.24 The proposals involve the construction of two roundabouts at the A494 (Bala) and A493 (Tywyn) junctions with the A470 Dolgellau by-pass. The Scheme has been proposed following safety concerns over the current layout of the existing junctions. As the proposed roundabouts are within the Snowdonia National Park and within close proximity to the Meirionnydd Oak Woods and Bat Sites SAC, it was considered important to reduce the extent of lighting and light spill from the carriageway as much as possible. Construction of the A494 junction was completed in 2016. The work on the A493 junction commenced February 2017.
- 6.25 A Record of Determination, a Non Statutory Environmental Report and an Assessment of Likely Significant Effects Report have been used to determine whether significant cumulative effects with the Proposed Improvement are likely.
- 6.26 The potential cumulative impacts with the Proposed Improvement on local bat populations and the Meirionnydd Oakwood's and Bat sites SAC have been considered.
- 6.27 Although the Proposed Improvements are both within 30km of the Meirionnydd Oakwoods and Bat sites SAC, there is no cumulative effect between the two Proposed Improvements as the A470 Dolgellau junctions AIES concludes that there is no effect on the integrity of the SAC.
- 6.28 Because the A470 Dolgellau junction improvement is within 30km of the Proposed Improvement, the disruption and severance of local bat population commuting routes during construction and operation was considered.
- 6.29 With Proposed Improvement mitigation, the disruption of commuting routes at the A470 Dolgellau junction improvement is not considered to significantly affect the conservation status of any of the bat species included in the Proposed Improvement assessments. Therefore, there are no likely cumulative impacts on disruption of bat commuting routes in combination with the Proposed Improvement.
- 6.30 Table 6.5 summarises this assessment of cumulative effects between the two Proposed Improvements.

Table 6.4: Cumulative Effects between the Proposed Improvement and the A470 – Dolgellau Junction improvement (A493, A494 junctions)

Impact of Proposed Improvement	Cumulative Impact with additional project/s	Spatial Extent	Scale of Significance	Timing/Duration of Cumulative Impact	Mitigation/Enhancement of Cumulative Impact	Certainty	Significance of Cumulative Effect (based on Table 2.6: HA205/08)
Ecological Receptors (see Chapter 5.4)							
Degradation of the local bat population	Disruption/ severance of bat commuting routes during construction and operation	Local	Llanbedr Negative; Not Significant A470 Roundabout; Not significant	Long term	Not required	Low	Dolgellau junction improvement Proposed Improvement concludes that with mitigation, the disruption of commuting routes is not considered to significantly affect the conservation status of any of the bat species included in the assessments. No likely cumulative impact in combination with the Proposed Improvement.

Development projects with valid planning permissions as granted by the Local Planning Authority, and for which formal EIA is a requirement or for which non-statutory environmental impact assessment has been undertaken

- 6.31 Gwynedd Council provided details of the Dwyryd Visual Impact Provision (VIP). However National Grid are proposing to continue with the pre-construction, environmental survey and planning works to align construction activities with the nuclear connection project 2024 which means it is not considered as a 'reasonably foreseeable' project to be considered at this time with our Proposed Improvement .
- 6.32 SNPA provided details of the 'The Bungalow' housing development proposal which is the nearest project to the Llanbedr Access Improvements proposal, located approximately 48m to the east of the Llanbedr Access Improvements Proposed Improvement. The application for the proposal to construct six residential dwellings on the site of The Bungalow property was refused in October 2016. The developer needed to supply more information including effects on bats, therefore this project at this time cannot be considered for cumulative effects with the Proposed Improvement.

Summary

- 6.33 This chapter has considered the cumulative effects of the Proposed Improvement, both for incremental impacts within the Proposed Improvement and also as multiple impacts associated with other committed projects.
- 6.34 No Incremental impacts within the Proposed Improvement would occur during the construction phase of the Proposed Improvement with mitigation measures.
- 6.35 During operation of the Proposed Improvement, there could be an incremental cumulative effect from noise and visual impacts which could increase the significance of adverse effect upon residential properties reported in Chapters 5.3 and 5.7 respectively. It is considered likely to have an increased adverse significance of effect on some receptors than the impacts experienced in isolation. The scale of the cumulative impacts and change in significance of effect depends upon the exposure of individual properties to the two separate impacts which has not been determined in detail at this stage. However there does not appear to be a correlation between the areas where noise and visual impacts as a result of the Proposed Improvement are most prevalent and therefore the significance of the cumulative effect is not expected to be higher than moderate.
- 6.36 Potential cumulative effects with the A470 – Dolgellau junction improvement are not considered to be significant following implementation of mitigation measures.

Chapter 7.0: Environmental Management

This chapter explains how the proposed mitigation measures to address the Proposed Improvement's predicted significant effects and how the principles of sustainable development and good practice will be delivered during the construction phase of the Proposed Improvement. It also summarises the method used to compile the Environmental Masterplans.

7.1 Environmental Management Plan

7.1.1 In accordance with modern standard practice for major development works, an Environmental Management Plan (EMP) would be developed and maintained for the Proposed Improvement. An EMP provides the framework for recording environmental risks, commitments and other environmental constraints and clearly identifies the structures and processes that will be used to manage and control these aspects. The EMP also seeks to ensure compliance with relevant environmental legislation, government policy objectives and Proposed Improvement-specific environmental objectives and principles. It also provides the mechanism for monitoring, reviewing, auditing and managing environmental performance, compliance and change throughout the road project's life cycle.

7.1.2 In the early stages of a project the EMP will be in outline only. It will later be refined and expanded into a Construction Environmental Management Plan (CEMP) as more information becomes available and there is more certainty in terms of the road project's layout, construction methods, programme and the likely environmental effects. Towards the end of the construction period the CEMP will be refined into a CEMP (Aftercare) (CEMPA) to cover the period between construction and handover. The CEMPA will progress into a Handover Environmental Management Plan (HEMP) which will contain essential environmental information needed by the body responsible for the future maintenance and operation of the asset.

7.1.3 The indicative contents of a CEMP are as follows:

- Introduction & background: giving a brief summary of the project, any relevant strategy or programme context and the purpose of the CEMP;
- Project team roles and responsibilities: particularly important where there are multiple organisations involved in a project, *e.g.* several sub-contractors. This section should also detail where queries should be directed within the team (including contact details), and escalated up to technical specialists as required. It should also make the lines of communication clear;
- Induction, training and briefing procedures for construction staff: detailing procedures to ensure construction staff receive an adequate introduction to the environmental aspects of the project, a site induction and training (if this information is contained in other documents, an appropriate cross reference should be provided, rather than replication of information);
- Environmental Objectives and Principles to be achieved throughout the road project's lifecycle;
- Proposed mitigation measures and commitments to be addressed throughout the project's development;
- Change management process and procedure for assessing changes to the agreed design against environmental commitments and requirements and agreed during the consents process. This should include a mechanism for liaising with the Overseeing Organisation;
- Environmental Commitments Register (ECR): the environmental mitigation measures and promises made in the ES, SIAA and public inquiry (if applicable);
- Consents, commitments and permissions: this should provide a record of the consents and permissions from Statutory Bodies and other stakeholders and any commitments made to them;
- Method Statements to be implemented during the construction process;
- Protection of sensitive areas: detailing how sensitive areas within, adjacent to, and off the site are to be protected during the design, construction and maintenance of works;

- Environmental risk assessments: detailing the environmental risks associated with all activities on the project, the mitigation measures to remove or reduce the risks and assigned responsibilities for the risks;
- Environmentally significant changes: detailing procedures to be followed if any significant changes are encountered once a project commences and the grounds which would result in a change to the CEMP, *e.g.* the use of alternative construction methods or design. This should also detail who has responsibility for overseeing and assessing the environmental and compliance implications of changes and managing any changes to existing agreements or commitments, particularly those agreed in the consents process;
- Environmental monitoring and evaluation requirements: setting out what monitoring needs to be undertaken against the project's environmental objectives, principles and relevant environmental actions and commitments, by who and the associated reporting requirements;
- Procedures for monitoring and reviewing compliance with the CEMP: *e.g.* daily/weekly/monthly inspection/audit reports and procedures for rectification of failings;
- Summary of procedures to be followed in the event of an environmental emergency or breaching of EMP measures, and;
- Annexes: there should be a number of annexes (or cross references to other documents where relevant information is held) including:
 - Site Waste Management Plans, Retained Vegetation Management Plan and any other management plans relating to the works;
 - The project's Environmental Management System (ISO14001 certification) requirements;
 - References to other relevant information, such as the construction programme, project completion report, design drawings, details of consultation and communication, meeting minutes, reports, technical notes *etc.*;
 - Record of management actions undertaken during construction and implementation and the outcomes;
 - Environmental method statements;
 - Record of environmental monitoring and evaluation undertaken during construction;
 - Record of environmental incidents, and;
 - Environmental Masterplans

7.1.4 The appointed contractor would be required to operate an Environmental Management System (EMS) certified against ISO14001 and would formulate and maintain a CEMP throughout the construction and aftercare phases of the Proposed Improvement. This would include the prior development of detailed method statements, consultation with statutory consultees, measures to ensure employment of suitably qualified and experienced specialist sub-contractors and the monitoring of mitigation measures. The Overseeing Organisation or its delegated representative would supervise the satisfactory implementation and execution of the CEMP and subsequent CEMPA. The following HEMP would then be managed by the delegated trunk road authority.

7.1.5 A 5 year soft landscaping contract would address commitments for the Landscape and Nature Conservation commitments, Chapter 5.4: These include management commitments for :

- Treatment of invasive species and Injurious weeds
- Habitat mitigation areas i.e. lowland meadow, rush pasture
- Woodland planting areas
- Hedgerows

7.2 Environmental Masterplan

7.2.1 The environmental mitigation proposals have been summarised on an Environmental Masterplan (see Figures 7.1 – 7.5 Volume 1a) prepared using the methods recommended in the DMRB, Volume 10, Section 0⁶⁷. This provides a consistent system for defining and achieving the environmental objectives, which may be policy or route specific. The Environmental Masterplan forms the basis for the development of the Environmental Management Plan and also for the detailed design and implementation of the Proposed Improvement and the environmental mitigation measures.

Functions and Elements

7.2.2 The DMRB, Volume 10, Section 0 method uses a system of 'Functions' and 'Elements' to describe environmental features. The use of this system enables environmental data to be recorded and developed in a consistent manner and linked through all stages of a Proposed Improvement from initial design through to construction requirements and management action plans. The codes represent all of the environmental objectives, apart from Air Quality. Physical environmental these elements form an integral part under the heading of 'Environment'.

7.2.3 Each existing or proposed environmental feature on or adjacent to the Proposed Improvement has one or more 'Functions' and an 'Element' which describes its physical attributes or designation in statutory terms. The basis of recording and showing these features is that they have an interaction with the Proposed Improvement *i.e.* if there are features that do not have an environmental function, or form a constraint upon the design or operation of the project, they would not be recorded. All features ('Elements') may have a multiple purpose and therefore can be ascribed more than one 'Function' *e.g.* a vertical barrier may be designed to achieve visual screening, noise attenuation and vehicle containment.

7.2.4 Within the overall environment of the Proposed Improvement and its surroundings there are many features that influence the design and maintenance; of these the Landscape Elements cover the largest area. The landscape and protected species elements help to mitigate the adverse impacts of the Proposed Improvement, and thus require regular maintenance or inspection to achieve their longer term objectives. The landscape elements are divided into broad classification types *e.g.* hedges or walls that are then subdivided again according to their detailed design or management needs, in conjunction with the stated 'Function'. For Proposed Improvement-specific purposes, additional sub-types have been added to further define the requirements. Environmental Elements are those features that are relevant to achieving the non-landscape Environmental Objectives, such as Nature Conservation. The functions and elements applicable to the Proposed Improvement are presented in Table 7.1.

7.2.5 The achievement of the functions and elements included in the Environmental Masterplans will be managed and monitored via the Environmental Management Plan process described in Section 7.1.

⁶⁷ The Design Manual for Roads and Bridges, Volume 10, Section 0: Environmental Objectives, Highways Agency, February 2001.

Table 7.1: Functions and Elements relating to the Proposed Improvement (see also Environmental Masterplans, Figures 7.1 – 7.7, Volume 1a)

Elements
<i>Environmental Elements</i>
E1.1 - Noise Reduction Road Surfacing on main carriageway
E2.1 - Water pollution control measures
E3.2 - Ecological protection measures
<i>Landscape Elements</i>
LE1.3 - Proposed species-rich grassland
LE2.1 - Proposed woodland
LLE 2.4- Linear belt of native trees and shrubs
LE2.7 - Scattered native individual trees
LE2.8 - Proposed scrub planting
LE4.3 - Proposed species rich native hedgerows
LE6.1 – Diverted water bodies
LE 6.3- Reedbed
LE 6.4- Proposed marshland and wet grassland: rush pasture
LE7.1 –Proposed stone wall (mortared)
LE7.2 – Post and wire stock proof fence
LE7.3 – New Road carriageway
LE7.4 - Footway
<i>Planning & Policy Features</i>
P3.1 - Heritage Features
P4.4 - Public Rights of Way
P5.1 - Proposed stock-proof fencing
Functions
EFA - Visual Screening
EFB - Landscape Integration
EFC - Enhancing the Built Environment
efd - Nature Conservation & Biodiversity
EFE - Visual Amenity
EFF – Heritage
EFH - Water Quality
EFJ - Agricultural/Highway Boundary
EFK – Access

Chapter 8.0: Conclusions

8.1 Summary of Significant Effects

8.1.1 The significant effects before mitigation during both the construction and operational phases of the Proposed Improvement have been identified in Chapters 5.1 to 5.10

8.1.2 The following summary is the residual significant effects after proposed mitigation during both the construction and operational phases of the Proposed Improvement.

8.1.1 Air Quality

Construction Phase

8.1.1.1 Assuming the relevant mitigation measures outlined in Section 8.2.2 are implemented, the residual effect from all dust generating activities is predicted to be negligible, in accordance with the IAQM guidance.

Operational Phase

8.1.1.2 The predicted concentrations for annual mean NO₂ and PM₁₀ were below the AQS objective at all modelled receptors. In accordance with the advice outlined in IAN 174/13²⁸ only receptors which exceed the AQS objective are used to inform significance. The Proposed Improvement is therefore deemed not to have a significant impact on air quality and mitigation measures are not required.

8.1.2 Cultural Heritage

8.1.2.1 Due to the nature of the impact on many of the archaeological features (*i.e.* direct impact resulting in destruction of the feature during the construction phase) many of the mitigation measures would not reduce the overall magnitude of impact and significance of effect. Nevertheless the mitigation measures would provide an opportunity to record such features before they are lost to the scheme.

5.1.2.2 Table 5.2.4 In Chapter 5.2 summarises the residual effects remaining for all historical features after the proposed mitigation measures and further assessment have been applied.

8.1.2.3 The main asset which would be impacted by the scheme is the Meini Hirion standing stones SAM, the impact to which would be Moderate Adverse (indirect) following implementation of the proposed mitigation. As part of the assessment the standing stones were subject to a tranquillity assessment as well as visual impact assessment. This determined that the noise levels at the site would reduce by 3.5dB once the scheme was operational, at year 15 there would be a 3.1dB reduction. There would undoubtedly be a visual impact, especially during construction and in the first years of operation until the new screen planting becomes established, visual clutter would be reduced with the relocation of overhead power lines. The magnitude of the visual impact in year one would be Moderate Adverse, by year 15, with the established screen planting this would be reduced to Slight Adverse during the summer.

8.1.2.4 The assessment has also identified potential beneficial impacts to Listed Buildings and Scheduled Ancient Monuments on the current A496 in Llanbedr due to a potential reduction in traffic

8.1.2.5 The proposed scheme would be located within the Arduwy Landscape of Outstanding Historic Interest, an area which is rich in heritage assets dating from the Mesolithic through to modern times. The design of the scheme has been successful in reducing visual impact and given its location in relatively low lying land, views to the scheme would be fairly restricted. The ASIDOHL has shown that there would be impact to the HLCA within which the scheme is located, and RAE Llanbedr to which would have increased management needs once the scheme was operational. Although the results of the assessment seem fairly severe, no consideration is given to the beneficial impacts the scheme could have on the heritage assets within the areas. Assessment of the impacts using DMRB guidance shows that following implementation of the proposed enhancements included in the design the significance of the impact is greatly reduced once planting becomes established. The greatest impact would be to HLCA 14 and 15 where the significance of the impact would be Moderate/Slight Adverse.

8.1.3 Landscape

Landscape Character

Construction Phase

8.1.3.1 It is anticipated that the construction effects during the peak activity period would be greater than the operation effects of the Proposed Improvement. During construction two local landscape character areas (LCA 05 and LCA 08) would experience a **large adverse** significance of effect. Five of the remaining six LCAs would experience a **slight adverse** significance of effect and one (LCA 07), would experience a **neutral** significance of effect.

Operational Phase

8.1.3.2 In winter of the opening year the magnitude of impact would reduce for all the LCAs affected by the Proposed Improvement resulting in two LCAs (LCA 05 and LCA 08) experiencing a moderate adverse significance of effect. The remaining six LCAs would all experience a neutral significance of effect. These reductions would be brought about by the inherent design features of the Proposed Improvement such as the cladding to the structures, the road side stone walls and the greening of the engineered earthworks due to the establishment of the grass seeding. Over time and by design year 15 the proposed planting mitigation would further help to soften the engineered elements of the Proposed Improvement and provide further integration. However due to the open low lying nature of LCA 05 the embankment with traffic on it would continue to be a noticeable element which new planting would not fully integrate. In addition, the cutting within LCA 08 would continue to form a noticeable element within the local landscape. LCA 03 would experience a slight adverse significance of effect, whilst the remaining five LCAs (01, 02, 04, 06 & 07) would experience a neutral significance of effect.

Visual Amenity

Construction

8.1.3.3. During construction five representative viewpoints (B, C, D, E and F) would experience a **large adverse** significance of effect and two viewpoints (A and G) would experience a **slight adverse** significance of effect.

Operational

8.1.3.4. Operational Phase 8.1.3.3 In the opening year (winter), of operation the magnitude of impact would be reduced, and over time the establishment of mitigation planting would help to soften the Proposed Improvement. By design year 15 (summer), three viewpoints (B, C and D) would experience a **moderate adverse** significance of effect, three viewpoints (A, E and F) would

experience a **slight adverse** significance of effect, and viewpoint G would experience a **neutral** significance of effect.

Snowdonia National Park - Effects on the Special Qualities

8.1.3.5 This section looks at the effects of the Proposed Improvement on the special qualities of the Snowdonia National Park including the settlement of Llanbedr and the tranquillity experienced by users on a section of the Wales Coastal Path.

- There would be a moderate adverse effect on the local landscape of the Lowland Plain. It is recognised in both LANDMAP and within the landscape characterisation work undertaken by SNPA that this landscape is of high to moderate quality, with some recent developments including caravan parks affecting the overall appearance of the area.
- The view from two PRoW which traverse the banks of the Afon Artro within LCA 05, including a section of the Wales Coastal Path would be directly affected by the Proposed Improvement, resulting in a localised moderate adverse impact on the tranquillity and solitude experienced by walkers on the national trail.
- The Proposed Improvement, through the removal of through traffic on the A496, would have a potential local improvement on Llanbedr's townscape and associated listed structures along the A496 corridor.

Visual Effects on the SAM - Llanbedr Standing Stones

Operational

8.1.3.6 The Proposed Improvement would be visible on embankment and on structure as it crosses the Morfa Dyffrn (LCA 05) to the north. The removal of the overhead power lines running east to west would help to partially reduce the visual clutter in the view composition, although the repositioned line would remain visible against the skyline. The proposed improvement would have a noticeable change (moderate adverse magnitude of impact) on the north and west view from the standing stones (Viewpoint F), resulting in a moderate adverse significance of effect at opening year.

8.1.3.7 At year 15, with the establishment of the proposed mitigation planting, the passing traffic on the embankment would be increasingly filtered in east and north westerly views. However, it is anticipated there would be a framed filtered view to the traffic on structure as it crosses the watercourse 160m to the north west of the standing stone. The new screen planting along the watercourse to the north would help to restrict views towards the north and the proposed junction into Llanbedr. At year 15 the magnitude of impact would reduce to minor adverse, resulting in a slight adverse significance of effect in summer views, but rising to moderate adverse in winter as a result of the loss of leaf cover on the intervening planting.

8.1.3.8 In terms of the overall tranquillity experienced at the standing stones, although there would be a perceived reduction in traffic noise, the Proposed Improvement would result in visual intrusion. Overtime the visual intrusion would reduce as the proposed mitigation establishes so that by summer year 15 there would be a slight adverse significance of effect on tranquillity.

8.1.4 Nature Conservation

8.1.4.1 With the embedded design mitigation and additional mitigation in place to reduce or avoid potential impacts from construction activities or operation of the Proposed Improvement, there are likely to be locally significant residual negative impacts on important habitats including trees and woodland, coastal and floodplain grazing marsh, lowland meadow and purple moor grass and rush pastures due to permanent habitat loss. Most of these residual effects would be compensated by habitat creation including planting a greater area of native broad-leaved

woodland, scattered trees and scrub than that lost; creation of a larger area of rush pasture than the area to be lost; and significantly more species-rich drier grassland, equivalent to lowland meadow, than the area to be lost. In addition, reedbed creation is proposed that would more than mitigate for any loss or damage of reedbed habitat, although this is not considered to be a significant impact. These habitat creation areas would also compensate for a residual loss of foraging habitat that could otherwise be significant for species such as polecats and hedgehogs. As additional compensation for loss or damage to woodland and RAWs, management of part of Lower Wood RAWs is proposed, to replace non-native species with native broad-leaved tree species. The only loss of habitat that would not be compensated would be loss of floodplain grazing marsh but this is considered to be locally significant at most.

- 8.1.4.2 Barn owls could also experience a negative residual effect due to the increased risk of road mortality due to severance of suitable foraging habitat during operation. No compensation is proposed for this but it is considered that the risk would be low due to the low number of barn owls recorded in the vicinity, and locally significant at most.
- 8.1.4.3 For lesser horseshoe bats, it is considered that there would be a positive residual impact of local significance due to the construction of a large roost structure that would more than mitigate for the loss of two transitional roosts within the builder's yard. This would provide suitable habitat for lesser horseshoes throughout the year, as well as providing roosting habitat for the other bat species recorded within the scheme corridor, that could even include rare species such as greater horseshoe and barbastelle in the future due to increasing temperatures shifting their range further north.
- 8.1.4.4 A positive residual effect could also remain for lichens due to the removal of the A496 and its associated traffic flow further away from trees supporting the notable species *Gyalecta carneola* and *Punctelia reddenda*. This should result in a reduction in air pollution from vehicle emissions, which should improve conditions for the growth of these populations and would be locally significant at most.
- 8.1.4.5 Cultural ecosystem services would suffer a locally significant negative residual impact during construction due to the temporary loss of the picnic and fishing area and also the closure of part of PRoW 1. This could not be compensated but is only a short-term impact and the degradation of these services during operation due to the presence of the Proposed Improvement would be compensated by the provision of additional footway along Mochras Road and an extra section of footpath leading to the Meini Hirion SAM within the floodplain. With the compensation provided by the provision of a much larger area of lowland meadow habitat than that lost, and replacement of rush pasture habitat, the habitat available as forage for pollinators would be greatly increased by the Proposed Improvement, resulting in a net gain overall for pollinators and the services they provide to local agriculture.
- 8.1.4.6 In addition to the compensatory measures described above, enhancement is proposed to create additional features of benefit to local biodiversity, including planting additional hedgerows, provision of an interpretation board about the local habitats and species, a lighting strategy to reduce disruption to bats commuting along the river corridor from the nearby maternity roost, creation of a reptile hibernaculum and control of invasive plant species along the Afon Artro river corridor.
- 8.1.4.7 Overall, it is considered that although there could be locally significant negative residual effects on coastal and floodplain grazing marsh and barn owl in the long-term, there would be long-term benefits to a number of ecological features including lesser horseshoe bats, notable lichen species, lowland meadow habitat and pollinators, and much of the biodiversity provided by the

0.63ha of floodplain grazing marsh would be provided by the 0.54ha of rush pasture habitat to be created at Ch. 1250-1400. The majority of biodiversity value within the scheme corridor would be associated with the important habitats to be lost and created, and these amount to a loss of approximately 2.18ha and a gain of approximately 4.72ha, resulting in a net gain.

8.1.5 Geology and Soils

Construction phase

8.1.5.1 No mitigation is considered to be required for geological features, other than the consideration of radon gas during excavation work. The magnitude of impact on geology during the construction period is therefore considered to remain **Negligible beneficial** and of **Neutral significance** due to new areas of drift geological strata being exposed by the proposed cutting in glacial till.

8.1.5.2 Due to the proposed mitigation measures during the construction period noted above the magnitude of impact on soils is considered to be **Negligible** and of **Neutral** significance.

8.1.5.3 Due to the proposed mitigation measures during the construction period noted above the magnitude of impact on groundwater is considered to be **Negligible adverse** and of **Neutral** significance.

8.1.5.4 As the source and pathway of any likely contaminants e.g. fuel oils, silt etc. should be managed using standard site practices the magnitude of impact is assessed as being **Negligible adverse** and of **Neutral significance**.

Operational Period

8.1.5.5 Due to the low value associated with its importance of geological features and the provision of a new exposure of drift geology within the cutting the magnitude of impact on geology during the operational period is considered to be **Negligible beneficial** and of **Neutral**.

8.1.5.6 Due to the mitigation measures proposed to reduce the construction impact on the soils affected, the magnitude of impact (after mitigation) on soils during the operational period is considered to be **Negligible adverse** and of **Neutral** significance as a result of the poor quality of the existing soils and the low impact of the works.

8.1.5.7 As no aquifers are present within the study area the magnitude of impact (after mitigation) is assessed as **Negligible adverse** and of **Neutral** significance.

8.1.5.8 Overall, following the adoption of the outlined mitigation measures, there would not be expected to be a long term significant environmental impact associated with ground contamination as a result of the proposed scheme and the overall impact would be **Negligible adverse** and the Degree of Significance **Neutral**.

8.1.6 Materials

Construction phase

8.1.6.1 The generation of site clearance and excavated waste material which needs to be disposed away from site thereby reducing capacity of local waste management facilities has potential to create a **moderate** and **minor** adverse impact respectively.

8.1.6.2 The import of materials for the construction of the Proposed Improvement, which could reduce resource and availability of raw construction materials (and the associated risk of introducing contaminating substances or invasive species), has potential to create a **moderate** adverse impact.

8.1.6.3 Movement of materials to/from the construction site causing temporary disturbance to traffic flows and increasing local air pollution and noise levels has potential to generate a **minor** adverse impact, while the movement of materials across the site, which could affect the integrity of ecological features and surface water quality, and can also generate dust which can impact environmental and human receptors has potential to generate a **moderate** adverse impact.

8.1.6.4 The storage and processing of earthworks and construction materials, which can impact upon sensitive ecological receptors directly through site clearance activities, by causing silt-laden run-off to enter surface waters, and generating dust which can impact human receptors as well as the environment has potential to generate a **moderate** adverse impact.

8.1.6.5 Mitigation measures to remedy the adverse impacts identified above are identified in Section 8.2.6. Through application of mitigation measures can be identified and implemented which will reduce the significance of the identified environmental effects to no more than **minor adverse**

Operational phase

8.1.6.6 No significant adverse effects are anticipated being associated with Materials for the operational phase of the scheme.

8.1.7 Noise and Vibration

Construction phase

8.1.7.1 During the construction of the proposed scheme, there may be potential for the ambient noise level at sensitive receptors to be exceeded. In the absence of mitigation, the effects of the construction activity on the nearby receptors are likely to range from **negligible** to **major** dependent upon their distance from the proposed scheme. However, these effects would be temporary and should be reduced to **negligible** with the implementation of the suggested mitigation measures.

8.1.7.2 Beyond 200m from the works, construction noise impacts are expected to be negligible.

Operational Phase

8.1.7.3 The following is concluded with regard to the information presented in Table 5-7-6 above, based on the assumption that all receptors have a high sensitivity in the future year of the Scheme:

- 7 dwellings and 1 other sensitive receptor are predicted to experience a 0.0dB change in road traffic noise in the long term as a result of the Scheme. This would result in a long-term impact classification of **no change**. The other sensitive receptor which falls into this banding is Ysgol Gynradd School
- 63 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise of between 0.1dB to 2.9dB as a result of the Scheme. This would result in a long-term impact classification of **negligible adverse**.
- 8 dwellings and no other sensitive receptor are predicted to experience long term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of the Scheme. This would result in a long-term impact classification of **minor adverse**.

- 8 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise levels of between 5.0dB to 9.9dB as a result of the Scheme. This would result in a long-term impact classification of **moderate adverse**.
 - 2 receptors and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels above 10.0dB as a result of the Scheme, this would be classified as a **major adverse** impact at these receptors.
 - 114 dwellings and 1 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 0.1dB to 2.9dB as a result of the Scheme. This would result in a long-term impact classification of **negligible beneficial**. The other sensitive receptors which falls into this banding is Ysgol Gynradd School
 - 24 dwellings and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of the Scheme. This would result in a long-term impact classification of **minor beneficial**. The other sensitive receptors which falls into this banding is Gwynfa Care Home.
 - 22 dwellings and 1 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 5.0dB to 9.9dB as a result of the Scheme. This would result in a long-term impact classification of **moderate beneficial**.
 - 0 dwellings and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of greater than 10.0dB in the short term as a result of the Scheme.
- 8.1.7.4 The assessment shows that in the opening year of the scheme there are more receptors that will experience perceptible noise decreases than increases. In the future year, a greater number of properties will experience perceptible noise decreases than increases. A total of 69 properties show an increase in noise level in the short term as opposed to 176 properties that present a decrease in noise level. Of these properties, 9 experience an increase of 5 dB or more while 32 properties experience a decrease of 5 dB or more. In the long term, 81 properties present an increase in noise level while 160 properties experience a decrease in noise level.

8.1.8 Effects on all Travellers

Construction phase

Non-Motorised Users

Pedestrians

- 8.1.8.1 It is not expected that traffic volumes within the centre of Llanbedr would reduce significantly during construction of the Proposed Improvement as the new alignment is almost exclusively offline. However the impacts upon pedestrians travelling along the desire lines described previously are generally expected to be minimal during construction.
- 8.1.8.2 The main impact upon the designated pedestrian network is expected to occur due to the realignment of a 200m section of Mochras Road which incorporates the Wales Coastal Path between the west flood bank of the Afon Artro and the railway. Users of the path are likely to be re-routed along a diversion route for certain periods of the works.
- 8.1.8.3 It is also likely that PRoW No 1 between the existing A496 and Coronation Bridge would be closed for a period during construction stage until it is possible to direct pedestrians through the permanent diversion route (see below), again the timing and length of such a closure depends upon the principal contractors works programme.
- 8.1.8.4 Overall it is considered that with good planning and site management the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon pedestrians in the study area, resulting in a **moderate** significant effect.

Cyclists

8.1.8.5 The main impact upon cyclists is expected to occur due to the realignment of a 200m section of Mochras Road, Local Cycleway between the railway crossing and the proposed bridge over Mochras Road and the Afon Artro. It is expected that cyclists would be accommodated during the construction phase however they are likely to be re-routed along a diversion route for certain periods of the works.

8.1.8.6 Overall it is considered that with good planning and site management the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon cyclists in the study area, resulting in a **moderate** significant effect.

Equestrians

8.1.8.7 The main impact upon equestrians during construction of the Proposed Improvement is also expected to centre on the realignment of a section of Mochras Road which leads directly towards the start/end of bridleway PRoW 43 near the railway crossing.

8.1.8.8 Overall it is considered that with good planning and site management the construction phase for the Proposed Improvement would generate a **minor adverse** temporary impact upon equestrians in the study area, resulting in a **slight** significant effect.

Vehicle Travellers

View from the road

8.1.8.9 As the Proposed Improvement is largely off-line it is expected that users of the A496 would follow the current route for the majority of the construction phase. It is expected that there would be a temporary adverse visual impact on views from the existing A496 towards areas to the west of the road due to the presence of construction plant and activities immediately adjacent to the route.

8.1.8.10 Views to the north and south along Mochras Road are largely obstructed by adjacent properties and road/riverside vegetation and are therefore expected to be largely unaffected during construction. On approaching the position of the proposed bridge over Mochras Road and the Afon Artro however views of immediate construction activities would become unavoidable and vegetation removal would likely open up views of the wider site, particularly to the north.

8.1.8.11 The construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon views from the road, resulting in a **moderate** significant effect.

Driver Stress

8.1.8.12 During construction the flow of traffic along the existing A496 is likely to be interrupted by traffic management measures where the Proposed Improvement ties into the existing road and where temporary site accesses are likely to be required. Similarly the flow of traffic along Mochras Road would be disturbed by site activities such as construction of the proposed bridge over the road and also realignment of a length of the road between the proposed bridge and the railway.

8.1.8.13 The extent and duration of this disruption to users of the A496 and Mochras Road would depend upon the principal contractor's programme of works, though any disruption would exacerbate current stress levels currently experienced towards the centre of Llanbedr and the junction between the A496 and Mochras Road, particularly during periods of heavy traffic.

8.1.8.14 Overall it is considered that with good site management the construction phase for the Proposed Improvement would generate a **moderate adverse** temporary impact upon views from the road, resulting in a **moderate** significant effect.

Operational Phase

8.1.8.15 It is considered that the measures embedded within the outline design would provide opportunities to improve safety and accessibility for NMUs within the study corridor therefore resulting in overall benefits during the operational phase. Such measures include:

- NMU provisions along the length of Mochras Road affected by the Proposed Improvement would be enhanced by provision of a 2m wide segregated route between the Mochras Road car park and the railway crossing;
- The potential interface between users of PRow 1 and the traffic along the new road where the Proposed Improvement crosses the existing flood bank would be removed by diverting pedestrians beneath the new road through a proposed underpass approximately 50m to the north of this intersection;
- Further enhancements would be introduced for NMUs along the length of Mochras Road between Llanbedr and the tie-in with the Proposed Improvement; these are likely to consist of traffic calming measures, an extended footway and improved lighting;
- Pedestrian access towards the Meini Hirion Standing Stones (Scheduled Ancient Monument) would be improved, possibly as a spur from PRow 1 near its intersection with the current A496;
- The use of traffic calming measures in Llanbedr village would be assessed after completion of the works i.e. once the effects of the reduction in traffic levels is known

Non-motorised users Pedestrians

8.1.8.16 The estimated change in traffic volumes would serve as a benefit for recreational users of the various PRow which start or finish on the existing A496; including PRow 1, 4 and 41 in particular. Traffic calming measures within Llanbedr and along Mochras Road would be considered on completion of the proposed works to act in combination with an expected reduction in traffic volume.

8.1.8.17 Changes to the alignment of PRow 1 where it meets the Proposed Improvement, and the length of the diversion in particular, are not expected to increase journey times or to compromise safety or enjoyment for users of this footpath. The extension of this footpath to take in the Meini Hirion Standing Stones would provide another benefit for pedestrians.

8.1.8.18 Overall the changes described above are expected to increase the use of PRow within the study area by making the centre of Llanbedr more accessible and network of footpaths safer and better integrated through improvements to Mochras Road; thereby generating a **moderate beneficial** impact of **moderate** significance.

Cyclists

8.1.8.20 Users of NCR 8, the designated Local Cycleway along Mochras Road and also cyclists which choose to use the route of the existing A496 through Llanbedr would benefit from increased safety and reduced severance within Llanbedr village and along Mochras Road due to the removal of a significant volume of traffic from these areas.

8.1.8.21 Overall the changes described above could be expected to increase the number of cyclists within the study area, principally by providing a reduced interface with road traffic, and thereby generating a **moderate beneficial** impact of **moderate** significance.

Equestrians

8.1.8.22 Bridleway /PRoW 43 from the direction of Mochras Road would be enhanced by a reduction in traffic volumes along the majority of this route and additional traffic calming measures. This would result in a **slight beneficial** impact of **slight** significance.

Vehicle Travellers

View from the road – A496

8.1.8.23 Overall the value of views for travellers along the Proposed Improvement within the study area has been assigned as medium and a **minor improvement** of **slight** significance in vehicle travellers' ability the surrounding landscape is expected.

View from the road – Mochras Road

8.1.8.24 Overall the value of views for travellers expected along Mochras Road within the study area has been assigned as low and a **negligible deterioration** of **slight** significance in vehicle travellers' ability the surrounding landscape is expected.

Driver Stress

8.1.8.25 One of the main aims of the Proposed Improvement is to reduce traffic congestion within Llanbedr village which is largely caused by the configuration of the bridge in the centre of the village and the A496/Mochras Road junction, and also as a result of reduced carriageway widths through the village due to current car parking arrangements.

8.1.8.26 Overall the Proposed Improvement could be expected to significantly reduce driver stress levels in the study area by removing traffic from the centre of Llanbedr, particularly in periods of increased traffic levels, and thereby generating a **major beneficial** impact of **large** significance.

8.1.9 Community and Private assets

Construction phase

Private properties

8.1.9.1 With implementation of the mitigation measures, construction phase impacts upon private properties are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance.

Land used by the community

8.1.9.2 The principal contractor would be encouraged to keep the Mochras Road car park open and accessible for as long as practicable during the construction phase, however when periods of closure are planned the contractor will notify the public in advance and will also consider opportunities for temporary alternative facilities nearby. Should the contractor choose to use the existing car park for storage or similar during periods of closure, care would be applied to prevent damage to surrounding trees and the facilities would be fully reinstated prior to re-opening.

8.1.9.3 With implementation of the mitigation measures described above construction phase impacts upon land used by the community are expected to be minor in magnitude resulting in an adverse environmental effect of slight significance.

Agricultural Assessment

8.1.9.4 No significant effects are predicted on agricultural land quality no specific mitigation is proposed.

Operational Phase

Private properties

8.1.9.5 Operational phase impacts upon private properties and associated land are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance.

Land used by the community

8.1.9.6 As no permanent loss of land is expected the operational phase impacts upon land used by the community are expected to be **minor** in magnitude resulting in an adverse environmental effect of **slight** significance.

Agricultural Assessment

8.1.9.7 The land use within the study area is grassland. The agricultural land affected is a mixture of Grade 4 (poor quality) and Grade 5 (very poor quality). The development would result in the permanent loss of around 5.25 ha of Grade 4 land and around 0.75 ha of Grade 5 land. The loss of poor and very poor quality land is considered to be of **neutral significance**.

The scheme would result in one equestrian business using agricultural land and two agricultural holdings being individually affected by the scheme. The magnitude of the development's impacts on agriculture and the land based business in the study area. Post mitigation, the magnitude of impacts range from **severe to moderate adverse** and the significance from **very large to slight adverse** depending on the sensitivity of the farm.

8.1.10 Road Drainage and the Water Environment

Construction Phase

8.1.10.1 Providing adherence to best practice guidance and the adoption of good working practices and strict adherence to the Environment Agency PPGs (as best practice), the magnitude of impact during construction would be **negligible, with neutral significance**.

Operational Phase

8.1.10.2 Water quality tests have been undertaken for each watercourse within the study area. The tests show that all discharges would comply with the EQS (environmental quality standards) for both copper and zinc and would meet and pass the Runoff Specific Thresholds for both copper and zinc.

8.1.10.3 Discharge from the drainage design following mitigation would pass the Tier 1 test from Method A - Assessment of Pollution Impacts from Routine Runoff to Surface Waters. However, pollution control measures would be provided at downstream outfalls to protect the sensitive downstream areas in the event of an accidental spillage on the highway. Operational impacts post mitigation would be **negligible, with neutral significance**.

8.1.10.4 The assessment findings illustrate that:

- Accidental spillages during construction and operation have been assessed and the probability of such accidents polluting the streams is low.
- Increased pollution to the streams and waterbodies within the area would not occur during the construction phase with the use of best practice guidance and specific pollution prevention controls.
- WFD status would not be degraded throughout construction of the Proposed Improvement or during its operation.
- The downstream sensitive receptors (protected/ designated sites) will not be adversely affected due to the construction or operational works.
- Increased flood risk to property within the area would not be increased post development.

- Discharge of surface water to streams would be reduced to pre-Proposed Improvement flow rates using flow control devices and attenuation areas.
- Compensatory floodplain area has been incorporated into the design through the use of culverts through the road structure spanning the length of the active floodplain being crossed by the development.
- The hydraulic model highlights the pre and post development flood risk and these are suitably mitigated within the design of the Proposed Improvement.
- It has been estimated that the road structure would, in the majority, remain flood free up to the 1 in 1000 year +CC event. It has been estimated and calculated that approximately 0.1km of the northern section of the development would be at risk of flooding during this event. The risk of flooding is accepted and is in line with guidance set out in TAN15.

Summary of Mitigation Measures

Mitigation measures that have been proposed to reduce the magnitude and significance of the effects identified in Chapter 8.1 are summarised in this chapter. These represent Proposed Improvement commitments that would form the basis of the Environmental Commitments Register and be incorporated within the CEMP.

8.2.1 Air Quality

Construction phase

8.2.1.1 IAQM Guidance on the assessment of dust from demolition and construction provides potential mitigation measures to reduce impacts as a result of fugitive dust emissions during the construction phase. These have been adapted for the Proposed Improvement based on the risk of dust affects (Chapter 5.1, Table 5-1-19) identified for dust management, demolition, earthworks, construction and trackout activities associated with the construction phase; and are summarised in Chapter 5.1, Table 5-1-24. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan (CEMP), if required by the LA.

Operational phase

8.2.1.2 No mitigation measures are proposed during the operational phase as no significant effects are predicted.

8.2.2 Cultural Heritage

Construction phase

8.2.2.1 The scope of mitigation would be agreed in advance of the works with the archaeological curator for the scheme (SNPA). The detailed methodology for mitigation during construction is detailed in Volume 2, Appendix A5 Written Scheme of Investigation (WSI). The following mitigation measures are proposed for the individual cultural heritage assets affected (see Figure 5.2.3, Volume 1a for asset locations):

- **None**
There will be no impact from the scheme therefore there is no need for mitigation measures.
- **Detailed Recording**
Creating a detailed record of the feature prior to the commencement of work on site. The record generally consists of detailed photographs, measured survey, field drawing and written description. This may be supplemented by additional techniques such as photogrammetry. Depending on the nature of the feature and impact this may also include archaeological excavation.
- **Basic Recording**
This involves creating a written description supplemented with photographs prior to works commencing.
- **Watching Brief**
This involves maintaining an archaeological presence during invasive works in the vicinity of an identified feature or area of archaeological potential. This may be supplementary to detailed or basic recording prior to the commencement of works.

The level of watching brief may be dependent on the likelihood of encountering archaeology or on the importance of a previously identified feature. The levels of watching brief are:

- Comprehensive – present during all groundworks
- Intensive – present during sensitive groundworks
- Intermittent – recording following groundworks
- Partial – as and when seems appropriate

This methodology would be employed in all areas of the scheme except for the defined area around the trackway to Plas y Bryn which will be subject to Strip, Map and Record. The watching brief would monitor all invasive works on an intensive basis, if certain areas were deemed to have lower archaeological potential the level of watching brief could be reduced upon agreement with the SNPA archaeologist.

- **Strip, Map and Record**

Strip, Map and Record is a method of mitigation used in areas of high archaeological potential. The method requires that all soils are removed under constant archaeological direction until either (a) the archaeological horizon or (b) the natural glacial subsoil or bedrock is reached. All identified archaeological features are investigated, mapped and recorded.

Typically 50% of each discrete feature and 10% of each linear feature would be investigated to determine function and date. Where necessary further investigation may take place. Where complicated features are identified, a new methodology may need to be formalised and agreed to ensure that appropriate methods are employed during the excavation.

This method will be employed in the area surrounding the possible cremation found in Trench 5 during the evaluation trenching.

- **Palaeoenvironmental Sampling**

During an archaeological watching brief on Ground Investigation pits to the north of Afon Artro it became evident that deep estuarine deposits were present. In order to ensure that the information held in these deposits is recovered prior to disturbance by the scheme, it is proposed that cores are collected and palaeoenvironmental analysis undertaken. Depending on the quality of the material it should be possible to gain an understanding of the development of the estuary through plant and insect remains and the development of the wider landscape through pollen analysis. Radiocarbon dating would also be used as part of the analysis to determine when changes in the landscape occurred.

Bulk soil samples will also be collected from suitable deposits during the investigation and excavation of features. These will be processed by wet sieving to recover charred plant remains which can be analysed and utilised for radiocarbon dating.

- **Avoidance**

Where possible it is always desirable to avoid unnecessary impact to heritage assets. Avoidance is the preferred option for all designated assets and potentially significant archaeology

- **Reinstatement or Relocation**

Features that should be reinstated or relocated with archaeological advice.

- **Planting and Seeding**

Supplemental tree and shrub planting would be employed in the existing field boundaries to the west, and on the flood embankment to the north, of the Meini Hirion standing stones. This will

provide screening from the route which will reduce the visual impact. The verges of the embanked northern section of the scheme would also be seeded to reduce the visual impact.

- **Interpretation**

Opportunities for increased interpretation will be explored at the Meini Hirion standing stones. Improved access and interpretation would increase knowledge and appreciation of the site. The details of this stage of mitigation would be discussed and finalised following completion of other aspects of mitigation, especially the palaeoenvironmental sampling, as the results may feed into the final interpretation of the site. Improved access would be accommodated by creating a public right of way to the site, it also expected that conditions for pedestrians would improve in Llanbedr allowing safer access along the current road.

- **Analysis and Reporting**

A full programme of post-excavation analysis and reporting would be implemented at the end of the fieldwork programme. If appropriate the results of fieldwork may also be released to the popular press to keep the public informed of discoveries made during mitigation.

Operational phase

8.2.2.2 Planting is proposed to reduce visual impact on assets and Historic Landscape Character Areas., Designed mitigation measures which contribute significantly to the enhancement of the Historic Landscape Character Areas (detailed in Chapters 5.3 Landscape and Visual Impact, and 5.7 Noise) are summarised below in Table 5.2.6 where the Significance of Effect is based on the conditions at Year 15..

Table 5.2.6: Significance of Effect for Historic Landscape Character Areas after consideration of enhancement measures introduced to the design (operation) (DMRB Guidance)

Historic Landscape Character Area	Value	Magnitude of Impact	Enhancement measures in design	Magnitude of Impact	Significance of Effect
Llandanwg (04)	High	Negligible	<ul style="list-style-type: none"> • Utilisation of cutting to reduce visual intrusion • Seeding and planting on embankments • Hedgerow planting • Native woodland planting • Replacement of overhead lines with underground services • Covered attenuation ponds • Low noise surface on carriageway • Utilisation of local stone in walling, including some dry- 	Negligible	Neutral/Slight adverse
RAE Llanbedr (11)	High	Negligible		Negligible	Neutral/Slight adverse
Coastal plain behind RAE Llanbedr (14)	High	Moderate		Minor	Moderate/Slight adverse
Fieldscape, mid-hill slopes around Cae'r Meddyg (15)	High	Moderate		Minor	Moderate/Slight adverse

Llanbedr (18)	High	Negligible	stone walls • Access provisions to reduce severance	Negligible	Neutral/ Slight beneficial
Llanfair (23)	High	Negligible		No Change	Neutral

8.2.3 Landscape and Visual Impact

Construction phase

8.2.3.1 No mitigation is proposed for the Construction phase

Operational

8.2.3.2 Landscape mitigation has been developed as part of the iterative design process to reduce the effects of the Proposed Improvement on the landscape and surrounding views.

8.2.3.3 *Treatment of Highways Structures*

- In order to reduce the impact of 5 new structures on the local landscape, all external concrete walls and abutments would be faced with stone-effect cladding in keeping with local materials.
- Highway boundary walls will be constructed of local stone in keeping with the appearance of the existing A496.
- In order to soften the appearance of the proposed cutting, it is proposed to reduce the profile of the engineered slopes by softening the upper line and grading out the lower levels.

8.2.3.4 *Changes to existing power lines*

As part of the Proposed Improvement the existing overhead power lines located around the northern section of the Proposed Improvement outline will be replaced underground.

8.2.3.5 *Mitigation Planting*

Landscape planting mitigation measures would be implemented to help over time to integrate the Proposed Improvement with the landscape and to screen it in sensitive views. These mitigation measures have also taken into consideration other ecological and heritage design requirements.

8.2.3.6 *Landscape integration*

- New native species boundary hedgerow planting located to the western & eastern side of the highway to the southern and northern ends of the proposed improvement.
- New low level scrub planting species planting along the northern bank Afon Artro.
- New native species hedgerow translocation along the southern and eastern edges of the realigned Mochras Road leading from the station to the new Mochras road junction.
- New block woodland planting is proposed to the northern side of the north junction to merge with the existing mature vegetation located along the boundaries of the existing A496.

8.2.3.7 *Visual Screening*

To reduce the impact on the wider landscape and views, screening planting is proposed;

- New woodland/ native scrub planting with trees located between the existing cutting and the Maes Artro Holiday Park.
- New native scrub and tree planting wrapping around the end properties on the Mochras Road, connecting into the existing woodland block to the east of the Proposed Improvement and connecting as far as Mochras Road.

- New 3m wide native species scrub planting with intermittent trees located along the southern edge of the Maes Artro holiday Park.
- New planting along the proposed embankments to the western side of the Proposed Improvement to the southern end adjacent to the access to Tyddn Du Farm

8.2.3.8 As a result of this mitigation, the visual effects on views from the north looking south from viewpoints A and E would be reduced. In addition, the effect on views west from viewpoint B will also be reduced.

8.2.3.9 *Offsite Planting*

To reduce the impact on the setting of the Meini Hirion Standing Stones SAM, offsite mitigation planting has been proposed in consultation with Snowdonia National Park & CADW:

- Infill native scrub, shrub and tree planting is proposed to reinforce the existing mature tree line located west of the SAM adjacent to the between the Proposed Improvement.
- New understorey planting is proposed along the line of the same tree line to reinforce low level screening
- New shrub and low level tree planting is proposed along the northern edge of the flood bund to the north of the standing stones from Llanbedr village to the east and as far west as the woodland planting block (in bullet below) then continuing with scrub planting to east of the bridge over Watercourse 2, to screen views towards the northern junction
- A small block of tree planting (four trees) is proposed directly north of the above screen planting to continue the existing tree line to the south of the watercourse 2 and improve screening north and west towards the Proposed Improvement.

This planting would be essential scheme mitigation and included in the CPO.

8.2.4 Nature Conservation

8.2.4.1 For locations of existing and proposed features associated with the mitigation, compensation and enhancement measures described below, see Figures 7.1-5: Environmental Master Plan (Volume 1a).

Embedded Mitigation

Features Mitigated: Bats; Badger; Polecat; Hedgehog

8.2.4.2 During consideration of alternative solutions, a T junction was selected for the proposed junction with Mochras Road, rather than a roundabout, due to the lighting requirements associated with a roundabout and the potential negative impacts on bats (**Ch. 800**).

Features Mitigated: Coastal and floodplain grazing marsh; Purple moor grass and rush pastures; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Reptiles; Amphibians

8.2.4.3 Numerous 900mm flood alleviation pipes provided at 2.9m centres at the base of the embankment that crosses the fluvial floodplain between the two proposed bridges (provided as flood mitigation, see Chapter 5.10: Road Drainage and the Water Environment). As mitigation specifically for ecological features, a 900mm pipe would also be located centrally higher in the embankment between the two bridges to provide access at times of inundation (**Ch. 900 – 1100**).

Features Mitigated: Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Reptiles; Amphibians

8.2.4.4 2.2m x 2.2m box culvert for Watercourse 3 to the north of the proposed northern junction with Llanbedr (provided as mitigation for severance of a badger territory and also access to an area of habitat creation provided as compensation for habitat lost). This culvert would include 400mm

mammal ledges on each side, with 600mm head room and sufficient height above the water level to remain dry in a 1 in 100 year flood event (**Ch. 1230 - 1250**).

Features Mitigated: Badger; Polecat; Hedgehog; Brown hare

8.2.4.5 2.3m high cattle underpass at northern end (provided as mitigation for severance of pastoral agricultural land (see Chapter 5.9: Community and Private Assets)) (**Ch. 1180**).

Features Mitigated: Pen Llyn a'r Sarnau SAC; Coedydd Derw a Safleoedd Ystlumod Meirion SAC; Reedbed; River; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Riparian breeding birds; Reptiles; Amphibians; Migratory fish

8.2.4.6 Single span bridge (approximately 16m square span between abutments) over Watercourse 2 to the north of the proposed Artro bridge (provided as mitigation for a number of species, including otters and bats) allowing approximate headroom above water level of the ditch of 3.3m (Ch. 1100).

Features Mitigated: Pen Llyn a'r Sarnau SAC; Coedydd Derw a Safleoedd Ystlumod Meirion SAC; River; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Riparian breeding birds; Reptiles; Amphibians; Migratory fish

8.2.4.7 Double span bridge (approximately 42m between abutments) over the Afon Artro (integral part of scheme design, to allow passage for the river, Mochras Road and livestock on each side of the river) allowing approximate headroom above river of at least 5.8m (**Ch. 900**).

Features Mitigated: Pen Llyn a'r Sarnau SAC; Coedydd Derw a Safleoedd Ystlumod Meirion SAC; River; Bats; Otter; Badger; Polecat; Hedgehog; Migratory fish

8.2.4.8 Permanent underbridge lighting of road/footway to be located at edge of footway and directed away from the Afon Artro river corridor at locations where light spill would be screened by proposed bridge piers to ensure minimal lighting of river corridor (<1 lux at southern bank) as mitigation for ecological features including lesser horseshoe bats and otters. Low level bollard lighting with baffles / directional hoods would be used to achieve this (**Ch. 890**). No additional lighting proposed throughout the rest of the scheme corridor.

Features Mitigated: Coedydd Derw a Safleoedd Ystlumod Meirion SAC; Bats; Badger; Polecat; Hedgehog; Brown hare

8.2.4.9 2.6m x 2.6m wildlife and cattle underpass adjacent to Maes Artro (provided as mitigation for lesser horseshoe bats and severance of pastoral agricultural land) (**Ch. 530**).

Features Mitigated: Morfa Dyffryn SSSI; Bats; Badger; Polecat; Hedgehog

8.2.4.10 Provision of two covered attenuation areas, one on each side of the proposed road, to the south of the proposed Artro bridge (**Ch. 850**); and an open attenuation pond to the east of the Proposed Improvement to the south of Maes Artro (**Ch. 370**). The pond would be fenced off with stock-proof fencing, which would allow a marshy/wet area providing suitable habitat for a number of species. Filter strips and filter drains would be also be incorporated into the scheme design (**Ch. 900 – 1100**).

Features Mitigated: River; Bats; Otter; Badger; Polecat; Hedgehog; Brown hare; Barn owl; Migratory fish

8.2.4.11 1m high boundary walls to be provided on each side of the new road (provided as mitigation for visual impacts on landscape, see Chapter 5.3: Landscape), which would reduce light spill from traffic to the adjacent habitats. These would extend through most of the Proposed Improvement corridor, except for the main cutting and northern and southern tie-ins (**Ch.300 – 550 and 830 - 1400**).

Additional Mitigation, Compensation and Enhancement

Water Quality

Features Mitigated: Pen Llyn a'r Sarnau SAC; Morfa Dyffryn SSSI; Coastal and floodplain grazing marsh; Purple moor grass and rush pastures; Reedbeds; Rivers; Bats (and therefore Coedydd Derw a Safleoedd Ystumod Meirion SAC); Otter; Amphibians; Fish; and Cultural services provided by the river corridor and fluvial floodplain

8.2.4.12 Mitigation:

- Standard pollution prevention measures would be applied during construction, as detailed in Chapter 5.10: Road Drainage and the Water Environment
- Statutory Consents would be required for works within all of the watercourses that pass through the Proposed Improvement corridor. All conditional mitigation described within these consents would be undertaken
- No in-channel works within the Afon Artro or Watercourse 2 (unless previously agreed with NRW)
- Periodic monitoring of water quality pre-, during and post-construction to ensure mitigation measures are working successfully.
- The agricultural underpasses would be drained in such a manner that does not discharge directly into watercourses *i.e.* filtered through/over adjacent ground or designed to drain away from such features.

Air quality

Features Mitigated: Coedydd Derw a Safleoedd Ystumod Meirion SAC; Pen Llyn a'r Sarnau SAC, Morfa Dyffryn SSSI, Restored Ancient Woodland Sites (RAWS); Lowland mixed deciduous woodland; and Lichens

Mitigation:

8.2.4.13 Mitigation for dust and emissions during construction, as described in Chapter 5.1: Air Quality (Table 5.1.24).

Trees and hedgerows

Other Features Mitigated/Compensated: Lowland mixed deciduous woodland; RAWS; Badger; Polecat; Hedgehog; Breeding birds; Reptiles; Amphibians; and Lichens

Mitigation:

8.2.4.14 Mitigation for trees and hedgerows during construction,

- Translocation of the 150m section of hedgerow located within the scheme footprint (southern boundary of Mochras Road between car park and railway) (**Ch. 750 - 860**)
- Trees of particular ecological importance (other than Lichen tree 1) to be retained, including Lichen Trees 2 – 5 and mature oak in vicinity of proposed junction with Mochras Road, which may be a lesser spotted woodpecker nesting site. These retained trees may require localised adjustments in the scheme design at the detailed design stage, such as local steepening of the embankment
- Retention of line of trees and scrub forming eastern boundary of the existing A496 at the northern end of the Proposed Improvement (and including Lichen Trees 3 - 5), 160m of which lies within the construction area (**Ch. 1330 - 1580**)
- An arboricultural survey would be undertaken when the detailed design is finalised, of all trees to be retained within or immediately adjacent to the proposed construction area, in order to produce a Method Statement detailing measures required to ensure minimal damage to these trees, according to BS5837:2012

- Arboricultural supervision to be provided for all works within the root protection areas of the trees described in bullet point 2 above, which would be undertaken according to the Method Statement described above.

Compensation:

8.2.4.15 The loss of woodland habitat would be compensated by planting 0.65ha of native broad-leaved woodland in the following areas:

- Planting of a woodland belt grading into scrub from east to west on the north side of the northern proposed junction into Llanbedr (Ch. 1240)
- Woodland planting (including creation of a woodland glade) within the area of land owned by Gwynedd Council to the south of Lower Wood and adjacent to the west of Maes Artro, to include a woodland glade between the former aquarium bat roost, the mitigation roost proposed and the underpass to the southwest (Ch. 430 – 620)
- Planting of a 3m wide woodland belt running along the northwest and southwest boundaries of the properties Swn yr Afon and Lismore to the south of the Afon Artro (Ch. 690 - 800)
- Planting of a 3m wide woodland belt running along the southwest boundary of Maes Artro holiday village to link the proposed woodland planting with the existing woodland and SAC to the southeast (Ch. 380 - 440)
- Woodland planting along the northern side of the proposed attenuation pond adjacent to the southern proposed junction into Llanbedr (Ch. 380)
- Woodland planting to fill the gap between the Proposed Improvement and the existing road, including within the footprint of the redundant existing road adjacent to the east of the builder's yard (Ch. Ch. 300 - 340).
- Production and implementation of a management plan to improve the condition of 0.56ha of Lower Wood RAWS (25336) within Gwynedd Council ownership by replacing non-native species with native broad-leaved trees of local provenance. This would involve the phased replacement of non-native plant species, including cherry laurel and beech with native broad-leaved trees, including crab apple as a food source for badgers. Details of the management would be included in a Woodland Management Plan to be agreed with SNPA, and could be implemented in collaboration with the Wildlife Trusts
- The loss of any scrub and approximately 14 scattered mature trees would be compensated by the following:
 1. The inclusion of at least five standard trees, including sessile oak, within the proposed species-rich hedge along the western boundary of the Proposed Improvement adjacent to the Sewage Works at the northern end
 2. Planting of trees and scrub, such as willow, hazel and alder, to fill in existing gaps in the lines of trees and scrub within the fluvial floodplain between the Afon Artro and Watercourse 2, proposed as landscape screening (see Chapter 5.3: Landscape)
 3. Planting of trees and scrub, such as willow, hazel, alder and sessile oak, to fill in existing gaps or gaps created by construction, along both banks of the Afon Artro to the east of the Proposed Improvement
 4. Planting of common gorse on both banks of the Afon Artro on each side of the proposed Artro bridge
 5. Planting of a line of native low-growing shrubs that would achieve a maximum height of 3-4m, such as blackthorn, guelder rose and dog rose, along the north side of the flood embankment leading from Llanbedr towards the bridge over Watercourse 2 as landscape screening (Ch. 1080 - 1090)
 6. Planting of common gorse leading into the bridge over Watercourse 2 from the east (Ch. 1070 - 1100)
 7. Planting of a small group of at least five larger trees such as alder and willow between the line of shrubs and the gorse to the north of the flood embankment (4 and 5 above);

8. Planting of common gorse between the flood embankment to the west of the bridge over Watercourse 2, along the bottom of the scheme embankment and up to the 2.2m box culvert for Watercourse 3, leaving a gap at the location of the 2.3m livestock underpass (Ch. 1150 - 1240)
 9. Planting of gorse scrub to replace any areas of non-native invasive plant species removed in the vicinity of the Afon Artro
 10. Planting of a short hedgerow (with a gate for agricultural access) to bridge the gap between the proposed underpass to the west of Maes Artro and the proposed woodland planting within Gwynedd Council owned land (Ch. 540)
 11. Planting of a line of native broad-leaved trees, including sessile oak, between the partly retained copse to the west of the southern underpass and Plas y Bryn Farm further to the west (Ch. 550), to be thinned out at the end of the five year soft landscaping aftercare contract to leave four trees to be protected from stock and managed to ensure their retention and development into large standard trees
 12. Planting of an area of scrub on the western embankment of the Proposed Improvement at the southern end (Ch. 170 – 200) as landscape screening
- All planting would be comprised of native broad-leaved species of local provenance and wherever conditions are suitable would include tree species that could provide a substrate for the notable lichen species to be retained within the scheme corridor. Suitable species include ash and oak (suitable for all three lichen species); hornbeam, ash, aspen and wych elm (suitable for *S. graphidioides*); and willow and rowan (suitable for *G. carneola* and *P. reddenda*).

8.2.4.16 **Enhancement:**

Species-rich native hedgerows would be planted on the western boundary of the northern tie-in and both boundaries of the southern tie-in, as well as the short length to be provided between the southern underpass and the compensation woodland planting area adjacent to Maes Artro, amounting to an additional 600m of hedgerow habitat compared to the current extent.

Coastal and floodplain grazing marsh

Other Features Mitigated: Purple moor grass and rush pastures; Bats including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter; Rivers; Fish; Ecosystem services; Pen Llyn a'r Sarnau SAC; and Morfa Dyffryn SSSI

8.2.4.17 **Mitigation:**

- Topsoil removed from areas to be permanently lost within the fluvial floodplain (Ch. 900 - 1100) to be stored separately and used in habitat creation (rush pasture compensation) area at Ch. 1230 – 1450
- Schedule works within the fluvial/tidal floodplain to avoid periods of highest inundation and periods of prolonged or significant rainfall leading to waterlogged conditions
- Use of protective boarding/matting and low ground pressure machinery where possible in temporary construction areas within the fluvial floodplain
- No site compound, machinery or storage of materials to be located within the fluvial floodplain.

8.2.4.18 **Enhancement:**

- An interpretation board would be provided in the vicinity of the proposed footpath to the Meini Hirion Standing Stones Scheduled Ancient Monument (SAM) within the fluvial floodplain to the north of the Afon Artro. This would provide information to the public about the coastal and floodplain grazing marsh and associated habitats and species, including purple moor grass and rush pastures, reedbeds, brackish ditches, willow scrub, and wildlife including otters, brown hares, bat

species, breeding bird species, reptiles and amphibians and a diverse range of invertebrate and plant species.

Lowland meadow

Other Features Mitigated/Compensated: Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Invertebrates; Pollination services

8.2.4.19 Mitigation:

- Topsoil permanently removed from lowland meadow area to be lost (**Ch. 700 - 870**) to be stored separately and spread above underground Attenuation Area 2 and all verges, cutting and embankment slopes in this area, incorporating re-aligned section of Mochras Road and junction leading to the proposed bypass
- These areas not to be reseeded but left to regenerate naturally and managed appropriately during operation to maintain species-richness. This may include the removal of certain weed species during the maintenance period and cutting once or twice annually, with removal of arisings
- Restricted access to lowland meadow habitat during wet conditions
- Use of protective boarding/matting and low ground pressure machinery where possible within this habitat
- No site compound or storage of machinery or materials within lowland meadow habitat.

8.2.4.20 Compensation:

- Pre-construction NVC survey of the fields potentially supporting lowland meadow habitat to be lost to the Proposed Improvement
- Seeding of verges, embankments and cutting slopes throughout scheme corridor (other than those areas to be top-soiled with soil from the lowland meadow habitat within the construction area) with an appropriate seed mix using species identified during the pre-construction NVC survey to re-create an additional 2.83ha of lowland meadow habitat. The areas to be seeded would be left as sub-soil where possible to reduce their fertility and the seed mix would be comprised of locally-occurring fine grasses and wildflower species, including yellow rattle (*Rhinanthus minor*) to increase species diversity due to its parasitism on grasses. The seed mix should be designed to include species flowering throughout the season if possible, to ensure a supply of pollen and nectar for pollinator species throughout the flowering season
- Habitat created to be managed appropriately to maintain species-richness, including the removal of certain weed species during the maintenance period and cutting once or twice annually, with removal of arisings
- In order for this habitat creation to benefit the latticed heath moth, the species mix should include some of the moth's foodplant species, including white clover and common bird's-foot trefoil. The inclusion of common bird's-foot trefoil would also provide the only forage plant of the wall mason bee.

Purple moor grass and rush pastures

Other Features Compensated: Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter; Badger; Polecat; Hedgehog; Breeding birds; Invertebrates; Pollination services

8.2.4.21 Compensation:

- Creation of approximately 0.54ha of rush pasture to the east of the scheme at **Ch. 1230 - 1450**. This would be achieved by lowering the ground level within this area and replacing the topsoil with topsoil from the existing area to be permanently lost from the fluvial floodplain between the Afon Artro and Watercourse 2, which is partly composed of purple moor grass and rush pasture. This

would therefore include a seed bank comprising suitable species for the establishment for this habitat. Following topsoiling, the area would be left to regenerate naturally

- Appropriate management of this area, including control of weed species under the five year soft landscaping contract and cutting once or twice a year (in early autumn and/or early spring) with removal of arisings
- Once the habitat has become established, introduction of a low level of grazing, which could be undertaken by letting the area to a local farmer, under an appropriate Grazing Management Plan.

Reedbeds

Other Features Mitigated/Compensated: Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC); Otter (and therefore Pen Llyn a'r Sarnau SAC); Breeding birds; Reptiles; and Amphibians

8.2.4.22_Mitigation:

- All reedbed habitat within temporary construction areas to be retained (**Ch. 1060 - 1130**)
- Reedbed habitat to be marked out on the ground prior to construction activities in these areas, with warning signs to prevent access that could cause damage to this habitat during construction, unless agreed with the Environmental/Ecological Clerk of Works.

8.2.4.23_Compensation:

- Creation of approximately 0.04ha of reedbed within diverted section of Watercourse 3 adjacent to the proposed rush pasture habitat creation area to the east of the Proposed Improvement at the northern end (**Ch. 1230 – 1340**)
- This reedbed creation would be achieved by following guidance such as 'Bringing Reedbeds to Life: Creating and Managing Reedbeds for Wildlife' (RSPB, 2014), which is likely to include creating appropriate conditions within the diverted section of Watercourse 3 allocated for reedbed creation, and possibly seeding with seed harvested from the existing reedbed within Watercourse 2. Methodology to be agreed with SNPA
- Future management of reedbed habitat created should follow guidance such as that cited above, in agreement with SNPA.

Rivers

Other Features Mitigated: Amphibians; and Migratory fish and brook lamprey; Otters (and therefore Pen Llyn a'r Sarnau SAC); and Bats, including Lesser horseshoe (and therefore Coedydd Derw a Safleoedd Ystlumod Meirion SAC)

8.2.4.24_Mitigation:

- Disruption to Watercourse 3 due to the permanent culverting of 31m of this watercourse would be reduced by inserting the culvert below the existing channel bed level to allow for natural bed formation within the culvert. This would allow for the natural formation of a low flow channel within the newly accumulated bed material, which should retain sufficient depth of water for aquatic life under most conditions. This watercourse would not be deepened or widened up- or downstream of the proposed culvert and bank reinforcement would be avoided (**Ch. 1180 - 1240**)
- Further disruption to aquatic species or other species that use the fluvial corridors as foraging or commuting habitat, such as otters and bats, would be mitigated during construction by the avoidance of night-time working, site facilities or construction lighting within 30m of any watercourses
- During operation, impacts relating to disruption of commuting or foraging species would be mitigated by a commitment not to significantly increase light levels along the river corridor of the Afon Artro during operation of the Proposed Improvement.

Bats

Other Features Mitigated: Coedydd Derw a Safleoedd Ystlumod Meirion SAC

8.2.4.25 Mitigation:

- To mitigate for the removal of two buildings containing lesser horseshoe and brown long-eared occasional day roosts within the Builder's Yard (**Ch. 300**) a new purpose-built roost would be created within suitable habitat to the south of the Former Aquarium within the Gwynedd Council owned land adjacent to Maes Artro (**Ch. 550**). This new roost would be constructed well in advance of the demolition of the existing roost buildings and would provide suitable habitat for lesser horseshoe bats and other bat species throughout the year. This would provide greater roosting potential for a larger number of bats and species than the roosts to be lost
- The two buildings supporting bat roosts within the builder's yard would be demolished when bats are absent (and only once the alternative mitigation roost, as described above, has been provided). A licence from NRW would be obtained to cover this work. Pre-construction roost surveys are likely to be required to inform the license application. All associated mitigation required as a condition of the license would be undertaken
- Full endoscope survey of all mature trees to be removed prior to their removal and trees immediately adjacent to the proposed works. For each tree with bats or potential for bats recorded, three tree bat boxes to be erected within suitable habitat nearby and suitable replacement tree stock planted
- Trees with bat roosting potential to be sectionally felled under the Watching Brief of a licensed bat worker
- If actual roosts recorded during endoscope survey, an EPS disturbance licence for bats to be obtained from NRW and associated mitigation undertaken
- Works within 150m of the Former Aquarium maternity roost would be avoided between June and August (when females are likely to have dependent young)
- The use of additional temporary artificial lighting would be avoided between dusk and dawn from April to October (when bats are most active)
- A licence from NRW would be obtained to cover any potential disturbance of the roost, with conditional mitigation likely to include pre-construction roost surveys, no construction activities in the vicinity of the roost between June and August; no night-time working or artificial lighting and minimal vegetation clearance in the vicinity of the roost
- Connectivity at the locations of the embedded bridges, culvert and underpasses would be maintained by avoiding disturbance due to noise or lighting during the most active periods for bats (dusk to dawn between April and October); removal of physical barriers (such as machinery and materials); and temporarily 'bridging' any gaps created in linear features between dusk and dawn using a temporary linear structure such as willow-hurdling, brash woven into heras fencing or potted plants
- All construction works associated with the Afon Artro with the potential to disturb foraging bats would be avoided between dusk and dawn from April to October
- Woodland planting and erection of a close board fence along southwest boundary of Maes Artro holiday village and Gwynedd Council owned land (**Ch. 380 - 630**) to screen existing and proposed maternity roosts and associated commuting routes within Lower Wood from traffic noise and lights and provide habitat connectivity to the underpass.
- Low level planting in the vicinity of actual and potential bat crossing points including the proposed bridges over the Afon Artro and Watercourse 2, as well as the culvert leading to the proposed area of rush pasture and reedbed habitat at the northern end, to lead bats into them and underneath the new road
- Low level planting to screen the proposed under-bridge lighting of the road/footway from the river corridor
- Clearance of trees and vegetation that could encourage bats to cross over the new road, including at **Ch. 320, Ch. 550 and Ch. 700**

- Works to minimise the bat roosting potential of retained buildings within the builder's yard to the west of the Proposed Improvement that could encourage bats to cross over the new road at this location
- Planting to link the existing maternity/hibernation roost in the former aquarium, the proposed compensation roost and also Unit 34 (Coed Hafod-y-Bryn) of the Coedydd Derw a Safleoedd Ystlumod Meirion SAC to the proposed underpass adjacent to Maes Artro, with a close board fence adjacent at least until vegetation establishes
- Planting between Plas-y-bryn Farm and the area of retained copse in order to guide bats to the underpass proposed at **Ch. 530**
- All guidance planting described above to be managed appropriately to ensure its continued functionality.

8.2.4.26 **Enhancement:**

- A lighting strategy would be devised and implemented to minimise/reduce light spill to the river corridor for the length of the proposed footway between Mochras Road and the Afon Artro. This would be designed to ensure that dark corridors are created or retained where lesser horseshoe bats have been found or are most likely to be commuting between the existing and proposed roosts in Lower Wood to the south and the foraging corridor of the Afon Artro. This would be incorporated at the detailed design stage, and agreed in consultation with NRW and SNPA.

Otter

Other Features Mitigated: Pen Llyn a'r Sarnau SAC

8.2.4.27 **Mitigation:**

- Provision of an artificial holt on the northern bank of the Afon Artro well in advance of construction commencement
- Otter license to be obtained and any associated conditional mitigation undertaken in addition to the mitigation above
- Pre-construction survey to check for further resting sites/holts and any additional mitigation arising from this
- Excavations to be covered or an egress provided for trapped animals
- No night-time working, site facilities or construction lighting within 30m of any watercourses
- No night-time working, site facilities or construction lighting within 100m of identified resting sites
- Access to be maintained for otters between dusk and dawn along all watercourses within the scheme corridor by removal of any physical barriers such as machinery and materials
- Planting in the vicinity of proposed otter underpasses including the proposed bridges over the Afon Artro and Watercourse 2, as well as the culvert leading to a proposed area of rush pasture and reedbed habitat at the northern end, to lead otters into them and underneath the new road
- Retention of the area of reedbed habitat leading into the proposed 2.2m box culvert for Watercourse 3 and any other existing otter habitat in the vicinity of potential otter underpasses where possible
- All guidance planting described above to be managed appropriately to ensure its continued functionality
- Otter-proof fencing to be provided for an appropriate distance on each side of all proposed otter underpasses, including the two bridges, the dry pipe within the flood embankment and the 2.2m box culvert at the northern end (**Ch. 1230 – 1250**)
- No significant increase in light levels along the river corridor of the Afon Artro during operation.

Badger

8.2.4.28 **Mitigation:**

- As mitigation for the loss of an annexe badger sett, an artificial badger sett would be provided nearby at least six months prior to commencement of construction. The sett to be destroyed would be closed under ecological supervision and according to standard guidelines, under a badger derogation license from NRW. The sett closure would need to take place between July and November inclusive (outside the badger breeding season) following at least three weeks' ecological monitoring to ensure that all animals have left
- A badger license would be required from NRW, along with all conditional mitigation, for all works likely to cause significant disturbance or damage to a badger sett, such as use of heavy machinery within 30m of an active sett; use of light machinery within 20m of an active sett; and hand digging or scrub clearance within 10m of an active sett
- A pre-construction survey would be undertaken to identify any additional badger setts requiring licensing or additional mitigation measures
- As described for otters above, any excavations would be covered or an egress provided
- All site facilities would be located at least 50m away from any active setts
- There would be no construction lighting or night-time working within 50m of any active badger setts
- Provision of badger-proof fencing to guide the animals towards the safe crossing points incorporated as embedded mitigation, including the 2.2m box culvert, two bridges, 900mm dry pipe within the fluvial floodplain and two cattle underpasses
- Provision of an increased area of good quality foraging habitat to the east of the Proposed Improvement (the same side as the retained and proposed setts within the territories to be severed) due to the proposed planting areas to the south of Lower Wood and within other areas to the east, including a total of 0.65ha of woodland planting compared to the 0.4ha to be lost (see 'compensation' measures below)
- Planting proposed in the vicinity of the underpasses to lead animals into them, as described for otters and bats above
- Badger license and associated mitigation for all maintenance works likely to cause disturbance/damage to an active badger sett.

Polecat, Hedgehog and Brown hare

8.2.4.29_Mitigation:

- Mitigation described for other species and habitats above, including provision of otter/badger-proof fencing and planting to guide animals (including hedgehogs, hares and also polecats to a lesser extent) towards the embedded safe crossing points; and clearance of vegetation that could lead to animals crossing over the road at other locations
- Creation of areas of suitable habitat for polecats and hedgehogs (woodland, lines of trees and scrub, rush pasture and reedbed) to the east of the Proposed Improvement, where the majority of polecat records have been recorded and the most suitable habitat for hedgehogs exists at present, to reduce the need for animals to cross to the west of the scheme
- Due to the likelihood that the majority of polecats would be able to pass through otter/badger-proof fencing, post-construction monitoring of road casualties would be undertaken comprising a monthly walkover of the Proposed Improvement for 12 months and if this suggests that there may be a significant increase in polecat mortality due to the new road, further mitigation should be considered that could include:
- Replacement of otter/badger-proof fencing (5cm mesh) with finer mesh fencing (maximum 3cm mesh)
 - Provision of additional underpasses, such as at the southern end in the vicinity of the builder's yard where a polecat RTA was recorded in 2004.

Breeding birds, including Lesser spotted woodpecker, Barn owl and Red kite

8.2.4.30_Mitigation:

- Vegetation removal outside breeding bird season (March to August inclusive) or ecologist check for active nests immediately prior to removal, and works scheduled to avoid disturbance of active nests if any are found, with a suitable buffer zone around the nest to be agreed with the ecologist until all broods have fledged
- Pre-construction survey for nesting lesser spotted woodpeckers and red kites would be undertaken in the April and for barn owls between March and August prior to any scheduled construction activities. Should any active nests be identified, works would be scheduled to avoid disturbance or destruction of the nest site while it is still active. Another survey would be undertaken in the following breeding bird season to assess whether the birds have returned to a nest site or adopted another one in the Proposed Improvement corridor. Construction works would then be programmed accordingly to avoid disturbance or destruction of active nests. Should any nest sites of these species require destruction (following the fledging of all young), it may be necessary to provide alternative nesting habitat as compensation for habitat lost, depending on consultation with NRW and SNPA.
- Provision of alternative nesting habitat to replace habitat lost during site clearance by reconstruction of 200m of dry stone wall (as described for Wall mason bee below), erection of riparian nest boxes on proposed bridge and culvert structures and erection of nest boxes suitable for tree-nesting species within the area of Lower Wood within Gwynedd Council ownership
- Provision of 1m high boundary walls at the top of the embankments and 1.4m otter/badger-proof fencing at the top of cutting areas may help to raise the flight level of barn owls attempting to cross over the new road. The hedgerows proposed at the northern and southern tie-ins as landscape mitigation could also help
- Due to the potential for the mitigation described above to not sufficiently reduce the increased risk of barn owl road casualty, post-construction monitoring of road casualties would be undertaken comprising a monthly walkover of the Proposed Improvement for 12 months and if any barn owl casualties are recorded, further mitigation should be considered that could include:
- Erection of fencing higher than the boundaries currently proposed within high risk areas
- Increasing the height of the boundary walls in high risk areas such as between the Artro and Watercourse 2 or where no mammal-proof fencing is provided.

Reptiles and Amphibians

8.2.4.31_Mitigation:

- Ecological Watching Brief during the removal of suitable habitat, including boundary features, damp grassland and rush pasture, woodland and scrub and topsoil stripping in these areas
- Clearance works described above to be undertaken during the active season (mid-March to mid-October) or at temperatures above 5°C
- Ecological Watching Brief during the diversion of 45m of Watercourse 0, where palmate newts have been recorded, along the base of the proposed embankment, to be undertaken between July and October inclusive (within the active season but outside the breeding season) or at temperatures above 5°C between November and February
- Translocation of any reptiles/amphibians found to a suitable receptor site identified by the ecologist
- Wherever gully pots are utilised, these are to be amphibian-friendly throughout the Proposed Improvement, with the design to be agreed in consultation with SNPA and NRW.

8.2.4.32_Enhancement:

- An artificial reptile hibernaculum would be constructed within the habitat creation area to the north of the proposed northern junction with Llanbedr (**Ch. 1250**) on the boundary of the proposed rush pasture area and the adjacent woodland and scrub planting. The structure could be created using waste materials from the Proposed Improvement, such as stones and brash, according to standard guidelines such as those provided in the DMRB.

Migratory fish and brook lamprey

8.2.4.33 Mitigation:

- No in-channel works within the Afon Artro or Watercourse 2 (unless previously agreed with NRW)
- No in-channel works within any watercourse during the fish spawning season (generally mid-October to mid-April)
- Statutory Consents and associated mitigation for working in watercourses, expected to include fish rescues.

Invertebrates

8.2.4.34 Mitigation:

Approximately 200m of dry stone wall that would be removed during site clearance for the footprint of the construction area, would be reconstructed as a replacement dry stone wall in a sunlit location along the northern boundary of the realigned Mochras Road in the vicinity of the proposed junction with the realigned A496. This would replace potential nesting habitat for the wall mason bee that would otherwise be lost, and would also be suitable for a range of other invertebrates.

Sharp rush

8.2.4.35 Mitigation:

- All sharp rush to be retained
- Areas of sharp rush within 50m of the construction area to be marked out on the ground prior to construction activities, with warning signs to prevent access that could cause damage to this species during construction.

Lichens

8.2.4.36 Mitigation:

- Lichen Tree 1, supporting the regionally important *Schismatomma graphidioides*, and lying directly within the footprint of the main cutting proposed to the south of the Afon Artro, would be felled during site clearance and the trunk section supporting this species would be relocated to the part of Lower Wood under Gwynedd Council ownership to the east. Prior to felling, the location of the important lichen should be carefully marked out based on the pre-construction survey report, ensuring no damage to the lichen itself. Measures would need to be taken to ensure the retention without damage of the sensitive lichen population on this tree during felling and relocation. The population of *S. graphidioides* on the section of trunk would then be retained in a location providing a similar microclimate to its current location, in the vicinity of suitable receptor trees for this species, such as hornbeam, ash, aspen, oak and wych elm. The habitat selected for the relocation of this species should have the characteristics of woodland edge and should be at least 50m from the construction area to minimise impacts from construction dust
- Lichen Trees 2 – 5 to be retained. These trees to be marked out on the ground prior to construction activities, with warning signs to prevent access that could cause damage during construction
- Regular visual inspections to be undertaken to monitor dust levels in the vicinity of Lichen Trees 2 - 5, during works in the vicinity, particularly during periods of dry or windy weather. Works in these

areas to be postponed until wetter periods or additional mitigation to be agreed, if existing mitigation is not suppressing dust sufficiently.

Non-native invasive plant species

8.2.4.37 Mitigation:

- All areas of non-native invasive plant species within 30m of the proposed construction area and any site facilities to be marked out prior to construction activities
- Treatment of all invasive species located within the construction area of the Proposed Improvement with an appropriate herbicide, such as glyphosate, in accordance with guidance from NRW
- Any topsoil or plant material removed from the southern bank of the Afon Artro, contaminated with Japanese knotweed, Himalayan balsam and Montbretia, to be treated according to NRW guidance, likely to include encapsulation within a root barrier membrane and burial at a depth of at least 2m, or burial at a depth of 5m, covered by a root barrier membrane and 5m of inert fill or topsoil
- Material removed from the area contaminated with Japanese knotweed at the southern extent of the Proposed Improvement, also to be treated in this way
- Topsoil from wooded areas potentially contaminated with Rhododendron seed (at northern and southern tie-ins) to be re-used in adjacent areas of proposed planting and not moved to another location
- Measures to treat, control and prevent the spread of non-native invasive plant species within the footprint of the Proposed Improvement to be included in the CEMP, such as washing down vehicles leaving contaminated areas, and secure segregated storage of material contaminated with these species
- Ongoing control of invasive species to be included as part of a 5 year soft landscaping aftercare contract.

8.2.4.38 Enhancement:

- All non-native invasive plant species occurring on both banks of the Afon Artro between Pont Llanbedr within the village to the east and the northern corner of the triangular plot including the car parking / picnic area owned by Gwynedd Council to the west of the Proposed Improvement (SH 58098 27013) would be treated with an appropriate herbicide whilst managing invasive species within the scheme corridor. This area would include all invasive species recorded along the Afon Artro during the baseline Extended Phase 1 Habitat Survey for the Proposed Improvement undertaken in 2014 (and updated in 2015), including Japanese knotweed, Himalayan balsam and Montbretia. This would be incorporated into the CEMP and five year soft landscaping aftercare contract.

Ecosystem services

8.2.4.39 Compensation:

- The provision of approximately 290m of additional footway along the southern bank of the Afon Artro, to link the existing footway along Mochras Road to the east with the car park and footway to the station to the west
- The provision of an additional section of footpath leading to the Scheduled Ancient Monument (SAM) within the fluvial floodplain, proposed as mitigation for cultural heritage impacts (see Chapter 5.2: Cultural Heritage).

8.2.5 Geology and Soils

Construction

- 8.2.5.1 The only geological mitigation measure is for the risk of potential radon gas during the construction period. It is recommended that all excavations should be left uncovered and open to the atmosphere at all times. Any works in confined or enclosed spaces will require a review of this assessment.
- 8.2.5.2 Mitigation measures that would apply to all areas of disturbed soil are as follows:
- Topsoil and subsoil layers would be identified and clearly defined before being stripped and stored separately under favourable weather conditions so that a proper soil profile could be re-established;
 - Soils for reinstatement would be derived from the site if possible. Storage mounds would be located locally in small batches, re-used in as close to the original location as possible and would not exceed 2m in height;
 - Soil handling would be avoided during wet conditions and would not be compacted by heavy machinery once spread. Soil would be kept free of contamination by invasive plant species, such as Japanese Knotweed.
- 8.2.5.3 All areas where no site traffic is permitted during the construction period would be clearly defined in order to reduce the level of compaction of the existing soils.
- 8.2.5.4 In order to avoid contamination of soils and groundwater by leakages and spills of harmful substances, during the construction period all precautions would be taken by the contractor to ensure that this risk is minimised. The contractor would also be required to have an effective emergency spill response procedure in place.
- 8.2.5.5 During the earthworks, vigilance would be maintained with regard to the possible presence of contaminated material. If any suspicious substances were encountered, work would cease and specialist advice would be sought.
- 8.2.5.6 The potential impacts on the health of construction workers (such as possible contact with contaminated soils) would be mitigated by the adoption of appropriate health and safety and hygiene practices including the use of PPE (Personal Protective Equipment) as necessary.
- 8.2.5.7 Further investigation would be undertaken at the start of construction to determine the potential sources of contamination within the boundary of the proposed scheme in order to:
- (i) confirm the exact nature of any contamination present;
 - (ii) more accurately assess any resulting risk posed, and;
 - (iii) allow for design/implementation of appropriate design and mitigation measures.
- 8.2.5.8 Potential impacts on the Afon Artro watercourse would be mitigated by the adoption of working practices to minimise the exposure of potentially contaminated soils and to prevent any direct run off into or siltation of watercourses. This would include the phasing of earthworks to minimise the area of soils exposed at any one time. In particular, working practices would also be adopted to minimise leaching from any stockpiles of spoil awaiting off-site disposal.
- 8.2.5.9 Any fuel or oil stored on site during construction works would be undertaken in accordance with current good practice and as a minimum, secondary containment would be provided. Care would be exercised during use to prevent spillages.

8.2.5.10 There is a duty of care with regard to the management and disposal of waste generated during the works to ensure that this is undertaken in an environmentally responsible fashion. If possible, materials would be re-used in the works if this did not present any risk to human health or the wider environmental receptors, such as controlled waters or sensitive protected sites. Any off-site disposal of surplus soil would be to a suitably-licensed facility. .

Operational Period

8.2.5.11 No mitigation measures are proposed for geology or soils during the operational period because no significant impacts are expected to occur to geological features or beyond the initial loss of soils.

8.2.5.12 As the drainage design for the scheme considers any likelihood of pollution generated during the operational phase entering the surface water and groundwater systems no further mitigation measures are proposed for the operational phase .

8.2.6 Materials

8.2.6.1 Decisions and measures to minimise environmental effects generated from the use of materials and generation of waste would mainly be implemented during detailed design and construction of a project. In order to direct the principal contractor and detailed designer towards resource efficient solutions the following series of contractual requirements and best practices design guidance will provide a framework for sustainable decision making.

Construction phase

CEEQUAL

8.2.6.2 It is envisaged that the framework provided by the CEEQUAL assessment manual will be used to integrate the principles of sustainable development into the design and construction of the Proposed Improvement.

Site Waste Management Plan

8.2.6.3 Part of the duties placed upon the eventual contractor and their designers will be the preparation and early implementation of a Site Waste Management Plan (SWMP), allowing waste management principles to be adopted from the outset, thereby resulting in greater benefits.

8.2.6.4 Other than excavated earthworks materials the most potentially significant waste streams during site clearance are estimated to be existing fences, gates and hedgerow material, and the principal contractor will be required to develop plans for their treatment based on the waste hierarchy. Some materials could be utilized by adjacent landowners should conditions allow and there are likely to be beneficial re-uses for vegetation material on site.

Construction Environmental Management Plan

8.2.6.5 The principal contractor will be required to establish a Construction Environmental Management Plan, the main purpose of which is to enable management of the construction phase to minimize all potential environmental impacts. With particular regard to the content of this chapter, the CEMP would identify procedures to minimize the impacts associated with the following aspects:

- additional land take selection
- use of temporary working areas
- storage of materials next to watercourses
- nuisance caused by construction traffic
- generation of dust

- 8.2.6.6 The principal contractor and their designers will consider the current estimated earthworks balance and will look to refine the design in order to reduce the volume of nett import required during the construction phase. Reducing the volume of imported material required during construction could provide substantial cost benefits as well as reducing the potential impacts associated with extraction of raw materials and limiting HGV trips.
- 8.2.6.7 Any imported materials required would be from approved sources and the suitability of the material checked. For any imported earthworks materials, appropriate chemical testing would be undertaken to confirm that no contamination is present within the imported materials (see also Chapter 5.5: *Geology and Soils*).
- 8.2.6.8 To mitigate the potential impacts of transporting materials to site, material would be derived from the nearest practicably available source and suitable location to keep HGV journey distances to a minimum.
- 8.2.6.9 Temporary working areas including compounds, storage areas and haul roads will be positioned to avoid sensitive ecological receptors such as watercourses, retained trees, bat roosts and active badger setts (see Chapter 5.4: *Ecology and Nature Conservation*). The temporary storage of materials will follow best practice guidance measures to prevent the generation of dust (see Chapter 5.1: *Air Quality*) and silt-laden run-off towards existing surface water receptors (see Chapter 5.10: *Road Drainage and the Water Environment*), and would also limit stockpile heights to maintain structure of topsoil during storage (see Chapter 5.5: *Geology and Soils*).

8.2.7 Noise and Vibration

Construction phase

- 8.2.7.1 Detailed measures to mitigate against construction noise impacts would be developed once a detailed construction programme and inventory of plant to be used is available, and would be agreed with relevant Stakeholders as part of each contractor's CEMP.
- 8.2.7.2 General construction management measures that would be put in place to limit environmental impacts. The CEMP for the proposed Development would include general measures to minimise noise impacts from the construction phase, including:
- 8.2.7.3 Best Practicable Means (BPM) (as outlined in Section 72 of the Control of Pollution Act 1974) would be employed in order to minimise noise and vibration levels throughout the period of the works.
- Recommendations and good practice as shown BS 5228 would be adopted.
 - The measures set out in BS 5228 will include the following as appropriate:
 - Construction works would be confined to the normal working hours as prescribed by Gwynedd Council;
 - Careful selection of plant, construction methods and programming. Only plant conforming with relevant national or international standards, directives and recommendations on noise and vibration emissions would be used;
 - Construction plant will be located, as far as is reasonably practicable, away from adjacent occupied buildings or as close as possible to noise barriers or site hoardings where these are located between the plant and the buildings;
 - Static and semi-static plant/equipment would be fitted with suitable enclosures where Practicable;

- Personnel would be instructed on BPM to reduce noise and vibration as part of their induction training and as required prior to specific work activities;
- When plant is not being used, it would be shut down and not left to idle;
- Vehicles would not wait with engines running;
- Where practicable, all audible warning systems and alarms would be designed to minimise noise. Broadband reverse alarms would be fitted to all vehicles;
- Local residents would be consulted in advance of the works commencing;
- Localised mobile screening would be used where reasonably practicable to reduce the noise levels from handheld tools such as breakers and saws.

8.2.7.4 A construction vibration assessment is required to be undertaken by the contractor, and appropriate mitigation measures proposed (if required) prior to works commencing. Any required mitigation measures would form part of the Construction Environmental Management Plan (CEMP)

Operational phase

8.2.7.5 The assessment of noise and vibration has been based on the Scheme with permanent acoustic mitigation in place (i.e. as part of the highway engineering design). The mitigation includes provision of low noise surfacing, embankments and placing of the Scheme in a cutting between chainage 550 and chainage 920.

8.2.7.6 It may be possible to mitigate against some of the worst affected areas. At this point it has not been decided if any mitigation is to be put in place. Additional mitigation options include, but may not be limited to bunding and acoustic screening.

8.2.7.7 The Noise Insulation Regulation 1975 (amended 1988) (HMSO, 1988) (Ref 1.7) are designed in part to offer compensation to dwelling affected by adverse effects. In this case, there are no dwellings with levels above the 68dB threshold and as a result it's not mandatory to include compensation or triple glazing as part of the scheme.

8.2.8 Effects on All Travellers

Construction phase

8.2.8.1 Good site working practices, including clear signage and consideration of the effects on all travellers when designing traffic management measures, would be employed during the construction phase.

Operational phase

8.2.8.2 The embedded design measures are aimed at providing ongoing access for all travellers within the study corridor on completion of the work. One of the main aims of the Proposed Improvement is to improve safety standards for users of this section of the A496 so beneficial effects are therefore predicted for this group and no mitigation measures are proposed during the operational phase.

8.2.9 Community and Private Assets

Construction phase

Agricultural land quality

8.2.9.1 As no significant effects are predicted on agricultural land quality no specific mitigation is proposed. However in accordance with best practice, the correct specification as to soils stripping, storage and replacement would be carried out to ensure that land utilised temporarily during the construction phase can be restored back to its current land quality.

Farm businesses

8.2.9.2 The following general works would normally be provided or paid for by way of compensation. However, such works would have to be agreed with the landowner/occupier beforehand and are not firm commitments as part of the scheme. Special attention would normally be paid to maintaining existing services currently serving the land. Typical examples are the maintenance of access, water supplies and drainage.

Returning Land used for Temporary Construction to the Owner

8.2.9.3 In some locations, where land acquired for construction is returned, it is often a design policy to keep the gradients below 1:10 unless the field itself is at a steeper gradient, in which case the original contours are maintained. Where land is in permanent pasture (as is the case here), gradients may be increased to 1:5. In this way the amount of land which is permanently lost to agriculture can be minimised.

8.2.9.4 During the period when land is in aftercare, any shortfall in production can be made up through the payment of compensation. The business would therefore not be disadvantaged in the short term.

Reorganisation of Field Boundaries

8.2.9.5 Appropriate access to the affected fields would be provided where required and any farm boundaries such as hedgerows, fences and walls affected during construction would be reinstated to maintain the boundary and restore landscape and ecology features. Farms boundaries would generally be reinstated like for like.

Construction Mitigation

8.2.9.6 Haulfryn

Any land required on a temporary basis during construction period would be returned to the landowner on completion of the work.

8.2.9.7 Lack of continual access and temporary land take for construction could result in the owners of the horses removing them from the land, impacting on the landowner's income. This could be mitigated through financial compensation. Should this plot remain occupied during construction replacement facilities would be required prior to demolition of the stables and tack room.

8.2.9.8 Water troughs would be moved and re-located to an agreed alternative location before work begins if stock is to remain grazing the land. Fencing of the construction area would be erected if livestock are to remain on the land during construction.

Gwern Carnyddion and Plas y Bryn Farm

8.2.9.9 Any land required on a temporary basis during construction period would be returned to the landowner on completion of the work. Additionally the finished embankment slopes would be offered back to the landowner on completion of the works.

8.2.9.10 The loss of land temporarily for construction and following severance from the rest of the farm would impact on the day to day management and also potentially the ability to claim Basic Payment Scheme. The impact could be mitigated through financial compensation.

8.2.9.11 Land and surface drainage affected by the construction works would be reinstated and land restored to a functional state. Any damage to the land or surface drains would be made good.

Private Properties

8.2.9.12 Any areas subject to temporary land take would be carefully managed during the construction phase to prevent unnecessary damage to private property, and would be reinstated to the satisfaction of the property owner on completion of the works. Financial compensation would be provided to private property owners where land associated with the property is taken or negatively affected by the Proposed Improvement. Where accesses to private properties are affected by the works, temporary access would be provided throughout the duration of construction.

Land used by the community

8.2.9.13 The principal contractor would be encouraged to keep the Mochras Road car park open and accessible for as long as practicable during the construction phase, however when periods of closure are planned the contractor will notify the public in advance and will also consider opportunities for temporary alternative facilities nearby. Should the contractor choose to use the existing car park for storage or similar during periods of closure, care would be applied to prevent damage to surrounding trees and the facilities would be fully reinstated prior to re-opening.

Operational Mitigation

8.2.9.14 Haulfryn

The stables, fencing, water and access provided as mitigation during construction would be retained post-construction in order that the business is able to continue operating. Field boundaries such as stone walls and hedgerows would be re-built or replanted. Permanent land take would be financially compensated.

Gwern Carnyddion

Permanent land take would be financially compensated. Crossing the new road with farm machinery and livestock is perceived to be dangerous and may not be feasible depending on the slope of the embankments. The proposals include for a new underpass to enable movement of livestock between land either side of the new road. Field gates would be provided to contain livestock where necessary.

8.2.9.15 Plan y Bryn

Permanent land take would be financially compensated. Provision of new access to the farm and safe access to be able to continue to use the grassland to the east of the development is required. The proposals include for a new underpass to enable movement of livestock between land either side of the new road. Field gates would be provided to contain livestock where

necessary. Provision of water supply for severed land. Installation of adequate road drainage to ensure there is no increase in surface water flows.

Private Properties

8.2.9.16 The loss of vegetation which currently provides visual screening for private properties would be replaced as part of the soft landscaping works associated with the Proposed Improvement. The landscape mitigation strategy is discussed in more detail in Chapter 5.3: *Landscape Effects*.

8.2.10 Road Drainage and the Water Environment

Summary of mitigation

Construction

Generic Mitigation Measures

8.2.10.1 The risk of pollution during construction can be reduced by the adoption of good working practices and strict adherence to the Environment Agency Pollution Prevention Guidelines (PPGs) (2011-2016) and the CIRIA Pollution Prevention guidelines.

8.2.10.2 The key guidelines are:

- PPG 1 Understanding your environmental responsibilities- good environmental practice
- PPG 2 Above ground oil storage tanks
- PPG 3 Use and design of oil separators in surface water drainage systems
- PPG 4 Treatment and disposal of sewage where no foul sewer is available
- PPG 5 Works and maintenance in or near water
- PPG 6 Working at Demolition and Construction Sites
- PPG 22 Dealing with spills
- Control of pollution from highway drainage discharges (CIRIA report 142)
- Control of water pollution from construction sites (CIRIA C532)
- Containment systems for the prevention of pollution (CIRIA C736)

8.2.10.3 Additional good working practice has been collated from DMRB Volume 11 Section 3 Part 10, the Construction Industry Research and Information Association (CIRIA). Generic mitigation measures that would be applied prior to and during construction include the following:

- Provision of adequate temporary storage to contain surface runoff during the construction period, particularly when there are large areas of exposed earthworks or cutting, as these lead to substantial increases in surface flows during intense rainfall and can carry silt through to receiving watercourses.

- On-site availability of oil spill clean-up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak.
- Use of drip trays under mobile plant.
- Sediment- trapping matting installed downstream of any construction activities adjacent to or over watercourses.
- Preparation of incident response plans, prior to construction, and present on site throughout construction to inform sub-contractors of required actions in the event of a pollution incident.
- Timing of works close to watercourses so that they do not interfere with spawning fish.
- The use of construction materials on site free from contaminated material, so as to avoid any potential contamination of the watercourses.
- Ensuring that wet cement does not come into contact with river or groundwater.
- Testing of made soils and soils that have been reworked to identify any soil contamination.
- No storage of site compound, machinery or materials within the active floodplain.
- No in-stream works, without prior agreement from NRW.
- Use of pre-cast concrete where practical to limit use of wet mix concrete.

8.2.10.4 Sediment and erosion control measures would be implemented to ensure that increased siltation and erosion does not occur during construction. During construction an incident response plan would be in place to deal with any issues as soon as they occur for a particular site and to ensure that works are undertaken with the utmost care where they have potential to lead to contamination of any watercourse. Emergency action planning would include measures to be taken to prevent pollution caused by severe weather.

8.2.10.5 Wherever practicable, grey water systems would be used at site compounds to reduce runoff from site, improve water efficiency and lessen the potential for polluting discharges to surface watercourses.

Surface Water

8.2.10.6 Measures to avoid the contamination of surface waters during construction would be incorporated into the construction programme and method statements, and would be agreed with NRW prior to commencement of works. The need to prepare and enforce appropriate working practices during construction would be included in the CEMP. This would include requirement for appropriate training of site staff on water environment issues. An agreed contingency plan to deal with emergencies would also be established.

8.2.10.7 By employing best practice techniques listed below, the risks of pollutants reaching surface water features would be minimised to a level where any events that did occur would be contained and limited in scale:

- Use of pre-cast concrete where practical

- The use of concrete would be monitored carefully to ensure no accidental discharge into any watercourse
- Mixer washings and excess concrete would not be discharged to water
- All fuel, oils or chemicals stored on site would be located as far as is reasonably possible, and in no case less than 10m from any water body.
- Stores would be surrounded by an effective and impervious bund capable of holding the full contents of the store plus 10%. Protocol for the storage of fuel, equipment and construction materials, so as to minimise the risk of water pollution, is provided within PPG2.
- No materials, vehicles or site compound to be stored within the active floodplain.
- Dust suppression measures would be required in order to prevent entry of suspended solids into nearby water bodies, particularly in dry weather conditions.
- No plant would be used in-stream without prior consent from NRW. Plant operators and contractors would check vehicles and mobile plant on a daily basis for fuel and oil leaks and suitable maintenance would be promptly carried out.
- Plant and wheel washing facilities would be sited appropriately. To prevent indiscriminate washing out of the mobile plant, designated wash-out bays would be employed on site. This would avoid cementitious materials from being washed out directly onto the ground.
- A pumping/ de-watering plan will be implemented prior to the start of construction works

8.2.10.8 Regular monitoring of the surface water quality will also be carried out throughout the construction period to check for any changes to the water quality.

8.2.10.9 The use of sheet piles will be implemented for the construction of the abutments of the bridges to prevent any contamination into the nearby watercourses and to reduce the fluvial flood risk to the construction of the structures. This will have the dual purpose of ensuring quality is not affected and that the works are protected from flooding.

8.2.10.10 During construction there will be no in-channel works. Any requirements at detailed design stage for in-channel works will require consultation and agreement with NRW. These will be restricted to outside of fish spawning season if required.

Groundwater

8.2.10.11 Although there would be no direct discharges of surface water runoff to ground, precautionary mitigation would be taken during construction to minimise the potential for contaminants to reach any perched groundwater that may be present.

8.2.10.12 Best practice techniques, as outlined in the PPGs, would be employed throughout the construction process to minimise the risk of spillages. Appropriate phasing and scheduling of construction activities would play a key role in mitigating potential impacts. With best practice techniques employed, the potential for contamination of any underlying groundwater would be

minimised. Measures to avoid the contamination of groundwater during both construction and operation would be agreed with NRW prior to the commencement of works.

8.2.10.13 During construction the implementation of a pumping plan and strategy will be adopted to ensure that groundwater does not increase flood risk.

Hydromorphology and Hydrogeomorphology

8.2.10.14 This risk will be reduced using best working practices and reducing in-stream works. In-stream works will also not be permitted under high flow conditions. Due to the nature of the construction there will be no requirement for in-stream works. If the need for in-stream works arises, agreement with NRW will be sought prior to the works.

Flood Risk

8.2.10.15 To ensure that flood risk is not increased during construction, storage of materials and vehicles will not be within the floodplain or within areas known to have flooded in the past. In-stream works will not occur during times of increased rainfall and high flows. Increased runoff caused by compound or site areas will be restricted and attenuated to reduce increased runoff from increased impermeable surfaces into the watercourses.

Tidal/ Coastal flood risk

8.2.10.16 Timings of the works will be specifically outlined prior to the start-up of the works. Works will not be permitted during spring tides or during storm surge conditions. No works to be on going when tidal levels are predicted to be 2.5m AOD or higher, without prior approval of overseeing organisation and Natural Resources Wales.

8.2.10.17 For sections of the Proposed Improvement (approx. 200m) within the floodplain; a minimum of 900mm diameter pipes every 2.9m at base of embankment to allow flow of water onto the tidal and fluvial floodplain. During construction the pipes will be constructed as to ensure that the floodplain is not compromised. The staging of the works will allow continuous movement of water as required.

Operational Mitigation

Surface water

8.2.10.18 Mitigation measures for drainage and the water environment during operation are required for several reasons:

- To treat contaminants in normal runoff
- To deal with any accidental spillages occurring on the carriageway
- To attenuate flows from additional impermeable areas of road
- To prevent any increase to flood risk in the area
- To protect and enhance wildlife corridors near watercourses

8.2.10.19 Attenuation ponds provide surface attenuation of storm water runoff to aid in the control of surface water discharge. Ponds also allow for water quality treatment, primarily settlement of solids and uptake of heavy metals through plants. In total there are four attenuation areas within the Proposed Improvement project, one pond, two attenuation areas and attenuation within a new reed bed to the north of the project.

8.2.10.20 Pollution control measures are to be provided through the use of swales and filter strips.

8.2.10.21 Surface water runoff from the highway would be managed by the drainage network. The use of SuDS in the form of filter drains, filter strips and attenuation ponds/areas would be combined with over-sized pipes to allow efficient removal of excess water from the carriageway.

8.2.10.22 The agricultural underpasses would be drained in such a manner that does not discharge directly into watercourses *i.e.* filtered through/over adjacent ground or designed to drain away from such features.

Hydromorphology and Hydrogeomorphology

8.2.10.23 During operation there is no expected change to hydromorphology or hydrogeomorphology of the watercourses. The use of clean span bridges, spanning the width of the watercourses, will ensure that the watercourses are not altered from their natural state.

8.2.10.24 Discharge to watercourses will be reduced to the pre development Greenfield rates.

Winter maintenance

8.2.10.25 During operation of the Proposed Improvement it would be ensured that the maintenance contractors comply with current Environment Agency and NRW guidance and specifications as detailed in PPG10: Guidelines for storage of salt. It would be ensured that the use of de-icing salts would follow accepted practice and methodologies.

Fluvial Flood Risk

8.2.10.26 All new culverts, together with existing which are to be retained, have been assessed to ensure that each would pass a 1% (1 in 100) chance flow including 30% climate change. Checks have been made to ensure no adverse impact on flood risk up to a 0.1% (1 in 1000) chance event.

8.2.10.27 Measures to manage the risk of blockages of culverts have been incorporated into the Proposed Improvement. Further mitigation will be provided through the use of 900mm diameter culverts with 2.9 spacing to allow for both fluvial and tidal flow through onto and from the floodplain.

Pluvial Flood Risk

8.2.10.28 Runoff from the highway would be restricted using controls such as hydro-breaks, orifice plates, and balancing would be provided by ponds. Oversized pipes may be considered for storage in specific situations where space does not facilitate the use of ponds. Suitable access provision would be provided to all balancing facilities to allow for future maintenance.

Groundwater flood risk

8.2.10.29 During operation there is no direct discharge to groundwater sources. All surface water will be filtered, attenuated with settlement before discharging to the watercourse. During operation the risk of pollution to groundwater is therefore seen as low.

Tidal/ Coastal Flood Risk

8.2.10.30 The risk of tidal/ coastal flooding to the Proposed Improvement has been assessed and mitigated through the incorporation of the 900mm pipes through the floodplain. As the Proposed Improvement will be built on an embankment the risk of tidal/ coastal flooding is seen as low during more frequent return periods.

8.2.10.31 The majority of the Proposed Improvement is above the 1 in 1000 year +CC sea level and would therefore remain flood free up to this event. Approximately 0.1km of the northern section of the development is at risk of tidal flooding during this event.

Chapter 9.0: Abbreviations

This chapter provides a summarised reference of the abbreviations that have been used in this ES.

AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic (Monday – Friday)
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASIDOHL	Assessment of the Significance of the Impact of Development on Historic Landscape Areas
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BS	British Standard
BTO	British Trust for Ornithology
CEEQUAL	The Civil Engineering Environmental Quality Assessment and Award Proposed Improvement
CEMP	Construction Environmental Management Plan
CEMPA	Construction Environmental Management Plan (Aftercare)
CIRIA	Construction Industry Research & Information Association
CRow Act	Countryside and Rights of Way Act, 2000
CRTN	Calculation of Road Traffic Noise
DEFRA	Department for the Environment, Food and Rural Affairs
DM	Do Minimum scenario <i>i.e.</i> without the Proposed Improvement
DMRB	Design Manual for Roads and Bridges
DS	Do Something scenario <i>i.e.</i> with the Proposed Improvement
EAN	Environmental Advice Note
EC	European Commission
ECR	Environmental Commitments Register
ECoW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
EPS	European protected species
EPUK	Environmental Protection UK
ES	Environmental Statement
EQS	Environmental Quality Standards
EU	European Union
FCA	Flood Consequence Assessment
GAPS	Gwynedd Archaeological Planning Service
GAT	Gwynedd Archaeological Trust
GCR	Geological Conservation Review
GHGs	Greenhouse Gases
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GQA	General Quality Assessment
HAWRAT	Highways Agency Water Risk Assessment Tool
HDV	Heavy Duty Vehicle
HEMP	Handover Environmental Management Plan
HER	Historic Environment Register
HGV	Heavy Goods Vehicle
IAN	Interim Advice Note

IAQM	Institute of Air Quality Management
ICOMOS	International Council on Monuments and Sites
IEEM	Institute of Ecology and Environmental Management
JLDP	Joint Local Development Plan
JLTP	Joint Local Transport Plan
JNCC	Joint Nature Conservation Committee
LANDMAP	Landscape Assessment and Decision-Making Process
LAQM	Local Air Quality Management
LAQM.TG	Local Air Quality Management Review and Assessment Technical Guidance
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LDP	Local Development Plan
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LPA	Local Planning Authority
LTP	Local Transport Plan
MAFF	Ministry of Agriculture, Fisheries and Food
NERC Act	The Natural Environment and Rural Communities (NERC) Act, 2006
NGR	National Grid Reference
NIR	Noise Insulation Regulations 1975 (amended 1988)
NMU	Non-motorised User
NMWTRA	North and Mid Wales Trunk Road Agent
NNR	National Nature Reserve
NO _x / NO ₂	Oxides of Nitrogen / Nitrogen Dioxide
NRW	Natural Resources Wales
NTPF	National Transport Finance Plan
OS	Ordnance Survey
PM ₁₀ /PM _{2.5}	Particulate Matter
PMA	Private Means of Access
PPG	Pollution Prevention Guideline
PPW	Planning Policy Wales
PRN	Primary Reference Number
PRoW	Public Right of Way
RIGS	Regionally Important Geological Sites
RSPB	Royal Society for the Protection of Birds
RTP	Regional Transport Plan
SAC	Special Area of Conservation
SEB	Statutory Environmental Body
SIAA	Statement to Inform an Appropriate Assessment
SNPA	Snowdonia National Park Authority
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
TAN	Technical Advice Note
UDP	Unitary Development Plan
UKBAP	United Kingdom Biodiversity Action Plan
WCA	Wildlife and Countryside Act
WFD	Water Framework Directive, 2003
WG	Welsh Government
WTS	Wales Transport Strategy, 2008
ZoI	Zone of Influence