



Llywodraeth Cymru  
Welsh Government

## A55 Junctions 16 and 16A Improvements

### Environmental Statement

### Volume 3C Appendices Chapters 7-18

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# **A55 JUNCTION 16 ENVIRONMENTAL STATEMENT VOLUME 3 APPENDICES**

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**WATER FRAMEWORK DIRECTIVE ASSESSMENT**

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# **A55 JUNCTION 16**

## **APPENDIX 7.1**

# **WATER FRAMEWORK DIRECTIVE ASSESSMENT**

# **A55 JUNCTION 16 APPENDIX 7.1 WATER FRAMEWORK DIRECTIVE ASSESSMENT**

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# 1. INTRODUCTION

## 1.1 Brief

1.1.1 Ramboll UK Limited (Ramboll) has been appointed by the Welsh Government to undertake a Water Framework Directive (WFD) assessment of the proposed A55 Junction 16 Scheme (referred to as the 'Scheme') to be undertaken at Penmaenmawr (see Figure 7.1 for the location of the site and associated water features).

1.1.2 This WFD assessment has been prepared in order to support Chapter 7 ('Road Drainage and the Water Environment) of the Environmental Statement for the Scheme.

## 1.2 Proposals

1.2.1 Figure 7.1 shows that the Scheme extends for approximately 2.5 km along the length of the A55, from a point at the north-eastern end of Penmaenmawr to close to the entrance of the Penmaenbach tunnels.

1.2.2 The Scheme design includes the following elements that are associated with water or have an interaction with the water environment:

- a) Interception of drainage from road and catchment run-off into existing drainage network by measures including drainage ditches, filter drains and pipes/culverts;
- b) Extension of three existing culverts, including construction of headwalls, to facilitate widening of road embankments;
- c) Addition of one drainage outfall into the Afon Gyrach (taking catchment drainage only);  
and
- d) Discharge of drainage from the existing network into seven existing drainage outfalls on Penmaenmawr beach, discharging surface water drainage into the sea.

## 2. BASELINE ENVIRONMENT

### 2.1 The Site

2.1.1 Junction 16 (the Scheme) is to the northeast of Penmaenmawr, in Conwy County Borough. It is located at the base of hills sloping down from the south towards the coast and Conwy Bay which lies immediately to the northwest of the Scheme. The Conwy to Holyhead main railway line separates the Scheme from the bay.

### 2.2 Geology and Hydrogeology

2.2.1 The British Geological Survey 'Geology of Britain Viewer' and 1:50,000 geological map (sheet 94) shows that the solid geology within the Scheme area mostly comprises mudstone and rhyolite of the Conwy Rhyolite Formation, whilst approximately 350 m to the west of the Scheme area, the bedrock comprises siltstone of the Nant Ffrancon subgroup, all of which are Ordovician in age.

2.2.2 The near surface superficial deposits in the Scheme area comprise mainly Devensian Till (glacial till) comprising Diamicton which is Quaternary in age, which the BGS<sup>1</sup> indicate is a heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape. Localised deposits of peat, alluvium and blown sand are located along the line of the Scheme area, whilst Storm Beach Deposits (predominantly gravels) lie to the north and west of the Scheme, with Coastal Zone Deposits (predominately clay and silt) and Tidal Flat Deposits (predominantly sand and gravel) below the sea to the north of the Scheme. Further details of the geology associated with the Scheme is presented in Chapter 6.

2.2.3 The Ordovician bedrock is classified by Natural Resources Wales (NRW) as a Secondary B aquifer (low productivity, highly indurated (hardened by heating) rocks with limited groundwater content)<sup>2</sup> with high vulnerability<sup>3</sup>.

2.2.4 The superficial deposits beneath the Scheme (the glacial till) are classified by NRW as Secondary (undifferentiated) strata<sup>2</sup>, also of high vulnerability<sup>3</sup>.

### 2.3 WFD Surface Water Environment

2.3.1 The Scheme passes over the Afon Gyrach which flows in a general northerly direction, discharging into Conwy Bay approximately 500 m to the north-northeast of the village of Dwygyfylchi. The river was designated under the WFD for the Cycle 1 of the Directive (i.e. 2009 to 2015) but is no longer designated. This is anticipated to be due to its small size. For the purposes of Cycle 1 reporting, it was classified by NRW as having a mid-altitude catchment of extra small size, running through underlying siliceous geology<sup>4</sup>. For the period of 2009-2015 it was classified as having good overall status, with good chemical and ecological statuses as well as good hydromorphology and flow characteristics.

2.3.2 Conwy Bay runs along a line close to the north western boundary of the Scheme and is designated as a coastal water body under the WFD. Within it, less than 2 km from the Scheme

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<sup>1</sup> <https://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=TILL>

<sup>2</sup> <http://mapapps2.bgs.ac.uk/geoindex/home.html>

<sup>3</sup> Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.

<sup>4</sup> For definition see: <https://cdn.naturalresources.wales/media/684352/annex-chapter-3-final-for-publication.pdf>

are two areas designated at a European level for their habitat quality (see Figure 7.2), comprising:

- a) Liverpool Bay Special Protection Area (SPA), a marine area supporting large aggregations of wintering red-throated diver and common scoter as well as important marine foraging areas of little terns; and
- b) Menai Strait and Conwy Bay Special Area of Conservation (SAC), a marine area with sea inlets, which is designated to protect its rich and diverse habitats. The SAC overlaps the SPA.

2.3.3 There are no mitigation measures implemented in order to meet the requirements of the WFD in Conwy Bay.

2.3.4 Penmaenmawr has a designated bathing water which extends from southwest of the village in a north easterly direction and runs alongside and parallel to the southern end of the Scheme. The bathing water quality sampling point for the beach is situated at the north end of the promenade, approximately 500 m to the west of the current Junction 16 (see Figure 7.2). Ongoing bathing water monitoring shows it to have excellent water quality<sup>5</sup>. NRW do note that the bathing water at this location is subject to short term reduction in quality following rainfall (typically for up to 3 days), resulting from run-off of faecal material into the sea from livestock, sewage and urban drainage via rivers and streams<sup>5</sup>.

2.3.5 Penmaenmawr Waste Water Treatment Works lies immediately adjacent to the north easterly end of the Scheme on its seaward side. It discharges secondary treated sewage effluent into coastal waters via an outfall 360 m from the shore<sup>6</sup>.

## 2.4 WFD Groundwater Environment

2.4.1 The Llyn and Eryri groundwater body underlies the Scheme and a large area to the south and southwest of it (total area of 1,317 km<sup>2</sup>)<sup>7</sup>. The groundwater body is of poor quality due to the fact that water from it supplies:

- a) An associated surface water body that is not meeting its quality objectives under the WFD and groundwater contributes at least 50% of the relevant surface water standard; and
- b) A wetland where its contribution is potentially sufficient to cause significant damage to that wetland.

2.4.2 Although not subject to designation under the WFD, Ordnance Survey maps do indicate the presence of a number of springs and wells within 500 m of the Scheme, indicating the presence of groundwater close to the surface (see Figure 7.1).

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<sup>5</sup> <https://environment.data.gov.uk/wales/bathing-waters/profiles/profile.html?site=ukl1301-40180>

<sup>6</sup> <https://environment.data.gov.uk/wales/bathing-waters/data/bathing-water-profile/ukl1301-40180/2017:1>

<sup>7</sup> <https://nrw.maps.arcgis.com/apps/webappviewer/index.html?id=2176397a06d64731af8b21fd69a143f6>

## 3. WATER FRAMEWORK DIRECTIVE

### 3.1 Background

3.1.1 The WFD (2000/60/EC) was published in December 2000 and transposed into Welsh law in December 2003 through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, later being updated through The Water Environment (WFD) (England and Wales) (Amendment) Regulation 2015 and most recently The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The intention of the Directive is to provide a more holistic approach to protection of the water environment than had previously been in place, addressing a wide range of aspects of the water environment, including physico-chemical, chemical, hydromorphological and ecological.

3.1.2 The environmental objectives of the WFD are to:

- a) Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- b) Aim to achieve at least 'good' status for all water bodies by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve 'good' status by 2021 or 2027;
- c) Meet the requirements of Water Framework Directive Protected Areas;
- d) Promote sustainable use of water as a natural resource;
- e) Conserve habitats and species that depend directly on water;
- f) Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- g) Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- h) Contribute to mitigating the effects of floods and droughts.

3.1.3 The Directive requires that NRW define River Basin Districts and for each of these develop a River Basin Management Plan (RBMP). As part of this process all inland (above or below ground) and coastal waters have been allocated status categories in order to help inform where water bodies are at risk and/or protective/management measures need to be put in place.

3.1.4 The Scheme is situated within the area covered by the Western Wales River Basin District and thus the Western Wales River Basin Management Plan (RBMP).

### 3.2 Assessment Process

3.2.1 NRW recommend the use of a WFD assessment process developed by the Environment Agency (EA) for the purposes of marine licence applications<sup>8</sup> in Wales. The EA process sets out a structure as to how to assess the impact of activities in estuarine (transitional) and coastal waters with respect to the requirements of the WFD. Given the location of the Scheme immediately adjacent to a coastal water body, it is considered appropriate to utilise this guidance to inform this assessment. The aim of such WFD assessments is to assist the regulator in assessing:

- a) The impact an activity may have on the immediate water body and any linked water bodies; and

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<sup>8</sup> <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

b) Whether the activity complies with the relevant RBMP.

3.2.2 The process and logic of the EA procedure has been adopted for completion of the WFD in this report. The EA guidance adopts a three-stage process as follows:

- a) Screening – This excludes any activities that don't need to go through the scoping or impact assessment stages;
- b) Scoping – Identifies the receptors that are potentially at risk from your activity and need impact assessment; and
- c) Impact assessment – Considers the potential impacts of the activity, identifies ways to avoid or minimise impacts, and shows if the activity may cause deterioration or jeopardise the water body achieving good status.

## 4. ASSESSMENT

### 4.1 Screening

4.1.1 The nature of the project is such that it does not align with any of the screening criteria listed in the EA guidance as these are focussed on EA licensing requirements rather than the planning process. However, a WFD Assessment is required to support the Environmental Impact Assessment for the Scheme so the need for a WFD assessment has been screened in.

### 4.2 Scoping

4.2.1 The EA protocol provides a scoping template to complete to identify the potential risks to receptors associated with a project or activities and thus inform the scope of any required detailed impact assessment. The completed scoping template is presented below in Table 4-1 and Table 4-2.

**Table 4-1: Water Framework Directive Assessment Scoping – Baseline**

<b>Activity/Characteristic</b>	<b>Description Notes or More Information</b>	
Applicant name	Welsh Government	
Name of activity	Construction and operation of the Scheme	
Brief description of activity	Creation of new grade-separated junction, new overbridge and associated slip roads	
Location of activity (central point XY coordinates or National Grid reference)	Approximately 273404E, 377664N	
Footprint of activity (ha)	Site area is approximately 30 ha	
Use or release of chemicals (state which ones)	None	
Water body type	Groundwater	Coastal
WFD water body name	Llyn and Eryri	Conwy Bay
Water body ID	GB41002G204600	GB671010400000
River basin district name	Western Wales	Western Wales
Water body total area	1317 km <sup>2</sup>	49.7 km <sup>2</sup>
Overall water body status	Poor (Cycle 2)	Moderate (Cycle 2)
Ecological status	N/A	Moderate (Cycle 2) (due to quality of invertebrate populations, infaunal quality index score)
Chemical status	Poor (qualitative) (Cycle 2)	Fail (Cycle 2) (due to the presence of mercury and trichlorobenzenes)
Quantitative Status	Good (quantitative) (Cycle 2)	N/A
Target water body status and deadline	Poor by 2015	Good by 2021
Hydromorphology status of water body	N/A	-

Activity/Characteristic	Description Notes or More Information		
Heavily modified water body and for what use	N/A	Yes – for coastal protection	
Higher sensitivity habitats present (low resistance to, and recovery rate, from human pressures)	Habitat	Distance from Scheme (m)	Area (ha)
	Mussel beds	130 m northwest. Adjacent to Penmaenmawr Waste Water Treatment Works	0.4
Lower sensitivity habitats present (medium to high resistance to, and recovery rate from, human pressures)	Cobbles, gravel and shingle	Minimum 30 m northwest	Extensive strip of cobbles, gravel and shingle forming the beach adjacent to the whole length of the Scheme plus additional areas to the west and east along the coast
	Intertidal soft sediments like sand and mud	Minimum 40 m northwest	Extensive area extending full length of the Scheme plus additional areas to the west and east along the coast
	Rocky shore	40 m northwest	Extensive strip of rocky foreshore forming the beach adjacent to the whole length of the Scheme plus additional areas to the west and east along the coast
	Subtidal soft sediments like sand and mud	Approximately 300 m to northwest	Significant area along full length of Scheme and extending out into Conwy Bay
Phytoplankton status	Blooms of the algae <i>Phaeocystis</i> can occur along the coastline during warm and calm weather in May and June. NRW report that this typically produces a cream or brown scum along the water's edge but is otherwise harmless <sup>5</sup> .		
History of harmful algae	Not recorded by NRW		
WFD Protected Areas within 2 km	Bathing water – Penmaenmawr (excellent quality) SPA – Liverpool Bay (UK9020294) SAC – Menai Strait and Conwy Bay (UK0030202) Shellfish water – Conwy		

4.2.2 Within each topic presented below, the conclusions as to whether further impact assessment is required or not is indicated in bold text, with the reasoning for that decision in the 'Topic' Risk Issues column to the right.

**Table 4-2: Water Framework Directive Assessment Scoping – Specific Risk Information**

<b>HYDROMORPHOLOGY</b>			
<b>Assess Further if Activity:</b>	<b>Yes</b>	<b>No</b>	<b>Hydromorphology Risk Issue(s)</b>
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status	Requires impact assessment	Impact assessment not required	No. The adjacent water bodies are of moderate status.
Could significantly impact the hydromorphology of any water body	Requires impact assessment	Impact assessment not required	No. The Scheme discharges run-off through the existing drainage system into the adjacent coastal water body.
Is in a water body that is heavily modified for the same use as your activity	Requires impact assessment	Impact assessment not required	No. The Scheme discharges into a coastal water body which is classified as a Heavily Modified Water Body (HMWB) but not for purposes the same as the nature of the Scheme.
<b>BIOLOGY - HABITATS</b>			
<b>Asses further if the Footprint<sup>1</sup> of Activity is:</b>	<b>Yes</b>	<b>No</b>	<b>Biology Habitats Risk Issue(s)</b>
0.5 km <sup>2</sup> or larger	Yes to one or more – requires impact assessment	No to all – impact assessment not required	No. The Scheme does not lie within a surface water body and the extent of potential effects from discharge of highway drainage are expected to have a footprint of less than 0.5 km <sup>2</sup> .
1% or more of the water body's area			No. The Scheme does not lie within a surface water body and takes up less than 1% of the underlying groundwater water body. Highway runoff would be discharged via outfalls into the Conwy Bay water body but the area affected by such outfalls would be less than 1% of its overall area.
Within 500 m of any higher sensitivity habitat			Yes. The closest higher sensitivity habitat is located approximately 130 m from the Scheme (see Plate 1).
1% or more of any lower sensitivity habitat			No. The Scheme does not lie with a lower sensitivity habitat. Highway runoff would be discharged via an outfall across a lower sensitivity habitat (rock and shingle beach) but the area affected by such outfalls would be less than 1% of the overall area of lower sensitivity habitats.

<b>FISH</b>			
<b>Assess Further if Activity:</b>	<b>Yes</b>	<b>No</b>	<b>Biology Fish Risk Issue(s)</b>
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	Continue with questions	Go to next section	No. The Scheme is not located within an estuary.
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	Requires impact assessment	Impact assessment not required	
Could cause entrainment or impingement of fish	Requires impact assessment	Impact assessment not required	
<b>WATER QUALITY</b>			
<b>Assess Further if Activity:</b>	<b>Yes</b>	<b>No</b>	<b>Water Quality Risk Issue(s)</b>
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns <b><i>continuously for longer than a spring neap tidal cycle</i></b> (about 14 days)	Requires impact assessment	Impact assessment not required	No. Discharge of highway run-off only occurs during and for a period of a few days after rainfall events.
Is in a water body with a phytoplankton status of moderate, poor or bad	Requires impact assessment	Impact assessment not required	Phytoplankton status is not recorded by NRW, however they do report that blooms of the algae <i>Phaeocystis</i> can occur along the coastline during warm and calm weather in May and June, but that the blooms are harmless <sup>5</sup> . Conclusion: Scheme does not fit criteria for assessment.
Is in a water body with a history of harmful algae	Requires impact assessment	Impact assessment not required	This information is not available. Given the nature of the proposed works this is not considered to be an issue.
<b>Assess Further if Activity Uses or Releases Chemicals (e.g. Through Sediment Disturbance or Building Works) and</b>	<b>Yes</b>	<b>No</b>	<b>Water Quality Risk Issue(s)</b>
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	<b>Requires impact assessment</b>	Impact assessment not required	Road run-off has the potential to contain a range of contaminants including the following in the EQSD list: copper, zinc, polyaromatic hydrocarbons (PAHs).

It disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment	Impact assessment not required	No. No dredging or construction in the water environment is required as part of the Scheme.
<b>If Activity has a Mixing Zone (such as Discharge Pipeline or Outfall)</b>			
<b>Assess further if:</b>	<b>Yes</b>	<b>No</b>	<b>Water Quality Risk Issue(s)</b>
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	<b>Requires impact assessment</b>	Impact assessment not required	Surface water from the Scheme would be discharged via seven outfalls into the Conwy Bay water body. The water being discharged has the potential to contain a range of contaminants including the following in the EQSD list: copper, zinc, polyaromatic hydrocarbons (PAHs).
<b>PROTECTED AREAS<sup>2</sup></b>			
<b>Assess Further if Activity is:</b>	<b>Yes</b>	<b>No</b>	<b>Protected Areas Risk Issue(s)</b>
Within 2 km of any WFD Protected Area <sup>3</sup>	<b>Requires impact assessment</b>	Impact assessment not required	Yes. The Scheme lies within 2 km of the following Protected Areas: Bathing water – Penmaenmawr SPA – Conwy Bay, Liverpool Bay SAC – Conwy Bay Shellfish water – Conwy
<b>INVASIVE NON-NATIVE SPECIES (INNS)</b>			
<b>Assess Further if Activity Could:</b>	<b>Yes</b>	<b>No</b>	<b>INNS Risk Issue(s)</b>
Introduce or spread INNS	Requires impact assessment	Impact assessment not required	No INNS have been identified at the site

<sup>1</sup> Note that a footprint may also be a temperature or sediment plume. For dredging activity, a footprint is 1.5 times the dredge area

<sup>2</sup> Protected Areas include SACs, SPAs, shellfish waters, bathing waters and nutrient sensitive areas

<sup>3</sup> A regulator can extend the 2 km boundary if your activity has an especially high environmental risk

4.2.3 Where no risk to potential receptors is identified at scoping stage, impact assessment does not need to be completed. The potential risks to receptors which the scoping exercise concludes need to be taken forward for detailed impact assessment, are presented in Table 4-3.

**Table 4-3: Potential Risks to be Assessed**

<b>Receptor</b>	<b>Potential Risk to Receptor?</b>	<b>Note the Risk Issue(s) for Impact Assessment</b>
Hydromorphology	No	
Biology: habitats	No	Part of the Scheme is located approximately 130 m from mussel beds
Biology: fish	No	
Water quality	Yes	Project involves discharge of water containing EQSD substances into Protected Area
Protected areas	Yes	The Scheme is located within 2 km of a number of Protected Areas
Invasive non-native species	No	

### 4.3 Impact Assessment

4.3.1 The impact assessment below is written in the context of the following early stage scheme alignment design and environmental masterplan elements being implemented:

- a) Completion of construction works under the management of a Construction Environmental Management Plan (CEMP); for example, management of surface water run-off from exposed earthworks and construction compounds, provision of spills kits and emergency spill procedures; and
- b) Inclusion of attenuation measures to limit flow to existing rates for existing areas of road and at greenfield rates for newly constructed highway (allowing for climate change). This would have the additional benefit of contributing to pollution control.

### 4.4 Water Quality

4.4.1 The scoping stage identified the potential for surface water highway run-off from the Scheme to have a detrimental effect on adjacent water bodies due to the presence of pollutants from the EQSD list within it. The Scheme would discharge surface water run-off via seven existing outfalls and one proposed new outfall along the length of the Scheme into the Conwy Bay water body, which currently classified as failing with respect to its chemical status due to the presence of mercury and trichlorobenzenes.

4.4.2 In order to assess the potential quality of water being discharged from the Scheme to the adjacent designated water body a water quality assessment has been completed utilising Highways England’s Water Risk Assessment Tool (HEWRAT). This is the tool adopted by the Welsh Government for such purposes. The details of this assessment and its outcome are presented in Appendix 7.3.

- 4.4.3 For discharges of road runoff from the Scheme to (freshwater) surface watercourses, a water quality assessment using HEWRAT (Appendix 7.3 to the Environmental Statement) determined that the discharges pass all aspects of the water quality assessment for routine runoff.
- 4.4.4 For discharges to the sea, the HEWRAT methodology was adapted for use in saline waters (as there is no better alternative) and the results are set out in Appendix 7.3 to the Environmental Statement. The assessment concluded that the discharge of routine runoff from the Scheme to Conwy Bay would have a negligible impact.
- 4.4.5 In conventional use for flowing watercourses, HEWRAT determines whether fine sediments in the road runoff would be likely to accumulate or disperse. Where sediments accumulate there can be associated water quality risks from sediment-bound pollutants including copper, zinc and poly-aromatic hydrocarbons (PAHs). The low-flow rate of the watercourse and the channel dimensions are key parameters used to determine whether fine sediment is likely to accumulate or disperse (and thereby whether the risk is acceptable or not). Where runoff from the Scheme would discharge direct to the sea, it is not possible to use HEWRAT to determine whether sediments accumulate or disperse. However, by its nature, the coastal environment where runoff would discharge is dynamic and subject to currents, waves and tides which would disperse fine sediments such that they would not be sufficiently concentrated to be toxic to aquatic organisms living in or near bed sediments.
- 4.4.6 In considering whether the potential impact on water quality from routine runoff from the Scheme would be acceptable or and/or significant, it is relevant that the existing A55 and Junction 16 already discharge to Conwy Bay via the same outfalls.
- 4.4.7 Taking all of the above into account, the impact of routine runoff on the water environment of Conwy Bay is considered to be negligible both from dissolved and sediment-bound contaminants.
- 4.4.8 A spillage risk assessment has been completed and is presented in Appendix 7.3. The assessment concludes that the annual probability of a spillage that could cause a Category 1 or 2 incident<sup>9</sup> is less than 0.5 % and thus that no specific pollution control measures would be required<sup>10</sup>. It should be noted that the removal of the roundabout will decrease the risk of spillage when compared to the current situation and thus will provide betterment in that respect.
- 4.4.9 Given the predicted levels of contaminants, mitigated by the inclusion of pollution control measures in the Scheme design and the significant dispersion within the coastal water body it is concluded that the discharge of surface water run-off from the Scheme would not result in significant impacts on the quality of the water within the Menai Strait water body and that the Scheme provides betterment over the current situation.
- 4.4.10 While the drainage strategy is to discharge road runoff to surface water, elements of the drainage system may be unlined and give rise to the potential for runoff to infiltrate into the ground. An assessment was made of the potential impact on groundwater quality and is presented in Appendix 7.3. This concluded that the impact would be negligible. The Llyn and Eryri groundwater body would therefore not be affected.

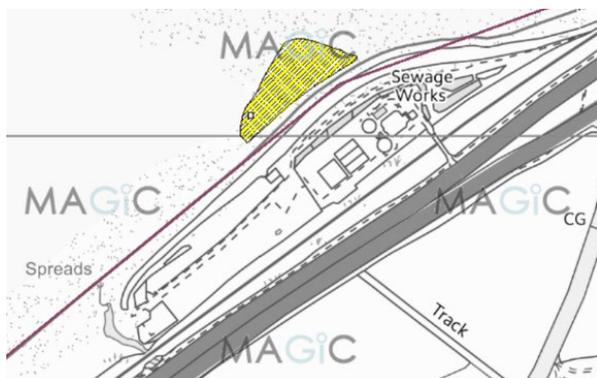
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<sup>9</sup> Category 1 or 2 incidents are defined in Incidents and their Classification: the Common Incident Classification Scheme (CICS), Operational Instruction 04\_01, Environment Agency, 2011

<sup>10</sup> Highways England, Design Manual for Roads and Bridges LA113 Road Drainage and the Water Environment

## 4.5 Biology: Habitats

- 4.5.1 Government mapping<sup>11</sup> shows the location of a mussel bed adjacent to the Penmaenmawr waste water treatment works (see Plate 1). The bed is situated between the Afon Gyrach to the southwest and two nearby outfalls to the northeast.



**Plate 1: Mussel Bed**

(Reproduced from Ordnance Survey digital map data © Crown copyright 2019. All rights reserved. Licence number 100040631)

- 4.5.2 Surface water from the Scheme would be discharged via the Afon Gyrach and the nearby outfalls. As discussed in Section 4.2, any effects associated with such discharges are not considered to be significant.

## 4.6 Protected Areas

- 4.6.1 The Scheme lies within 2 km of a number of Protected Areas, as detailed in Table 4-2. Potential effects on these Protected Areas would be associated with the quality of water discharged from the Scheme. As discussed in Section b), the effects associated with this are not considered to be significant. Chapter 8 discusses the potential effects of the Scheme on the adjacent SPAs and SAC. The assessment within that chapter concludes that any effects would be neutral.
- 4.6.2 The Penmaenmawr designated bathing water runs alongside and parallel to the southern end of the Scheme and has excellent water quality (see Paragraph 2.3.3). It is noted as sometimes being subject to short term reduction in quality following rainfall, due to run-off from a variety of sources including urban drainage. Faecal content and turbidity are the main parameters of concern with respect to bathing water quality. Road run-off should not contain any faecal content so the Scheme would not result in any change in that context. Increased run-off from the Scheme during periods of high rainfall could contribute to the turbidity of the sea on a very localised basis during such events, but inclusion of flow attenuation within the Scheme drainage design would assist in negating that and thus would not be expected to have any detrimental effect on the status of the bathing water.
- 4.6.3 The Conwy designated shellfish water commences upstream of the town of Conwy within the Afon Conwy, and, at the mouth of the river, widens in both easterly and westerly directions for several kilometres along the coast. Part of this shellfish water is located adjacent to the northern half of the Scheme (see Figure 7.2).

<sup>11</sup> <https://magic.defra.gov.uk/MagicMap.aspx>

4.6.4 Surface water from the Scheme would be discharged into this area from four outfalls. As discussed in Section 4.2, any effects associated with this are not considered to be significant.

4.6.5 Given the above discussion, it is concluded that the discharge of surface water run-off from the Scheme would not result in significant impacts on the quality Protected Areas within 2 km of the Scheme and that the flow attenuation within the Scheme would provide betterment over the current situation.

#### 4.7 **Mitigation Measures Assessment**

4.7.1 The Scheme is unable to have an impact on formal mitigation measures for the Conwy Bay water bodies as there are none currently in place.

#### 4.8 **Deterioration and Risk to Good Status Assessment**

4.8.1 The identified effects associated with the proposed Scheme would be limited in extent and time. As such no deterioration in water body classification would occur, the proposed Scheme would:

- a) Not result in reduction of WFD classification in any water bodies;
- b) Not put at risk the good status/potential of any water body; and
- c) Not inhibit any water body from progressing towards good status/potential.

## **5. CONCLUSIONS**

- 5.0.1 It is concluded from the above assessment that, with implementation of the noted design measures plus environmental management during construction, the proposed Scheme would not result in deterioration of the adjacent coastal water bodies. It is thus in compliance with the requirements of the WFD and supports the Western Wales RBMP.

## **APPENDIX 7.2 FLOOD CONSEQUENCES ASSESSMENT**

Intended for  
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# **A55 JUNCTION 16**

## **APPENDIX 7.2**

# **FLOOD CONSEQUENCES**

# **ASSESSMENT**

## **A55 JUNCTION 16 APPENDIX 7.2 FLOOD CONSEQUENCES ASSESSMENT**

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# 1. INTRODUCTION

1.0.1 Ramboll UK Limited trading as Ramboll (Ramboll) was appointed by the Welsh Government ('client') to undertake a Flood Consequences Assessment (FCA) for the proposed A55 Junction 15 Improvement Scheme (referred to as the 'Scheme').

## 1.1 Scope and Objectives

1.1.1 This document considers the risks of various sources of flooding to the site and the consequent risk of flooding to downstream receptors (such as people, property, habitats, infrastructure and statutory sites) from the Scheme as a result of surface water runoff and loss of floodplain storage. A comparison is made between the current situation and the proposed Scheme.

1.1.2 This FCA has been carried out in accordance with Road Drainage and the Water Environment<sup>1</sup>, Planning Policy Wales (PPW)<sup>2</sup> and Technical Advice Note (TAN) 15<sup>3</sup>. It is to be used to assist the Local Planning Authority (LPA) and Natural Resources Wales (NRW), when considering the flooding issues of the Scheme, as part of a planning application.

1.1.3 This report provides an assessment of the flood risk to the site based upon flood data and the flood maps provided by the NRW and Conwy Local Flood Risk Management Strategy<sup>4</sup>.

1.1.4 The references for the key sources of information used to prepare this document are included in the footnotes. Ramboll cannot accept liability for the accuracy or otherwise of any information derived from third party sources.

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<sup>1</sup> Highways England (2019), *LA113 – Road Drainage and the Water Environment*, Design Manual for Roads and Bridges, Volume 11

<sup>2</sup> Welsh Government (2018). *Planning Policy Wales*. [online] 10th edn. Gov.Wales. Available at: <https://gov.wales/sites/default/files/publications/2019-02/planning-policy-wales-edition-10.pdf> [accessed 21/06/2019]

<sup>3</sup> Welsh Assembly Government (2004). *Planning Policy Wales, Technical Advice Note 15: Development and Flood Risk*

<sup>4</sup> Conwy County Borough Council (2013). *Conwy Local Flood Risk Management Strategy. Strategic Environmental Assessment – Environmental Report*. [online] Available at: <https://www.conwy.gov.uk/en/Resident/Crime-and-emergencies/Preparing-for-Emergencies/Flooding/documents/Strategic-Environmental-Assessment-Environmental-Report.pdf> [accessed 21/06/2019]

## 2. SITE CONTEXT

### 2.1 Application Site Description

- 2.1.1 Junction 16 (the Scheme) lies to the northeast of Penmaenmawr in Conwy County Borough. It is located at the base of hills sloping down from the south towards the coast and Conwy Bay which lies immediately to the northwest of the Scheme. The Conwy to Holyhead main railway line separates the Scheme from the bay.
- 2.1.2 Figure 7.1 of the Environmental Statement (ES) shows that the Scheme extends for approximately 2.5 km along the length of the A55, from a point at the north-eastern end of Penmaenmawr to close to the entrance of the Penmaen-bach tunnels.
- 2.1.3 Junction 16 of the A55 is currently a roundabout with three exits; northeast and southwest to the A55 and south toward Penmaenmawr. The safety improvement Scheme proposes to remove the roundabout so that the A55 dual carriageway is continuous at this location. Access and egress to/from the southbound carriageway would be via new slip roads. There would be no access/egress to/from the northbound carriageway at this location. Approximately 1.5 km northeast of the Junction 16 roundabout there are currently southbound off and on slips near Dwygyfylchi. The Scheme would upgrade this junction by modifying and adding on/off slips to allow traffic to join and leave the A55 in all directions. To connect the two junction locations, a link road will be constructed parallel to the A55. Various earthworks would be required to form the embankments and cuttings required for the Scheme.
- 2.1.4 The link road would cross the Afon Gyrach main river approximately 1 km northeast of the existing Junction 16 roundabout. Further description of the Scheme and its boundaries are given in the ES Chapter 2 The Scheme.

### 2.2 Site Topography

- 2.2.1 In this location the A55 runs southwest-northeast parallel with the coast. Generally, to the southeast (landward) side the land is higher than the A55, sloping down toward the road and Conwy Bay beyond. To the northwest (seaward) side lies a cycle trail and railway and beyond those the land drops down to the beach.

### 2.3 Geological Setting

- 2.3.1 The British Geological Survey (BGS) map of the area (1:50,000 scale map series, Bedrock and Superficial Deposits Edition), accessed via online digital mapping<sup>5</sup>, indicates that the solid geology beneath the Scheme is the Conwy Rhyolite Formation of Ordovician age. Under most of the Scheme this is mainly rhyolite (igneous), but to the southwest of the existing Junction 16 roundabout there is an area of mudstone.
- 2.3.2 The near-surface superficial deposits under the Scheme comprise mainly Devensian till (glacial till)<sup>6</sup> which is Quaternary in age, although some storm beach deposits (predominantly gravels) are located to the southwest of the existing Junction 16 roundabout.

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<sup>5</sup> British Geological Survey (BGS). (2019) *Geology of Britain Viewer*. [online] Available at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> [accessed 29/10/2019]

<sup>6</sup> Till, Devensian-Diamicton comprise sedimentary deposits and are glacial in origin. They are detrital, created by the action of ice and meltwater, they can form a wide range of deposits and geomorphologies associated with glacial and inter-glacial periods during the Quaternary

## 2.4 Hydrological Setting

- 2.4.1 The Scheme runs parallel with the sea at Conwy Bay. At its closest the A55 is within approximately 15 m of the sea wall.
- 2.4.2 Approximately 1 km northeast of the existing Junction 16 roundabout the Afon Gyrach main river flows under the existing A55 and adjacent railway before discharging to Conwy Bay.
- 2.4.3 Toward the northeast end of the Scheme, at approximate chainage 2350 (approximately 425 m southwest of the Penmaen-bach tunnels), there is a small unnamed watercourse herein referred to as Watercourse 425. The location of the watercourse is shown on figures within Appendix 2.5. Watercourse 425 passes under the A55 in a culvert.
- 2.4.4 At approximate Scheme chainage 1050 another small watercourse is culverted under the A55 (shown on figures within Appendix 2.5). This watercourse appears to be an often-dry ditch crossing a field to the south of the road and is traced no further than Ysguborwen Road on mapping (100 m south). The watercourse/ditch passes under the A55 in a culvert.

## 2.5 Hydrogeological Setting

- 2.5.1 NRW has developed Groundwater Source Protection Zones (SPZs) to assist in the assessment of risk to groundwater supplies taken from an abstraction point. The site does not lie within one of these Groundwater SPZs.
- 2.5.2 The Ordovician bedrock is classified by BGS<sup>7</sup> as a Secondary B aquifer with high vulnerability<sup>8</sup>. The superficial deposits beneath the Scheme (the glacial till) are classified by BGS as a Secondary (undifferentiated) aquifer, also of high vulnerability.

## 2.6 Existing Highway Drainage

- 2.6.1 Most of the runoff from the existing A55 within the Scheme boundary drains directly to Conwy Bay via a series of sea outfalls. Some runoff drains to the Afon Gyrach where it is crossed by the A55 and also to Watercourse 425. There is not believed to be any attenuation of flow rates prior to discharge. Further details are given in the Junction 16 Drainage Strategy Report (document A55J15J16-RAM-05-16-RP-D-0001).

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<sup>7</sup> British Geological Survey (BGS). (2019) *Geindex Onshore*. [online] Available at: <http://mapapps2.bgs.ac.uk/geindex/home.html> [accessed 29/10/2019]

<sup>8</sup> Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits

## 3. FLOOD RISK

### 3.1 Fluvial Flood Risk and Flood Risk from the Sea

3.1.1 The NRW flood maps identify areas in Wales at risk of flooding by allocating them into flood risk zones. Based on the NRW indicative flood maps available online<sup>9</sup>, Figure 7.3 of the ES shows the flood zones in and around the Scheme.

3.1.2 Flood Zones are defined as:

- a) Flood Zone 1 - the extent of a flood from rivers or from the sea with less than a 0.1% (1-in-1,000) chance of happening in any given year;
- b) Flood Zone 2 - the extent of a flood from rivers or from the sea with up to a 0.1% (1-in-1000) chance of happening in any given year, or contains areas recorded to have flooded in the past; and
- c) Flood Zone 3 – the extent of a flood from rivers with a 1% (1-in-100) chance or greater of happening in any given year, or the extent of a flood from the sea with a 0.5% (1-in-200) chance or greater of happening in any given year.

3.1.3 Figure 7.3 shows that the majority of the Scheme is in Flood Zone 1 (Zone 1 is shown without colour on Figure 7.3). Land adjacent to the Afon Gyrach is within Flood Zone 2 and Flood Zone 3. The extent of predicted flooding from the Afon Gyrach is constrained to a narrow strip of land (approximately 50 m wide) along the river due to the relatively steep topography on either side. Approximately 300 m upstream from where the A55 cross the Afon Gyrach, a small residential area (Gardd Eryri) lies to the east of the river within Flood Zones 2 and 3.

3.1.4 The Scheme would include construction of a link road which crosses the Afon Gyrach immediately upstream of the existing A55 crossing. To ensure the new structure for the crossing would not increase the risk of flooding to residential receptors, a hydraulic modelling exercise has been carried out. The modelling report forms Appendix 7.5 to Chapter 7 of the Environmental Statement. The modelling concluded that the structure carrying the link road over the Afon Gyrach should have an opening size (shape, width and height) the same or larger as the existing A55 arch structure.

3.1.5 The modelling also concluded that in extreme rainfall events<sup>10</sup> there would be some afflux (increase) in flood level immediately upstream of the proposed structure. During a 1-in-100 year + 30% climate change event, the afflux immediately upstream would be 10 mm. During a 1-in-1000 year event the afflux would be 130 mm. The modelling shows that afflux is limited to a distance of 28 m on the upstream side. It may be less than 28 m but this is the position of the next cross-section in the model. The land that would be impacted by this minor increase in flood level in this very rare event is currently pasture and would become land purchased and retained by Welsh Government. Given that the land that would experience afflux in flood level would be wholly owned by the Welsh Government, and that no residential receptors or other buildings would be affected, the afflux is considered acceptable. This principle has been discussed with and accepted by NRW.

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<sup>9</sup> National Resources Wales (NRW). (2019) *Flood Risk Maps* [online] Available at: [https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood\\_Risk/viewers/Flood\\_Risk/virtualdirectory/Resources/Config/Default](https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default) [accessed 17/10/2019]

<sup>10</sup> Rainfall events with return periods of 2 years, 30 years, 75 years, 100 years, 100 years + a 30% climate change allowance, and 1000 years were modelled.

- 3.1.6 The modelling also shows that a freeboard of more than 600 mm would remain between the soffit of the proposed structure and the peak flood level during a 1-in-1000 year event, thus allowing floating debris to pass under and through the structure.
- 3.1.7 The new structure to carry the link road over the Afon Gyrach will be 8 m upstream of the existing structure which carries the A55. An access route to the 8 m section of the river that lies between the two will be provided in order to allow both maintenance works by Welsh Government on the structures and in-river works by NRW as required.
- 3.1.8 Watercourse 425 crosses the fields between the Penmaen-bach hillside and is culverted beneath the A55. The watercourse is short, with a length of approximately 300m, running across an open field. At this location the proposed Scheme includes an off-slip from the A55 south-bound which would require the existing A55 embankment to be widened and the Watercourse 425 culvert to be extended. The NRW indicative flood map for rivers and the sea (Figure 7.3) shows Watercourse 425 and adjacent fields to be in Flood Zone 1, i.e. less than a 1-in-1000 chance of flooding in any given year. Given the small size of this watercourse, the low risk of flooding and that a culvert extension is required (rather than a new culvert), flood risk impacts are considered to be negligible.
- 3.1.9 In the location of the often-dry watercourse/ditch at Scheme chainage 1050, the proposed Link Road would run parallel with the A55 such that the existing culvert would require extension. The NRW indicative flood map for rivers and the sea (Figure 7.3) shows the location of this watercourse and adjacent fields to be in Flood Zone 1, i.e. less than a 1-in-1000 chance of flooding in any given year. Given the small size of this watercourse, the low risk of flooding and that a culvert extension is required (rather than a new culvert), flood risk impacts are considered to be negligible.

## **3.2 Surface Water Drainage Flood Risk**

- 3.2.1 The Flood and Water Management Act 2010 defines surface water flooding as flooding that takes place when surface runoff generated by rainwater falls on the surface of the ground and has not yet entered a watercourse, drainage system or public sewer.
- 3.2.2 The NRW flood risk maps for surface water flooding are provided in Figure 7.4 to Figure 7.6 of the ES. Based on the mapping, surface water flooding may be expected on the A55 carriageway during extreme rainfall events. However, the mapping is based only on topography and does not account for the highway drainage system which, if working as designed, would restrict the flooding on the carriageway to the degree permitted by the Design Manual for Roads and Bridges (DMRB).
- 3.2.3 Part of a field to the southeast of the A55, between the Afon Gyrach and the Puffin Café is shown to be at risk of surface water flooding. The proposed link road would pass through this area. However, the link road would be raised above the original ground level on a low embankment such that the road would not be at risk of surface water flooding. A ditch is proposed running along the southern boundary of the link road. This will intercept surface water flows and convey these to the Afon Gyrach. The flow in the ditch would bypass the proposed attenuation pond and would not therefore impact on the ability of the pond to attenuate road runoff.
- 3.2.4 The fields adjacent to Watercourse 425 are shown to be at risk of surface water flooding. A realigned south-bound off-slip would cross this area as part of the Scheme. The existing culvert carrying the watercourse would be extended. The off-slip itself would be raised on embankment

and not at risk of surface water flooding. A drainage ditch would run along the toe of the embankment to convey water away from the embankment in order to prevent slope stability issues. Further details are provided in the drainage strategy (document A55J15J16-RAM-05-16-RP-D-0001).

- 3.2.5 The Scheme would result in a larger area of impermeable road surface than at present. Without mitigation this would lead to an increased rate of surface water runoff which could exacerbate surface water flooding. To prevent this, the Scheme would include attenuation systems such as oversized pipes and ponds to temporarily store runoff and discharge it at a rate no greater than the existing rate. Further details of the proposals are given in the drainage strategy (document A55J15J16-RAM-05-16-RP-D-0001).
- 3.2.6 With the proposed drainage system and attenuation in place, the Scheme would not lead to an increase in the frequency or extent of surface water flooding.

### **3.3 Groundwater Flood Risk**

- 3.3.1 Groundwater flooding<sup>11</sup> is not considered by the NRW and Conwy County Borough Council to be a significant issue for the region within and around the Scheme.
- 3.3.2 Attenuation ponds will be shallow, approximately 1.5 m deep and are unlikely to experience groundwater ingress. Further consideration will be given at detailed design stage and, if it is then considered that groundwater ingress and reduction of pond capacity is a risk, a solution will be used such as lining the ponds.

### **3.4 Risk from Reservoirs, Canal and Other Artificial Sources**

- 3.4.1 There are no reservoirs or canals in the vicinity of the site. The NRW indicative mapping database indicates that there is no risk of flooding from reservoirs within the site boundary.
- 3.4.2 The location of the Scheme, away from built-up areas, means that the risk of flooding caused by burst water pipes or blocked foul sewers is very low. Where the Scheme extends to associated work on connecting roads, there is a risk of flooding from such sources, but the risk is considered low and is unlikely to change as a result of the Scheme.

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<sup>11</sup> Groundwater flooding, where it occurs, is caused by the emergence of water originating from sub-surface permeable strata. A groundwater flood event results from a rise in groundwater level sufficient for the water table to intersect the ground surface and inundate low lying land. Groundwater floods may emerge from either point or diffuse locations. They tend to be long in duration developing over weeks or months and prevailing for days or weeks

## 4. JUSTIFICATION TEST

- 4.0.1 Transport and utilities infrastructure, such as the A55 is classified as 'less vulnerable development' according to TAN15. For less vulnerable development to be permitted in Flood Zone C a 'justification test' must be passed. In a planning context, Flood Zone 2 forms the basis of Zone C in the Welsh Government Development Advice Map. The only part of the Scheme which would lie within Flood Zone C is where the link road crosses the Afon Gyrach.
- 4.0.2 TAN15 states that, to pass the justification test it must be demonstrated that:
- 1) The development's location within Zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or
  - 2) The development's location in Zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region; and
  - 3) The development concurs with the aims of PPW and meets the definition of previously developed land; and
  - 4) The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in Sections 5 and Section 7 and Appendix 1 (of TAN15) found to be acceptable.
- 4.0.3 As stated in the 2018 A55 Public Consultation document "The key objective for the scheme is to improve access to regional, national and international markets and employment opportunities; in addition to improving resilience and safety and reducing delays both to local traffic as well as people travelling along the A55." Part 1 and Part 2 of the test is therefore considered to be met.
- 4.0.4 The scheme objectives align with the aims of PPW (Part 3), as it supports the policy to create sustainable transport infrastructure, taking into account the needs of users of active and sustainable transport.
- 4.0.5 For Part 4 of the test, the potential for and consequences of a flood have been discussed in this report. The risk of flooding to the Scheme itself is low as it is within Flood Zone 1 and, where the proposed link road crosses the floodplain of the Afon Gyrach, is elevated on embankment. The potential for surface water flooding on the road itself will be mitigated by the road drainage system and would conform to DMRB standards. In terms of flood risk to the surrounding area, modelling of the Afon Gyrach has shown that the proposed link road structure does not exacerbate flood risk to residential receptors or other buildings. The small afflux in water levels which is expected to occur in rare events would only affect land immediately adjacent to the scheme and which would be owned by Welsh Government. Although the Scheme would increase the impermeable area of road, discharge rates would be attenuated so that they do not exceed current discharge rates from the A55.
- 4.0.6 The mitigation measures are therefore considered to negate the potential adverse impacts such that there is no change and, in terms of Part 4 of the justification test, the consequences are acceptable.

## 5. SUMMARY

- 5.0.1 The A55 Junction 16 Improvement Scheme is located to the northeast of Penmaenmawr, Conwy. The Scheme runs parallel with Conwy Bay and is within approximately 15 m of the sea at its closest point.
- 5.0.2 The A55 and Junction 16 are in mostly in Flood Zone 1, at low risk of flooding from rivers or the sea. The Afon Gyrach passes under the A55 approximately 1 km northeast of the existing Junction 16 roundabout. A narrow strip of land (approximately 50 m wide) along this river lies within Flood Zones 2 and 3. Approximately 300 m upstream from the A55 a small residential area (Gardd Eryri) lies next to the river within Flood Zones 2 and 3.
- 5.0.3 The proposed Scheme includes a new link road running parallel with the A55 which would cross the Afon Gyrach immediately upstream of the existing A55 crossing. The Afon Gyrach would pass under the new link road through a structure with the same opening dimensions (height, width) as the existing A55 structure. Hydraulic modelling of the river and the new structure has been undertaken to assess the impact on flood risk. The modelling concluded that while there is a minor afflux (increase) of flood water levels immediately upstream of the structure in extreme rainfall events (10 mm in a 1-in-100 year event including a 30% allowance for climate change and 130 mm in a 1-in-1000 year event), this would impact land which is currently used for pasture only and would be owned and retained by Welsh Government as part of the Scheme. No residential receptors or other buildings would be affected and the afflux is therefore considered acceptable.
- 5.0.4 The modelling also concluded that floating debris would be able to pass under and through the proposed new structure as the freeboard during a 1-in-1000 year flood event would be more than 600 mm.
- 5.0.5 Where the A55 crosses Watercourse 425 and the unnamed watercourse/ditch at chainage 1050, the existing culverts will require extension. Impacts on flood risk at these locations are considered negligible.
- 5.0.6 The Scheme itself would have drainage systems designed to DMRB requirements such that the extent of surface water flooding on the carriageway would be restricted to the degree permitted by the DMRB.
- 5.0.7 Where the proposed link road would pass through areas at risk of surface water flooding the road itself would be raised above the original ground level on a low embankment. The drainage systems associated with the link road, including ditches along the embankment toe, would serve to reduce the risk of surface water flooding.
- 5.0.8 The Scheme would result in a larger area of impermeable road surface with the potential to increase discharge rates and exacerbate flooding elsewhere. To prevent this the Scheme would include attenuation systems to reduce the runoff rate so that it is no greater than at present.
- 5.0.9 In terms of flood risk to the surrounding area, the mitigation measures are considered to negate the potential adverse impacts such that there is no change.
- 5.0.10 Based on TAN15, the Scheme is classified as 'transport and utilities infrastructure' and is 'less vulnerable development'. Such development in Flood Zone 3/Flood Zone C requires a 'justification test' to be passed. The only part of the Scheme which would lie within Flood Zone C is where the

link road crosses the Afon Gyrach. Given the Scheme is promoted by the Welsh Government for improving safety and that mitigation measures negate the potential adverse impacts of the Scheme on flood risk, the consequences are considered to be acceptable and the justification test passed.

## **APPENDIX 7.3**

### **WATER QUALITY RISK ASSESSMENT**

Intended for  
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# **A55 JUNCTION 16**

## **APPENDIX 7.3**

### **WATER QUALITY RISK**

### **ASSESSMENT**

# **A55 JUNCTION 16 APPENDIX 7.3 WATER QUALITY RISK ASSESSMENT**

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## APPENDICES

### Appendix A

Groundwater and Spillage Risk Assessment Results

# 1. INTRODUCTION

## 1.1 Background

- 1.1.1 Ramboll UK Limited (Ramboll) has been appointed by the Welsh Government ('client') to undertake a Water Quality Risk Assessment for the proposed A55 Junction 16 Scheme (referred to as the 'Scheme').
- 1.1.2 Following the guidance outlined in the Design Manual for Roads and Bridges (DMRB) LA113 - Road Drainage and the Water Environment<sup>1</sup> an assessment of the impact on water quality has been made in relation to both routine runoff from the proposed Scheme and the risk of potential spillages. The Highways England Water Risk Assessment Tool (HEWRAT) has been used for this purpose. HEWRAT is approved by Welsh Government for use in Wales.
- 1.1.3 This report outlines the assessment of predicted impacts on the water quality of the waterbodies which receive drainage from the Scheme. This report supports Chapter 7 ('Road Drainage and the Water Environment') of the Environmental Statement (ES) for the Scheme.

## 1.2 Site Context

- 1.2.1 Junction 16 (the Scheme) lies to the northeast of Penmaenmawr in Conwy County Borough. It is located at the base of hills sloping down from the south towards the coast and Conwy Bay which lies immediately to the northwest of the Scheme. The Conwy to Holyhead main railway line separates the Scheme from the bay.
- 1.2.2 Figure 7.1 of the Environmental Statement (ES) shows that the Scheme extends for approximately 2.5 km along the length of the A55, from a point at the north-eastern end of Penmaenmawr to close to the entrance of the Penmaen-bach tunnels.
- 1.2.3 Junction 16 of the A55 is currently a roundabout with three exits; northeast and southwest to the A55 and south toward Penmaenmawr. The Scheme aims to reduce congestion and delays caused by the existing roundabout by replacing it with a dual carriageway with free-flowing traffic in both directions. Access and egress to/from the southbound carriageway would be via new slip roads. There would be no access/egress to/from the northbound carriageway at this location. Approximately 1.5 km northeast of the Junction 16 roundabout there are currently southbound off and on slips near Dwygyfylchi. The Scheme would upgrade this junction by modifying and adding on/off slips to allow traffic to join and leave the A55 in all directions. To connect the two junction locations, a link road would be constructed parallel to the A55. Various earthworks would be required to form the embankments and cuttings required for the Scheme.
- 1.2.4 The Scheme runs parallel with the sea at Conwy Bay. At its closest the A55 is within approximately 15 m of the sea wall. Approximately 1 km northeast of the existing Junction 16 roundabout the Afon Gyrach main river flows under the existing A55 and adjacent railway before discharging to Conwy Bay. The link road would cross the Afon Gyrach. A number of other small watercourses pass under the A55 in culverts.

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<sup>1</sup> Highways England (2019), LA113 – Road Drainage and the Water Environment, Design Manual for Roads and Bridges, Volume 11, Section 3

### **1.3 Highway Drainage**

- 1.3.1 Most of the runoff from the existing A55 within the Scheme boundary drains directly to Conwy Bay via a series of sea outfalls. Some runoff drains to the Afon Gyrach where it is crossed by the A55 and also to an unnamed watercourse approximately 425 m west of the Penmean-bach tunnel (herein referred to as 'Watercourse 425'). There is not believed to be any attenuation of flow rates prior to discharge. Watercourse 425 passes under both the A55 and the adjacent railway in a culvert which discharges directly to the beach, i.e. downstream of the A55 there is no further 'natural' part of the watercourse. Highway drainage is discharged to Watercourse 425 within the culvert, not upstream nor downstream of it.
- 1.3.2 Further details of the highway drainage are given in the Junction 16 Drainage Strategy Report (document A55J15J16-RAM-05-16-RP-D-0001).
- 1.3.3 The Scheme would discharge surface water runoff via the same outfalls plus one additional outfall to the Afon Gyrach which would take drainage from the link road. The additional impermeable surface area of the Scheme would generate a higher discharge rate than at present if unmitigated. To ensure the flow rate passing through pipes under the railway does not increase, the new drainage system would incorporate attenuation systems. Drainage layout drawings for the scheme are issued separately.

## 2. METHODOLOGY

### 2.0 General

- 2.0.1 LA113 specifies procedures for the assessment of pollution impacts from both routine runoff and spillages on receiving waters. In order to assess the potential quality of water being discharged from the Scheme a water quality assessment has been completed utilising HEWRAT (the tool referenced by LA113). Further background information on the assessment method and procedures is contained within LA113 and the HEWRAT User Guide (which is opened via HEWRAT).
- 2.0.2 HEWRAT is designed for application in freshwater rivers and streams so its application to saline waters has limitations. However, there is currently no better alternative. For discharges to the Afon Gyrach, HEWRAT has been used as designed. For discharges to the sea, the method has been adapted as described in Section 2.1.
- 2.0.3 The process for assessment of spillage risk, and whether the level of risk is acceptable, is applicable to freshwater and saline waterbodies alike.
- 2.0.4 While neither the existing A55 nor the Scheme includes drainage systems that are designed to discharge to ground, the Scheme may include drainage system components, including attenuation ponds, which are unlined such that road runoff may infiltrate the ground. An assessment of potential impacts on groundwater quality is therefore also included.

### 2.1 Routine Runoff (Surface Water)

- 2.1.1 In normal use HEWRAT has three steps of assessment:
- 1) Step 1 - compares end-of-pipe concentrations with RSTs;
  - 2) Step 2 - compares in-river concentrations with RSTs and EQSs after dilution, and determines whether fine sediment would accumulate or disperse; and
  - 3) Step 3 - incorporates mitigation if required and re-compares to the relevant standards.
- 2.1.2 These steps have been applied to discharges to the Afon Gyrach and Watercourse 425. For discharges to sea the method of assessment is outlined below. As noted earlier, once Watercourse 425 enters the culvert under the A55 it does not daylight again until it discharges to the beach.
- 2.1.3 While saltwater Environmental Quality Standards (EQSs) relate to annual average concentrations, aquatic organisms can tolerate higher pollutant concentrations for short periods of time. This is relevant to highway discharges as they are intermittent, occurring only during and for a short time after a rainfall event. As a result, and as a more relevant measure than EQSs, the research which underpins HEWRAT established runoff specific thresholds (RSTs) for 24 hour and six hour periods (albeit only for copper and zinc concentrations for freshwater organisms). Concentrations below the RST24 and RST6 thresholds for less than 24 hours and six hours respectively are therefore considered acceptable in terms of risk to aquatic ecology. For the assessment of this Scheme, the RST6 value has been used (rather than the RST24) due to the tidal nature of the receiving water body.
- 2.1.4 For those discharges from the Scheme which are not to a river but to Conwy Bay, the assessment herein will utilise the HEWRAT-generated end-of-pipe concentrations (Step 1). It should be noted that it is not normally expected that end of pipe concentrations would meet the RSTs or EQSs as aquatic organisms would not be expected to be living in the water in the pipe. The HEWRAT assessment considers in Step 2 the available dilution in low-flow conditions

and whether the diluted concentrations would meet the RSTs and EQSs. Although HEWRAT Step 2 cannot be applied for discharges to sea, the principle of assessing the available dilution is applied.

## **2.2 Routine Runoff (Groundwater)**

2.2.1 Although the drainage strategy does not rely on discharge to ground, infiltration may occur through unlined drainage components such as attenuation ponds. An assessment of potential impacts on groundwater/groundwater-receptors is therefore included. This uses the simple assessment matrix provided in LA113 and HEWRAT. Where the simple assessment returns a 'low' risk then, in accordance with LA113, no further assessment nor mitigation is necessary. Where the assessment returns a 'medium' or 'high' risk, further and proportionate consideration is given to the risk and how it should be addressed.

## **2.3 Spillage Risk**

2.3.1 The spillage risk assessment methodology in LA113 provides the probability of a spillage impacting on the receiving surface waterbody or groundwater body. The probability is the product of two separate risks:

- a) The probability that there will be a spillage with the potential to cause a serious pollution incident<sup>2</sup>; and
- b) The probability - assuming such a spillage has occurred - that the pollutant will cause a serious pollution incident.

2.3.2 This is assessed on the basis of the likelihood of a road traffic accident occurring and resulting in a spillage. It is calculated by assessing the type of road, road length, presence of junctions and roundabouts, Annual Average Daily Traffic (AADT) and percentage of Heavy Goods Vehicles (HGVs) for the road drainage catchment. If a spillage occurs, the probability of it causing a serious pollution incident is then influenced by the response time of the emergency services and this is factored into the calculation.

2.3.3 LA113 defines the acceptable level of risk as being an annual probability of less than 1%. Where discharge is into (or in close proximity to) a sensitive area, such as a Site of Special Scientific Interest (SSSI) or Special Area of Conservation (SAC), the acceptable level of risk is taken to be an annual probability of less than 0.5%.

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<sup>2</sup> A serious pollution incident is a Category 1 or 2 incident as defined in *Incidents and their classification: the Common Incident Classification Scheme (CICS)*, Operational Instruction 04\_01, Environment Agency, 2011

### 3. INPUT PARAMETERS

#### 3.0 Routine Runoff (Surface Water)

3.0.1 The input parameters required for a HEWRAT Step 1 assessment are summarised in Table 3.1.

**Table 3.1: Routine Runoff (Surface Water) Input Parameters – Step 1**

Parameter	Value	Notes
Annual Average Daily Traffic (AADT)	<50,000	The two-way AADT flow along the A55 mainline north of J16 and north of J16A is predicted to be 43,145 and 47,352 vehicles respectively in the design year of 2037. Refer to ES Chapter 2 for further details. HEWRAT uses bands with the lowest being <50,000 so this value can be applied both north of J16 and north of J16A.
Climatic region	Colder - Wet	Climatic regions shown in HEWRAT Help Guide. A55 J16 Scheme lies within the Colder – Wet region
Rainfall site	Colwyn Bay	Closest rainfall site available to use in HEWRAT is Colwyn Bay with a standard average annual rainfall (SAAR) of 788 mm. The SAAR for Penmaenmawr is likely higher than this. However, using the lower SAAR value for Colwyn Bay is a conservative approach as it assumes less dilution of road runoff.

3.0.2 The input parameters required for a HEWRAT Step 2 assessment are summarised in Table 3.2. These are used only for discharges to watercourses (Afon Gyrach and Watercourse 425).

**Table 3.2: Routine Runoff (Surface Water) Input Parameters – Step 2**

Parameter	Afon Gyrach	Watercourse 425	Notes
Q <sub>95</sub> river flow (m <sup>3</sup> /s)	0.039	0.0024	Afon Gyrach value obtained from Wallingford Hydrosolutions LowFlows Estimation Service Watercourse 425 value pro-rata on catchment area from Afon Gyrach value
Impermeable road area (ha)	3.355	0.633	Proposed catchment areas, cumulative for each watercourse.
Permeable area (ha)	0	0	Unknown – assumed zero (worst case as no dilution from permeable area)
Base flow index	0.516	0.516	BFI taken from catchment descriptors
Water hardness	Low	Low	Unconfirmed but likely to be low based on geology (in HEWRAT low is <50 mg CaCO <sub>3</sub> /l)
Bed width (m)	4.65	1.2	Afon Gyrach values measured by survey Watercourse 425: highway discharge directly to culvert which discharges to beach. Approximate values used for culvert
Manning's n	0.035	0.025	
Side slope (m/m)	0.423	0.5	
Long slope (m/m)	0.0019	0.0019	

3.0.3 The Afon Gyrach at the A55 has a catchment area of 7.62 km<sup>2</sup>. Watercourse 425 has a catchment area of 0.46 km<sup>2</sup>. Both are ungauged catchments and no measured Q<sub>95</sub> values are available. A Q<sub>95</sub> value was obtained from Wallingford Hydrosolutions (Lowflows Estimation Service) for the Afon Gyrach at the A55 crossing. The Q<sub>95</sub> value for Watercourse 425 is a pro-rata value based on the relative catchment areas compared with the Afon Gyrach.

3.0.4 The impermeable road area of 3.355 ha draining to the Afon Gyrach is the combined area for all highway drainage networks which discharge to the river. This includes existing networks C, D and E (proposed larger areas) plus the east section of the proposed Link Road (networks defined in Drainage Strategy Report (document A55J15J16-RAM-05-16-RP-D-0001). The assessment is therefore a cumulative assessment for all existing and proposed outfalls which discharge to the Afon Gyrach. Watercourse 425 receives runoff from highway drainage network B only. The assessment incorporates the proposed future area of this network. Further information on the highway drainage networks is given in the Drainage Strategy Report.

### 3.1 Routine Runoff (Groundwater)

3.1.1 The input parameters required for a LA113 groundwater simple assessment are summarised in Table 3.3. Refer to LA113 Table C.1 for parameter ranges.

**Table 3.3: Routine Runoff Input Parameters - Groundwater**

Parameter	Value	Notes
Traffic Flow	≤50,000 AADT	The two-way AADT flow along the A55 mainline north of J16 and north of J16A is predicted to be 43,145 and 47,352 vehicles respectively in the design year of 2037. Refer to ES Chapter 2 for further details. LA113 uses bands with the lowest being <50,000 so this value can be applied both north of J16 and north of J16A.
Rainfall depth (annual average)	≥1060 mm	The precise average annual rainfall for Penmaenmawr is not known but is around 1,000 mm to 1,100 mm. The highest risk band (≥1060 mm) has therefore been selected as a conservative measure.
Drainage area ratio	>50 to <150	At this stage the attenuation ponds have not been designed in detail. Based on the drained area and the likely size of the ponds, the ratio >50 to <150 has been used (medium risk). This is a conservative assumption given that most of the runoff in the attenuation ponds would discharge via pipes to watercourses or direct to the sea and not to ground.
Infiltration method	"Region" shallow infiltration systems, (e.g. infiltration basin)	Although the attenuation ponds are not infiltration basins they are a 'region' type asset.
Unsaturated zone	Depth to water table ≤5 m	The 2019 geotechnical investigation of the Scheme struck groundwater generally less than 5 m below ground. See ES Chapter Geology and Soils for further details.
Flow type	Dominantly intergranular flow	Near surface superficial deposits comprise mainly Devensian Till – a heterogenous mixture of clay, sand, gravel and boulders. See ES Chapter Geology and Soils for further details.
Unsaturated zone clay content	≥15 % clay minerals	Based on clay content of Devensian Till.
Organic carbon	<15% to >1% soil organic matter	Organic matter percentage in most samples from the geotechnical investigation of the Scheme within the range <15% to >1%.
Unsaturated zone soil pH	pH <8 to >5	pH in most soil samples tested is in the range <8 to >5, for example trial pit TP203 (near the proposed location of an attenuation pond) recorded a pH of 7.7 at a depth of 1m.

### 3.2 Spillage Risk

3.2.1 The input parameters required for a spillage risk assessment are summarised in Table 3.4. Given the proximity of the Scheme to Conwy Bay and that runoff discharges either directly to Conwy Bay or to watercourses shortly upstream of their flowing into Conwy Bay, a single cumulative assessment of spillage risk has been undertaken.

**Table 3.4: Spillage Risk Input Parameters**

Parameter	Value (A55)	Value (Link Road)	Notes
Water body type	Surface watercourse	Surface watercourse	Choice of surface watercourse or groundwater
Junction type	Slip road	Slip road	Proximity to different types of junction (roundabout, slip-road etc) affects the risk of traffic collisions. Most sections of the Scheme are in close proximity to slip-roads so this type has been selected (this type uses a higher spillage risk factor than 'no junction')
Length of road (m)	2,300	1,700	Includes the length of the Junction 16 Scheme on the A55 plus the length of the link road
Spillage factor	0.83	0.83	Spillage factor determined by junction type and road type. Refer to LA113, Table D.1. Factor for slip road used throughout although some sections are 'no junction'. Use of slip road factor is more conservative.
Road type	A-road	A-road	Choice of A-road or motorway
Urban or rural	Rural	Rural	Influences risk of spillage. Rural/Urban determined by built up area and speed limit
Location (response time for emergency services)	< 1 hour	< 1 hour	Choice of <20 minutes, <1 hour or >1 hour
Traffic flow (AADT)	47,352	3,181	For Design Year 2037 - refer to ES Chapter 2 for further details. A55 value uses total of northbound plus southbound north of J16A
% Heavy Goods Vehicle (HGV)	8.23%	5.19%	From predicted traffic flows for the design year of 2037. Refer to ES Chapter 2 for further information. For A55 the %HGV is used from north of J16 as it is slightly higher (worst case) than J16A.

## 4. RESULTS AND DISCUSSION

### 4.0 Routine Runoff – Discharges to Sea

4.0.1 Using the methods described in Section 2 and the input parameters set out in Section 3, HEWRAT has been used to determine concentrations of dissolved copper and zinc in the routine highway runoff for the Scheme. Table 4.1 gives the results from Step 1, the end-of-pipe concentrations, i.e. before any dilution has occurred. The comparative RST6 values are also given. Note that end-of-pipe concentrations are not affected by the area of the impermeable road catchment.

**Table 4.1: Routine Runoff Concentrations - HEWRAT Step 1**

Parameter	RST6	Predicted Concentrations			
		Mean	90%ile	95%ile	99%ile
Copper (µg/l)	42	25	46	56	108
Zinc (µg/l)	120	70	144	190	396

4.0.2 The results shown in Table 4.1 indicate that, with respect to both copper and zinc in water, the respective RST6s are met for almost 90% of rainfall events without factoring in the dilution that would occur upon discharge.

4.0.3 Taking the highest exceedance value from Table 4.1, a dilution of  $\times 3.3$  volumes would be required for the zinc concentration to be lower than the RST6 in 99% of rainfall events. Given the large dilution available in the tidal waters at and around the outfalls, this dilution factor would be achieved at small distance from the outfalls.

4.0.4 For example, a storm lasting 60 minutes with a return period of five years in the coastal area of North Wales would have an expected rainfall depth<sup>3</sup> of 17 mm. The total impermeable area of the Scheme is approximately 10 ha of which 6 ha discharges direct to the sea. The sea outfall with the largest proposed impermeable catchment area is Network A with 1.9 ha (refer to Drainage Strategy Report for details). 17 mm of rainfall would produce 323 m<sup>3</sup> of runoff from Network A. To achieve  $\times 3.3$  dilution would require 1,066 m<sup>3</sup> of sea water. Taking a water depth of 1 m (although the depth would vary as the tide rises and falls) this indicates that an appropriate level of dilution would occur within an area of approximately 35 m  $\times$  35 m from this outfall. It should also be noted that the 323 m<sup>3</sup> of runoff is not discharged all at once but over a period longer than the 60 minute storm and that during this period tides, currents and wave action would be likely to increase the rate of dilution and dispersion.

4.0.5 Whether 1,066 m<sup>3</sup> is an acceptably small volume within which contaminant concentrations would be in excess of the RST6 is subjective. However, the example above is very conservative in that it considers the dilution volume required when two rare events occur simultaneously, namely runoff concentrations at their 99%ile during a large and rare rainfall event (60 minute storm with a return period of five years).

4.0.6 In conventional use for flowing watercourses, HEWRAT determines whether fine sediments in the road runoff are likely to accumulate or disperse. Where sediments accumulate there can

<sup>3</sup> Centre for Ecology and Hydrology, *Flood Estimation Handbook*, 2013

be associated water quality risks from sediment-bound pollutants including copper, zinc and poly-aromatic hydrocarbons (PAHs). The low-flow rate of the watercourse and the channel dimensions are key parameters used to determine whether fine sediment is likely to accumulate or disperse (and thereby whether the risk is acceptable or not). Given that the runoff from the Scheme would discharge to the sea, it is not possible to use HEWRAT to determine whether sediments accumulate or disperse. However, by its nature, the coastal environment where runoff would discharge is dynamic and subject to currents, waves and tides which would disperse fine sediments such that they would not be sufficiently concentrated to be toxic to aquatic organisms living in or near bed sediments.

#### 4.1 Routine Runoff – Discharges to Watercourses

4.1.1 Using the methods described in Section 2 and the input parameters set out in Section 3, HEWRAT has been used to determine concentrations of dissolved copper and zinc in the routine highway runoff for the Scheme which discharges to the Afon Gyrach and Watercourse 425. Table 4.2 to Table 4.4 give the results from Step 2:

- The in-river runoff event concentrations, i.e. after dilution has occurred and the comparative RST values;
- The in-river annual average concentrations and the comparative EQS values;
- The low flow river velocity and extent of sediment deposition; and
- The pass/fail results for each of the above.

**Table 4.2: HEWRAT Step 2 – In-river Runoff Event Concentrations**

Watercourse	Parameter	RST6	RST24	Predicted Concentrations				Pass/Fail
				Mean	90%ile	95%ile	99%ile	
Afon Gyrach	Copper (µg/l)	42	21	0.24	0.68	1.14	2.69	Pass
	Zinc (µg/l)	120	60	0.83	1.62	3.32	11.33	Pass
Watercourse 425	Copper (µg/l)	42	21	0.65	1.90	3.08	7.09	Pass
	Zinc (µg/l)	120	60	2.18	4.81	9.20	30.43	Pass

**Table 4.3: HEWRAT Step 2 – In-river Annual Average Concentrations**

Watercourse	Parameter	EQS (µg/l)	Annual Average Concentration (µg/l)	Pass/Fail
Afon Gyrach	Copper	1	0.07	Pass
	Zinc	10.9	0.23	Pass
Watercourse 425	Copper	1	0.20	Pass
	Zinc	10.9	0.64	Pass

**Table 4.1: HEWRAT Step 2 – In-river Sediment Deposition**

Watercourse	Parameter	Result	Pass/Fail
Afon Gyrach	Accumulating?	No	Pass (Protected Area Alert)
	Low Flow Velocity (m/s) <sup>i</sup>	0.18	
	Extensive deposition?	No	
	Deposition Index <sup>ii</sup>	0	
Watercourse 425	Accumulating?	No	Pass (Protected Area Alert)
	Low Flow Velocity (m/s) <sup>i</sup>	0.13	
	Extensive deposition?	No	
	Deposition Index <sup>ii</sup>	0	

<sup>i</sup> Low Flow Velocity lower than 0.1 m/s would cause deposition (HEWRAT defined threshold)

<sup>ii</sup> Deposition index of over 100 is considered unacceptable (HEWRAT defined threshold)

4.1.2 Table 4.2 to Table 4.4 indicate that discharges to both the Afon Gyrach and Watercourse 425 pass all aspects of the water quality assessment for routine runoff.

4.1.3 Table 4.1 notes a 'Protected Area Alert'. As the discharge is within 1 km of a protected site for conservation (the Menai Strait and Conwy Bay SAC and Liverpool Bay SPA), HEWRAT returns an Alert with an underlying Pass. As noted earlier, the coastal environment where runoff would discharge is dynamic and subject to currents, waves and tides which would disperse fine sediments such that they would not be sufficiently concentrated to be toxic to aquatic organisms living in or near bed sediments.

## 4.2 Routine Runoff to Surface Water – Summary

4.2.1 In considering whether the potential impact on surface water quality from routine runoff from the Scheme would be acceptable or and/or significant, it is relevant that the existing A55 and Junction 16 already discharge to Conwy Bay directly through sea outfalls and via the Afon Gyrach and Watercourse 425. The total impermeable area is increasing from approximately 6 ha to 10 ha, though most of this increase is the proposed link road which would carry a traffic loading of only 3,181 vehicles per day in the Design Year of 2037. A value of less than 10,000 vehicles per day is considered in DMRB as possibly below the level at which pollution from road runoff needs to be assessed.

4.2.2 Taking all of the above into account, the impact of routine runoff on the water environment of the Afon Gyrach, Watercourse 425 and Conwy Bay is considered to be negligible from routine-runoff (both from dissolved and sediment-bound contaminants).

### **4.3 Routine Runoff (Groundwater)**

- 4.3.1 Using the methods described in Section 2 and the input parameters set out in Section 3, HEWRAT has been used to determine the risk score and screening level for groundwater quality.
- 4.3.2 In accordance with LA113 risk scores and screening level are banded as follows:
- <150 = low risk
  - 150 to 250 = medium risk
  - >250 = high risk
- 4.3.3 The assessment results are shown in Appendix A – as direct output from HEWRAT. The risk score is 195, giving a screening level risk of medium.
- 4.3.4 A result of medium requires further consideration. There are a number of factors which specifically influence the risk to groundwater quality at the Scheme which are not considered in the generic HEWRAT assessment. These are considered below.
- 4.3.5 The HEWRAT assessment assumes that the drainage system is designed to infiltrate road runoff into the ground. However, the drainage strategy is designed to discharge to surface water but, through unlined components which may include attenuation ponds, some runoff may infiltrate into the ground. The great majority of runoff would discharge to surface watercourses or the sea, which would occur quickly due to the very small distance between the Scheme and the sea. Any potential impact of runoff on groundwater quality is thereby greatly reduced (both in terms of opportunity to infiltrate and time to do so).
- 4.3.6 Further information on the hydrogeology of the site is provided in ES Chapter 6. In summary:
- 1) The site is not located in a groundwater abstraction source protection zone (SPZ);
  - 2) The aquifers below the Scheme are designated as secondary; and
  - 3) The Envirocheck Report does not contain any records of groundwater abstractions within 500 m of the Scheme area.
- 4.3.7 The proximity of the Scheme to the coast is also likely to mean that groundwater is in hydraulic continuity with the sea such that any sizeable future groundwater abstraction is unlikely to occur, and should it do so it would be likely to be subject to saline intrusion.
- 4.3.8 Given these additional, site-specific, factors, it is considered that the risk of impacting groundwater and any receptors that might rely upon groundwater, is negligible.

### **4.4 Spillage Risk**

- 4.4.1 Using the methods described in Section 2 and the input parameters set out in Section 3, HEWRAT has been used to determine the likely annual probability for a spillage which results in a serious pollution incident.
- 4.4.2 In accordance with LA113, for discharges to a sensitive area such as Conwy Bay<sup>4</sup>, the risk of a serious pollution incident is deemed acceptable if the annual probability is less than 0.5% (1 in 200 years).

---

<sup>4</sup> Within Conwy Bay are areas designated at a European level for their habitat quality including Lavan Sands Special Protection Area (SPA), Liverpool Bay SPA and the Menai Strait and Conwy Bay Special Area of Conservation (SAC)

- 4.4.3 The assessment results are shown in Appendix A – as direct output from HEWRAT.
- 4.4.4 The assessment concludes that the annual probability of a spillage that could cause a serious pollution incident has a return period of 0.17% (1 in 595 years), i.e. less than 0.5% and therefore acceptable without pollution control measures. The assessment is also cumulative for the whole scheme; the risk of a pollution incident at any one of the outfalls would be lower.
- 4.4.5 It is noted that of the various road types (slip road, roundabout, side road, no junction etc), roundabouts are associated with the highest rate of serious spillages with, for example, a rate more than ×3 greater than slip roads. Further details are given in LA113, Table D.1. Removal of the existing Junction 16 roundabout would therefore decrease the risk of spillage and thus provide betterment in that respect.
- 4.4.6 Taking the above into account, the likelihood of a serious pollution incident resulting from a spillage on the Scheme is considered to be acceptably low and would be lower than the existing situation.

## 5. SUMMARY

- 5.0.1 The A55 Junction 16 Improvement Scheme lies to the northeast of Penmaenmawr, Conwy. The Scheme runs parallel with Conwy Bay in this location and is within approximately 15 m of the sea at its closest point.
- 5.0.2 Drainage from the existing A55 and Junction 16 already discharges to the sea, the Afon Gyrach and an unnamed watercourse referred to in this report as Watercourse 425. Rainfall runoff from the Scheme would drain to the same waterbodies.
- 5.0.3 Assessments have been undertaken to determine the risk to water quality from routine runoff and the likelihood of a spillage and subsequent pollution incident. The assessments have been carried out in accordance with LA113 of the DMRB. Where the discharge is to the sea (rather than a freshwater watercourse) the LA113 assessment method has been adapted as described above.
- 5.0.4 It is normal for runoff from trunk roads to rely on a degree of dilution and dispersal in the receiving waterbody to achieve acceptable concentrations. Routine runoff from the Scheme which discharges to the sea requires only a small volume of seawater to dilute dissolved contaminants to concentrations below the thresholds given in LA113. The coastal environment at the outfalls is dynamic and subject to currents, waves and tides which would disperse sediments.
- 5.0.5 Where discharges are to freshwater watercourses (Afon Gyrach and Watercourse 425), the dilution and dispersion is sufficient for the discharges to pass all aspects of the assessment (short-term concentrations, annual average concentrations and sediment dispersal).
- 5.0.6 While the drainage strategy is to discharge road runoff to the sea, elements of the drainage system may be unlined and give rise to the potential for runoff to infiltrate into the ground. An assessment was made of the potential impact on groundwater quality. Although the HEWRAT assessment returned a medium risk result, after consideration of further site specific factors, it was concluded that the impact would be negligible.
- 5.0.7 For sensitive receiving waters such as Conwy Bay, a spillage risk less than 0.5% is acceptable. For the Scheme, the return period for a spillage which results in a serious pollution incident was calculated to be 0.17 % and therefore within the acceptable threshold such that no pollution control measures would be required. Roundabouts are generally associated with a higher risk of accidents (and therefore spillages) than slip roads such that replacement of the existing Junction 16 roundabout with slip roads would reduce the risk of spillage.
- 5.0.8 It is concluded that the impact of the Scheme on the water environment of Conwy Bay would be negligible.

## **APPENDIX A**

# **Groundwater and Spillage Risk Assessment Results**

**Groundwater Risk Assessment Results**

Component Number		Weighting Factor	Property or Parameter	Risk Score	Component score	Weighted component score
1	<b>SOURCE</b>	10	Traffic flow	<=50,000 AADT	1	10
2		10	Rainfall depth (annual averages)	>=1060 mm rainfall	3	30
3		10	Drainage area ratio	>50 to <150	2	20
4	<b>PATHWAY</b>	15	Infiltration method	"Region", shallow infiltration systems (e.g. infiltration basin)	2	30
5		20	Unsaturated zone	Depth to water table <=5 m	3	60
6		20	Flow type (Incorporates flow type an effective grain size)	Dominantly intergranular flow (e.g. non-fractured consolidated deposits or unconsolidated deposits of fine-medium sand or finer)	1	20
7		5	Unsaturated Zone Clay Content	>=15% clay minerals	1	5
8		5	Organic Carbon	<15% to >1% SOM	2	10
9		5	Unsaturated zone soil pH	pH <8 to >5	2	10

<b>TOTAL SCORE</b>	<b>195</b>
<b>RISK SCREENING LEVEL</b>	<b>Medium</b>

## Spillage Risk Assessment Results



View Parameters

Reset Spillage Risk

Go To Interface

### Assessment of Priority Outfalls

#### Method D - assessment of risk from accidental spillage

		Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse	Surface watercourse						
D2	Length of road draining to outfall (m)	2,300	1,700						
D3	Road Type (A-road or Motorway)	A	A						
D4	If A road, is site urban or rural?	Rural	Rural						
D5	Junction type	Slip road	Slip road						
D6	Location (response time for emergency services)	< 1 hour	< 1 hour						
D7	Traffic flow (AADT two way)	47,352	3,181						
D8	% HGV	8.23	5.19						
D8	Spillage factor (no/10 <sup>9</sup> HGVkm/year)	0.83	0.83						
D9	Risk of accidental spillage	0.00272	0.00009	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60						
D11	Risk of pollution incident	0.00163	0.00005	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	No	No					<b>Totals</b>	<b>Return Period (years)</b>
D13	Return period without pollution reduction measures	0.00163	0.00005	0.00000	0.00000	0.00000	0.00000	0.0017	595
D14	Existing measures factor	1	1	1					
D15	Return period with existing pollution reduction measures	0.00163	0.00005	0.00000	0.00000	0.00000	0.00000	0.0017	595
D16	Proposed measures factor	1	1	1					
D17	Residual with proposed Pollution reduction measures	0.00163	0.00005	0.00000	0.00000	0.00000	0.00000	0.0017	595

Column A refers to the A55 mainline

Column B refers to the Link Road

**APPENDIX 7.4**  
**HYDROLOGICAL CALCULATIONS RECORD**

Intended for  
**Welsh Government**

Document type  
**Appendix**

Date  
**June 2020**

# **A55 JUNCTION 16**

## **APPENDIX 7.4**

### **HYDROLOGICAL**

### **CALCULATIONS RECORD**

## **A55 JUNCTION 16 APPENDIX 7.4 HYDROLOGICAL CALCULATIONS RECORD**

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Document type **Report**  
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Prepared by **Chris Day / Chara Sifaki**  
Checked by **Steve Cox**  
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Description **A55 Junction 16 Appendix 7.4: Hydrological Calculations Record**

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## APPENDICES

**Appendix A**  
Pooling Group Composition

# 1. INTRODUCTION

## 1.1 Background

- 1.1.1 The Afon Gyrach hydraulic model has been built to assess the effects on flood risk of the proposed A55 Junction 16 Scheme. The Scheme would see the construction of a link road which crosses the Afon Gyrach on a new structure immediately upstream of the existing A55 crossing of the river.
- 1.1.2 This report provides a record of the hydrological calculations used to determine the flood flows used in the model. This calculation record is based on a supporting document to the Flood Estimation Handbook (FEH)<sup>1</sup>.
- 1.1.3 This hydrological assessment has been used to inform the hydraulic model which will determine flood impacts of the proposed new structure.
- 1.1.4 The Afon Gyrach catchment extends from Tal y Fan to Dwygyfylchi and covers an area of approximately 7.6 km<sup>2</sup>.

## 1.2 Potential Flow Assessment Techniques

- 1.2.1 A range of flood flow return periods (2 year, 5 year, 10 year, 25 year, 50 year, and 100 year return periods) were required using the most appropriate method. A description of each method considered is presented below.

### *FEH Statistical*

- 1.2.2 The statistical analysis approach as described in Volume 3 of the FEH is used to estimate a flood peak for an event with a given return period. This approach involves the estimation of the index flood (Q<sub>med</sub>) and the derivation of a growth curve. The growth curve is then multiplied by the Q<sub>med</sub> value to produce a Flood Frequency Curve (FFC).
- 1.2.3 The pooling group approach is applied in the statistical analyses unless the flood record at a river gauge is at least twice the required return period. The pooling group approach would therefore be required for this hydraulic modelling exercise as there is no flow data for the model location on the subject watercourse.
- 1.2.4 The basic principle of the pooling group approach is to combine data from the subject site with flood data from other similar sites. An FFC is therefore estimated using a more extensive data set. This method is undertaken using FEH WINFAP software.

### *FEH Rainfall-Runoff Method*

- 1.2.5 This method is based on the Flood Studies Report (FSR) rainfall-runoff method, the application of which was restated in the FEH. It involves creating a design storm from rainfall data and running it through a simple catchment model based on a variety of parameters from observed data or catchment descriptors as provided in FEH. The method can be used to provide peak flows and hydrographs. A complete description of the methodology is provided in Volume 4 of the FEH.

---

<sup>1</sup> Centre for Ecology and Hydrology (CEH), *Flood Estimation Handbook (FEH)*, 2013

### *ReFH Rainfall Runoff Method*

1.2.6 Several issues were identified in the FEH rainfall-runoff method and a revitalised rainfall-runoff method (ReFH) was developed in order to make improvements to the methodology (Kjeldsen et al, 2005<sup>2</sup>). The ReFH method was developed to improve the way that observed flood events are modelled. The key improvements were:

- a) A new baseflow model which provides a more objective method of separating total runoff into baseflow and direct runoff;
- b) A loss model based on the uniform model of Moore (1985);
- c) A more flexible unit hydrograph shape; and
- d) Improved handling of antecedent soil moisture conditions.

1.2.7 The ReFH method has superseded the FEH rainfall-runoff method for most fluvial flood risk applications in England and Wales.

### *IH Report 124 Method*

1.2.8 The Institute of Hydrology (IH) Report 124<sup>3</sup> method is based on the FSR mean annual flood plus growth curve approach and research carried out on 71 small rural catchments. The report describes an alternative procedure to calculate QBAR (rural), the mean annual flood for small rural catchments to which geographically-based growth curves are applied to estimate flow for a given return period. This method was developed in order to improve flood estimation on small rural catchments and is not therefore applicable in this case.

### *Modified Rational Method*

1.2.9 In some cases, it is not possible to derive flows for small catchments using the methods described above. This is often the case for small sub-catchments which feed drainage channels or ditches that are not delineated in FEH. In such circumstances, it may be appropriate to use the modified rational method as described in the Wallingford Procedure. This method assumes that the surface water runoff rate arising from a rainfall event for the whole catchment area is assumed to be equal to the volume flowing through the watercourse as a result of the rainfall event.

---

<sup>2</sup> Kjeldsen T R, Stewart E J, Packman J C, Folwell S and Bayliss A C. (2005) Revitalisation of the FSR/FEH rainfall-runoff method. DEFRA R&D Technical Report FD1913/TR, CEH Wallingford

<sup>3</sup> Institute of Hydrology Report 124 – Flood Estimation on Small Catchments

## 2. METHOD STATEMENT

2.0.1 The following sections of the report follow the NRW supporting guidance document "Flood estimation calculation record"<sup>4</sup>

### 2.1 Overview of Requirements for Flood Estimates

2.1.1 As set out previously, the study has been undertaken to improve the understanding of flooding processes in the Afon Gyrach catchment (North Wales) and to assess the effects on flood risk of the proposed A55 Junction 16 Scheme.

2.1.2 This hydrological assessment has been used to inform the hydraulic model which will determine flood impacts of the proposed new structure.

2.1.3 The Afon Gyrach catchment extends from Tal y Fan to Dwygyfylchi and covers an area of approximately 7.6 km<sup>2</sup>.

2.1.4 Design peak flow estimates and hydrographs will be produced for the 50%, 20%, 10%, 4%, 3.33%, 2%, 1.33%, 1% and 0.1% Annual Exceedance Probability (AEP) design events. The effects of climate change are to be considered for the 1% AEP event. An additional model run will be undertaken for this event with flow increased by 30% in accordance with Welsh Government Guidance<sup>5</sup>.

2.1.5 The locations where flow estimates are to be derived are detailed within section 0.

### 2.2 Overview of Catchment

2.2.1 The Afon Gyrach flows from south to north from Tal y Fan (source, National Grid Reference (NGR) 272453 372870) to Dwygyfylchi. It flows through rural areas and Dwygyfylchi village prior to discharging into the sea at Conwy Bay.

2.2.2 The Afon Gyrach catchment is a mid-altitude, rural catchment of extra small size, running through underlying siliceous geology. The BFIHOST value of the catchment is 0.516 (moderately impermeable).

2.2.3 The shape of the catchment is long and narrow, and this may contribute to some attenuation due to differential timing of water from different parts of the catchment reaching the outlet.

### 2.3 Source of Flood Peak Data

2.3.1 The NRFA Peak Flow Dataset Version 8 was used to provide flow data for the relevant gauging stations described as being suitable for use within a pooling group.

### 2.4 Gauging Stations (Flow or Level)

2.4.1 There are no available gauging stations within the subject catchment or within a catchment of suitable close proximity and hydraulic similarity to the subject watercourse for direct calculation.

---

<sup>4</sup> Natural Resources Wales, Flood estimation calculation record, (supporting document to the NRW Flood Estimation Technical Guidance Note, GN008)

<sup>5</sup> <https://gov.wales/sites/default/files/publications/2018-11/flood-consequence-assessments.pdf>

## 2.5 Data Available at Each Flow Gauging Station

2.5.1 Not Applicable as there are no available gauging stations available for such purposes.

## 2.6 Rating Equations

2.6.1 Not Applicable as there are no available gauging stations available for such purposes.

## 2.7 Other Data Available and How it has been Obtained

2.7.1 There is no historic flood flow or rainfall data for the Afon Gyrach catchment. Therefore, both the WINFAP (FEH Statistical) and ReFH methods will be used to check predicted flow data.

## 2.8 Initial Choice of Approach

2.8.1 The main site of interest is the area upstream of A55 main road in Dwygyfylchi. The main source of flooding is likely to be fluvial flows generated within the Afon Gyrach catchment. There are no unusual features to consider within the catchment. The FEH methodologies are not entirely appropriate given the very small size of the Afon Gyrach catchment (7.6 km<sup>2</sup>). The ReFH method is likely to best represent the routing of water through the catchment. The FEH Statistical Method will be used as a check against the results of ReFH method.

2.8.2 Further discussion of the potential flow estimation methodologies is provided in Table 2.1 below.

**Table 2.1: Flow Estimation Methodologies**

Methodology	Discussion
FEH statistical	As the FEH Statistical Method only produces a single peak flow and not a flood hydrograph, the ReFH Method has been preferred. However, the FEH Statistical Method has been used to check the results of the ReFH method. (WINFAP-FEH 3 software)
FEH rainfall-runoff method	It is possible to build a simple catchment model based on a variety of parameters from observed data. However, the ReFH method has superseded the FEH rainfall-runoff method for most fluvial flood risk applications in England and Wales. Therefore, the FEH Rainfall-Runoff Method has been discounted.
ReFH rainfall runoff method	The ReFH method is considered to be an improvement on the FEH Rainfall-Runoff Method. As the BFIHOST value is less than 0.65 within the catchment, the use of the standard ReFH would be acceptable. The ReFH method will, therefore, be used. (ReFH 2 Design Flood Modelling Software)
IH report 124 method	The IH124 method is typically used for calculating greenfield runoff for catchments under 2km <sup>2</sup> in area. The catchment areas in this study are above this threshold so the ReFH method has been selected
Modified rational method	Not in accordance with current EA FEH Guidelines. FEH methods should be used in preference.

### 3. LOCATION WHERE FLOOD ESTIMATES REQUIRED

#### 3.1 Summary of Subject Sites

3.1.1 Table 3.1 below gives the location details of the subject site for the FEH statistical method check flow estimates.

**Table 3.1: Subject Site Location Details**

<b>Site Code</b>	<b>GYR01</b>
Watercourse	Afon Gyrach
Site	Downstream extent of Afon Gyrach
Easting	273560
Northing	377774
Area on FEH (km <sup>2</sup> )	7.6
Reasons for choosing above locations	Flow estimates have been derived at the downstream extent of the watercourse. Catchment descriptors were derived from FEH online web service

#### 3.2 Important Catchment Descriptors at the Subject Site

**Table 3.2: Subject Site Catchment Descriptors**

<b>Site Code</b>	<b>GYR01 (Afon Gyrach)</b>
FARL	0.986
PROPWET	0.59
BFIHOST	0.516
DPLBAR (km)	3.85
DPSBAR (m/km)	189.6
SAAR (mm)	1367
SPRHOST	31.37
URBEXT	0.0007
FPEXT	0.0187

#### 3.3 Checking Catchment Descriptors

3.3.1 The catchment boundary was checked using a combination of LiDAR data and 1:50,000 scale Ordnance Survey (OS) mapping. As an additional check, ArcHydro tool within ESRI's ArcGIS was used to delineate the topographic catchment.

- 3.3.2 The FEH Soil values (SPRHOST and BFIHOST) were visually checked against soil maps (ESRI GIS data) at the downstream model extent and the FEH values are representative of the soil types within the catchment boundaries.
- 3.3.3 The urban areas shown on the FEH online web service were compared against OS 1:50,000 mapping. There were no recent urban developments within the catchment and therefore, the FEH URBEXT values were used.
- 3.3.4 The FARL value was checked against the OS mapping for surface water features within the catchment. There are minor surface water features throughout the catchment, and this corresponds with the FEH FARL values at the flow estimation point.
- 3.3.5 The URBEXT1990 was used for the ReFH method calculations, in line with the software default. The URBEXT2000 was used for the FEH Statistical method. No update to the URBEXT values were considered necessary due to the essentially rural nature of the catchment.

## 4. STATISTICAL METHOD

### 4.1 Search for Donor Sites for QMED

4.1.1 The WINFAP FEH 3 software offers a range of potential Donor Stations for adjusting QMED. These are automatically selected on the basis of the centroid distance from the subject site and consideration given to values for Area, SAAR, BFIHOST, FARL and URBEXT.

### 4.2 Donor Sites Chosen and QMED Adjustment Factors

4.2.1 A range of donor stations is offered by the WINFAP FEH 3 software. The closest gauge geographically is Station 66006. As this gauge is at the closest geographic centroid and also generates the largest adjusted value for QMED, it has been selected so as to ensure a conservative approach to the methodology.

4.2.2 The Qmed using annual maxima flow data at the gauge is  $71.6\text{m}^3/\text{s}$  and the Qmed using the catchment descriptor equation is  $69.4\text{m}^3/\text{s}$ . Therefore, an adjustment ratio of 1.032 has been applied to the Qmed value of  $4.985\text{m}^3/\text{s}$  derived from catchment descriptors at the subject site.

4.2.3 As the Qmed data at the gauging station was determined from Annual Maxima data and not Peaks Over Threshold, no climatic variation adjustment was necessary.

### 4.3 Overview of Estimation of QMED

Table 4.1: QMED Estimation

Site Code	Method	Initial QMED ( $\text{m}^3/\text{s}$ )	NRFA Code	Distance between Centroids $d_{ij}$ (km)	Adjustment Ratio from Donor Gauge	Final QMED ( $\text{m}^3/\text{s}$ )
GYR01	QMED Donor	4.985	66006	19.86	1.032	5.03

### 4.4 Derivation of Pooling Groups

4.4.1 The composition of the pooling groups is given in Appendix A. Several subject sites may use the same pooling group.

**Table 4.2: Pooling Group Derivation**

Name of Group	Site Code from Whose Descriptors Group was Derived	Subject site Treated as Gauged? (enhanced single site analysis)	Changes Made to Default Pooling Group, with Reasons	Weighted Average L-Moments, L-CV and L-skew, (before urban adjustment)
GYR01	GYR01	No Gauge	<p>Initial pooling group was highly heterogenous. A revised initial pooling group was set up with an increased total length and then several stations were removed.</p> <p><i>Stations Removed</i></p> <ul style="list-style-type: none"> <li>• 49005 (Bolingey Stream @ Bolingey Cocks Bridge); and</li> <li>• 7011 (Black Burn @ Pluscarden Abbey).</li> </ul> <p>These stations' records were removed due to short station length (WINFAP-FEH recommends that they should be removed from the pooling group).</p> <ul style="list-style-type: none"> <li>• 28058 (Henmore Brook @ Ashbourne)</li> </ul> <p>This station record was removed due to outlying negative L-Skew and high discordancy (WINFAP-FEH recommends that it should be removed from the pooling group).</p> <ul style="list-style-type: none"> <li>• 47021 (Kensey @ Launceston Newport);</li> <li>• 44013 (Piddle @ Little Puddle); and</li> <li>• 44008 (South Winterbourne @ Winterbourne Steepleton).</li> </ul> <p>These stations' records were removed due to high discordancy (WINFAP-FEH recommends that they should be removed from the pooling group).</p>	<p>Observed average of L-CV / L-skewness distance: 0.0846</p> <p>Weighted average L-CV: 0.217</p> <p>Weighted average L-SKEW: 0.226</p>

## 4.5 Derivation of Flood Growth Curves

**Table 4.3: Flood Growth Curves Derivation**

Site Code	Method (SS, P, ESS, J)	If P, ESS or J, Name of Pooling Group	Distribution Used and Reason for Choice	Note any Urban Adjustment or Permeable Adjustment	Parameters of Distribution (location, scale and shape) after adjustments	Growth Factor for 100 year Return Period
GYR01	P	GYR01	Generalised Logistic (GL) distribution – Only method with an acceptable fit. GL is the recommended distribution for UK catchments.	No urban or permeable adjustment.		2.75

#### 4.6 Flood Estimates from the Statistical Method

**Table 4.4: Flood Peak Flows at GYR01**

<b>AEP (%)</b>	<b>Return Period (year)</b>	<b>Flood peak flow (m<sup>3</sup>/s)</b>
50	2	5.03
20	5	6.81
10	10	8.14
3.33	30	10.54
2	50	11.84
1.33	75	12.97
1	100	13.84
0.5	200	16.17
1 + CC	100 +30 CC	17.99

## 5. REVITALISED FLOOD HYDROGRAPH (REFH) METHOD

### 5.1 Parameters for ReFH Model

5.1.1 The parameters were estimated from catchment descriptors and are easily reproducible, so have not been listed in full below.

### 5.2 Design Events for ReFH Method

Table 5.1: ReFH Design Events

Site Code	Urban or Rural	Season of Design Event (summer or winter)	Storm Duration (hours)	Storm Area for ARF (if not catchment area)
GYR01	Rural	Winter	6:15	Catchment Area Used

### 5.3 Flood Estimates from the ReFH Method

Table 5.2: ReFH Flood Estimates at GYR01

AEP (%)	Return Period (years)	ReFH flood peak flow (m <sup>3</sup> /s)
50	2	4.72
20	5	6.35
10	10	7.80
3.33	30	10.79
2	50	12.44
1.33	75	13.84
1	100	14.89
0.5	200	17.60
0.1	1000	24.70
1 + CC	100 +30% CC	19.36

## 6. DISCUSSION AND SUMMARY OF RESULTS

### 6.1 Comparison of Results from Different Methods

6.1.1 Table 6.1 compares peak flows from the ReFH method to those from the FEH Statistical method at the Afon Gyrach for two key return periods.

**Table 6.1: Peak Flow Comparison**

Site Code	Ratio of Peak Flow to FEH Statistical Peak	
	Return Period Two Years (50% AEP event)	Return Period 100 Years (1% AEP event)
	ReFH	ReFH
GYR01	0.85	1.08

### 6.2 Final Choice of Method

6.2.1 The ReFH method produced similar peak flows to the FEH Statistical method. As the ReFH method offers a greater flow rate for the 1 in 100 AEP, this will be used for the modelling exercise.

### 6.3 Final Results

6.3.1 The final flow estimates taken forward to the hydraulic modelling exercise are presented in Table 6.2.

**Table 6.2: Final Flow Estimates**

AEP (%)	Return Period (years)	ReFH flood peak flow (m <sup>3</sup> /s)
50	2	4.72
20	5	6.35
10	10	7.80
3.33	30	10.79
2	50	12.44
1.33	75	13.84
1	100	14.89
0.5	200	17.60
0.1	1000	24.70
1 + CC	100 +30% CC	19.36

**APPENDIX A****POOLING GROUP COMPOSITION**

<b>Station</b>	<b>Distance</b>	<b>Years of Data</b>	<b>QMED AM</b>	<b>L-CV</b>	<b>L-SKEW</b>	<b>Discordancy</b>
28033 (Dove @ Hollinsclough)	0.165	43	4.205	0.231	0.369	0.985
45816 (Haddeo @ Upton)	0.306	25	3.456	0.306	0.399	1.748
25011 (Langdon Beck @ Langdon)	0.744	32	15.533	0.235	0.334	1.925
71003 (Croasdale Beck @ Croasdale Flume)	0.78	37	10.9	0.212	0.323	0.441
47022 (Tory Brook @ Newnham Park)	0.842	25	6.18	0.273	0.149	1.344
25003 (Trout Beck @ Moor House)	0.888	45	15.12	0.167	0.302	0.92
27051 (Crimple @ Burn Bridge)	0.908	46	4.539	0.219	0.148	0.357
206006 (Annalong @ Recorder)	0.989	48	15.33	0.189	0.052	2.77
54022 (Severn @ Plynlimon Flume)	1.163	38	14.988	0.156	0.171	1.284
91802 (Allt Leachdach @ Intake)	1.227	34	6.35	0.153	0.257	1.156
25019 (Leven @ Easby)	1.352	40	5.384	0.343	0.378	2.901
27010 (Hodge Beck @ Bransdale Weir)	1.415	41	9.42	0.224	0.293	0.203
27032 (Hebden Beck @ Hebden)	1.502	52	3.923	0.207	0.244	0.352
26802 (Gypsey Race @ Kirby Grindalythe)	1.533	19	0.109	0.309	0.183	1.817
48009 (St Neot @ Craigshill Wood)	1.555	12	8.469	0.245	0.373	0.927
57017 (Rhondda Fawr @ Tynewydd)	1.569	17	24.06	0.136	0.018	1.953
49003 (de Lank @ de Lank)	1.578	52	13.985	0.223	0.209	0.088
25012 (Harwood Beck @ Harwood)	1.662	49	33.265	0.19	0.225	1.026
48004 (Warleggan @ Trengoffe)	1.689	49	9.983	0.255	0.257	0.701
46005 (East Dart @ Bellever)	1.729	54	38.967	0.158	0.066	1.302
48007 (Kennal @ Ponsanooth)	1.921	50	4.236	0.194	0.222	0.251
72014 (Conder @ Galgate)	2.018	50	16.465	0.233	0.162	0.275
72007 (Brock @ Upstream of a6)	2.022	40	28.964	0.199	0.218	0.607
73015 (Keer @ High Keer Weir)	2.041	27	12.33	0.205	0.281	0.192
76811 (Dacre Beck @ Dacre Bridge)	2.177	18	35	0.197	0.24	0.961
24006 (Rookhope Burn @ Eastgate)	2.225	20	24.62	0.152	0.117	1.056
51003 (Washford @ Beggearn Huish)	2.227	50	6.113	0.199	0.078	0.977
47009 (Tiddy @ Tideford)	2.23	49	6.85	0.197	0.208	0.2

## HYDROLOGICAL CALCULATIONS RECORD

<b>Station</b>	<b>Distance</b>	<b>Years of Data</b>	<b>QMED AM</b>	<b>L-CV</b>	<b>L-SKEW</b>	<b>Discordancy</b>
48001 (Fowey @ Trekeivesteps)	2.261	49	17.316	0.218	0.282	0.171
28041 (Hamps @ Waterhouses)	2.261	33	26.126	0.223	0.291	1.351
76011 (Coal Burn @ Coalburn)	2.282	41	1.84	0.165	0.315	1.119
73009 (Sprint @ Sprint Mill)	2.294	49	42.351	0.179	0.188	0.238
21017 (Ettrick Water @ Brockhoperig)	2.316	41	60.364	0.203	0.276	0.176
26014 (Water Forlornes @ Driffield)	2.366	20	0.431	0.297	0.127	2.088
41020 (Bevern Stream @ Clappers Bridge)	2.391	49	13.66	0.203	0.181	0.465
49004 (Gannel @ Gwills)	2.404	49	15.022	0.257	0.104	1.674

**APPENDIX 7.5**  
**AFON GYRACH FLOOD MODELLING**

Intended for  
**Welsh Government**

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**June 2020**

# **A55 JUNCTION 16 APPENDIX 7.5 AFON GYRACH FLOOD MODELLING REPORT**

# A55 JUNCTION 16 APPENDIX 7.5 AFON GYRACH FLOOD MODELLING REPORT

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Description **A55 Junction 16 Appendix 7.5: Afon Gyrach Flood  
Modelling Report**

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## APPENDICES

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# 1. INTRODUCTION

1.0.1 Ramboll UK Limited (Ramboll) has been appointed by the Welsh Government ('client') to build a hydraulic 1D HEC-RAS model of the Afon Gyrach at Dwygyfylchi to understand the baseline flood risk from the watercourse and assess the effects on flood risk of the proposed A55 Junction 16 Scheme. The Scheme would see the construction of a link road which crosses the Afon Gyrach on a new structure immediately upstream of the existing A55 crossing of the river at national grid reference 273580, 377759. No previous modelling exists for this watercourse.

## 1.1 Scope and Objectives

1.1.1 This report provides detailed information on the hydraulic model build process undertaken to assess the baseline flood risk from the Afon Gyrach and the effects of the proposed new structure on flood risk. The objective of the modelling was to determine what impacts the Scheme would have on flood risk and inform the structure design such that any changes to flood risk would be of an acceptable scale.

## 2. QUALITATIVE DESCRIPTION OF FLOOD RESPONSE

### 2.1 Description of the Study Area

#### Model Reach

2.1.1 The Afon Gyrach upstream extent was set upstream of Glan-Yr-Afon Road and the downstream extent at the sea (Conwy Bay) so that any potential impacts on residential housing to the southeast of the new crossing would form part of the assessment. Plate 2.1 shows the Afon Gyrach extent, including the 1D model domain, the locations of the newly surveyed cross sections, the upstream and downstream model boundary locations and the key hydraulic control structures featured within the model.

Plate 2.1: Study Area Model Extent



#### Hydrological Description

2.1.2 The Afon Gyrach drains a predominantly rural catchment, extending to approximately 7.6 km<sup>2</sup> in area. The river flows from south to north from Tal y Fan (source, National Grid Reference (NGR) 272453 372870) to Dwygyfylchi. It flows through rural areas and Dwygyfylchi village prior to discharging into the sea at Conwy Bay.

## **2.2 Existing Understanding of Flood Risk**

### **Sources of Information**

2.2.1 Sources of third-party information used to understand the flood risk of this site are detailed below:

- National Resources Wales (NRW) flood map for planning;
- NRW long term flood risk information; and
- The British Geological Survey (BGS) Geology of Britain Viewer.

### **Analysis of Historic Flood Risk**

2.2.2 The rural nature of the catchment with limited receptors means that there is a lack of evidence in terms of photos, flood depths and extents for the study area.

## **2.3 Availability of Existing Hydraulic Models**

2.3.1 A detailed hydraulic modelling study has not previously been carried out for Afon Gyrach on behalf of the Welsh Government. NRW and the local authority have been consulted in relation to previous studies and no existing model data are available.

## 3. MODEL APPROACH AND JUSTIFICATION

### 3.1 Model Conceptualisation

- 3.1.1 A hydraulic 1D HEC-RAS model was used to simulate the baseline flood risk of Afon Gyrach and assess the effects of the proposed A55 Junction 16 Scheme on flood risk. A 1D modelling approach allows for the detailed modelling of in-channel flow mechanisms and an appraisal of impacts in the floodplain.
- 3.1.2 An initial review of ground elevations and topography in the vicinity of the site did not suggest wide-scale complex interactions between the channel and the floodplain. As the primary consideration of the model was to determine the potential impact of a new structure (which can be accurately simulated using 1D software) the additional data requirements, computational effort and cost associated with a 2D model was considered disproportionate in view of the relative straightforwardness of watercourse hydraulics in this case.
- 3.1.3 The upstream and downstream model extents were set with consideration of the backwater effect from key features and structures. The downstream extent was set at the sea (Conwy Bay) which is the outlet (mouth) of Afon Gyrach. The Glan-Yr-Afon Road is a key constriction point acting to control flows and is therefore an appropriate location for the upstream model extent whilst also allowing assessment of any impacts on residential properties in the vicinity of the watercourse.

### 3.2 Software Proposed

- 3.2.1 HEC-RAS hydraulic modelling software was used to model flood risk at the Afon Gyrach. HEC-RAS is an industry-standard hydraulic modelling software package for flood risk modelling. The slope of the river, the limited areas of true floodplain surrounding it and the lack of complicated out-of-bank flow routes meant that 1D-2D modelling was not considered to add significant value beyond a 1D-only approach.

### 3.3 Topographic Survey

- 3.3.1 New channel survey data was collected (Appendix A), consisting of 22 cross-sections and 4 structures. The channel cross-section survey locations were carefully chosen to capture the key characteristics of the model.
- 3.3.2 The most up-to-date NRW filtered composite LiDAR data (1 m resolution) was used, obtained through Open Government Licence<sup>1</sup>.

---

<sup>1</sup> Lle Geo-Portal for Wales (2019). *Lle – Map Browser* [online] Available at: <http://lle.gov.wales/map#l=108h;109h;110h;111h;112h;113h;114h;115h;116h;117h;118h;119h;120h;121h;122h;123> (Accessed 12/08/2019)

## 4. INPUT DATA

4.0.1 Data available to inform the model build is detailed in Table 4.1. This provides information on data sources, availability and type. An assessment of uncertainties and the quality of data, its appropriateness for the intended use, known deficiencies, and any processing undertaken on those data are included in Table 4.1.

**Table 4.1: Afon Gyrach HEC-RAS Model – Input Data**

<b>Data Type</b>	<b>Source</b>	<b>Format</b>	<b>Quality</b>	<b>Uncertainties</b>	<b>Post-processing</b>
LiDAR	NRW – Open Government Licence	GIS - Ascii	1 m resolution. No modification to the data was required	LiDAR ground levels using filtered data usually have an uncertainty of $\pm 150$ mm depending on land use	Filtered LiDAR was used to extend certain cross-sections for the HEC-RAS model
Cross-section channel survey	Maltby Surveys	CAD	22 cross-sections Four structures	Low uncertainty – survey data verification as reported by Maltby Surveys.	Survey data was used to model the 1D watercourse in the HEC-RAS model
OS Master map	Ordnance Survey	GIS - Shapefile	Complete coverage of the study area	Low uncertainty	The OS data was used as a reference source during model construction and for presenting outputs
Conveyance Estimation System (CES)	Department for Environment, Food & Rural Affairs (Defra)/ Environment Agency (EA)	Roughness document (.rad)		Low uncertainty – sensitivity testing has been undertaken to test potential error	The data was used to create the various Manning 'n' roughness zones throughout the HEC-RAS 1D domain
HEC-RAS model	Developed for this study	HEC-RAS 5.0.7	The HEC-RAS model has been developed as part of this study using recent LiDAR and survey data	A technical model review was undertaken	The HEC-RAS domain covers the entire study reach

## 5. TECHNICAL METHOD AND IMPLEMENTATION

5.0.1 This section describes the methods used in the hydrological assessment and hydraulic modelling (including post-processing). Focus is on non-standard aspects of modelling rather than a detailed description of every stage of the process or a repeat of procedures that are documented elsewhere.

### 5.1 Hydrological Assessment

5.1.1 Hydrological calculations were carried out following methodologies described in the Flood Estimation Handbook (FEH) to determine the flood flows used in the hydraulic model. The full Hydrological Calculations Record is included in Appendix 7.4 (to chapter 7 of the Environmental Statement).

5.1.2 One set of design inflows were required for the Afon Gyrach hydraulic modelling study. The short length of the modelled watercourse (595 m) is such that lateral inflows are not relevant. The catchment area is relatively small, approximately 7.6 km<sup>2</sup>. The Revitalised Flood Hydrograph (ReFH2) has therefore been applied.

5.1.3 Flows were estimated at the downstream extent of the Afon Gyrach watercourse (NGR 273560, 377774). This approach will allow for all flows within the catchment to be accounted for within the model and is appropriate for very small catchments, following the conservative approach adopted for flood mapping studies.

5.1.4 Flows were estimated for a 6 hour 15 minute storm duration in line with ReFH2 calculations. The catchment was delineated using FEH online resources and respective catchment descriptors were used in the hydrological analyses.

### 5.2 Hydraulic Model Build

5.2.1 Plate 5.1 shows a schematisation of the Afon Gyrach 1D HEC-RAS model. Cross sections (or river stations as they are sometimes referred to within HEC-RAS) are named according to the nomenclature defined by Maltby Surveys i.e. a prefix of "GRY01\_" to denote the river reach with a suffix defined by the chainage from the furthest downstream cross section and as presented below. For example, cross section GRY01\_100.462 denotes a cross section 100.462 m upstream of the downstream boundary on the river reach.

Plate 5:1: Afon Gyrach Model Schematisation



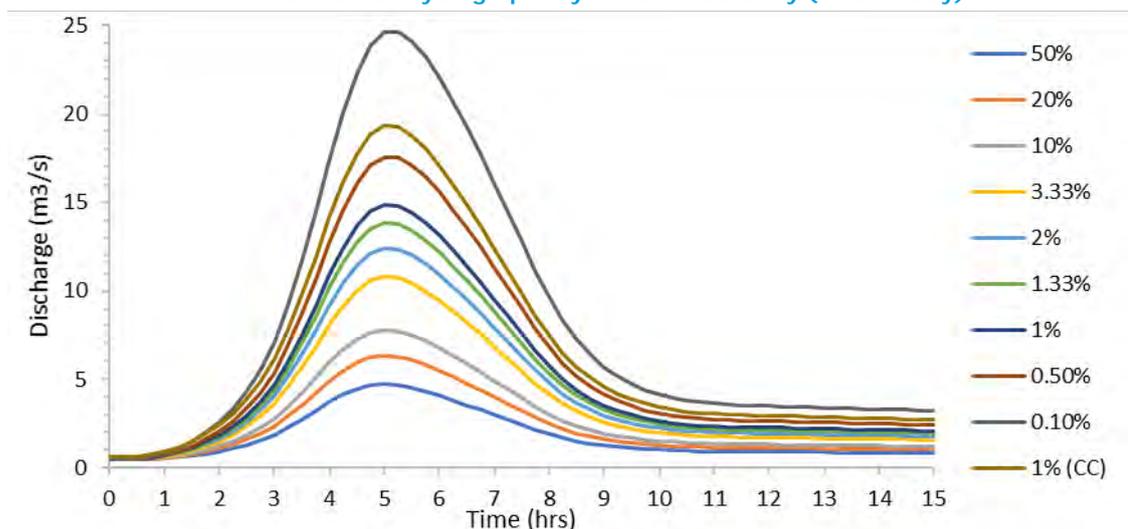
### Inflow Boundaries

5.2.2 The model has one inflow boundary, a flow-time (QT) boundary simulating upstream inflows for the Afon Gyrach (GYR01\_516.529). Chart 5.2 presents estimated flood flow hydrographs for a range of annual probabilities at this location as calculated using ReFH2. An annual probability of 1% is equivalent to a 100-year return period, 2% is equivalent to a 50-year return period etc.

**Table 5.1: Annual Exceedance Probability and equivalent Return Period event**

Annual Exceedance Probability (%)	Return Period (1 in x-year)
50%	2
20%	5
10%	10
3.33%	30
2%	50
1.33%	75
1%	100
0.5%	200
0.1%	1000

**Chart 5.2: Hydrographs by Annual Probability (Present Day)**



5.2.3 Peak flows calculated using ReFH2 were used in steady-state simulations using the hydraulic model. A 30% allowance for climate change (cc) has also been made on top of the 1% AEP event in accordance with NRW criteria<sup>2</sup>.

### Downstream Boundary

5.2.4 The critical flood mechanisms being examined in this study were associated with fluvial rather than tidal effects. The location of the proposed new structure would be at least 5 m above ordnance datum meaning that interaction with high tides was considered unlikely to represent the most conservative set of conditions for the downstream boundary. A single downstream boundary has therefore been applied, modelled as Normal Depth (Friction Slope: 0.019) boundary in the 1D domain at the river outlet (GYR01\_0.000). The downstream boundary was also subject to sensitivity testing.

<sup>2</sup> Welsh Government (2019). *Flood Consequences Assessments: Climate change allowances* [online] Available at: <https://gov.wales/sites/default/files/publications/2018-11/flood-consequence-assessments.pdf> [Accessed 28/10/2019]

## Existing Structures

5.2.5 Three existing structures have been included in the hydraulic model (Table 5.1). These structures are considered to influence local hydraulics and flood risk. Each was incorporated as a discrete structure running through an otherwise solid bridge deck within HEC-RAS as opposed to developing a bridge deck over an existing cross-section.

- Arch-shaped structure under Glan-Yr-Afon Road (River Station 455, Upstream face GYR01\_00459, Downstream face GYR01\_451);
- Concrete semi-cyclical structure under A55 Road (River Station 75, Upstream face GYR01\_00077, Downstream face GYR01\_00043)
- Arch-shaped rail structure with elevated concrete bed; and (River Station 35, Upstream face GYR01\_00037, Downstream face GYR01\_00029).

**Table 5.2: Existing Structures**

Structure	Arch shaped Structure Under Glan-Yr-Afon Road	Concrete Structure Under A55 Road	Arch shaped Rail Structure with Elevated Concrete Bed
Span (m)	4.3	4.88	4.79
Rise (m)	1.65	2.21	2.24
Upstream invert level (mAOD)	11.77	4.97	4.35
Downstream invert level (mAOD)	11.68	4.48	4.41
Skew Angle	17°	17°	5°

5.2.6 The wooden footbridge approximately 15 m upstream of Glan-Yr-Afon Road was not included in the hydraulic model. The structure does not constrict the water flow and it is located approximately 400 m upstream of the key structures (structure under A55 road and railway). Ineffective flow areas were input into the model at the cross section upstream of each structure in line with the cross section stations for the structure openings.

## Existing Inline Structures

5.2.7 Two weirs have been included in the hydraulic model as inline structures. They are considered to influence local hydraulics and flood risk.

- Natural weir 1 (River Station 392.5, Weir Crest GYR\_00393, Broad Crested); and
- Man-made weir 2 (River Station 26.8, Weir Crest GYR\_00027, Broad Crested).

## Proposed Structures

5.2.8 The A55 Junction 16 Scheme would involve the construction of a link road crossing the Afon Gyrach via a new structure 8 m upstream of the existing A55 crossing of the river. One of the purposes of the modelling is to determine the dimensions of the new structure in order that it does not unacceptably exacerbate flooding. The new structure was modelled with the same dimensions as the existing structure under the A55 road and slope in accordance with the average slope between surveyed cross sections 100.462 and 77.469. The same bed roughness is used as for the channel upstream and downstream of the new structure. These data have been incorporated into a post-development version of the model as follows (Table 5.2):

- Arch-shaped structure under the proposed link road (River Station 95, Upstream face GYR01\_100.462, Downstream face GYR01\_85.460)

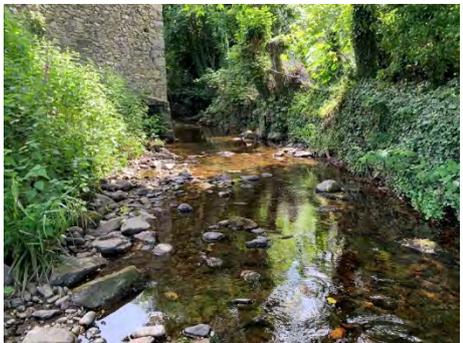
**Table 5.3: Proposed Structure**

Structure	Concrete semi-circular structure under Existing A55 Road	Arch-shaped structure under the Proposed Link Road
Type	Arch	Arch
Deck Height (mAOD)	8.39	8.5
Structure Soffit (mAOD)	7.18	7.49
Span (m)	4.88	4.88
Rise (m)	2.21	2.21
Length (m)	34.9	15
Upstream Invert Level (mAOD)	4.97	5.28
Downstream Invert Level (mAOD)	4.48	5.15
Roughness (n)	0.05	0.068
Skew Angle	17°	14°

**Roughness**

5.2.9 Table 5.3 presents the roughness values set for the 1D domain. These were calculated using CES software. The CES Roughness report is included in Appendix B.

**Table 5.4: Afon Gyrach Roughness Values**

1D Type	Manning's 'n'	Details	Photograph
Channel cross-section	0.068	Bed material: Gravels, cobbles and boulders Vegetation: Mosses (attached to bed and banks) Irregularities: Tree root incursion from banks	
Arch shaped structure under Glan-Yr-Afon Road	Top: 0.03 Bottom: 0.05	Structure over channel Bed material: Gravels, cobbles and boulders	

1D Type	Manning's 'n'	Details	Photograph
Concrete structure under A55 Road	Top: 0.03 Bottom: 0.05	Concrete structure, straight Bed material: Gravels, cobbles and boulders	
Arch shaped rail structure	Top: 0.03 Bottom: 0.03	Structure over channel with elevated concrete bed	

### Modelling Assumptions Made

5.2.10 The representation of any complex system by a model requires several assumptions to be made. In this case, it has been assumed that:

- Cross-sections accurately represent the shape and variation of the river;
- Model parameters have been determined appropriately;
- Design flows are an accurate representation of flows of a given return period;
- The surveyed cross-sections of hydraulic structures and the units used to represent them in the model provide an adequate representation of the situation; and
- LiDAR data accurately reflect bank heights and particularly that the filtered LiDAR has appropriately removed the influence of vegetation along the banks.

5.2.11 The accuracy of hydraulic models is heavily dependent on the accuracy of the hydrological and topographical data on which they are based.

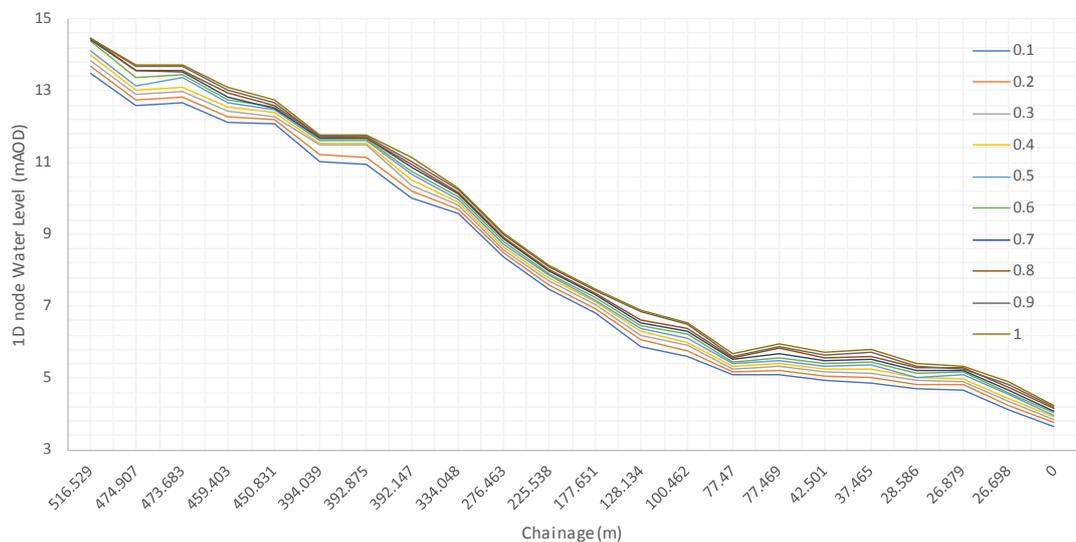
5.2.12 While every effort has been made to accurately reflect the situation on the ground and estimate model parameters, these can never be completely certain. Sensitivity tests have therefore been carried out to highlight the sensitivity of the model to uncertainty/variation in input parameters.

## 6. MODEL PROVING

### 6.1 Calibration and Validation

- 6.1.1 Gauge data for the Afon Gyrach catchment is not available. A formal calibration and validation was not possible. In lieu of the lack of catchment data, a comprehensive sensitivity analysis has therefore been completed.
- 6.1.2 Chart 6.1 presents a long profile of 10 increments of the 1% AEP flow run through the model in steady state runs. Despite some areas where there is a hydraulic jump from one cross section to the next downstream, the change in flow rate generally results in a consistent increase in water level which is indicative of a stable model.

Chart 6.1: Long-profile of 10 Incremental Flows (deciles of the 1% AEP flow)



### 6.2 Verification

- 6.2.1 The Afon Gyrach catchment is rural, with few built receptors with regards to flood risk. This means that there is a lack of historical flooding information and verification of the frequency of flooding indicated by the model was not possible.

### 6.3 Run Parameters

- 6.3.1 The model was run in steady-state with a supercritical flow regime. Initial tests suggested Froude numbers in excess of 0.8 for all cross sections for the majority of flow rates so this was considered appropriate.

## 7. MODEL RESULTS

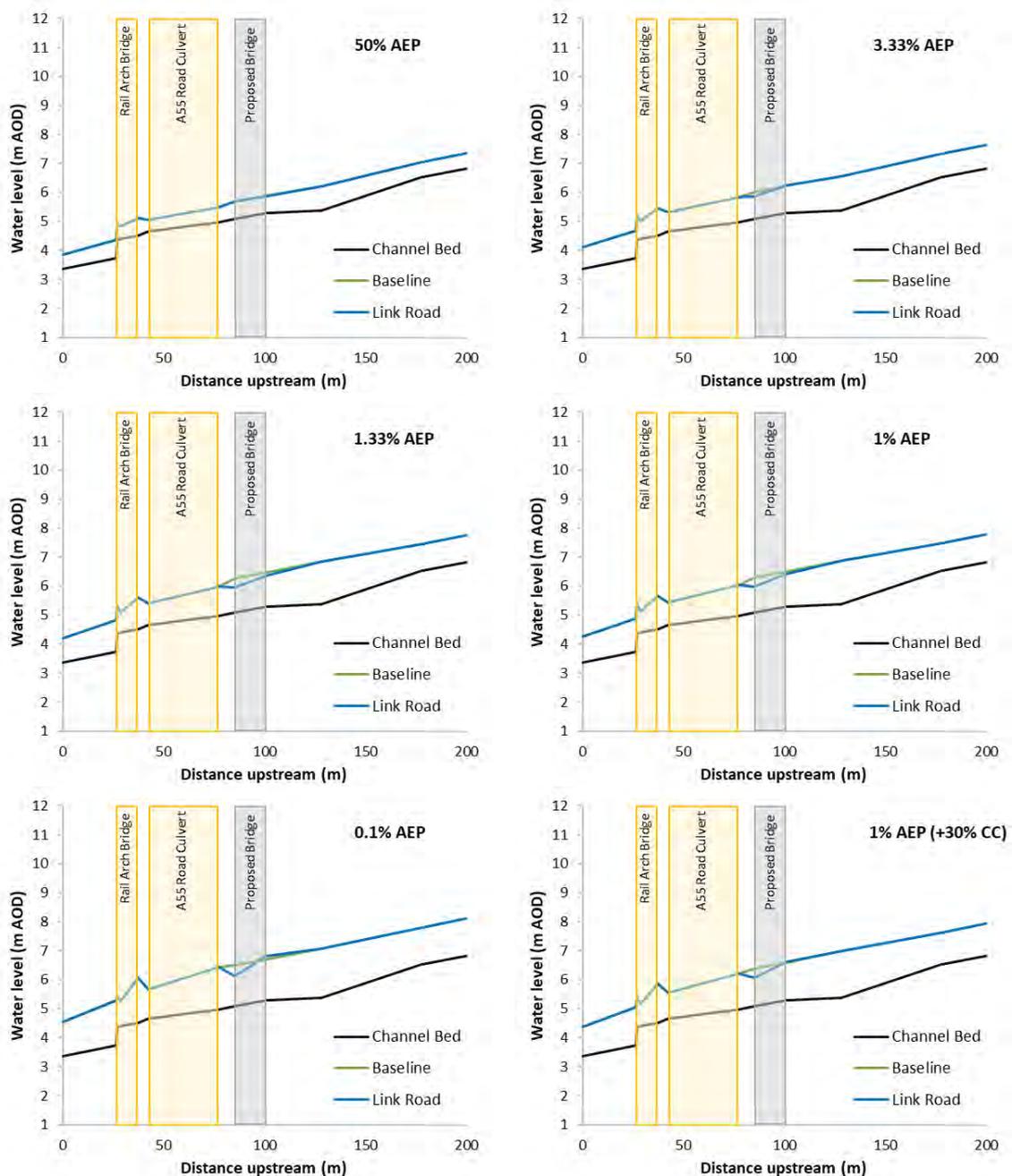
7.0.1 This section describes the results for the baseline and proposed scheme 1D HEC-RAS models of Afon Gyrach. As part of the deliverables for this study, the following outputs have been produced:

- Tabular data for all modelled design flood events
  - Peak flood levels along the centre line of the main channel

### 7.1 Peak Flood Levels

7.1.1 Chart 7.1 shows graphically the water level profiles for a range of AEP flood events along the Afon Gyrach watercourse under the Baseline and Proposed Scheme, the position of key structures and the channel bed profile at the downstream extent of the model.

Chart 7.1: Long Section Profile of Simulated Water Levels in the 1D Channel



- 7.1.2 The model results indicate the proposed structure has very limited impact on water levels along the Afon Gyrach. For all AEP events, the water level results are identical in most of the channel cross sections. The exception to this is immediately upstream and downstream of the proposed structure.
- 7.1.3 Chart 7.1 shows the controlling influence of the Afon Gyrach structures on the upstream water levels. There is a delicate relationship between the backwater effect and the steep gradient of the channel bed. The proposed structure interrupts the backwater effect caused by the existing A55 structure, effectively shifting the backwater effect upstream. The shift results in a reduction in water levels at the downstream face of the proposed structure (cross section 85.46), 8 m upstream of the existing A55 structure.
- 7.1.4 The model indicates the proposed structure reduces the flood level immediately upstream (cross section 100.462) for AEP events up to and including the 0.5% AEP event. In contrast, the 0.1% AEP event and the 1% AEP plus climate change event results indicate some afflux (increase in flood level). The 1% AEP plus 30% climate change event has a 0.01m afflux with a peak water level of 6.61 mAOD and the 0.1% AEP event has a 0.13m afflux, with a peak water level of 6.82m AOD.
- 7.1.5 This change from reduction to increase in flood levels is related to the balance between the backwater effect and the channel gradient. The channel gradient upstream of the proposed structure (gradient 0.004) is shallower than the channel gradient upstream of the A55 structure (gradient 0.013). It would therefore be expected that the proposed structure would incur a shallower backwater effect during equivalent return periods compared to the A55 structure. Up to an including the 0.5% AEP event, the head loss from the interruption of the proposed structure to the backwater effect from the A55 structure is greater than the new backwater effect incurred by the proposed structure. This is only simulated to reverse during the 0.1% AEP event and the 1% AEP plus climate change event.
- 7.1.6 The difference in flood levels are shown in Table 7.1.

**Table 7.1: Water Level Comparison in Metres of Baseline and Proposed Scheme Scenarios**

Model Chainage	AEP event					
	50%	3.33%	1.33%	1%	0.1%	1% (+ 30% CC)
516.529	0	0	0	0	0	0
474.907	0	0	0	0	0	0
473.683	0	0	0	0	0	0
459.403	0	0	0	0	0	0
450.831	0	0	0	0	0	0
394.039	0	0	0	0	0	0
392.875	0	0	0	0	0	0
392.147	0	0	0	0	0	0
334.048	0	0	0	0	0	0
276.463	0	0	0	0	0	0
225.538	0	0	0	0	0	0
177.651	0	0	0	0	0	0
128.134	0	0	0	0	0	0
100.462	-0.01	0	-0.10	-0.08	+0.13	+0.01
85.46	0	-0.15	-0.32	-0.32	-0.36	-0.33
77.469	0	0	0	0	0	0
42.501	0	0	0	0	0	0
37.465	0	0	0	0	0	0
28.586	0	0	0	0	0	0
26.879	0	0	0	0	0	0
26.698	0	0	0	0	0	0
0	0	0	0	0	0	0

## 7.2 Freeboard

7.2.1 The freeboard between the peak 1% AEP plus 30% for climate change event flood level and the structure soffit would be 880 mm. The freeboard in the 0.1% AEP event would be 670 mm. In both cases the freeboard is greater than the standard 600 mm generally regarded as sufficient for floating debris would be able to pass under and through the proposed structure.

## 7.3 Velocity

7.3.1 To assess the impact of the proposed structure on channel velocities and the potential impact on channel and bank scour, an assessment of the channel velocities has been undertaken using the HEC-RAS model output. Calculation of velocity has been undertaken for the channel cross sections immediately up and downstream of the structure, as HEC-RAS does not generate a velocity value through the structure itself.

7.3.2 The model results indicate that in-channel velocity increases at the proposed structure compared to the baseline scenario as a result of the constricting effect of flows through the proposed structure compared to the existing open channel. Whilst there is an increase in channel velocity as the sections immediately adjacent to the structure, the HECRAS model results indicate no change to channel velocity at the channel sections away from the structure,

indicating that the impact is localised to the area of channel immediately up and downstream of the structure, with the hydraulic influence dissipating away from the structure.

7.3.3 It is noted that the velocity values for the proposed structure are similar to the A55 road structure or the rail arch structure velocity values (Table 7.2 and Table 7.3).

**Table 7.2 – Velocity values at the upstream face of Afon Gyrach structures**

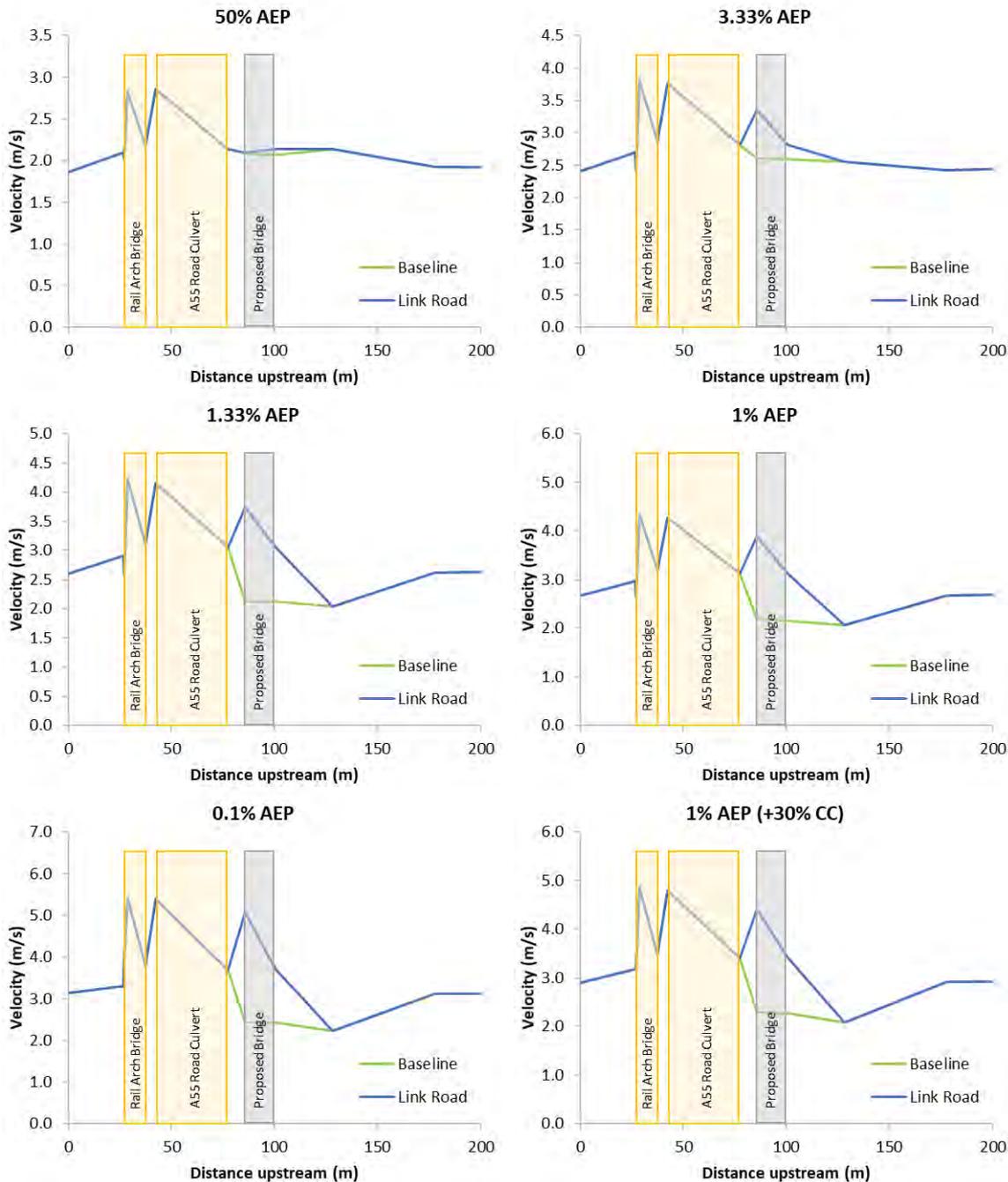
Structure	50%	3.33%	1.33%	1%	0.1%	1% (+ 30% CC)
<b>Proposed structure</b>	2.14	2.82	3.06	3.13	3.71	3.42
<b>A55 road structure</b>	2.14	2.81	3.05	3.13	3.69	3.41
<b>Railway structure</b>	2.18	2.87	3.11	3.19	3.78	3.48

**Table 7.3 - Velocity values at the downstream face of Afon Gyrach structures**

Structure	50%	3.33%	1.33%	1%	0.1%	1% (+ 30% CC)
<b>Proposed structure</b>	2.10	3.35	3.74	3.89	5.07	4.42
<b>A55 road structure</b>	2.86	3.77	4.15	4.28	5.40	4.80
<b>Railway structure</b>	2.83	3.82	4.22	4.35	5.42	4.86

7.3.4 The impact of the structure on flow velocities and scour should be examined in greater detail at the detailed design stage, and can be based on the results of the HEC-RAS model as part of a robust approach.

Chart 7.2: Long Section Profile of Simulated Velocity in the 1D Channel



## 7.4 Sensitivity Analysis

7.4.1 Table 7.4 summarises the model sensitivity results.

7.4.2 The sensitivity analysis has been performed on the 1% AEP event for the proposed scheme model. The following parameters were tested:

- Model inflows (+/- 20%)

7.4.3 Model inflows for the 1% AEP event were increased and decreased by  $\pm 20\%$ . The results of this sensitivity test show increased and decreased flow depths compared to the proposed

scheme model. The biggest increase was identified at cross section 459.403 (0.15 m) and the biggest decrease was at 128.134 so the most sensitive cross sections were found to be away from the proposed new crossing. The maximum increase upstream of the proposed new crossing (100.462) was 0.13 m.

- Channel roughness (+/- 20%)

7.4.4 The sensitivity testing of model roughness by  $\pm 20\%$  predicts virtually no impact anywhere in the model. This indicates that the model is not overly sensitive to model roughness and the impact at cross sections near to the proposed new crossing are all zero. Error in the definition of channel roughness is not therefore predicted to impact on the model in key areas.

- Downstream boundary conditions (+/- 20%)

7.4.5 The sensitivity testing of the downstream boundary by increasing and decreasing the friction slope by  $\pm 20\%$  predicted no differences in flood risk compared to the proposed scheme model. This indicates that the model is not sensitive to changes to the downstream boundary.

- Proposed structure blockage (+20% of river width blocked)

7.4.6 A model blockage scenario was simulated by increasing the width of the ineffective flow areas at the upstream cross section (100.462) by 20% by river width during the climate change-corrected 1% AEP flow. The results of this model run show that, in the event of such a blockage water levels could increase by 0.14 m immediately upstream of the structure. Further upstream there would be no impact (the impact at cross section 128.134 would be zero).

**Table 7.4: Model Sensitivity Results**

*Values in table give change in peak flood level in metres*

Chainage	Scenario						
	Inflows		Channel Roughness		Downstream Boundary Depth		Structure Blockage
	-20%	+20%	-20%	+20%	-20%	+20%	
516.529	-0.03	0.03	0	0	0	0	0
474.907	-0.05	0.03	-0.05	0	0	0	0
473.683	-0.09	0.03	-0.05	0	0	0	0
459.403	-0.16	0.15	0	0	0	0	0
450.831	-0.06	0.04	0	0	0	0	0
394.039	-0.08	0.02	0	0	0	0	0
392.875	-0.04	0.04	0	0	0	0	0
392.147	-0.17	0.15	0	0	0	0	0
334.048	-0.12	0.11	0	0	0	0	0
276.463	-0.11	0.11	0	0	0	0	0
225.538	-0.11	0.1	0	0	0	0	0
177.651	-0.11	0.09	0	0	0	0	0
128.134	-0.26	0.04	0	0	0	0	0
100.462	-0.14	0.13	0	0	0	0	0.14
85.46	-0.07	0.06	0	0	0	0	-0.1
77.469	-0.14	0.13	0	0	0	0	0
42.501	-0.09	0.07	0	0	0	0	0
37.465	-0.15	0.13	0	-0.01	0	0	0
28.586	-0.07	0.05	0	0	0	0	0
26.879	-0.12	0.06	-0.12	0	0	0	0
26.698	-0.13	0.11	0	0	0	0	0
0	-0.11	0.09	0	0	0	0	0
<b>Maximum</b>	<b>-0.03</b>	<b>0.15</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.14</b>
<b>Minimum</b>	<b>-0.26</b>	<b>0.02</b>	<b>-0.12</b>	<b>-0.01</b>	<b>0</b>	<b>0</b>	<b>-0.1</b>

## 8. CONCLUSIONS

- 8.0.1 Ramboll UK Limited (Ramboll) has been appointed to build a hydraulic 1D HEC-RAS model of the Afon Gyrach at Dwygyfylchi to understand the baseline flood risk from the watercourse and assess the effects on flood risk of the proposed A55 Junction 16 Scheme. The Scheme would see the construction of a link road which crosses the Afon Gyrach on a new structure immediately upstream of the existing A55 crossing.
- 8.0.2 Based on a comparison of the baseline scenario and the proposed scheme scenario, there is likely to be some afflux (increase in flood levels) of up to +0.13 m immediately upstream of the proposed structure during a 0.1% AEP event. In a 1% AEP plus 30% climate change event the afflux is only +0.01 m. The afflux would be limited to a distance of between 5 m and 28 m upstream of the upstream end of the proposed structure. All of the land within this area that is adjacent to the watercourse is used for pasture. No residential receptors or other buildings would be affected, including the nearest residential receptors at Gardd Eryi.
- 8.0.3 The hydrograph for the Afon Gyrach is calculated to rise and fall within 10 hours. The model was run in steady-state such that the hydrograph was not used in the model (only the peak flows) however using this as a guide, it is predicted that flood events on this watercourse would be relatively short-lived meaning that effects on the pasture would be limited.
- 8.0.4 The modelling has shown that the proposed structure, which has the same dimensions as the existing A55 structure, will convey flood flows without impact on residential receptors and only minimal, short-lived, impact on pasture for a distance up to 28 m upstream of the structure. As such, the dimensions of the new structure (span, rise) need not be any larger than the existing A55 structure.
- 8.0.5 The freeboard between the peak 1% AEP plus 30% for climate change event flood level and the structure soffit would be 880 mm. The freeboard in the 0.1% AEP event would be 670 mm. In both cases the freeboard is greater than the standard 600 mm generally regarded as sufficient for floating debris would be able to pass under and through the proposed structure.
- 8.0.6 In the event of a blockage, as simulated as part of the sensitivity tests, this is predicted to increase flood levels immediately upstream of the new structure by 0.14 m though 28 m further upstream the afflux is zero. The sensitivity test allowing for error in peak flow calculations predicted the potential for flood levels to rise upstream of the new structure by 0.13 m. Downstream boundary depth and roughness sensitivity tests showed no differences in comparison with the design model runs. The sum of potential increases in flood levels at cross section 100.462 from the various sensitivity tests would therefore be 0.27 m. This would not lead the freeboard above the flood level and structure soffit to be less than 600 mm. The modelling is therefore considered suitably robust to allow the design assumptions to be carried forward.

# **APPENDIX A**

## **AFON GYRACH SURVEY DATA**







## **APPENDIX B CES ROUGHNESS REPORT**

### Roughness values for Afon Gyrach

Roughness (1D only) Manning's 'n' for channels (Chow, 1959)	1D location	Manning's 'n'
River Station 517	GYR01_00517	0.068
River Station 475	GYR01_00475	0.068
River Station 474	GYR01_00474	0.068
River Station 464	GYR01_00464	0.068
River Station 459	GYR01_00459	0.068
River Station 451	GYR01_00451	0.068
River Station 394	GYR01_00394	0.068
River Station 393	GYR01_00393	0.068
River Station 392	GYR01_00392	0.068
River Station 334	GYR01_00334	0.068
River Station 276	GYR01_00276	0.068
River Station 226	GYR01_00226	0.068
River Station 178	GYR01_00178	0.068
River Station 128	GYR01_00128	0.068
River Station 100	GYR01_00100	0.068
River Station 77	GYR01_00077	0.068

<b>Roughness (1D only)</b> <b>Manning's 'n' for channels (Chow, 1959)</b>	<i>1D location</i>	<b><i>Manning's 'n'</i></b>
<b>River Station 43</b>	<i>GYR01_00043</i>	<b><i>0.068</i></b>
<b>River Station 37</b>	<i>GYR01_00037</i>	<b><i>0.068</i></b>
<b>River Station 29</b>	<i>GYR01_00029</i>	<b><i>0.068</i></b>
<b>River Station 27</b>	<i>GYR01_00027</i>	<b><i>0.068</i></b>
<b>River Station 26</b>	<i>GYR01_00026</i>	<b><i>0.068</i></b>
<b>River Station 0</b>	<b><i>GYR01_00000</i></b>	<b><i>0.068</i></b>

<b>ES Chapter 8 Appendices</b>	
8.1	Reptile Survey Report
8.2	Bat Activity Survey Report
8.3	Aquatic Survey Report
8.4	Wintering Bird Survey Report

**APPENDIX 8.1**  
**REPTILE SURVEY REPORT**

R I C H A R D S  
M O O R E H E A D & L A I N G L T D

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P L A N N I N G | L A N D S C A P E | E N V I R O N M E N T

**A55 Junctions 15 and 16 Improvements**

**Reptile Survey Report for Junction 16**

for

**WELSH GOVERNMENT**

November 2019

3066



# R I C H A R D S

M O O R E H E A D & L A I N G L T D

PLANNING | LANDSCAPE | ENVIRONMENT

## A55 JUNCTIONS 15 and 16 Improvements

### Reptile Survey Report for Junction 16

for

Welsh GOVERNMENT

NOVEMBER 2019

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## **1 INTRODUCTION**

### **1.1 Background**

- 1.1.1 Richards Moorehead & Laing Ltd (RML) were commissioned to undertake ecological surveys and assessment to inform the A55 Junctions 15 and 16 road improvement Scheme. A habitat appraisal across the Scheme as to the potential to support reptiles was carried out as part of the initial appraisal. Following on from this habitat appraisal, two areas of land which would be affected by the Scheme were identified for further survey work. This report sets out the methods and results of the reptile surveys undertaken for the J16 Scheme.
- 1.1.2 The Scheme involves changes to both Junction 16 and 16A. At Junction 16 the existing roundabout at the eastern approach to Penmaenmawr would be replaced by westbound on and off-slip roads. The new arrangement at Junction 16 would only be used by westbound vehicles for access to Penmaenmawr and by vehicles leaving Penmaenmawr to travel west towards Bangor. The new at-grade junction would require additional land take to the south of A55 and to the south of Conwy Road to facilitate the west bound on and off slips and connections to Conway Road and Ysguborwen Road.
- 1.1.3 A new grade-separated junction would be constructed further east at Junction 16A, at Dwygyfylchi, with a new overbridge and with on and off east and west bound slip roads that would provide four-way movement. The slip-roads would rise on embankments to a height of 7 metres above the dual-carriageway, to meet an overbridge across the A55.
- 1.1.4 There would also be access off the eastbound off slip road to the Dwr Cymru /Welsh Water (DCWW) water treatment works. A new link road running roughly parallel to the A55 on the south side would form a new junction with Ysguborwen Road in the

west. Extending east it would pass close to the north side of houses in Maes-y-Llan and then loop round the south side of Puffin Café and Service Station to meet the new grade separated Junction 16A. Glan-Yr-Afon Road, to Dwygyfylchi and Capellulo, would meet with the link road at a 'T' junction close to Junction 16A.

## 1.2 Legislation and Protection

1.2.1 There are six species of reptile native to the UK, these are:

- Common (or viviparous) lizard *Lacerta vivipara*;
- Sand lizard *Lacerta agilis*;
- Slow-worm *Anguis fragilis*;
- Adder (or viper) *Vipera berus*;
- Grass snake *Natrix natrix*; and
- Smooth snake *Coronella austriaca*

1.2.2 All reptiles are protected under the Wildlife and Countryside Act 1981 (as amended), making it illegal to intentionally kill or injure a reptiles.

1.2.3 Additional protection is afforded to the rarer reptiles (smooth snake and sand lizard) which also receive legal protection under the Conservation of Habitats and Species Regulations 2017. Under this legislation it is illegal to deliberately injure, kill, capture or disturb a rare reptile, or to damage or obstruct any place used for shelter or protection. Rare reptiles may only be handled by licensed ecologists.

1.2.4 In addition, certain species are also listed as species of Principal Importance in Wales as listed in Section 7 of The Environment (Wales) Act 2016. The Environment (Wales) Act introduces a new, enhanced Biodiversity and Resilience of Ecosystem Duty on public bodies to ensure that biodiversity is an integral part of decision making. Section

7 of the Act places a duty on the Welsh Ministers to publish, review and revise lists of living organisms and types of habitat in Wales, which they consider are of key significance to sustain and improve biodiversity in relation to Wales. Reptile species currently listed on Section 7 include all species with the exception of smooth snake. The Smooth Snake is the UK's rarest reptile and is only found on the heathlands of Dorset, Hampshire, Surrey and West Sussex.

### 1.3 Aims of the Study

The aims of the study are listed below:

- to determine the habitats within the Scheme footprint and assess their potential to support reptiles;
- to carry out presence/ absence surveys based on DMRB guidance

### 1.4 Survey Area Description

1.4.1 The roundabout at Junction 16 consists of poor semi-improved grassland with the adjacent verges of a similar species composition. Broadleaved and mixed plantation woodland occurs around the slip roads to the west and east adjacent to Conway Road and Ysgubowen Road with scrub planting to the north of the A55 associated with the railway and cycle path. Heading east, the grassland is a mixture of improved pasture and poor semi-improved grassland. The Afon Gyrach crosses the Scheme area and flows under the A55 to the east of the Scheme.

1.4.2 The village of Penmaenmawr is located to the west of the Junction, whilst Dwygyfylchi is located to the east beyond which is a caravan park. A sewage works is located on the seaward side of the A55, beyond the railway, to the east of the Junction. The wider environs consist of improved pasture, woodland and heathland.

- 1.4.3 The Scheme would traverse areas of improved and poor semi-improved grassland to the east of the Scheme, a new road is routed across the Afon Gyrach, in fields behind the shell garage through areas of scrub planting and grazed fields where it would join the existing slipway.
- 1.4.5 The location and extent of habitats present are shown on Figures 8.3 to 8.5, which are provided in Volume 2 of the Environmental Statement.



## 2. SURVEY METHODS

### 2.1 Personnel and Quality Assurance

- 2.1.1 All surveys were carried out in accordance with DMRB current best practice guidelines by experienced ecologists. The survey was led by Donna Hall and Robert Jones and assisted by Louise Henry.
- 2.1.2 Principal Ecologist Donna Hall is the ecology lead for this scheme. She is a full member of CIEEM with over 15 years of experience working within multi-disciplinary consultancies. Donna holds European Protected Species survey licenses for bats, great crested newts which cover all counties in England and Wales and a survey license for the white-clawed crayfish (England only). Donna is also an accredited license holder for dormice in Wales in respect of volunteer survey work. Donna has undertaken numerous reptile surveys and has been involved in a large reptile habitat and translocation Scheme in the North West of England and smaller schemes in Denbighshire.
- 2.1.3 Ecologist Robert Jones conducted the surveys. He has been involved in ecology work for ten years and has been licensed to survey dormice (Wales) for four years. He has undertaken numerous surveys including for bats, badgers, reptiles and great crested newts as well as undertaking the Ecological Clerk of Works role for a number of schemes, including for reptile translocation projects.
- 2.1.4 Graduate Ecologist Louise Henry assisted in the surveys. Louise has a degree in Ecology and Environmental Biology and has worked in ecology for 4 years in both the consultancy and voluntary sectors. She is a Graduate member of CIEEM and has a keen interest in botany as well as experience in conducting surveys for bats, reptiles and dormice.

## 2.2 Desk Study and Consultations

2.2.1 The North Wales Environmental Information Service (Cofnod) was contacted in September 2017 (search updated October 2018) to obtain the following ecological data:

- Details of any statutory and non-statutory nature conservation designations within 2 km of the site; and
- Records of any reptile species within 2 km of the site recorded within the last 10 years.

2.2.2 Survey data from previous surveys which were carried out as part of the early Scheme options were reviewed. These were:

- TACP (October 2015) A55 Junctions 15 and 16 Improvements Ecological Statement
- Atkins (January 2009) A55 Junctions 15 & 16 Study Environmental Report
- Natural Resources Wales (NRW) and the County Council Ecologist have been engaged in discussions over the methods and extent of ecological surveys (13th June 2018) and via Environmental Liaison Group meetings. No objection from NRW or the County Ecologist was obtained at that time.

## 2.3. Habitat Appraisal

2.3.1 An appraisal of habitats with the potential to support reptiles was assessed during the extended phase 1 habitat surveys based on guidance produced by DMRB. Habitat was assessed based on the following features:

- a) Location in relation to species range as assessed from existing records obtained from COFNOD;
- b) Vegetation structure: ideal reptile habitat has a variable structure with a mixture of vegetation heights, scrub, bare patches etc;

- c) Insolation and basking sites: reptiles need warm areas on which to bask, these include south facing slopes and/or walls or bare ground;
- d) Aspect and topography: undulating topography, banks, hummocks, hollows, south-facing slopes are all important for reptiles;
- e) Connectivity to nearby good quality habitat: essential to allow colonisation;
- f) Prey abundance and foraging opportunity: areas which contain relatively high concentrations of prey species, generally associated with b, c and d;
- g) Refuge opportunity: places of shelter such as dense scrub, dry stone walls, logs, tree roots;
- h) Hibernation habitat potential: free draining structures, often in south facing banks, which gaps, i.e. dry-stone walls and log piles; and
- i) Disturbance.

2.3.2 The site was then categorised as to whether it provides poor, good or exceptional habitat for reptiles, based on the extent of and occurrence of these features.

## 2.4 Presence / Absence Surveys

2.4.1 Once the habitat had been 'appraised' presence/absence surveys were then conducted based on guidance provided in DMRB to those areas which were found to support good reptile habitat.

2.4.2 Two areas were identified, land to the south of Puffin Café and land to the north of Ysguborwen Rd. The locations of these are provided on Figures 8.10 and 8.11, provided in Volume 2 of the Environmental Statement.

- 2.4.3 Land to the south of Puffin café is 0.93ha, land to the north of Ysguborwen Rd is 1.2ha. Twenty four refugia (constructed from 0.5 m x 0.5 m roofing felt) were deployed within land to the south of Puffin café, whilst thirty four were deployed in land to the north of Ysguborwen Rd. These were deployed on the 16th July and left to ‘bed down’ for one month. Only one size of refugia was utilised as natural refugia occurs on site in the form of dry-stone walls which supplemented the refugia.
- 2.4.4 Five presence/absence surveys were then conducted, in suitable weather conditions over the period 15th August 2019 to 12th September 2019 a minimum of two days apart.

## 2.5 Survey Limitations

- 2.5.1 Limitations to the surveys were that one refugia were moved. Sheep graze the field to the north of Ysguborwen Rd. Horse graze the field to the south of Puffin Café. However, this did not influence the results significantly, as none of the refugia were lost.
- 2.5.2 No detailed population estimate was undertaken as it is considered unnecessary to inform upon the effects of the Scheme. The DMRB states that:

*‘given the large survey effort necessary for population estimates to be made for any species, this should be restricted to those situations where, on the basis of the magnitude of the predicted impacts and the importance of the population, it is clearly warranted’.*

### 3. RESULTS

#### 3.1 Desk Study

- 3.1.1 Sychnant Pass Site of Special Scientific Interest (SSSI) is located 317 m due east. The habitats associated with this SSSI site suitable for reptiles due to areas of heath with smaller areas of bracken and acid grassland. This habitat would not be affected.
- 3.1.2 Records for the grass snake slow worm were recorded 300 m due south within a caravan park adjacent to the golf course.
- 3.1.3 Species records from COFNOD are provided in Table 1.

**Table 1. Reptile records located within 2 km of the Scheme, from the last 10 years.**

Species	Distance from Scheme (m)	Location
Slow worm	305 m	Caravan site
Grass snake	305 m	Caravan site
Grass snake	1056 m	Conwy Mountain
Grass snake	1126 m	Pen Pyra
Common lizard	1301 m	Pensychnant Nature Reserve
Grass snake, common lizard	1371 m	Pensychnant
Common lizard	1382 m	Pensychnant Nature Reserve
Common lizard	1396 m	Pensychnant

Species	Distance from Scheme (m)	Location
Common Lizard	1419 m	Pensychnant Nature Reserve
Common Lizard	1441 m	Pensychnant
Common Lizard	1498 m	Pensychnant Nature Reserve
Common Lizard	1501 m	Pensychnant
Common Lizard	1580 m	Penmaen-bach seepages
Common Lizard	1661 m	Pensychnant
Common Lizard	1721 m	Pensychnant
Grass Snake	1749 m	Pensychnant Nature Reserve
Slow-worm	1756 m	Pensychnant Nature Reserve
Slow-worm, common lizard	1757 m	Pensychnant Nature Reserve
Slow-worm	1759 m	Pensychnant
Common Lizard	1818 m	Gwern Engen, Sychnant Pass
Common Lizard	1853 m	Pensychnant
Common Lizard	1878 m	Pensychnant Nature Reserve
Common Lizard	1892 m	Pensychnant Nature Reserve
Common Lizard	1902 m	Pensychnant Nature Reserve

Species	Distance from Scheme (m)	Location
Common Lizard	1904 m	Pensychnant Nature Reserve
Common Lizard	1974 m	Pensychnant Reserve
Common Lizard	1419 m	Pensychnant Nature Reserve
Common Lizard	1441 m	Pensychnant
Common Lizard	1498 m	Pensychnant Nature Reserve
Common Lizard	1501 m	Pensychnant
Common Lizard	1580 m	Penmaen-bach seepages
Common Lizard	1661 m	Pensychnant
Common Lizard	1721 m	Pensychnant

### 3.2 Previous reports

3.2.1 A Phase 1 habitat survey and initial protected species survey was conducted by TACP in September 2015 in respect of J15 and J16. Their report states that, in general, the surveyed area is of local ecological value for reptiles mainly due to the presence of un- managed grassland, hedgerows.

### 3.3 Habitat Appraisal

3.3.1 No 'exceptional' habitat was noted.

3.3.2 Two areas were identified which were considered to provide 'good' reptile habitat, land to the south of Puffin Café and land to the north of Ysguborwen Rd. The locations of these are provided on Figures 8.10 and 8.11, provided in Volume 2 of the

Environmental Statement. Both of these areas consisted of rough unmanaged grassland (with the exception of mild grazing) a varied structure, with areas of bare ground or dry stone walls which presented basking and refugia opportunities. The main limiting factor is considered to be connectivity to the wider environment and more suitable habitat.

### 3.4 Presence / Absence Surveys

3.4.1 No reptiles were recorded within land to the south of Puffin café. A peak count of eleven<sup>1</sup> slow worms were recorded within land to the north of Ysguborwen Rd. This area is less intensively managed and has a varied structure including dry stone walls, bracken and gorse scrub. The majority of slow worms were recorded along the field boundaries to the east, adjacent to the properties, the locations are highlighted on Figure 8.10, Volume 2 of the Environmental Statement.

3.4.2 The results of the presence / absence surveys are provided in Tables 2 – 7 .

---

<sup>1</sup> Based on five survey visits.



**Tables 2 – 7: Results of the presence absence surveys**

Visit number	1			
Date	15/08/2019			
Surveyor	DH/LH			
Weather	Moderate breeze, sunny intervals,			
Temperature	18 Deg C			
Cloud cover (%)	30			
Time of survey	12pm			
Findings	Slow worm	Common lizard	Adder	Grass snake
Mat / area where found (number of individuals)				
	95 1 Adult male			
	98 1 Adult female			
	15 1 Adult female			
	1 1 Adult female			
	8 3 adult 2 juv			
	14 1 adult			
	101 1 adult female			
Total number of each species	11	0	0	0
Other notes				
Visit number	2			
Date	20/08/2019			
Surveyor	LH/RJ			
Weather	Breezy and sunny			
Temperature	17 deg C			
Cloud cover (%)	50			
Time of survey	11:30			
Findings	Slow worm	Common lizard	Adder	Grass snake
Mat / area where found (number of individuals)				
	98 1 juvenile			
	15 1 adult female			
	1 1 juvenile			
	8 2 adult females			
Total number of each species	5	0	0	0
Other notes				



Visit number	3			
Date	02/09/2019			
Surveyor	LH/RJ			
Weather	slight drizzle, beaufort 4, dew on grass, intermittent sun			
Temperature	17 Deg C			
Cloud cover (%)	7 oktas			
Time of survey	10:30am			
Findings	Slow worm	Common lizard	Adder	Grass snake
Mat / area where found (number of individuals)				
	95 1 juvenile			
	104 1 adult female			
	82 1 adult female			
	109 1 adult female			
Total number of each species	4	0	0	0
Other notes				

Visit number	4			
Date	09/09/2019			
Surveyor	LH/RJ			
Weather	Earlier showers with sunny intervals			
Temperature	16 deg C			
Cloud cover (%)	6 oktas			
Time of survey	10:45			
Findings	Slow worm	Common lizard	Adder	Grass snake
Mat / area where found (number of individuals)				
	98 1 juvenile			
	104 1 adult male			
	12 1 juvenile			
Total number of each species	3	0	0	0
Other notes				



Visit number	5			
Date	12/09/2019			
Surveyor	LH/RJ			
Weather	Strong gusts of wind, sunny spells			
Temperature	19 Deg C			
Cloud cover (%)	6 oktas			
Time of survey	10:30			
Findings	Slow worm	Common lizard	Adder	Grass snake
Mat / area where found (number of individuals)				
	95 2 juvenile			
	104 1 adult female			
	14 1 adult male			
	109 1 adult female			
	109 1 juvenile			
	101 1 adult male			
	101 1 juvenile			
	8 1 adult female			
Total number of each species		9		
Other notes				

### At A Glance - Total Reptiles Found to Date

SLOW WORM	COMMON LIZARD	ADDER	GRASS SNAKE
32	0	0	0

### At A Glance - Peak Counts

SLOW WORM	COMMON LIZARD	ADDER	GRASS SNAKE
11	0	0	0

#### 4. SUMMARY AND CONCLUSION

- 4.1 The findings of the surveys are summarised in this section. Information on species status and distribution has been obtained from The Wales Biodiversity Partnership.
- 4.2 Reptiles have suffered declines in Wales and across the UK and are particularly vulnerable to the effects of habitat loss, fragmentation and change in condition.
- 4.3 No 'exceptional' habitat for reptiles was noted within the Scheme footprint.
- 4.4 Two areas were identified which provided 'good' habitat for reptiles and were subject to presence/ absence surveys.
- 4.5 No reptiles were recorded within land to the south of Puffin café. A peak count of eleven slow worms<sup>2</sup> were recorded within land to the north of Ysguborwen Rd. No other reptile species other than slow worm were encountered.

---

<sup>2</sup> Based on five survey visits



## 5. REFERENCES

- DMRB (May 2005) Volume 10 Environmental Design and Management  
Section 4 The Good Roads Guide – Nature Conservation Part 7 HA 116/05  
Nature Conservation Advice in Relation to Reptiles and Roads
- Environment (Wales) Act 2016  
(<http://www.legislation.gov.uk/anaw/2016/3/contents>)
- Wales Biodiversity Partnership  
<https://www.biodiversitywales.org.uk/Amphibians-Reptiles>
- The Conservation of Habitats and Species Regulations 2017  
<http://www.legislation.gov.uk/uksi/2017/1012/contents/made>
- Wildlife and Countryside Act 1981  
(<http://www.legislation.gov.uk/ukpga/1981/69>)



**APPENDIX 8.2**  
**BAT ACTIVITY SURVEY REPORT**

R I C H A R D S  
M O O R E H E A D & L A I N G L T D

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P L A N N I N G | L A N D S C A P E | E N V I R O N M E N T

**A55 Junctions 15 and 16 Improvements**  
**Bat Activity Survey Report for Junction 16**  
for  
**WELSH GOVERNMENT**

November 2019

3066



# R I C H A R D S

M O O R E H E A D & L A I N G L T D

PLANNING | LANDSCAPE | ENVIRONMENT

## A55 JUNCTIONS 15 and 16 Improvements

### Bat Activity Survey Report for Junction 16

for

#### WELSH GOVERNMENT

November 2019

3066

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## Appendices

Appendix A: Phase 1 Habitat Plan

Appendix B: Bats Survey Maps

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## 1 INTRODUCTION

### 1.1 Background

- 1.1.1 Richards Moorehead & Laing Ltd (RML) were commissioned to undertake bat activity and roost surveys to inform the A55 Junctions 15 and 16 road improvement Scheme. This report sets out the methods and results of the surveys undertaken for the J16 Scheme.
- 1.1.2 The Scheme involves changes to both Junction 16 and 16A. At Junction 16 the existing roundabout at the eastern approach to Penmaenmawr would be replaced by westbound on and off-slip roads. The new arrangement at Junction 16 would only be used by westbound vehicles for access to Penmaenmawr and by vehicles leaving Penmaenmawr to travel west towards Bangor. The new at-grade junction would require additional land take to the south of A55 and to the south of Conwy Road to facilitate the west bound on and off slips and connections to Conway Road and Ysguborwen Road.
- 1.1.3 A new grade-separated junction would be constructed further east at Junction 16A, at Dwygyfylchi, with a new overbridge and with on and off east and west bound slip roads that would provide four-way movement. The slip-roads would rise on embankments to a height of 7 metres above the dual-carriageway, to meet an overbridge across the A55.
- 1.1.4 There would also be access off the eastbound off slip road to the Dwr Cymru /Welsh Water (DCWW) water treatment works. A new link road running roughly parallel to the A55 on the south side would form a new junction with Ysguborwen Road in the west. Extending east it would pass close to the north side of houses in Maes-y-Llan and then loop round the south side of Puffin Café and Service Station to meet the new grade separated Junction 16A. Glan-Yr-Afon Road, to Dwygyfylchi and Capellulo, would meet with the link road at a 'T' junction close to Junction 16A.

## 1.2 Legislation

1.2.1 Bats and their roosts are protected under the Conservation of Species and Habitats Regulations 2017 and the Wildlife and Countryside Act 1981 (as amended). In summary, it is an offence to:

- Deliberately capture, injure or kill a bat
- Deliberately disturb a bat, including in particular any disturbance which is likely:
  1. to impair bats' ability to survive, to breed or reproduce, or to rear or nurture their young, or;
  2. in the case of hibernating or migratory species, to impair their ability to hibernate or migrate, or
  3. to affect significantly the local distribution or abundance of the species to which they belong
- Deliberately takes or destroy the offspring of bats
- Damage or destroy a breeding site or resting place of a bat
- Possess, control, transport, exchange or sell a bat or parts of a bat, alive or dead.

The legislation applies to all life stages of this species.

1.2.2 The Environment (Wales) Act (2016) introduces a new, enhanced Biodiversity and Resilience of Ecosystem Duty on public bodies to ensure that biodiversity is an integral part of decision making. Public authorities will be required to report on the actions they are taking to improve biodiversity and promote ecosystem resilience. The resilience of ecosystems is the main driver for Biodiversity Net Gain (BNG) in Wales.

1.2.3 Section 6 of the Act places a duty on public authorities to seek to maintain and enhance biological diversity (referred to as biodiversity). All public bodies, statutory undertakers, Ministers of the Crown and other public office holders are required to apply the duty when they are carrying on any functions in Wales, or in relation to Wales.

1.2.4 Section 7 of the Act places a duty on the Welsh Ministers to publish, review and revise lists of living organisms and types of habitat in Wales, which they consider are of key significance to sustain and improve biodiversity in relation to Wales. The following bat species are listed on Section 7 of the Act:

- Barbastelle bat *Barbastella barbastellus*
- Bechstein's bat *Myotis bechsteinii*
- Noctule *Nyctalus noctula*
- Common Pipistrelle *Pipistrellus*
- Soprano Pipistrelle *Pipistrellus pygmaeus*
- Brown long-eared bat *Plecotus auritus*
- Greater horseshoe bat *Rhinolophus ferrumequinum*
- Lesser horseshoe bat *Rhinolophus hipposideros*

### 1.3 Aims of the Study

The aims of the study are listed below:

- to determine the potential of structures which may be affected by the Scheme as to their potential to support bats
- to determine the use of the Scheme area by bats
- to make recommendations in order to inform the Schemes proposals

## 1.4 Survey Area Description

- 1.4.1 The survey area included all habitat to be affected by the Scheme with particular focus on boundary features, trees and structures.
- 1.4.2 The roundabout at Junction 16 consists of poor semi-improved grassland with the adjacent verges of a similar species composition. Broadleaved and mixed plantation woodland occurs around the slip roads to the west and east adjacent to Conway Road and Ysgubowen Road with scrub planting to the north of the A55 associated with the railway and cycle path. Heading east, the grassland is a mixture of improved pasture and poor semi-improved grassland. The Afon Gyrach crosses the Scheme area and flows under the A55 to the east of the Scheme.
- 1.4.3 The village of Penmaenmawr is located to the west of the Junction, whilst Dwygyfylchi is located to the east beyond which is a caravan park. A sewage works is located on the seaward side of the A55, beyond the railway, to the east of the Junction. The wider environs consist of improved pasture, woodland and heathland.
- 1.4.4 The Scheme would traverse areas of improved and poor semi-improved grassland to the east of the Scheme, a new road is routed across the Afon Gyrach, in fields behind the shell garage through areas of scrub planting and grazed fields where it would join the existing slipway.
- 1.4.5 The location and extent of habitats present are shown on Figures 8.3 to 8.5, which are provided in Volume 2 of the Environmental Statement and Appendix A of this report.



## 2. SURVEY METHODS

### 2.1 Personnel and Quality Assurance

2.1.1 All surveys were carried out in accordance with current best practice guidelines under the supervision of senior staff and appropriately licensed and/or experienced ecologists. The survey was led by Donna Hall (79592a:OTH:CSAB:2018) and assisted by Louise Henry, Matt Moss, Robert Jones and Bev Plummer (79592A:OTH:CSAB:2018).

### 2.2 Desk Study and Consultations

2.2.1 The North Wales Environmental Information Service (Cofnod) was contacted in September 2017 (search updated October 2018) to obtain the following ecological data:

- Information on statutory designated sites within distances of 30.0 km for Special Area of Conservation (SAC) designated for bats;
- Details of any statutory and non-statutory nature conservation designations which could support bats within 2 km of the site; and
- Records of any bat species within 2 km of the site recorded within the last 10 years.

2.2.2 Survey data from previous bat surveys which were carried out as part of the early Scheme options were reviewed. These were:

- TACP (October 2015) A55 Junctions 15 and 16 Improvements Ecological Statement
- Atkins (January 2009) A55 Junctions 15 & 16 Study Environmental Report

2.2.3 Natural Resources Wales (NRW) and the County Council Ecologist have been engaged in discussions over the methods and extent of ecological surveys (13th June 2018).

## 2.3 Preliminary Roost Assessment

- 2.3.1 Trees were assessed, from the ground, for the presence of potential roosting features (PRF) including holes in the trunk and lifted bark, and signs of bat presence including staining and scratch marks. The survey was conducted as part of the extended Phase 1 habitat surveys. Surveyors were equipped with close focus binoculars, high-powered torch and endoscope.
- 2.3.2 No existing structures would be directly affected by the Scheme, as such no roost assessment to structures was necessary.
- 2.3.3 The BCT Bat Survey Good Practice Guidelines (BCT. 2016 ) were used as a basis to evaluate the site features for their potential to support bats during summer and winter. Each tree was then categorised as per the criteria within the Bat Conservation Trust (BCT) survey guidelines as summarised in Table 1.

**Table 1. Assessment of Potential Roost Features and Habitat**

Suitability	Description of roosting habitat	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats	Lack of vegetation and foraging habitat within vicinity of the site and no connections to semi-natural habitats. Site located in a highly urbanised environment.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically.  No visible features within tree structure such as crevices, holes in trunk, hazard beam splits. However, it may have ivy cladding	Small amount of isolated habitat on site providing a potential foraging resource i.e. a single tree or a patch of introduced shrub. Maybe linked to small amount of adjacent semi-natural habitat surrounding site, however there are no distinct links to habitat further away.

Suitability	Description of roosting habitat	Commuting and foraging habitats
	and hidden features due to the size and age of the tree.	
Moderate	A structure or tree with one or more potential roost features that could be used by a larger number of bats but unlikely to support a roost of high conservation concern.	Suitable continuous habitat with good connectivity to the wider landscape such as trees, scrub, hedgerow, grassland.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and offers more long term security and likely to support a roost of high conservation concern.	Site is close and connected to known roosts. The site habitat is of high quality for foraging bats and includes features such as woodland, tree lined water courses, field margins and hedgerows. The site is well connected within the landscape to surrounding habitats and strong linear features such as hedgerows and tree lines extend from the site to the wider landscape.
Confirmed	Presence of field signs indicative of a bat roost including staining and scratch marks around a potential roost entry point combined with the following; urine staining, droppings clustered beneath a potential roosting feature and the presence of live or dead bats.	N/A

## 2.4 Bat Activity Survey - Transects

2.4.1 Bat activity surveys were conducted which included five transect surveys between June 2018 - September 2018 (inclusive) and three transects conducted between May – September 2019 (to land not accessible during the surveys conducted in 2018),

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survey dates are provided in Table 2 and 3. The survey effort was based on the habitat being of low suitability (due to the Schemes largely urban nature, following best practice guidance (Table 8.3 BCT 2016). This involves one survey visit per season (Spring – April/May, summer – June/July/August, autumn – September/October). Each transect route was initially scoped during daylight hours.

- 2.4.2 Due to late access provisions in 2018, bat surveys were not conducted within April/May as such the lack of April/May surveys may have missed some early season behaviours/activities. However, this was supplemented by conducting two transect surveys in June and by three surveys conducted over the summer or autumn period, making a total of five surveys.
- 2.4.3 Dusk surveys commenced on or just before sunset and lasted up to 3hrs after sunset (dependent upon length of transect route). Pre - dawn surveys commenced 1.5 – 2hrs before sunrise to on or just after sunrise. The transects were walked slowly by the surveyors using visual observations and recordings from bat detectors (Anabat walkabout and bat box duet) to identify bat activity and species.
- 2.4.4 Surveyors stopped for five minutes at locations along the route so as to gain additional information at ‘high risk’ locations, i.e. those where suitable habitats would be affected. All surveys were conducted in suitable weather conditions.
- 2.4.5 The bat transect routes are shown on Figures 8.6 - 8.9, Volume 2 of the Environmental Statement and Appendix B. Survey dates are provided in Table 2 (2018) and Table 3 (2019).

**Table 2. Transect route survey dates 2018**

Survey number	Month	Date	Dusk/pre-dawn
1	June	14/06/2018	Dusk
2	June	28/06/2018	Dusk (reversed)

Survey number	Month	Date	Dusk/pre-dawn
3	July	24/07/2018	Dawn
4	August	07/08/2018	Dusk (reversed)
5	September	04/09/2018	Dusk

**Table 3. Transect route survey dates 2019**

Survey number	Month	Date	Dusk
1	May	22/05/2019	Dusk
2	August	28/08/2019	Dusk (reversed)
3	September	18/09/2019	Dusk

2.4.6 During the surveys, the following details were noted:

- Weather and temperature
- Time bat detected/seen
- Frequency (kHz) at which the bat was detected
- Location within the survey area
- Direction of flight
- Species of bat
- Number of bats present
- Whether the bats appeared to be foraging or commuting

## 2.5 Emergence / Return to Roost

2.5.1 No emergence return to roost surveys were conducted to any trees as trees which may be affected were categorised as having negligible – low potential. Based on

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Table 7.1 of BCT guidelines, no further activity surveys are required, however this would need to be re-assessed as the Scheme progresses and further surveys undertaken if necessary.

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## 2.6 Static Detectors

- 2.6.1 Anabat Swift Detectors were deployed used in conjunction with the bat activity transects, placed at areas of higher value for bats (i.e. hedgerows, watercourses) which would be affected by the Scheme and where suitable locations could be accessed, and detectors were not at risk from theft.
- 2.6.2 The detectors were left in-situ for a minimum of five days, between the months of July – September in 2018 and July – October in 2019. Generally, the habitat within the Scheme area is considered to be of low value based on the guidance provided in Table 1. Following guidance as set out within the BCT Guidelines (Table 8.3 of the guidelines) static detector deployment used in conjunction with transect surveys should be conducted at one location per transect with data to be collected over five nights per season (spring-April/May, summer – June/July/August and autumn – September/October).
- 2.6.3 The detectors were set to automatically start recording at dusk until dawn. The locations of the statics and dates set are provided in Table 4. Locations of the static detectors deployed during the transects are also provided on Figures 8.6 to 8.9, Volume 2 of the Environmental Statement. The arrow on the figures represents the direction that the microphone was facing.

**Table 4. Locations of statics and dates set 2018 and 2019.**

Ref / Location	Date set	Date retrieved
<b>2018</b>		
ST1 / Afon Gyrach facing upstream to the north of the A55 and railway bridges	19 <sup>th</sup> June 2018	24 <sup>th</sup> June 2018

Ref / Location	Date set	Date retrieved
ST2 / Afon Gyrach facing downstream under the culverts towards the sea	17 <sup>th</sup> July 2018	22 <sup>nd</sup> July 2018
ST3/ due north within scrub opposite the Oasis centre	14 <sup>th</sup> August 2018	19 <sup>th</sup> August 2018
ST4/ Afon Gyrach facing downstream located in section of river adjacent to residential properties	24 <sup>th</sup> September 2018	1 <sup>st</sup> October 2018
<b>2019</b>		
ST1 / facing due east along hedge in fields to the north of Ysguborwen Rd	18 <sup>th</sup> July 2019	22 <sup>nd</sup> July 2019
ST2 / facing due west along hedge in fields to the north of Ysguborwen Rd	28 <sup>th</sup> August 2019	1 <sup>st</sup> September 2019
	21 <sup>st</sup> October 2019	28 <sup>th</sup> October 2019
ST3 / facing due east along hedge in fields to the south of the A55. East of Junction 16A.	18 <sup>th</sup> July 2019	22 <sup>nd</sup> July 2019
ST4 / facing due west along hedge in fields to the south of the A55. East of Junction 16A.	2 <sup>nd</sup> September 2019	8 <sup>th</sup> September 2019
	15 <sup>th</sup> October 2019	20 <sup>th</sup> October 2019

## 2.7 Data Analysis

2.7.1 After completion of each survey session and static detector recordings, digital bat recordings were analysed using Anabat Insight analysis software to confirm species identification. All the recordings were analysed using the 'BatClassify' Auto ID Plugin with an ID Tag Certainty Threshold of 60% match. Any obvious noise files were selected and removed to a separate folder. After running the analysis program, each recording was then audited and assessed following guidance as set out in Russ 2012 and Middleton et al (2014).

## 2.8 Survey Limitations

- 2.8.1 Due to late access provisions in 2018, bat surveys were not conducted within April/May as such the lack of April/May surveys may have missed some early season behaviours/activities. However, two transect surveys were conducted in June and static deployment was supplemented by three surveys conducted over the summer or autumn period. It is unlikely that species encountered, or numbers would alter the assessment of effects upon bats.
- 2.8.2 The field to the west of the Scheme (just to the east of Junction 16) was subject to three walked transects during 2019 conducted in May, August and September. No access was available to this field in 2018, though transects were conducted on PRow which include the footpaths which run adjacent to the A55 and Ysguborwen Rd. Very few bats were recorded adjacent to the A55. Static detectors were deployed within this field in August 2018 (on a fence post located outside the field boundary but directed towards the field) and July, August and October 2019 (along the hedgerow field boundary).
- 2.8.3 The field to the east of Junction 16A was subject to three walked transects in May, August and September 2019. Static detectors were deployed along the field boundary to the north in July, September and October 2019.
- 2.8.4 The time during the evening that the transect routes are surveyed would inevitably lead to a bias in relation to the time at which surveyors are positioned in the

transect and the bats that are recorded. To limit this bias, the starting point of the transect survey was alternated on each survey round.

- 2.8.5 Locations for the deployment of statics was constrained by access and the potential for theft or interference from locals. However, it is considered that all representative habitats within the Scheme footprint have been adequately surveyed.
- 2.8.6 Only one night of recording was possible in September 2018 at ST4 located upstream of the Afon Gyrach due to the memory card being full. There was a lot of recorded 'noise' due to its position near some riffles in the river which used up the card memory. In total, the Afon Gyrach which is considered to be a feature of higher value for bats within a Scheme context, was subject to static surveys in June, July and September 2018, a total of thirteen nights of surveys. In addition, this watercourse was subject to five walked transects, twice in June and once in July, August and September 2018, which is considered adequate to gain an understanding of use of the river corridor by bats.
- 2.8.7 No emergence return to roost surveys were conducted to any trees as trees which may be affected were categorised as having negligible – low potential. Based on Table 7.1 of BCT guidelines, no further activity surveys are required, however this would need to be re-assessed as the Scheme progresses and further surveys undertaken if necessary.



### 3. RESULTS

#### 3.1 Desk Study

3.1.1 Two Special Areas of Conservation (SACs) where bats are a feature interest are located within 30 km of the Scheme. These are:

- Mwyngloddiau Fforest Gwydir/ Gwydyr Forest Mines SAC, located 16.8 km due south
- Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC located 25 km due south.

3.1.3 The Lesser horseshoe bat *Rhinolophus hipposideros* is a feature of all of these sites.

3.1.3 There is one Site of Special Scientific Interest (SSSI) within 2 km, this is Sychnant Pass SSSI located 317 m due east.

3.1.4 There are no Local Nature Reserves (LNR) within 2 km.

3.1.5 Eight Candidate Local Wildlife Sites (LWS) are present within 2 km of the survey area, the closes of which is Orme View Vegetated Shingle and Reedbed located 73 m due north.

3.1.6 There are twenty two Ancient Semi-natural woodland sites, including Restored Ancient Woodland and Plantation on Ancient Woodland within 2 km of the survey area. The closest of which is located to the east of the Scheme at the base of the headland near to Penmaenbach tunnel approximately 50m east of the Scheme.

3.1.7 A number of bats were highlighted during the desk study, including noctule *Nyctalus noctula*, lesser horseshoe *Rhinolophus hipposideros*, soprano and common pipistrelle *Pipistrellus pygmaeus* and *P. pipistrellus* and whiskered/brandts *Myotis mystacinus/brandtii* agg, all recorded within 2 km of the survey area. The nearest roost is in Dwygyfylchi located within 300m in a property off of Glanyrafon Road. In

addition, a large maternity roost for the lesser horseshoe bat is located approximately 1.4 km due east in Pensychnant.

### 3.1.8 Species records from COFNOD are provided in Table 5.

**Table 5. Bat records located within 2 km of the Scheme, from the last 10 years.**

Species	Distance from Scheme (m)	Type of record
Noctule bat	197 m	Heard not seen
Common pipistrelle	197 m	Foraging over trees
Lesser horseshoe bat	197 m	Heard not seen
Noctule bat	300 m	Foraging
Common pipistrelle	300 m	Summer day roost in property
Soprano pipistrelle	300 m	Summer day roost in property
Lesser horseshoe bat	300 m	Foraging
Common pipistrelle	400 m	Roost
Common pipistrelle	520 m	Summer day roost in property
Soprano pipistrelle	520 m	Summer day roost in property
Lesser horseshoe bat	520 m	Foraging
Noctule bat	588 m	Foraging
Lesser horseshoe bat	588 m	Foraging

Species	Distance from Scheme (m)	Type of record
Common pipistrelle	600 m	Roost
Soprano pipistrelle	600 m	Roost
Common pipistrelle	616 m	Commute
Soprano pipistrelle	616 m	Commute
Whiskered/Brandt's bat agg.	1483 m	-
Noctule bat	1483 m	-
Common pipistrelle	1483 m	-
Soprano pipistrelle	1483 m	-
Lesser horseshoe bat	1483 m	Maternity roost

### 3.2 Previous reports

3.2.4 A Phase 1 habitat survey and initial protected species survey was conducted by TACP in September 2015 in respect of J15 and J16. Their report states that, in general, the surveyed area is of local ecological value for roosting and foraging bats.

### 3.3 Preliminary Roost Assessment

3.3.1 Trees which would be affected by the Schemes proposal were subject to a preliminary roost assessment. This included trees adjacent to Glan-Yr-Afon Rd (BRP 1 – BRP 5 on Figure 8.9, Volume 2 of the Environmental Statement) and two groups of pine located along the field boundary to the south of Puffin Café (BRP 7 and BRP 8 on Figure 8.7, Volume 2 of the Environmental Statement). No emergence surveys were

deemed necessary at this stage based on their current roost status of low or negligible. Table 7.3 of BCT guidance states that where trees were found to have low roost potential, no further surveys are required. However, it is advised that trees are re-assessed as the Scheme progresses.

### 3.4 Bat Activity Surveys – Transects

- 3.4.1 Five species of bat were recorded during the walked transects conducted in 2018 and 2019 as shown of Figures 8.6 to 8.9, Volume 2 of the Environmental Statement and Appendix B. These are common and soprano pipistrelle, noctule, whiskered/brandts and Daubentons *Myotis daubentonii* all recorded in 2018 and common and soprano pipistrelle, noctule, whiskered/brandts recorded in 2019.
- 3.4.2 The majority of activity was recorded along the Afon Gyrach and to the west of the Scheme area near to Junction 16 (stopping point 3 on Figure 8.6 Volume 2 of the Environmental Statement and Appendix B of this report) and to the east adjacent to the woodland.
- 3.4.3 The results of the transect survey provided in Table 6. The locations of the transect routes are provided on Figures 8.6 to 8.9 Volume 2 of the Environmental Statement and Appendix B of this report.

Key for table 6.

Ppip = Common pipistrelle *Pipistrellus pipistrellus*

Ppyg = Soprano pipistrelle *P. pygmaeus*

Nnoc = Noctule *Nyctalus noctula*

Mdau = Daubentons *Myotis daubentonii*

Mbra/Mmys = Whiskered/Brandts *Myotis brandtii/ Myotis mystacinus*

Pip = Pipistrelle species

SP# = Stopping point number

**Table 6. Transect survey results 2018 and 2019**

Date	Start and end times and time of sunset/sunrise	Transect route and survey number	Weather conditions	Time/Species recorded/ /Location and activity
14/06/2018	Start: 21:53 Finish: 00:15 Sunset: 21:44	Survey 1	Moderate, dry, 10% cloud cover. Average relative humidity of 45%. Average temperature of 17.7 °C.	23:43 – Ppip, Ppyg, Mdau, SP7, foraging along stream. Calls heard all of 5 minutes stopped for. 00:12 – Ppip, SP8, x1 pass heard not seen. 00:15-00:17 – Ppyg, Ppip, on Ffordd Glan yr Afon with Afon Gyrach passing underneath, x4 passes seen not heard.
28/06/2018	Start: 21:45 Finish 1:00 Sunset: 21:47	Survey 2	Calm, clear, no cloud, average relative humidity 42%, average temperature 24.9°C.	22:27 – 2 x bats species unknown, SP10, flying near canopy of tree, x1 pass close to stream. 23:37 – Ppip, Mdau, SP5, x3 passes foraging over water. 00:12 – Ppip, near SP3, x1 pass heard not seen. 00:20 – Ppip, SP3, x1 pass heard not seen / plantation tree line next to road. 00:37 – Ppip, SP1, x2 passes heard not seen 00:47 – Ppip, next to Saint Gwinin’s Church, x1 pass heard not seen. 00:55 – Ppip, lane to SP9, x1 pass heard not seen.
24/07/2018	Start: 3:00 Finish: 5:20 Sunrise: 5:19	Survey 3	Calm to moderate, light drizzle persistent, average relative humidity 65%, average temperature 18°C.	3:05 – Ppip, near SP1, x3 passes foraging. Calls heard all of 5 minutes stopped for (see below). 3:07 – Ppip, SP1, x3 passes foraging. 3:23 – Ppip, near SP3, x6 passes foraging. 3:42 – Ppip, footpath near to Puffin Café, foraging along footpath near to lamppost. 4:06 – Nnoc, near SP4, heard not seen.

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Date	Start and end times and time of sunset/sunrise	Transect route and survey number	Weather conditions	Time/Species recorded/ /Location and activity
				4:24 – Ppyg, SP7, Afon Gyrach culvert, x1 pass heard not seen.
07/08/2018	Start: 20:53 Finish: 23:34 Sunset: 21:00	Survey 4	30% cloud cover, moderate/calm windspeed, average relative humidity 47%, average temperature 15°C.	<p>21:33 – Ppyg, SP10, foraging near Afon Gyrach.</p> <p>21:35 – Ppyg, SP10, foraging near Afon Gyrach.</p> <p>21:36 – Ppyg, Ppip, SP10, foraging, a couple of passes.</p> <p>21:38 – Ppyg, SP10, x1 pass.</p> <p>21:40 – Ppyg, Afon Gyrach river crossing, x1 pass foraging along river.</p> <p>21:47 – Ppip, SP11, heard not seen foraging, pass.</p> <p>22:00-22:04 – Ppip, Ppyg, Mbra/Mmys, Afon Gyrach, SP5, foraging along river, flying in front of culvert and went through culvert to beach.</p> <p>22:16 – Possibly Ppip, faint, SP6, heard not seen.</p> <p>22:37 – Ppip, near SP4 near train tunnel and scrub/trees, 1 pass, a few bats, heard not seen</p> <p>22:39-22:42 – 2x Ppip, SP4, foraging up and down near tunnel entrance foraging.</p> <p>22:47 – Nnoc, in between SP4 and SP5</p> <p>23:09 – Ppip, SP3, x1 pass heard not seen.</p> <p>23:11-23:14 – Ppip, SP3, a few passes up and down tree line.</p> <p>23:17 – Ppip, near road crossing and Oasis Centre, x1 pass.</p> <p>23:19 – Ppip, SP2, trees near the Oasis Centre, x1 pass heard not seen.</p> <p>23:24 – Ppip, on road near SP2, x1 pass heard not seen.</p>

Date	Start and end times and time of sunset/sunrise	Transect route and survey number	Weather conditions	Time/Species recorded/ /Location and activity
				23:27 – Ppip, SP1, a few passes foraging, heard not seen. 23:31 – Ppip, SP1, x1 pass heard not seen. 23:34 – Ppip, east of SP1 x2 passes.
04/09/2018	Start: 20:00 Finish: 22:42 Sunset: 20:00	Survey 5	5% cloud cover, calm, average relative humidity 61.5%, average temperature 15°C.	20:20 – Ppip, just south of Junction 16 roundabout, commuting. 20:59 – Ppip, SP4, foraging along vegetation along train line. 21:20-21:24 – 2x Mdau sp., SP5 Afon Gyrach, foraging near and under culvert to beach. 22:08 – Ppyg, SP10, x2 passes foraging. 22:16-22:19 – Mdau sp., SP7, a few passes foraging and social calls. 22:22 – Nnoc, between SP7 and SP8, x1 pass heard not seen. 22:28 – Nnoc, SP9, x1 pass heard not seen. 22:31 - Nnoc, SP9, x1 pass heard not seen.
22/05/2019	Start: 21:10 Finish: 23:36 Sunset: 21:19	Survey 1	30% cloud cover, calm, average relative humidity 69%, average temperature 14°C.	<b>East Route</b> 21:51 – Ppip SP4 few passes foraging just below the tree canopy along woodland edge 21:58 – Ppip between SP4 and SP5 x 2 bats foraging up and down along woodland edge 22:04 – Ppyg SP5 continual foraging over and around scrub and tree planting 22:14 – Ppip Foraging along hedge within centre of field x 1 pass 22:17 – Ppip x 2 Foraging around trees with centre of field <b>West Route</b>

Date	Start and end times and time of sunset/sunrise	Transect route and survey number	Weather conditions	Time/Species recorded/ /Location and activity
				22:49 – Pip SP3 few passes, foraging over vegetation 22:51 – Ppip x 2 passes along boundary vegetation, foraging 22:59 – Ppip near to SP1 x 1 pass 23:13 – Ppip near to SP5 x 1 pass 23:19 – Ppip few passes, near to SP5 23:29 – Ppip x 1 pass SP2 23:32 – Ppip x 1 pass SP2 23:34 – Nnoc x 1 pass between SP1 and SP2 23:34 – Ppip x 1 pass east of SP2
28/08/2019	Start: 20:13 Finish: 22:42 Sunset: 20:13	Survey 2	0% cloud cover, calm, average relative humidity 56%, average temperature 15.5°C.	<b>West Route</b> 20:57 - Ppip heard not seen, field boundary west of SP3, centre of field 20:58 – Ppip forage along hedge field boundary west of SP3, centre of field 21:02 – Ppip as above 21:04 – Ppip, SP2 x 3 bats foraging around vegetation and along tree line <b>East Route</b> 21:47 – Ppip, SP7 X 1 pass 21:56 – Ppyg, SP6 heard not seen 22:02 – Ppip, SP5 x 2 bats foraging up and down woodland edge, social calls 22:10 – Ppip, SP4, x 2 passes and social calls 22:17 – Ppip, SP3, x 3 passes, heard not seen, social calls 22:26 - 22:28 – Ppip, Ppyg, SP2, few passes, heard not seen 22:32 – Ppip, SP2, few passes, heard not seen, foraging

Date	Start and end times and time of sunset/sunrise	Transect route and survey number	Weather conditions	Time/Species recorded/ /Location and activity
18/09/2019	Start: 19:26 Finish: 21:21 Sunset: 19:22	Survey 3	10% cloud cover, calm average relative humidity 66%, average temperature 12.5°C.	<p><b>West Route</b>  19:44 – Ppyg, SP3, x 1 pass and circled back at canopy height  19:49 – Ppip, south boundary near to residential properties, heard not seen x 2 passes  19:51 – Ppip, between SP2 and SP1, few passes up and down tree/hedge line  19:55 – Ppip, near to SP2, foraging along tree line  19:57 – Ppip, as above  20:03 – Ppyg, between SP4 and SP5, foraging around vegetation, along boundary</p> <p><b>East Route</b>  20:29 – Ppip, between SP3 and SP4, along tree line, x 1 pass heard not seen  20:36 – Mdau, SP4, heard not seen x 2 passes  20:54 – Ppip, SP2, few passes up and down woodland edge  20:59 – Ppyg, SP4, x 1 pass heard not seen, likely foraging along woodland edge  21:03 – Ppip, SP5, x 1 pass heard not seen, likely foraging along woodland edge</p>

### 3.5 Static Detectors

- 3.5.1 Static detectors were deployed in 2018 and 2019. In 2018 one was positioned on a fence post within an area of scrub and tree planting off the Ysguborwen Rd opposite the Oasis Christian Centre (ST3, Figure 8.6 Volume 2 of the Environmental Statement) and along the Afon Gyrach (ST1, ST2 and ST4, Figure 8.7 Volume 2 of the Environmental Statement). In 2019, when more areas were available for access, statics were positioned along HR1 (ST1 and ST2 on Figure 8.8 Volume 2 of the Environmental Statement) and HR8 and HR9 (ST3 and ST4 respectively, Figure 8.9 Volume 2 of the Environmental Statement).
- 3.5.2 Tables 7 and 8 detail the results obtained from the static detectors including species and number of passes recorded throughout the duration of the evening (dusk until dawn) with the analysis run as counts per minute. Graphs 1 – 10 show total number of passes per species per location.

Key for tables 7 and 8.

Ppip = Common pipistrelle *Pipistrellus pipistrellus*

Ppyg = Soprano pipistrelle *P. Pygmaeus*

MbraMmys = Whiskered/Brandts *Myotis mystacinus/brandtii* agg

Nnoc = Noctule *Nyctalus noctula*

Mnat = Natterers *Myotis nattereri*

Mdau = Daubentons *Myotis daubentoniid*

Rhip = Lesser Horseshoe bat *Rhinolophus hipposideros*

*Myotis* sp.

*Pip* sp.



**Table 7. Static detector results Junction 16 - 2018**

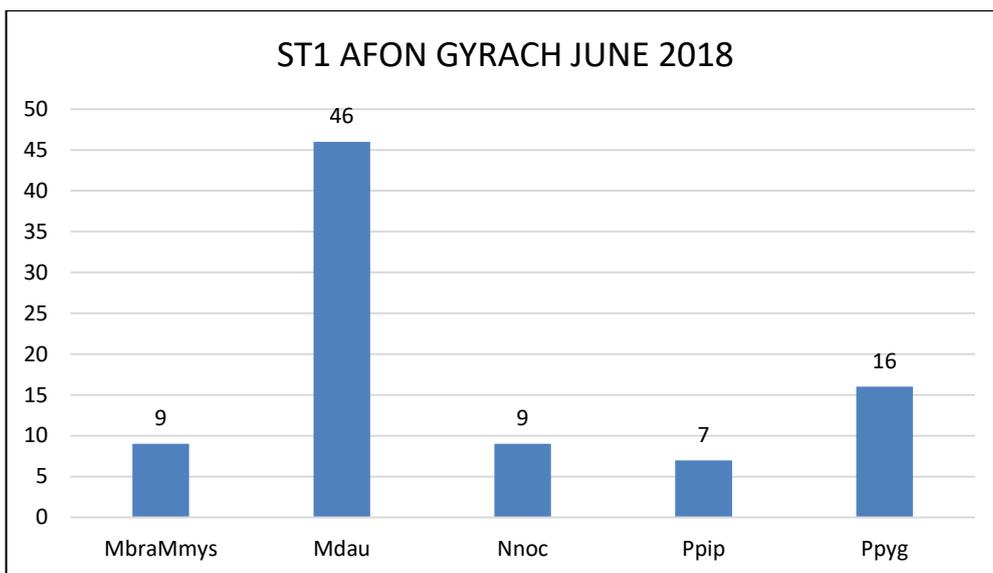
Location	Dates set	Sunset / sunrise	Min Temp Deg C <sup>1</sup>	Species recorded/number of passes per minute	Time of first/last recording
ST1 / Afon Gyrach facing upstream to the north of the A55 and railway bridges	19 <sup>th</sup> – 24 <sup>th</sup> June	21:43 (19 <sup>th</sup> ) 21:47 (24 <sup>th</sup> )  04:48 (19 <sup>th</sup> ) 04:49 (24 <sup>th</sup> )	Min – 8.6 Max – 20.2	MbraMmys 9 Mdau 46 Nnoc 9 Ppip 7 Ppyg 16	22:27 / 00:36 22:28 / 01:58 23:47 / 02:18 23:18 / 00:41 22:48 / 00:47
ST2 / Afon Gyrach facing downstream under the culverts towards the sea	17 <sup>th</sup> – 22 <sup>nd</sup> July-	21:30 (17 <sup>th</sup> ) 21:22 (23 <sup>rd</sup> )  05:10 (17 <sup>th</sup> ) 05:18 (23 <sup>rd</sup> )	Min – 12.2 Max – 18.7	MbraMmys 38 Mdau 20 Myotis sp 10 Nnoc 11 Pip sp. 8 Ppip 785 Ppyg 2377	22:12 / 02:55 23:07 / 04:11 23:02 / 03:02 21:01 / 23:01 23:32 / 00:59 22:03 / 04:33 22:01 / 04:56
ST3/ due north within scrub opposite the Oasis centre	14 <sup>th</sup> – 19 <sup>th</sup> August	20:45 (14 <sup>th</sup> ) 20:35 (19 <sup>th</sup> )  05:54 (14 <sup>th</sup> ) 06:03 (19 <sup>th</sup> )	Min – 14.4 Max – 21.1	Ppip 377 Ppyg 1	21:15 / 04:57 00:32 / 00:32
ST4/ Afon Gyrach facing downstream located in section of river adjacent to residential properties	24 <sup>th</sup> Sept – 1 <sup>st</sup> Oct*	19:08 (24 <sup>th</sup> )  07:03 (24 <sup>th</sup> )	Min – 8.8 Max – 11.8	MbraMmys 32 Mdau 7 Mnat 32 Myotis sp 2 Ppip 88 Ppyg 4	19:40 / 03:06 20:14 / 03:07 20:25 / 04:43 03:48 / 04:25 19:35 / 03:23 19:43 / 20:16

<sup>1</sup> Recorded over deployment period

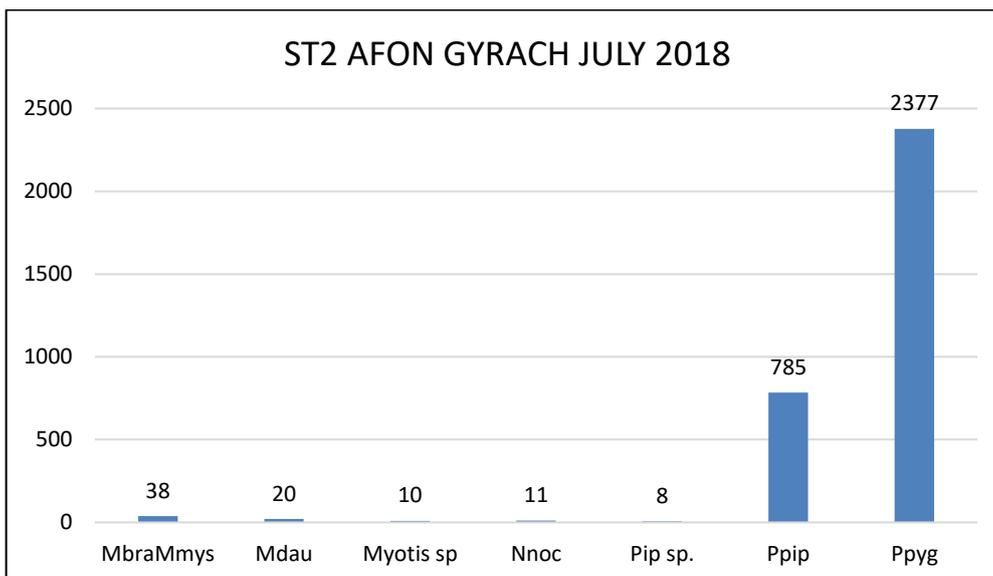
Location	Dates set	Sunset / sunrise	Min Temp Deg C <sup>1</sup>	Species recorded/number of passes per minute	Time of first/last recording
* = only one night of recording was carried out, memory card was full due to recording of 'noise' from the watercourse					

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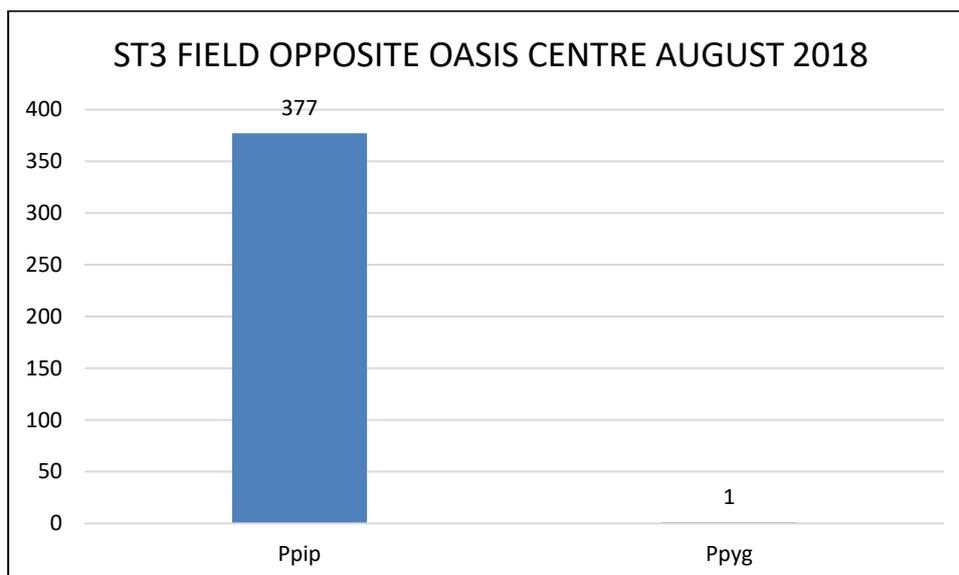




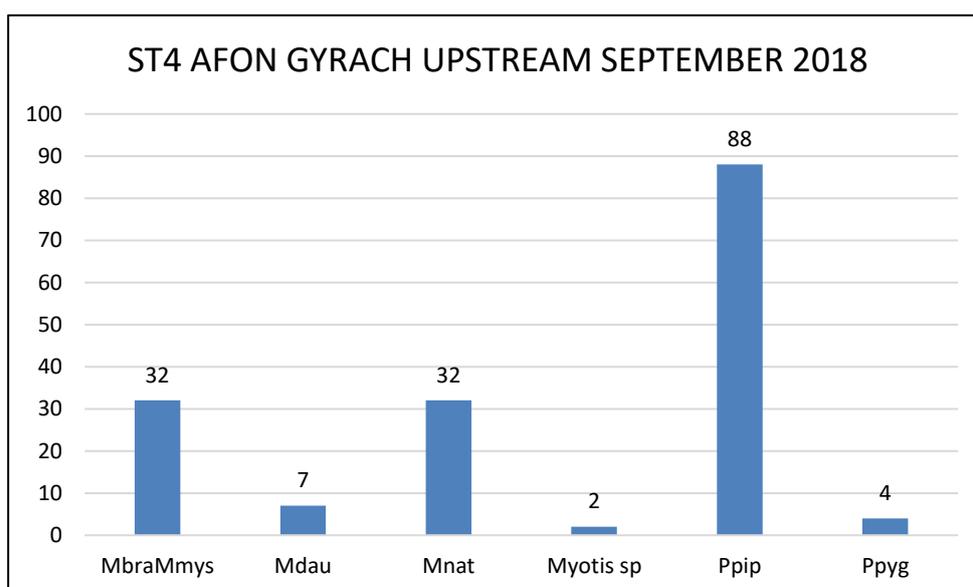
**Graph 2: Afon Gyrach facing upstream to the north of the A55 and railway bridges. Total number of passes per species / per month**



**Graph 3: Afon Gyrach facing downstream under the culverts towards the sea. Total number of passes per species / per month**



**Graph 4: Due north within scrub opposite the Oasis centre. Total number of passes per species / per month**



**Graph 5: Afon Gyrach facing downstream located in section of river adjacent to residential properties. Total number of passes per species / per month**

3.5.3 The follow species were recorded on the statics located along the Afon Gyrach:

- a) Whiskered/Brandts;
- b) Daubentons;
- c) Natterers;
- d) Myotis sp;
- e) Noctule;
- f) common pipistrelle; and
- g) soprano pipistrelles.

3.5.4 A total of seven species were recorded, the majority of activity was from the soprano pipistrelle with a large number of passes recorded in July. Only one night of recording was possible at ST4 located upstream due to the memory card being full. Within a Scheme context, the Afon Gyrach is considered to be an important foraging and commuting habitat.

3.5.5 Only common and soprano pipistrelles were recorded within the area of scrub and tree planting off the Ysguborwen Rd opposite the Oasis Christian Centre (ST3), with all but one of the passes from the common pipistrelle.



**Table 8. Static detector results Junction 16 - 2019**

Location	Dates set	Sunset / sunrise	Min Temp Deg C <sup>2</sup>	Species recorded/number of passes per minute	Time of first/last recording
ST1 / facing due east along hedge in fields to the north of Ysguborwen Rd	18 <sup>th</sup> – 22 <sup>nd</sup> July	21:32 (18th) 21:27 (22nd)  05:11 (18th) 05:17 (22nd)	Min – 12.8 Max – 20.8	Nnoc 53 Ppip 7	19:00 / 23:03 00:03 / 02:57
ST2 / facing due west along hedge in fields to the north of Ysguborwen Rd	28 <sup>th</sup> Aug – 1 <sup>st</sup> Sept	20:14 (28 <sup>th</sup> ) 20:05 (1 <sup>st</sup> )  06:18 (28 <sup>th</sup> ) 06:25 (1 <sup>st</sup> )	Min – 12.6 Max – 21.2	Nnoc 21	19:58 / 06:19
	21 <sup>st</sup> – 28 <sup>th</sup> Oct	18:06 (21 <sup>st</sup> ) 16:51 (28 <sup>th</sup> )  07:53 (21 <sup>st</sup> ) 07:07 (28 <sup>th</sup> )	Min – 10.01 Max – 14.5	Ppip 156 Ppyg 1	19:07 / 03:03 23:24 / 23:24
ST3 / facing due east along hedge in fields to the south of the A55. East of Junction 16A.	18 <sup>th</sup> – 22 <sup>nd</sup> July	21:32 (18th) 21:27 (22nd)  05:11 (18th) 05:17 (22nd)	Min – 13.6 Max – 19.7	Nnoc 2 Ppip 8 Ppyg 36	22:-07 / 02:00 00:30 / 03:35 22:13 / 22:22
ST4 / facing due west along hedge in fields to the south	2 <sup>nd</sup> – 8 <sup>th</sup> Sept	20:03 (2 <sup>nd</sup> ) 19:48 (8 <sup>th</sup> )	Min – 3.9 Max – 19.1	Myotis sp 1 Noctule 4	00:49 / 00:49 21:58 / 01:05

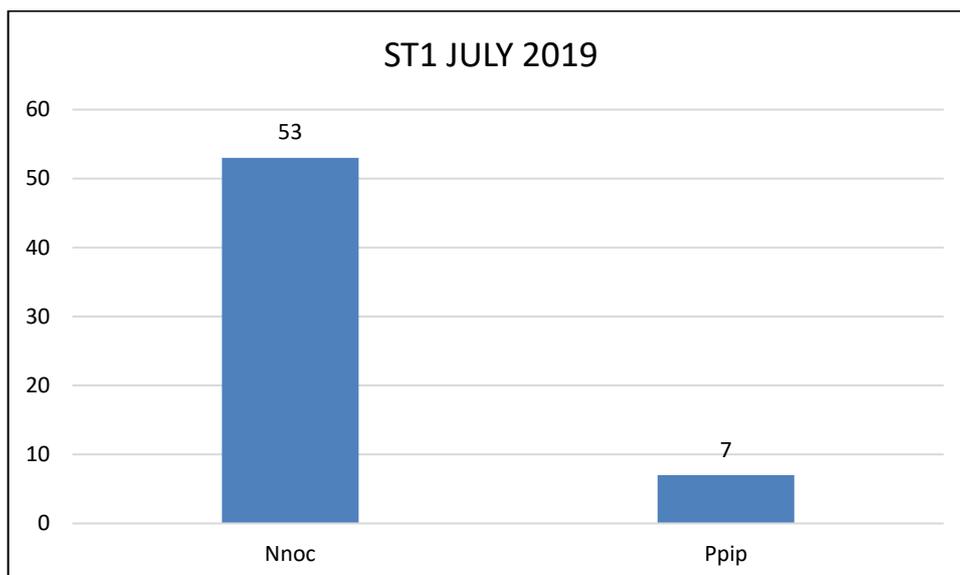
<sup>2</sup> Recorded over deployment period

Location	Dates set	Sunset / sunrise	Min Temp Deg C <sup>2</sup>	Species recorded/number of passes per minute	Time of first/last recording
of the A55. East of Junction 16A.		06:27 (2 <sup>nd</sup> ) 06:37 (8 <sup>th</sup> )		Pip sp. 2 Ppip 70 Ppyg 17 Rhip 1	20:13 / 21:28 20:39 / 02:02 20:12 / 23:58 03:54 / 03:54
	15 <sup>th</sup> – 20 <sup>th</sup> Oct	18:19 (15 <sup>th</sup> ) 18:08 (20 <sup>th</sup> )  07:42 (15 <sup>th</sup> ) 07:52 (20 <sup>th</sup> )	Min – 9.9 Max – 15.7	Nnoc 4 Pip sp. 1 Ppip 9 Ppyg 17	18:59 / 06:25 18:59 / 18:59 18:54 / 02:28 18:33 / 02:38

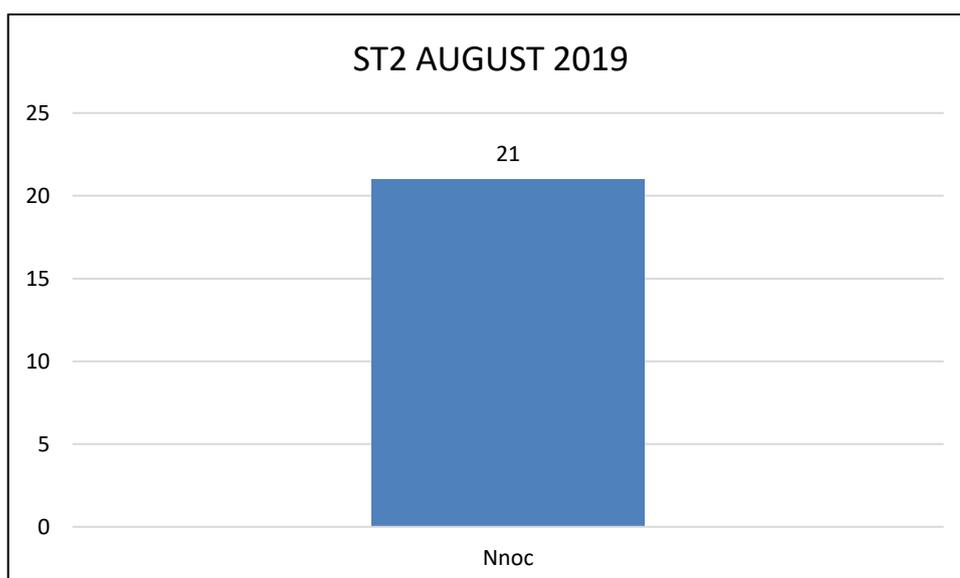
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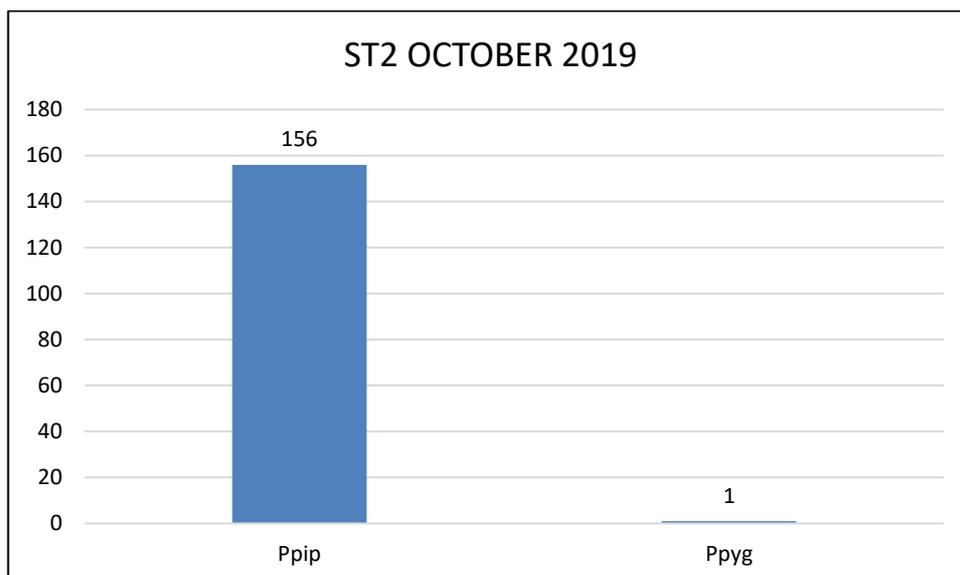




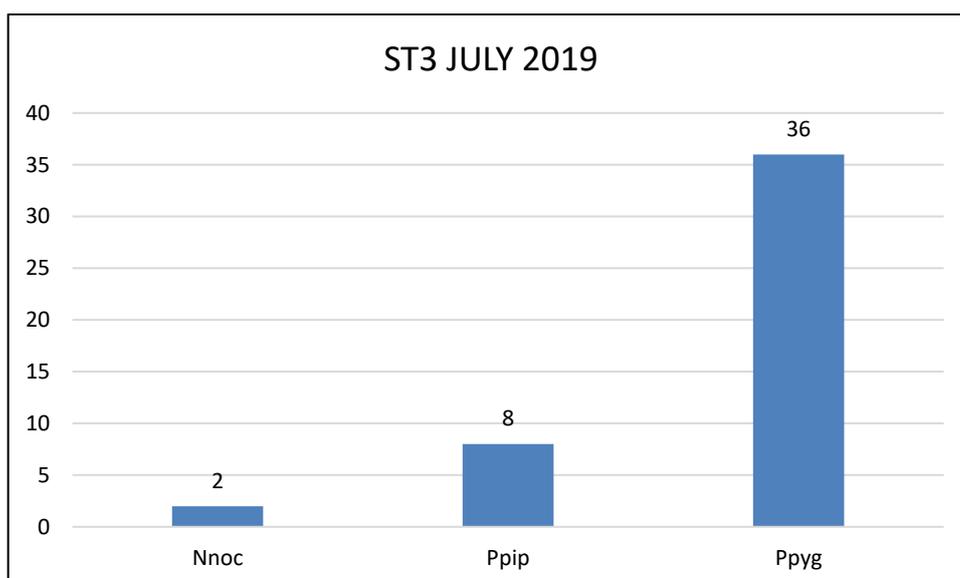
**Graph 6: Facing due east along hedge in fields to the north of Ysguborwen Rd.  
Total number of passes per species / per month**



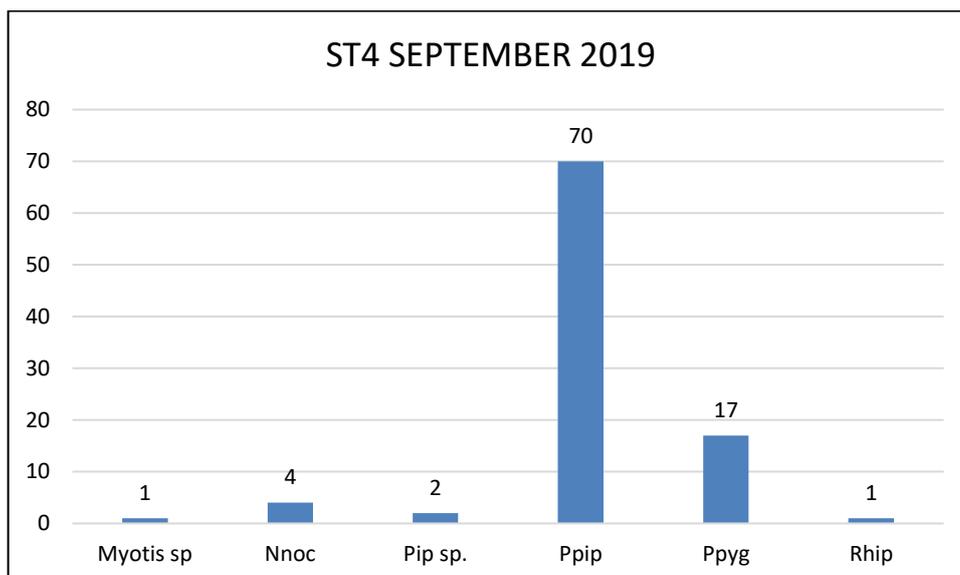
**Graph 7: Facing due west along hedge in fields to the north of Ysguborwen Rd.  
Total number of passes per species / per month**



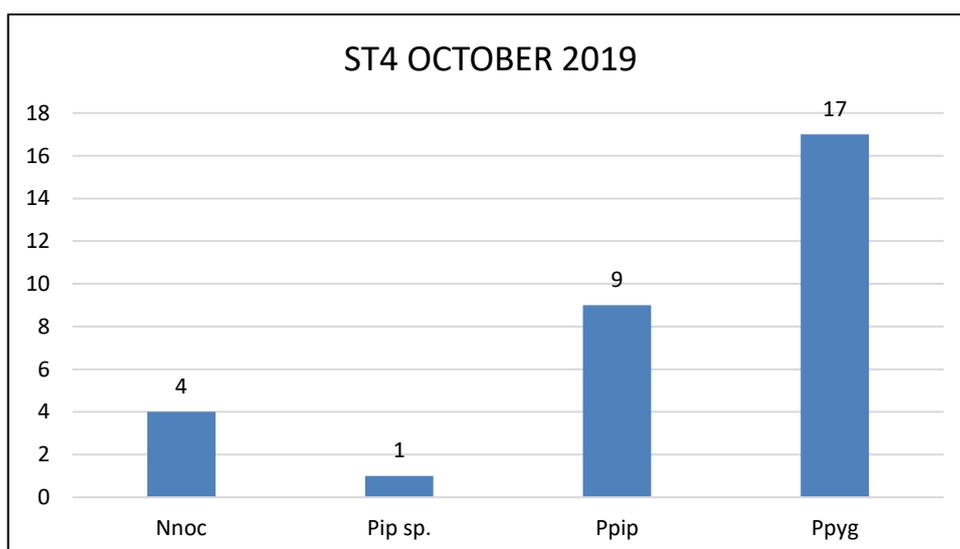
**Graph 8: Facing due west along hedge in fields to the north of Ysguborwen Rd. Total number of passes per species / per month**



**Graph 9: Facing due east along hedge in fields to the south of the A55. East of Junction 16A. Total number of passes per species / per month**



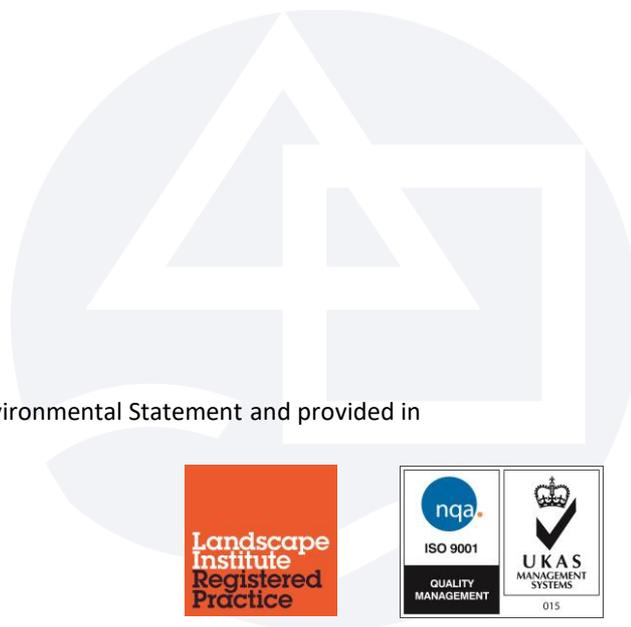
**Graph 10: Facing due west along hedge in fields to the north of Ysguborwen Rd.  
Total number of passes per species / per month**



**Graph 11: Facing due west along hedge in fields to the north of Ysguborwen Rd.  
Total number of passes per species / per month**

- 3.5.6 Noctule, common pipistrelle and soprano pipistrelle were recorded along HR1<sup>3</sup> (static locations ST1 and ST2 2019) over the periods July, September and October. The majority of recordings were from the noctule and common pipistrelle bat. Noctules forage and fly in open habitats as such, they may not be as heavily reliant on linear features such as hedgerows.
- 3.5.7 The following species were recorded along HR8<sup>3</sup> and HR9<sup>3</sup> (static locations ST3 and ST4 2019) over the periods June, Sept and October 2019; noctule, common and soprano pipistrelles, lesser horseshoe bat (one pass) and myotis a total of five species.

<sup>3</sup> As shown on the Phase 1 habitat plan submitted as part of the Environmental Statement and provided in Appendix A.



#### 4. SUMMARY AND CONCLUSION

- 4.1 The findings of the surveys are summarised in this section, along with a summary of the status and distribution of species at a national, county and local level. Information on species status and distribution has been obtained from The State of UK Bats (2017) and National Bat Monitoring Programme (NBMP) up to summer 2018.
- 4.2 No roosts have been identified from the surveys conducted to date. Trees which would be affected by the Scheme have low-negligible potential to support bat roosts, updated assessments would be required as the Scheme progresses.
- 4.3 The areas of mixed plantation woodland support foraging and commuting bats. However, there are no large or mature trees within the woodland plantation associated with the Scheme (in particular around Junction 16) with features such as cracked limbs or rot holes within these which could support a bat roost.
- 4.4 Five species of bat were recorded during the walked transects conducted in 2018 and 2019. These are common and soprano pipistrelle, noctule, whiskered/brandts and Daubentons. The majority of activity was recorded along the Afon Gyrach which would be crossed by the Scheme.
- 4.5 A total of seven species were recorded along the Afon Gyrach from the static detectors, the majority of activity was from the soprano pipistrelle with a large number of passes recorded in July. Within a Scheme context, the Afon Gyrach is considered to be an important foraging and commuting habitat.
- 4.6 Noctule, common pipistrelle and soprano pipistrelle were the main species recorded along field boundaries within the wider Scheme area with the majority of recordings from the noctule and common pipistrelle bat. Lesser horseshoe bat (one pass) and myotis were also encountered a total of five species.

- 4.7 The state of UK bats latest trends indicate that populations of the bat species noted at the site, are, in general, stable or recovering. Field Survey data for the UK show statistically significant population increases for both the common and soprano pipistrelle species since 1999. Both roost and hibernation surveys show significant population increases of the lesser horseshoe bat since 1999. The noctule and Natterers all show increases and whiskered/Brandts is stable. The long-term trend for Daubenton's bat shows a significant increase since 2013.
- 4.8 The results of the National Bat Monitoring Programme (NBMP) up to summer 2018 states that in Wales, the long-term trend for Daubenton's bat, Natterers and the lesser horseshoe bat shows a significant increase since 2013. Whilst for whiskered/Brandt the trend is not significantly different. There are insufficient data to calculate population trends for noctules in Wales, though throughout Great Britain, this species is considered to be stable. The common and soprano trend in Wales is showing a decline in roost counts but an upward trend in field survey data. However, it is likely that these species' frequent roost switching results in a negative bias in the roost count trend and this trend is not therefore considered a reliable measure of population change for soprano and common pipistrelles.
- 4.9 Little information could be found on the status of bats within Conwy. However, in general, it is considered that the current conservation status of bats within Conwy and within the Scheme footprint is stable and that the scheme would not be detrimental to the favourable conservation status of bats within a local, regional or UK wide spatial context.



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## APPENDICES

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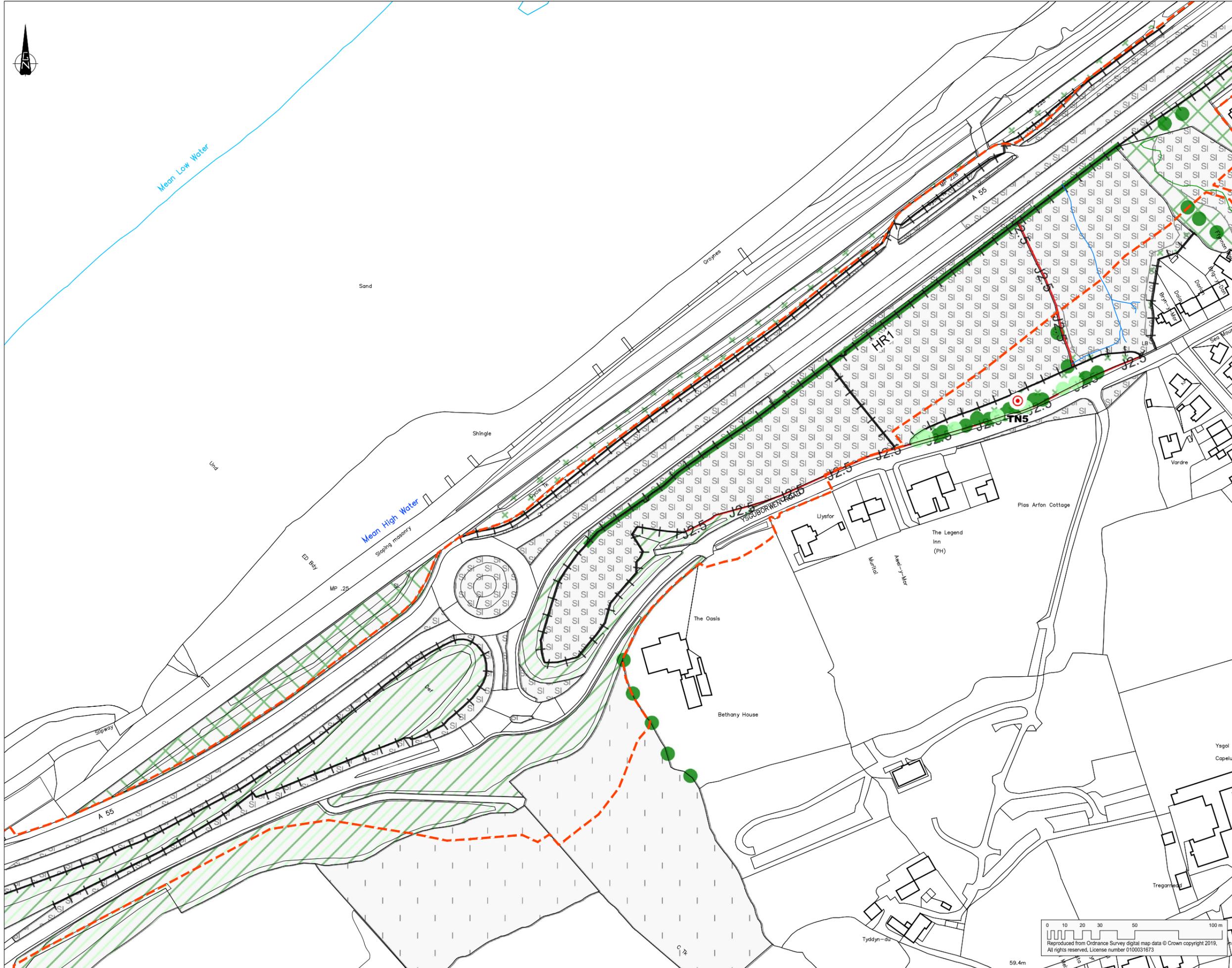


## Appendix A: Phase 1 Habitat Plan

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Notes

**Phase 1 Habitat Elements**

- Target note
- A1.3.2 - Mixed woodland plantation
- A2.1 - Scrub, dense/continuous
- A2.2 - Scrub, scattered
- A3.1 - Parkland, scattered trees, broad-leaved
- A3.2 - Parkland, scattered trees, coniferous
- B4 - Improved grassland
- B6 - Poor semi-improved grassland
- H1.1 - Mud/Sand
- H3 - Shingle above high tide mark
- J2.1.2 - Intact hedge species poor
- J2.4 - Fence
- J2.5 - Wall
- J3.6 - Buildings
- - - Proposed scheme extents

03	Proposed scheme extents added	29/01/20	RLJ	AS
02	Keys items amended	18/11/19	RLJ	AS
Rev	Description	Date	By	App
			Chk	

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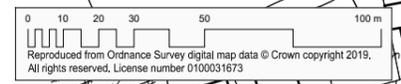
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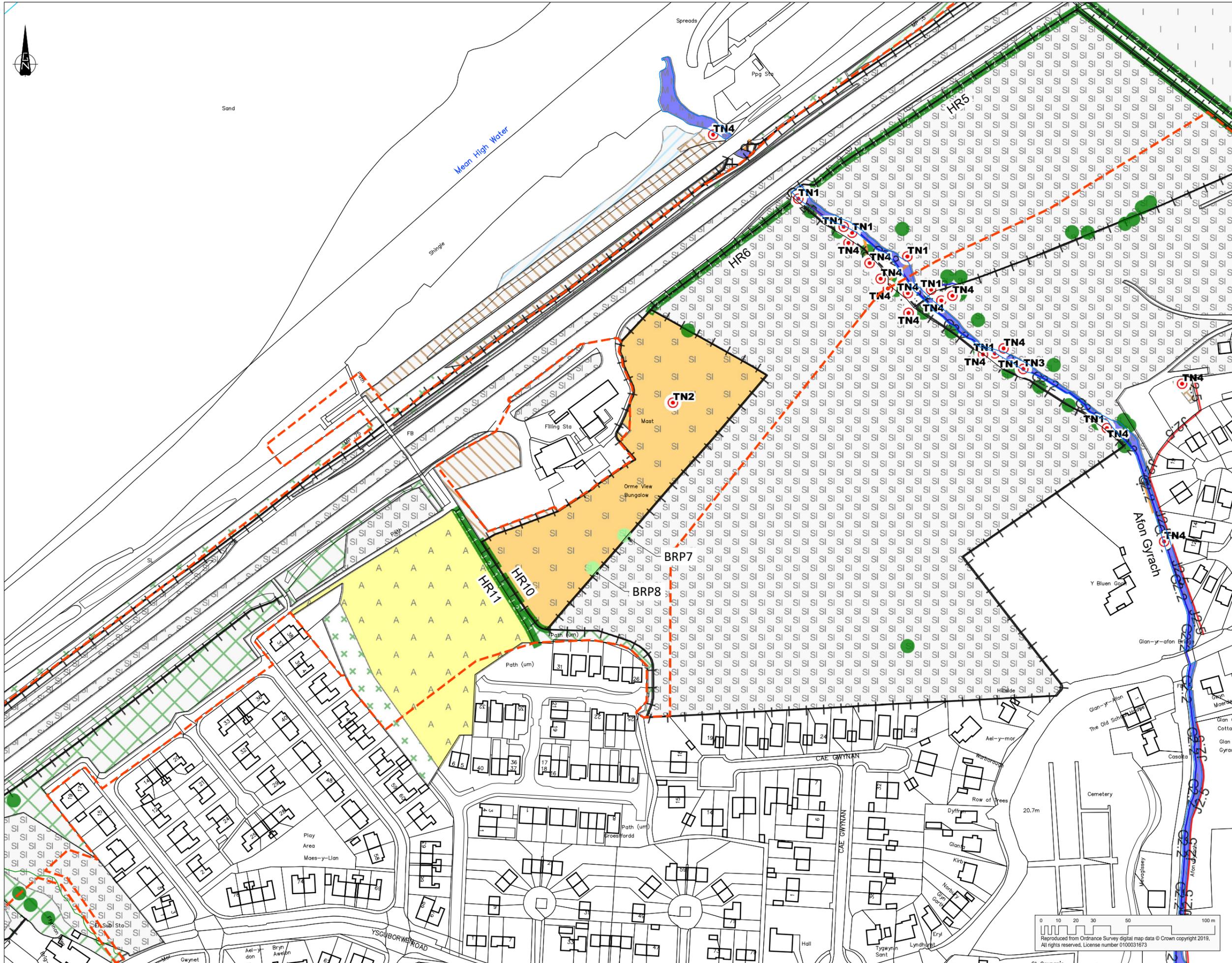


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**JUNCTION 16  
Figure 8.3  
Phase 1 Habitat Survey  
Sheet 01 of 03**

Project No:	Scale (0A1):	Drawn:	Date:
1620000620	1:2,000	RLJ	Aug 2019
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- Notes
- Phase 1 Habitat Elements**
- Target note
  - A1.3.2 - Mixed woodland plantation
  - A3.1 - Parkland, scattered trees, broad-leaved
  - A3.2 - Parkland, scattered trees, coniferous
  - A2.1 - Scrub, dense/continuous
  - A2.2 - Scrub, scattered
  - B2.2 - Semi-improved grassland
  - B4 - Improved grassland
  - B6 - Poor semi-improved grassland
  - C3.1 - Tall ruderal
  - F2.1 - Marginal vegetation
  - G2.2 - Running water
  - H1.1 - Mud/Sand
  - H3 - Shingle above high tide mark
  - J1.2 - Amenity grassland
  - J2.1.1 - Intact hedge species rich
  - J2.1.2 - Intact hedge species poor
  - J2.2.2 - Defunct hedge species poor
  - J2.4 - Fence
  - J2.5 - Wall
  - J3.6 - Buildings
  - Proposed scheme extents

03	Proposed scheme extents added	29/01/20	RLJ	AS
02	Keys items amended	18/11/19	RLJ	AS
Rev	Description	Date	By	App

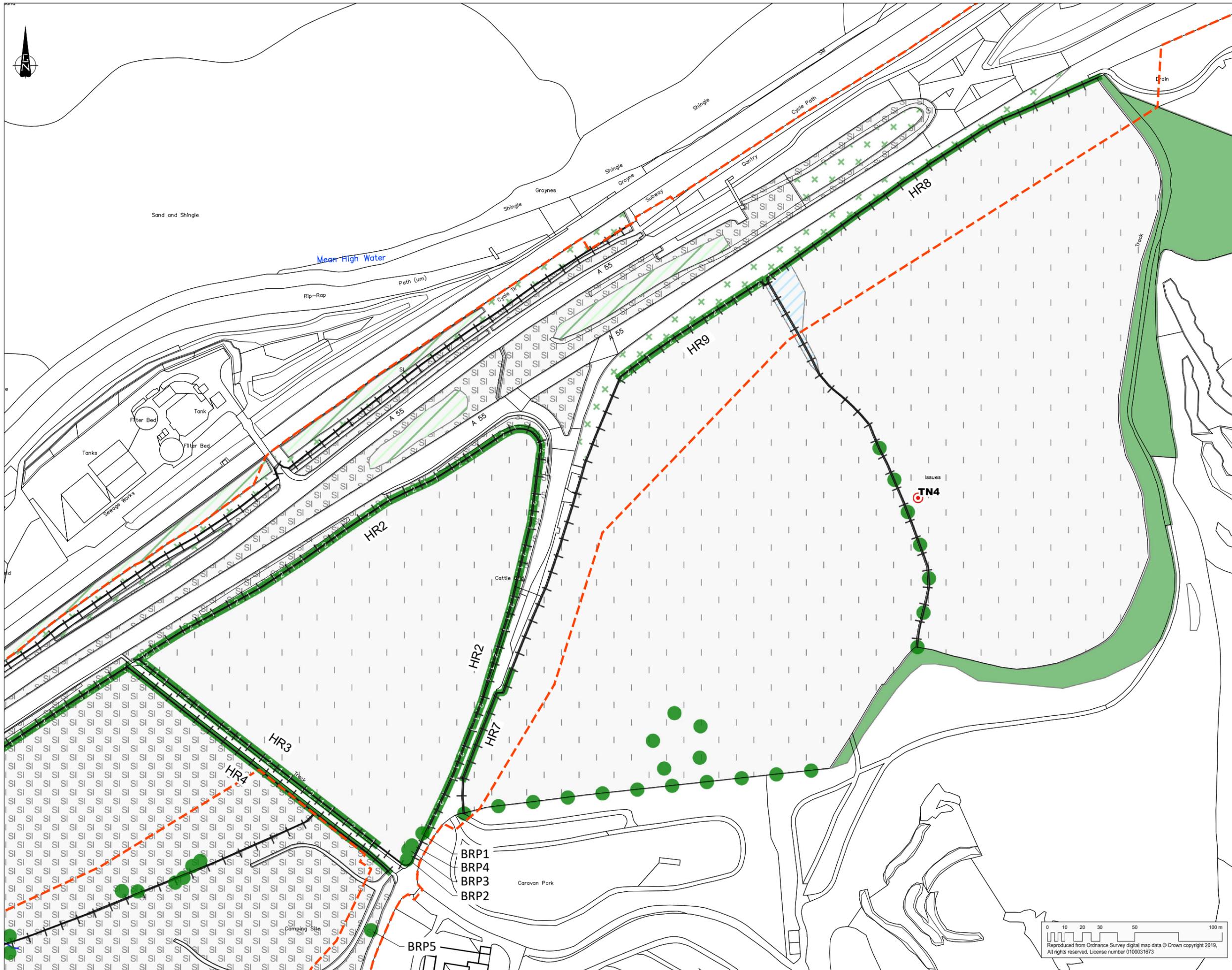
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Figure 8.4  
Phase 1 Habitat Survey  
Sheet 02 of 03**

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- Notes
- Phase 1 Habitat Elements**
- Target note
  - A1.3.2 - Mixed woodland plantation
  - A3.1 - Parkland, scattered trees, broad-leaved
  - A2.2 - Scrub, scattered
  - B4 - Improved grassland
  - B6 - Poor semi-improved grassland
  - F2.1 - Marginal vegetation
  - H1.1 - Mud/Sand
  - H3 - Shingle above high tide mark
  - J2.1.1 - Intact hedge species rich
  - J2.1.2 - Intact hedge species poor
  - J2.4 - Fence
  - J2.6 - Buildings
  - Proposed scheme extents

03	Proposed scheme extents added	29/01/20	RLJ	AS
02	Keys items amended	18/11/19	RLJ	AS
Rev	Description	Date	By	App

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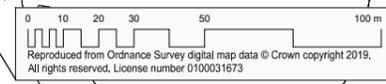
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**JUNCTION 16  
Figure 8.5  
Phase 1 Habitat Survey  
Sheet 03 of 03**

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## Appendix B: Bat Survey Plans

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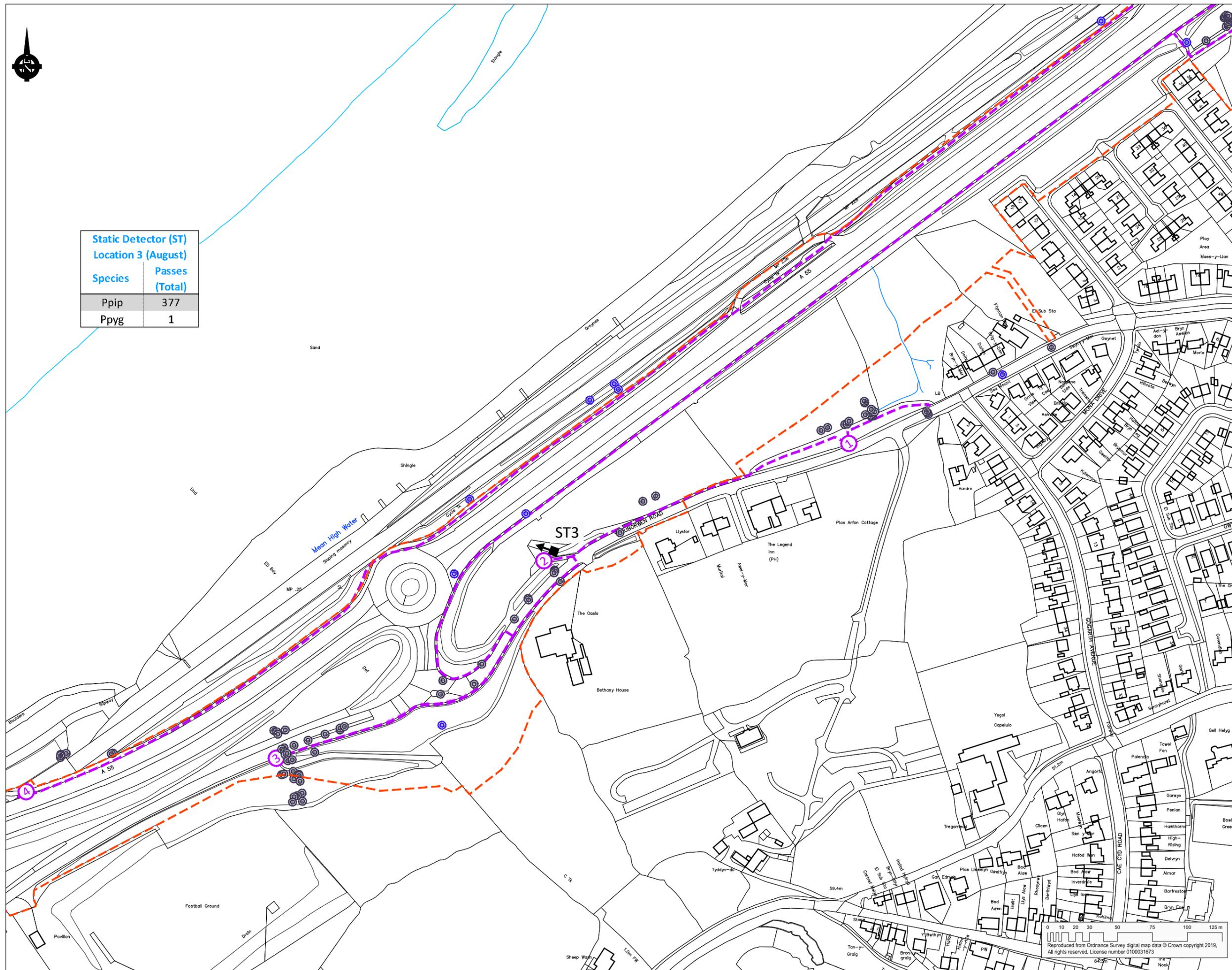
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Static Detector (ST) Location 3 (August)	
Species	Passes (Total)
Ppip	377
Ppyg	1



- Notes
- Transect route completed in 2018
  - 5 minute stopping point
  - Location for static detector
  - Means of access
  - Common Pipistrelle (Ppip) record during transect surveys
  - Soprano Pipistrelle (Ppyg) record during transect surveys
  - Noctule (Nnoc) record during transect surveys
- Notes:  
Transect to be walked over 3 occasions, with route reversed on one occasion.
- Proposed scheme extents

Rev	Description	Date	By	App
02	Proposed scheme extents added	29/01/20	RLJ	AS

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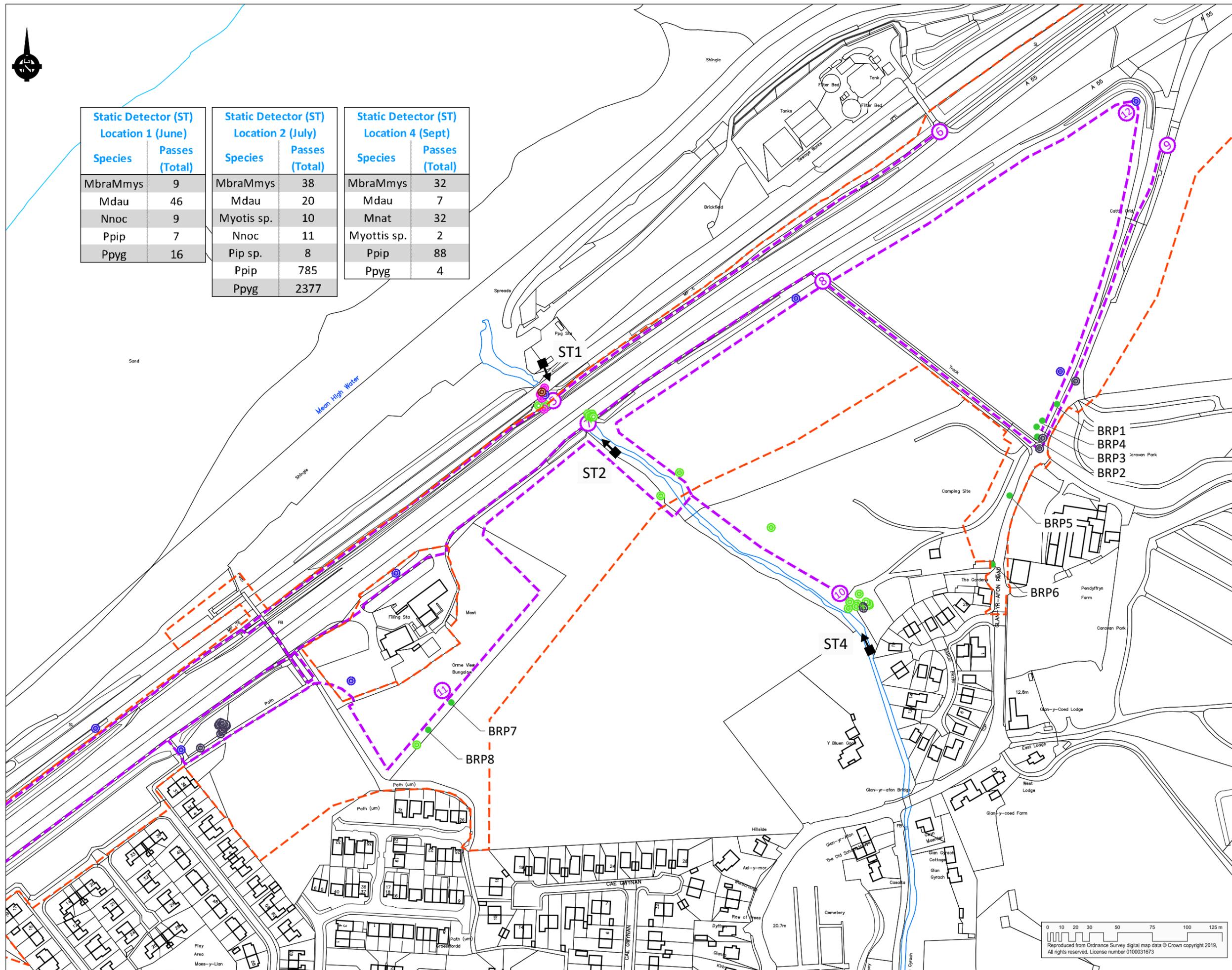
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Static Detector (ST) Location 1 (June)		Static Detector (ST) Location 2 (July)		Static Detector (ST) Location 4 (Sept)	
Species	Passes (Total)	Species	Passes (Total)	Species	Passes (Total)
MbraMmys	9	MbraMmys	38	MbraMmys	32
Mdau	46	Mdau	20	Mdau	7
Nnoc	9	Myotis sp.	10	Mnat	32
Ppip	7	Nnoc	11	Myotis sp.	2
Ppyg	16	Pip sp.	8	Ppip	88
		Ppip	785	Ppyg	4
		Ppyg	2377		



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- Notes
- Transect route completed in 2018
  - 5 minute stopping point
  - Location for static detector
  - Means of access
  - Common Pipistrelle (Ppip) record during transect surveys
  - Soprano Pipistrelle (Ppyg) record during transect surveys
  - Noctule (Nnoc) record during transect surveys
  - Whiskered/Brandts (MbraMmys) record during transect surveys
  - Daubentons (Mdau) record during transect surveys

Notes:  
Transect to be walked over 3 occasions, with route reversed on one occasion.

Proposed scheme extents

Rev	Description	Date	By	App
02	Proposed scheme extents added	29/01/20	RLJ	AS
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			Chk	

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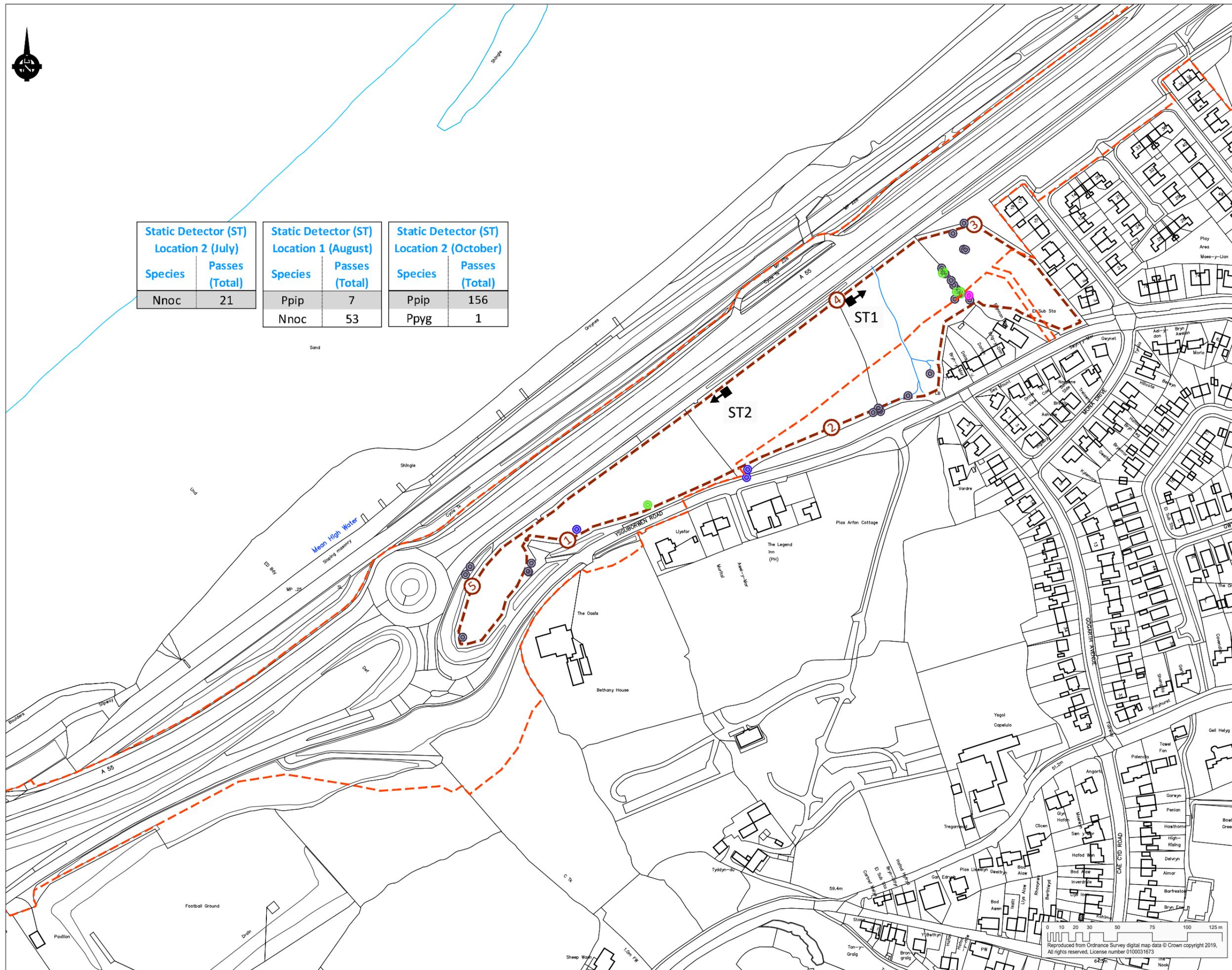
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Static Detector (ST) Location 2 (July)		Static Detector (ST) Location 1 (August)		Static Detector (ST) Location 2 (October)	
Species	Passes (Total)	Species	Passes (Total)	Species	Passes (Total)
Nnoc	21	Ppip	7	Ppip	156
		Nnoc	53	Ppyg	1



- Notes
- Transect route completed in 2019
  - 5 minute stopping point
  - Location for static detector
  - Means of access
  - Common Pipistrelle (Ppip) record during transect survey
  - Soprano Pipistrelle (Ppyg) record during transect survey
  - Noctule (Nnoc) record during transect survey
  - Whiskered/Brandts (MbraMmys) record during transect survey

Notes:  
Transect to be walked over 3 occasions, with route reversed on one occasion.

Proposed scheme extents

Rev	Description	Date	By	App
02	Proposed scheme extents added	29/01/20	RLJ	AS
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			Chk	App

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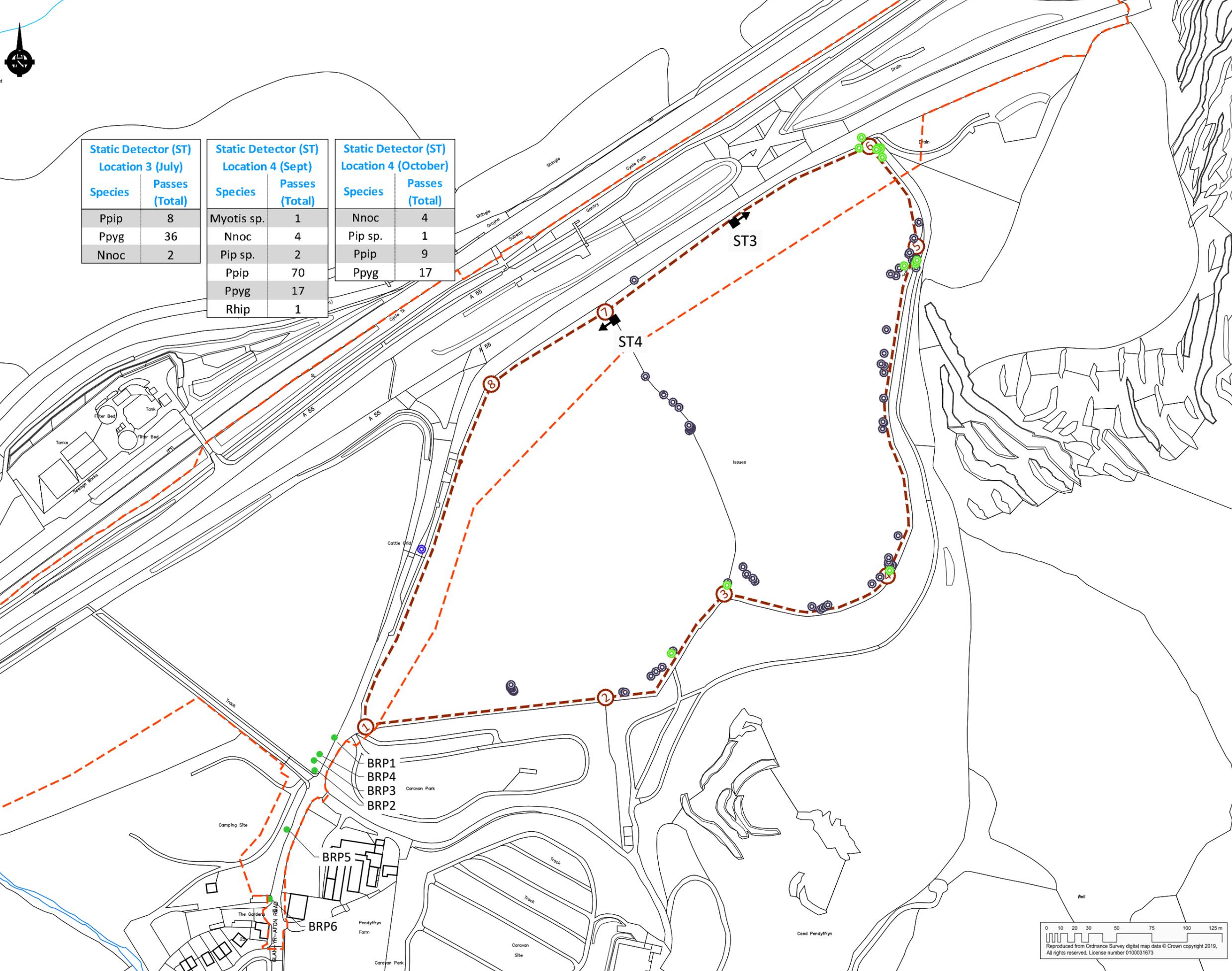
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### JUNCTION 16 Figure 8.8 Bat Transect Route 2019 Sheet 01 of 02

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Static Detector (ST) Location 3 (July)		Static Detector (ST) Location 4 (Sept)		Static Detector (ST) Location 4 (October)	
Species	Passes (Total)	Species	Passes (Total)	Species	Passes (Total)
Ppip	8	Myotis sp.	1	Nnoc	4
Ppyg	36	Nnoc	4	Pip sp.	1
Nnoc	2	Pip sp.	2	Ppip	9
		Ppip	70	Ppyg	17
		Ppyg	17		
		Rhip	1		

- Notes
- Transect route completed in 2019
  - 5 minute stopping point
  - Location for static detector
  - Means of access
  - Common Pipistrelle (Ppip) record during transect survey
  - Soprano Pipistrelle (Ppyg) record during transect survey
  - Noctule (Nnoc) record during transect survey
  - Whiskered/Brandts (MbraMmys) record during transect survey
- Notes:
- Transect to be walked over 3 occasions, with route reversed on one occasion.
- Proposed scheme extents

Rev	Description	Date	By	App
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			Chk	

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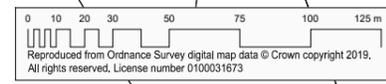
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Bat Transect Route 2019  
Sheet 02 of 02**

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Drawing No:	Rev:		
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**APPENDIX 8.3**  
**AQUATIC SURVEY REPORT**

R I C H A R D S

M O O R E H E A D & L A I N G L T D

---

P L A N N I N G | L A N D S C A P E | E N V I R O N M E N T

**A55 Junction 16 Improvements: Survey of the Macroinvertebrate Community  
of the Lower Reach of the Afon Gyrach**

for

**WELSH GOVERNMENT**

October 2019

3066



# R I C H A R D S

M O O R E H E A D & L A I N G L T D

P L A N N I N G | L A N D S C A P E | E N V I R O N M E N T

## A55 JUNCTION 16 Improvements: Survey of the Macroinvertebrate Community of the Lower Reach of the Afon Gyrach

for

**Welsh GOVERNMENT**

October 2019

3066

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QUALITY ASSURANCE PROCEDURES: QP4, QP7.3Doc6

Prepared by:	Rob Luxton	Date:	October 2019
Checked by:	Donna Hall	Date:	14 <sup>th</sup> October 2019
Approved by:	Andrew Sumner	Date:	14 <sup>th</sup> October 2019

### ISSUE RECORD

Rev:	Date:	Description	Prepared by:	Checked by:
02	11/02/20	Updates with comments from the Employers Agent	DH/RL	AS



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## 1 GLOSSARY AND ABBREVIATIONS

### 1.1 Glossary

**Benthic Algae** – Diverse group of micro-organisms including algae and diatoms that develop as a film on the rocky/stoney bed of rivers and streams particularly in shallow riffle areas.

**Discharge** – Volume of stream water passing a point over a set time period (metres cubed per second).

**Filamentous Algae** – Algal species that attach to stream substrate and grow as hair-like strands or filaments within the water flow. Often associated with nutrient enrichment.

**Electrical Conductivity** - A measure of waters ability to pass electrical flow. This ability is directly related to the concentration of conductive ions in the water. Ions include dissolved salts and inorganic materials such as alkalis, chlorides, sulphides, and carbonate compounds.

**Glide** – Stretch of flowing stream water. A transition zone out of a pool and into a riffle zone.

**Invertebrates** - Animals without backbones and bony skeletons.

**Macrophyte** – Aquatic / semi aquatic plants that grow in or near water. Plants can be submerged, emergent or floating.

**Pool** – Stretch of flowing stream water characterised by greater depth and smooth quiet surface movement.

**Riffle** – Stretch of flowing stream water characterised by shallow flow over rough stoney/ rocky streambed substrate, creating broken and noisy surface water.

**Riparian** – Zone of habitats that interface between terrestrial and stream habitats.

**Turbidity** – A measure of the degree to which stream water loses its transparency due to the presence of suspended solids.



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## 1.2 Abbreviations

ASPT score –	Average Score Per Taxon score
BMWP score –	Biological Monitoring Working Party score
EQR's –	Environmental Quality Ratios
IUCN –	International Union for Conservation of Nature
N-TAXA –	Number of taxa
RICT –	River Invertebrate Classification Tool
RIVPACS –	River Invertebrate Prediction and Classification System
WFD –	Water Framework Directive



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## 2 INTRODUCTION

### 2.1 Purpose of Study

- 2.1.1 Improvements are planned to the A55 at Junction 16, Penmaenmawr and Dwygyfylchi, Conwy County in North Wales. Richards, Moorehead & Laing Ltd were commissioned to undertake ecological surveys of surrounding habitats and species to determine the ecological value of the site and its surroundings. This survey work and report specifically targeted the aquatic macroinvertebrate community in the lower section of the Afon Gyrach which passes through the proposed development site and under the proposed new bridge/culvert. Its purpose was to provide baseline data on invertebrate community assemblages and to calculate indices that would describe the biological quality statuses of the habitats surveyed and enable mitigation for works affecting the watercourse to be planned effectively.
- 2.1.2 Improvements works to the road have potential to impact on the ecological quality of the Afon Gyrach both during construction and after through pollution, disturbance of in-stream and riparian habitats, loss of habitat and run-off from land disturbance and road surfaces. Aquatic macroinvertebrates assemblages are a good long-term indicator of water quality and habitat health and will provide a reliable source of information and baseline for incorporation into the ecological impact assessment for the road improvement scheme.

### 2.2 Survey Location

- 2.2.1 The Afon Gyrach has a small catchment area on the North Wales coast between Bangor and Conwy. It has its source at an altitude of approximately 300m and runs generally north for a length of 4.6 km. At its lower reach it passes along the eastern edge of Dwygyfylchi before passing under the A55 (grid ref. SH 73578 77762) and then the immediately adjacent and parallel railway line before discharging into the sea. The survey locations were immediately north and south of the current road and rail bridge (see Figure. 1).



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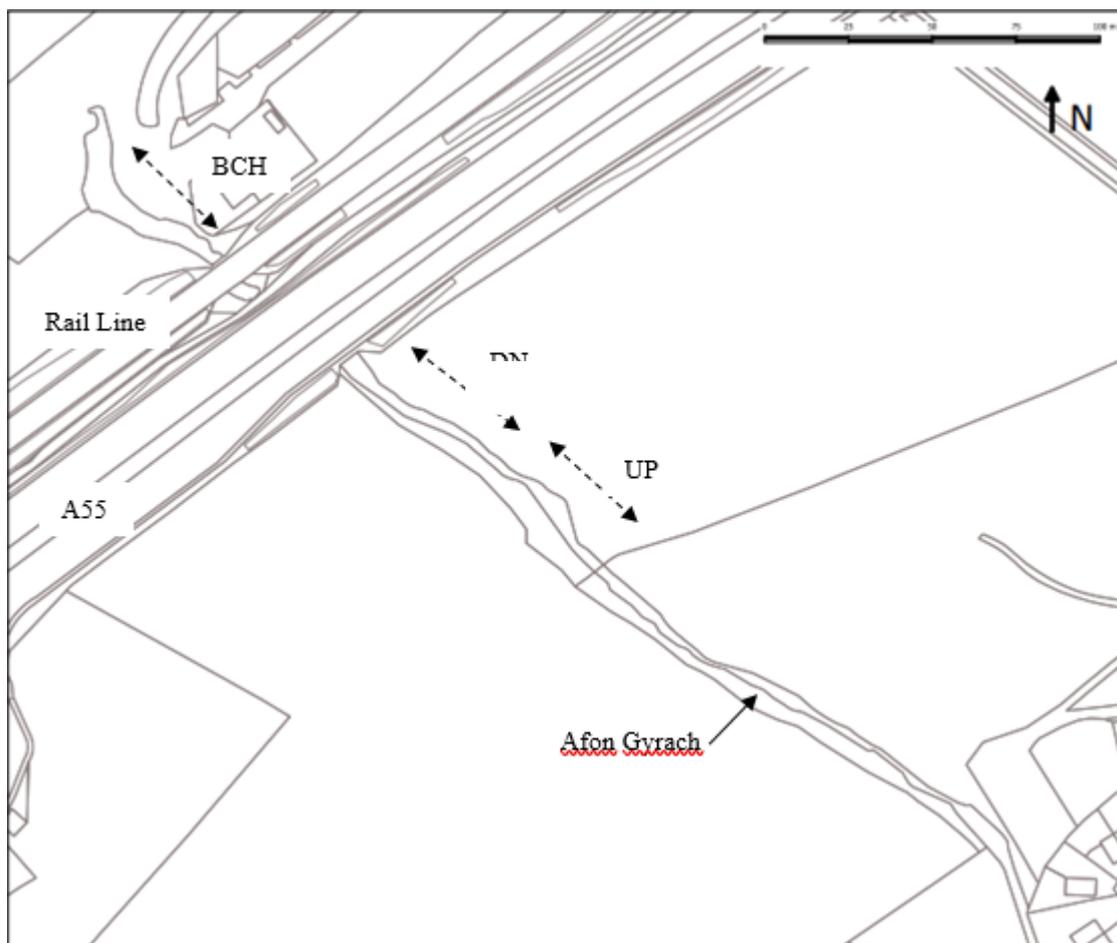
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Figure 1. Map of the lower reach of the Afon Gyrach.



### 3 METHODS

#### 3.1 Invertebrate Sampling

- 3.1.1 Surveys were conducted over two seasons; Spring (24th May 2019) and Summer (2nd August 2019) Frequency of survey, site location and sample number were chosen in line with guidance provided with the River Invertebrate Classification Tool (RICT), ([www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/](http://www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/) & Murry-Bligh, 1999). The location of survey sites is given as grid references in Appendix 1., Table 1. Two stream sampling sections were chosen south of the road (see Figure 1.). Both sections were similar in character apart from the density of tree canopy. The upstream section (labelled UP) had open to sparse tree cover in comparison to the downstream section (labelled DN) that had moderate levels of cover from a thin border of riparian trees. These upstream sections were also separated by a discharge pipe. The origin and type of discharge from this pipe is not known to the author. Downstream of these sections the stream passed underneath the road and rail crossings where the substrate consisted of mainly flat concrete slab. A third sample site (labelled BCH) was surveyed immediately north of the rail overpass where the stream returned to typical substrate for a short section before passing onto the tidal beach habitat. This further site was the only possible survey site downstream of the intended construction site.
- 3.1.2 Aquatic macroinvertebrates were collected from the in-stream substrate using a standard kick-netting technique. Samples were taken from riffle habitats using a long handle net with a 400µm mesh and collection bottle attachment. At each of the sampling positions a 3-minute kick netting transect across all in-stream habitat types (including differing substrate and flow characteristics) was undertaken. Additionally, sampling included a search of larger riverbed boulders and sweeping along submerged and overhanging riparian vegetation where it was present. This method followed standard practice for sampling shallow lotic habitats (Murry-Bligh, 1999) and is in line with requirements for analysis using the River Invertebrate Classification Tool RICT. All macroinvertebrates were sorted from sediment and debris and preserved in 70% ethanol. Identification was undertaken with a low-power light microscope to species where possible. Difficult to identify taxa were either taken to family or genera level.

## 3.2 Assessing Conservation Status

3.2.1 Current conservation status of the species identified was established in reference to the guidelines published by the International Union for Conservation of Nature (IUCN) (IUCN, 2012a, b & 2013) and the subsequent species reviews (Macadam, 2015 & 2016. Wallace, 2016). These provided a current review of threat status for various invertebrate taxa. International Union for Conservation of Nature procedures firstly record taxa 'threatened in the region of interest', then adjust those records to account for 'interactions with populations of taxa in neighbouring regions' (IUCN 2013). In parallel, the standard Great Britain system of assessing rarity which only uses GB distribution as a guide to status was also recorded. International Union for Conservation of Nature species status reviews inform British species protection legislation. Schedule 5 of the Wildlife and Countryside Act 1981 lists 70 invertebrate species, few of which are likely to be encountered within the Afon Gyrach. However, the list was reviewed and cross checked with survey results to identify any species that were listed.

## 3.3 Environmental Data Sampling

3.3.1 Additional data collected at sites included mean depth, mean width, velocity (gathered to calculate discharge category) and estimates of percentage substrate composition. Electrical conductivity was recorded using a portable Shayson water quality test meter. Further reference statistics were gathered from a 1:25000 ordnance survey map. These included National Grid Reference, altitude, slope, and distance from source. Procedures for collection of the above data followed the UK invertebrate sampling and analysis procedure for STAR project (2004); as required by RICT protocols ([www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/](http://www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/).)

## 3.4 Statistical Indices

3.4.1 The statistical scoring methodology followed the Biological Monitoring Working Party (BMWP) protocol also set out in UK Invertebrate (2004) which was devised to detect adverse inputs of organic materials (carbohydrates, fats and proteins) in watercourses but is used widely as a scoring system of general water quality. Within

this protocol, scoring taxa are those whose presence has a positive or negative correlation with clean water. Scoring invertebrate families are assigned a score 1-10. High-scoring aquatic macroinvertebrate taxonomic families are those that require well-oxygenated unpolluted water. These include certain families of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). Low-scoring families are more tolerant of poorly oxygenated polluted water (these include the Chironomidae midges and Oligochaeta worms). Not all families are used in the system. The sum of BMWP scores was then totalled to give an overall BMWP score for each survey site.

- 3.4.2 Total BMWP was then divided by the number of scoring taxa N-TAXA to give the Average Score Per Taxon (ASPT). ASPT is useful as it reduces the effect that small numbers of very high or low scoring taxa can have on a sample score. ASPT scores are also considered to be less prone to both differences in sampling effort and seasonal changes in invertebrate community composition in comparison to BMWP scores. A low ASPT implies that the invertebrate community occupying a sampled section of stream may be experiencing persistent or episodic pollution events.
- 3.4.3 Reference, environmental and biological index data were then entered into the RIVPACS IV (River Invertebrate Prediction and Classification System IV) analysis package which is now incorporated into RICT ([www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/](http://www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/)). RIVPACS predicts BMWP indices under best watercourse conditions using reference, physical and chemical data. It then divides observed indices by expected to produce Environmental Quality Indices (EQI). The closer the value is to 1 the better the water quality of the survey site.
- 3.4.4 However, RICT have incorporated the new RIVPACS IV as the official system for the Water Framework Directive macroinvertebrate classification of sites used by UK environmental protection agencies. RICT calculates Environmental Quality Ratios EQR's using the same methods as for EQI's but introduces bias data that represents sample analysis efficiency (likely occurrence of misidentification in the invertebrate data) and a corrective value that changes RIVPACS predictions into reference values.

EQR's were then assigned a Water Framework Directive WFD biological status in line with ranges given in this Survey Report Appendix 2., Table 4.

- 3.4.5 The accuracy of RIVPAVCS classifications and predictions is enhanced when data from two or more seasons is used to describe invertebrate communities and the physical and chemical characteristics of the watercourse. As such, physical and chemical data for the two seasons sampled for each site were averaged before being entered into RICT. When calculating BMWP, ASPT and N-TAXA scores for input into RICT invertebrate family lists for each season (Spring and Summer) were combined to give a score that represents the year, not an average of seasons.



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## 4 RESULTS

### 4.1 Survey and Site Conditions

- 4.1.1 For both Spring and Summer survey dates weather was warm, clear and calm. Discharge was moderate with low turbidity and insignificant sand or fine sediment inundation around a streambed dominated by cobbles and boulders at all survey sites. On both dates' substrate was generally covered in benthic algae with a very low occurrence of filamentous algae. Riparian trees provided light to moderate shade along survey site DN only. Sites UP and BCH experienced little to no canopy shading. The stream sloped gently through all sites creating a sequence of short riffle, pool and shallow glide habitats; pools were generally shallow and less common. The only in-stream macrophyte present at sites was the aquatic moss *Fontinalis antipyretica*, mainly present at site UP. For all physical and chemical data gathered from site and maps for entry into RICT, see this Survey Report Appendix 1., Tables 2 & 3.
- 4.1.2 Raw invertebrate data results for all three survey sites are described in Appendix 3., Table 5. Combined season BMWP system indices for each survey site are displayed in Table 1., section 4.3. Across all sites 34 invertebrate families were identified, 30 of which were BMWP scoring taxa. BMWP scores recorded at UP (150) and DN (135) of above 100 are generally regarded as signifying that the invertebrate community experiences clean unpolluted water and unimpacted habitat. The score at BCH (58) signifies a moderately impacted water quality and habitat.

### 4.2 Conservation Status: Notable Species

- 4.2.1 All but one species listed in this Survey Report Appendix 4, Table 6, are classed as of Least Concern (LC) under the IUCN threat category column. LC is defined as a taxon that 'does not qualify for Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Near Threatened (NT)'. The exception is *Wormaldia mediana*. This is a caddis species from the family Philopotamidae. At the larval stage it is not possible to separate it from *Wormaldia occipitalis* and *Wormaldia subnigra* which are both classed LC. The current status of *W. mediana* is Data Deficient (DD). DD is defined as when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. DD is not a category of threat. DD indicates that more information is required and acknowledges

the possibility that future research will show that threatened classification is appropriate.

- 4.2.2 Under the GB Rarity Status in this Survey Report Appendix 4. Table 6., *W. mediana* is also classed as Nationally Rare NR and *W. subnigra* is classed as Nationally Scarce NS. Also, of note is the mayfly *Rhithrogena germanica* from the family Heptageniidae which has a GB Rarity Status of NS. *R. germanica* is indistinguishable from *Rhithrogena semicolorata* at the larval stage; both have an IUCN Status of LC.

### 4.3 RICT RESULTS

- 4.3.1 RICT produces EQR's and classification status for N-TAXA and ASPT, giving six outcomes in Table 1. Of these six, three have a HIGH status, two GOOD and one BAD. The latter being for BCH N-TAXA. These data are produced by statistical comparison with an extensive and historical reference data set to provide robust ecological quality classifications ( See [www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/](http://www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/) )

**Table 1: RICT RESULTS: Observed and Expected BMWP Indices, EQR's and Classification**

Site	Index	Observed	Expected ref.adj.	EQR	WFD Biological Status
UP	BMWP	150	172.181	–	–
UP	N-TAXA	23	24.474	0.965	High
UP	ASPT	6.52	6.211	1.007	High
DN	BMWP	135	170.518	–	–
DN	N-TAXA	19	24.227	0.817	Good
DN	ASPT	7.1	6.183	1.091	High
BCH	BMWP	58	168.448	–	–
BCH	N-TAXA	10	23.627	0.473	Bad
BCH	ASPT	5.8	6.097	0.902	Good

## 5 DISCUSSION

### 5.1 Sampling Sites

5.1.1 UP and DN sites each recorded favourable EQR's and associated WFD Biological Statuses which suggests relatively unpolluted and robust habitats that support healthy invertebrate community assemblages. The RICT quality status (BAD) recorded at the BCH site stood out as the only EQR status below GOOD. There may have been several reasons for this result. Firstly, the site was somewhat isolated from the upstream sites separated by road and rail crossings. Underneath the crossings the substrate changed to approximately 40m of concrete slab (with a short break between the bridges). Light conditions underneath were dark producing little benthic algal food resource over flat substrate. This poor habitat is likely to have resulted in comparatively low recruitment from natural drift of species (as waterborne larvae and flying insects) into site BCH from upstream. No recruitment would occur from the downstream beach habitat.

5.1.2 Secondly, it is possible that the BCH site is subject to occasional saltwater inundation on seasonal high tides due to its close proximity to the tidal beach. Although not a regular occurrence, the effects on the freshwater invertebrate community would be significantly detrimental.

5.1.3 These two factors described above have the potential to reduce N-TAXA. In contrast ASPT status at BCH was GOOD, suggesting that species that have made it to the site enjoy clean freshwater conditions; however temporary that may be. Although BCH is the only possible sampling site downstream of the construction area, it may not be sensible to use it in future as an invertebrate sampling site as its N-TAXA may fluctuate significantly or remain significantly depressed as a result of the issues above.

### 5.2 Potential Effects of Construction on the Macroinvertebrate Community

5.2.1 The construction of a bridge or culvert to span the Afon Gyrach is likely to have three main impacts on the macroinvertebrate community. Firstly, at DN the possible replacement of the structurally complex streambed with a concrete slab (as with the

two existing bridges) would result in the loss of in-stream and riparian habitats for that section of stream. Secondly, at all sites the activity of machines disturbing soils on and around the site could increase the amount of fine sediments entering the flow and settling into the streambed causing detrimental effects on invertebrates. Lastly, at all sites again, the use of heavy machinery could result in the spillage of toxic fuels and oils etc. into the waters and riparian areas. It is unclear where the limits of construction activity will reach at the site. It would be advantageous if the top end of the field containing site UP was retained as an unimpacted zone to allow the stream section in this area to be kept as a reference/control site to assess against impacts at DN and BCH closer to the construction site. If this is not possible another reference site further upstream should be sought.

- 5.2.2 The surface substrate of the Afon Gyrach is composed of mainly boulders and cobbles. In addition, the subsurface substrate also includes a complex mixture of silt, sand, gravels. The arrangement of these is influenced by the flow regime, topography, geology and riparian vegetation to create a diverse set of physical meso-habitats both across the stream and along it. Each invertebrate species is adapted to use a particular or set of these habitats in order to find food and refuge resources. When the complexity of these habitats is reduced by the use of hard engineering, the capacity of the stream to support a diverse range of invertebrates is also reduced within the affected section of stream.
- 5.2.3 The movement of fine sediments downstream is a natural process and its extent is different for each stream according to the catchment it flows through. The addition of extra fine sediments through agricultural and construction activities can act to fill up the interstices between larger substrate. This will reduce the surface area of the habitat, eliminate refuge zones, bury sedentary species and reduce primary production by hindering the attachment of benthic algal; the food source of grazing invertebrates. Fine sediments can also have a direct effect on the invertebrates themselves by abrasion of their soft tissues and the clogging up of filter feeding apparatus and gills (Jones et. al. (2012).
- 5.2.4 Smith (2009) found that spillage of diesel into a stream could reduce abundance of invertebrates by over 90% and almost half the diversity of families present. Green & Trett (1989) reported that recovery of invertebrate communities from such a

pollution event was slow and could take many months with impacts on the whole freshwater stream community. As the proposed construction site is positioned at the end of the Afon Gyrach, the spillage of toxic fluids into and around the stream would have impacts in both the remaining freshwater habitat and the marine habitat that it enters. This could have implications for marine species and anadromous species such as Eel *Anguilla anguilla* Sea Trout *Salmo trutta*.



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## 6 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

- 6.1.1 The current WFD Biological Status on the lower reach of the Afon Gyrach is generally HIGH to GOOD.
- 6.1.2 Invertebrates of concern because of their GB Rarity Status are the caddis fly *W.mediana* and *W.subnigra*, as well as the mayfly *R. germanica*. Identification of these to species is not possible at the larval stage. However, the possibility exists that they are present. Survey of adult stages would be problematic due to unpredictable emergence times and low abundance.
- 6.1.3 The main threats to the whole aquatic macroinvertebrate community from construction works are loss of habitat, the addition of fine sediments into the flow and spillage of toxic fuels and oils etc.

### 6.2 Recommendations

- 6.2.1 Water quality status should be maintained and monitored during the construction works and post works period.
- 6.2.2 The southern end of the survey site should remain off limits for works activities to allow the stream section in that area to be used as a reference site.
- 6.2.3 Efforts should be made in all phases of works to limit habitat loss, reduce additional loading of silt and fine sediments from site works and road run-off and stop chemical spillage into and around the affected watercourse.

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## Survey Report Appendices



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## Appendix 1

**Table 2. Reference data.**

Survey Site	NGR	Easting	Northing	Altitude (m)	Slope	Discharge Category	Distance from Source (km)
<i>Upstream UP</i>	SH	273638	377719	7	12.5	1	4.5
<i>Downstream DN</i>	SH	273582	377757	5	12.5	1	4.55
<i>Beach BCH</i>	SH	273532	377799	1	12.5	1	4.6

**Table 3. Environmental data.**

Survey Site	Mean Width (m)	Mean Depth (m)	Boulders & Cobbles (%)	Pebbles & Gravel (%)	Sand (%)	Silt & Clay (%)	Conductivity (µS/cm)	Discharge Category
<i>Upstream UP</i>	2.65	11	85	12	3	0	94	1
<i>Downstream DN</i>	2.52	12.5	90	5	5	0	94	1
<i>Beach BCH</i>	3.2	25.6	95	5	0	0	94	1

## Appendix 2

**Table 4. RICT WFD biological status ranges.**

Status	EQR N-TAXA	EQR ASPT
HIGH	0.85	0.97
GOOD	0.71	0.86
MODERATE	0.57	0.75
POOR	0.47	0.63
BAD	<0.47	<0.63

## Appendix 3

Table 5. Invertebrate survey raw data.

ORDER/CLASS Family	BMWP	SPECIES	ABUNDANCE					
			Spring			Summer		
		SITES	UP	DN	BCH	UP	DN	BCH
<b>EPHEMEROPTERA</b>								
Baetidae	4	<i>Baetis rhodani</i>	7	10	3	1		2
		<i>Baetis niger</i>	7	4	3			
		<i>Baetis vernus</i>		1		9	3	8
Heptageniidae	10	<i>Rhithrogena germanica/semicolorata</i> <sup>†</sup>	2		1			
		<i>Ecdyonurus venosus/torrentis/dispar</i> <sup>†</sup>	4		6		2	1
		<i>Heptagenia sp.</i>					1	1
Ephemerellidae	10	<i>Serratella ignita</i>				1		5
<b>TRICOPTERA</b>								
Polycentropodidae	7	<i>sp.</i>	8	7	3			
		<i>Polycentropus flavomaculatus</i>				6		
		<i>Polycentropus irroratus</i>					3	
Lepidostomatidae	10	<i>Lepidostoa basale</i>		2				
Hydropsychidae	5	<i>Hydropsyche siltalai</i>	5	9				
Brachycentridae	10	<i>Brachycentrus subnubilus</i>	1	3				



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Rhyacophilidae	7	<i>Rhyacophila dorsalis</i>	11			7		
		<i>Rhyacophila obliterata</i>				1		
Philopotamidae	8	<i>Philopotamus montanus</i>					3	
		<i>Wormaldia mediana/oecipitalis/subnigra<sup>†</sup></i>					1	
Sericostomatidae	10	<i>Sericostoma personatum</i>				1	5	
Odontoceridae	10	<i>Odontocentrum albicome</i>					1	
<b>PLECOPTERA</b>								
Perlidae	10	<i>Dinocras cephalotes</i>	12	2		9	10	
Perlodidae	10	<i>Perlodes mortani</i>	2	6			4	
		<i>Isoperla grammatica</i>	1					
Chloroperlidae	10	<i>Chloroperla tripunctata</i>	5		2			
		<i>Chloroperla torrentium</i>			3			
Nemouridae	7	<i>Nemurella pictetii</i>	3					
Leuctridae	10	<i>Leuctra moselyi</i>	9			18	21	
		<i>Leuctra fusca</i>	2	3		5		
		<i>Leuctra nigra</i>	9	8				
		<i>Leuctra geniculata</i>	1					
<b>CRUSTACEA</b>								
Gammaridae	6	<i>Gammarus pulex</i>	12	9	7	30	16	6
Asellidae	3	<i>Asellus aquaticus</i>						2
<b>TURBELLARIA</b>								

Planariidae	5	<i>sp.</i>		2				
<b>ANNELIDA</b>								
Hirudinidae	3	<i>Heamopsis sanguisuga</i>				1		
Glossiphoniidae	3	<i>Glossiphonia heteroclita</i>				1		
<b>DIPTERA</b>								
Pecticiidae		<i>sp.</i>		3	1	4	9	7
Limoniidae		<i>sp.</i>					2	
Rhagionidae		<i>sp.</i>	2					
Muscidae		<i>sp.</i>				4		
Simuliidae	5	<i>sp.</i>	14	25	1			3
Chironomidae	2	<i>sp.</i>	11 4	36	4	14	4	2
<b>COLEOPTERA</b>								
Dryoptidae	5	<i>sp.</i>				2		
Elmidae	5	<i>sp.</i>	1	8				
Scirtidae	5	<i>sp.</i>						
Gyrinidae	5	<i>sp.</i>	3	6				
<b>MOLLUSCA</b>								
Valvatidae	3	<i>sp.</i>	1					
Lymnaeidae	3	<i>Limnaea pereger</i>				2	1	



Oligochaeta	1	<i>Haplotaxidae sp.</i>			1			
<b>Total Abundance</b>			<b>23</b>	<b>14</b>	<b>38</b>	<b>116</b>	<b>83</b>	<b>37</b>
			<b>6</b>	<b>4</b>				



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**Appendix 4:****Table 6. Species conservation status**

ORDER Family	Species	GB IUCN Status	Rationale	GB Rarity Status	Recorded In Wales
<b>EPHEMEROPTERA</b>					
Baetidae	<i>Baetis rhodani</i>	LC	A widespread species found in most running water habitats.		Y
	<i>Baetis niger</i>	LC	A widespread species found in streams and rivers throughout the UK		Y
	<i>Baetis vernus</i>	LC	Widespread species with recent increase in areas of occupancy		Y
Heptageniidae †	<i>Rhithrogena germanica</i>	LC	Indistinguishable at larval stage from <i>R. semicolorata</i> . Survey of adult stage suggests species is widespread but with very localized distribution.	NS	Y
	<i>R. semicolorata</i>	LC	Widespread species with recent increases in distribution.		Y
†	<i>Ecdyonurus venosus</i>	LC	Some difficulties in separation and identification of larvae however all three are considered to be widespread		Y
	<i>E.torrentis</i>	LC			?
	<i>E.dispar</i>	LC			Y
Ephemerellidae	<i>Serratella ignita</i>	LC	Widespread species with recent increases in distribution.		Y
<b>TRICOPTERA</b>					



Polycentropodidae	<i>Polycentropus flavomaculatus</i>	LC	A widespread and common species of stony rivers and lakes		y
	<i>Polycentropus irroratus</i>	LC	A widespread and common species of stony rivers and lakes		Y
Lepidostomatidae	<i>Lepidostoma basale</i>	LC	Locally common in rivers and streams. Associated with dead wood.		Y
Hydropsychidae	<i>Hydropsyche siltalai</i>	LC	Widespread and common species of streams and rivers.		Y
Brachycentridae	<i>Brachycentrus subnubilus</i>	LC	Widespread and locally abundant river species		Y
Rhyacophilidae	<i>Rhyacophila dorsalis</i>	LC	A widespread and common species of stony of streams and rivers		Y
	<i>Rhyacophila obliterata</i>	LC	A widespread stream and river species in Scotland, Wales and south western England		
Philopotamidae	<i>Philopotamus montanus</i>	LC	A widespread and common species of fast-flowing rivers in the north and west		y
†	<i>Wormaldia mediana</i>	DD	It has only been identifiable as an adult comparatively recently and is still not identifiable as a larva. It may have significantly declined post 2000 so a grading of DD has been chosen. It is mainly a northern and western species. The habitat is small fast stony rivers.	NR	Y
		LC			Y

	<i>W. occipitalis</i> <i>W. subnigra</i>	LC	A widespread and common species of small streams and larger trickles, but absent from south east England and East Anglia. A widespread species of rivers, especially those that flow from lakes. It may be declining.	NS	Y
Sericostomatidae	<i>Sericostoma personatum</i>	LC	A widespread and common species of streams, rivers and lakes.		y
Odontoceridae	<i>Odontocentrum albicome</i>	LC	A widespread and common species of stony streams and rivers		Y
<b>PLECOPTERA</b>					
Perlidae	<i>Dinocras cephalotes</i>	LC	Widespread species, recent increase of records		Y
Perlodidae	<i>Perlodes mortani</i>	LC	Widespread species, recent increase of records		Y
	<i>Isoperla grammatica</i>	LC	Widespread species, recent increase of records		Y
Chloroperlidae	<i>Chloroperla tripunctata</i>	LC	Widespread species, recent increase of records		Y
	<i>Siphonoperla torrentium</i>	LC	Widespread species, recent increase of records		Y
Nemouridae	<i>Nemurella pictetii</i>	LC	Widespread species, recent increase of records		Y

Leuctridae	<i>Leuctra moselyi</i>	LC	This is a widespread species however it is superficially similar to <i>L. hippopus</i> . Many biologists do not separate these species and the recording scheme has many records listed as <i>Leuctra hippopus/moselyi</i> .		Y
	<i>Leuctra fusca</i>	LC	Widespread species, recent increase of records		Y
	<i>Leuctra nigra</i>	LC	Widespread species, recent increase of records		Y
	<i>Leuctra geniculata</i>	LC	Widespread species, recent increase of records		Y
<p>KEY:</p> <p>LC – Least Concern DD – Data Deficient NS – Nationally Scarce NR - Nationally Rare.</p> <p>† Where species occur in the same row it has not been possible to separate them taxonomically</p>					



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**APPENDIX 8.4**  
**WINTERING BIRD SURVEY REPORT**

A55 Junctions 15 and 16 Wintering Bird Survey Report Intended for  
**Welsh Government**

Document type  
**Report**

Date  
**July 2018**

# **A55 JUNCTIONS 15 & 16 WINTERING BIRD SURVEY 2017/2018**

**A55 JUNCTIONS 15 & 16  
WINTERING BIRD SURVEY 2017/2018**

Revision **02**  
Date **31 Jan 2020**  
Made by **Martyn Owen Biome Consulting**  
Checked by **Donna Hall (RML)**  
Approved by **Andrew Sumner (RML)**  
Description

Ref 16200000620

## CONTENTS

<b>1.</b>	<b>BACKGROUND</b>	<b>1</b>
<b>2.</b>	<b>METHODOLOGY</b>	<b>2</b>
<b>3.</b>	<b>RESULTS</b>	<b>5</b>

## APPENDICES

### **Appendix A**

Figures

## 1. BACKGROUND

### 1.1 Project Background

Junction 15 and Junction 16 of the A55 are proposed for improvement works. These Junctions are located on North Wales coast, adjacent to the Irish Sea. Due to the presence of nearby statutorily designated sites and the identification of potential impacts to qualifying features, wintering bird surveys were completed to determine the assemblage of species present and the distribution of qualifying features in areas that could be subject to direct impacts and/or disturbance.

### 1.2 Designated Sites

The proposed development areas are located in close proximity to two Natura 2000 sites which are designated due to their avian importance. Junction 15 is in close proximity to both Liverpool Bay Special Protection Area (SPA) (0.3km/north) and Lavan Sands SPA (adjacent/north), and Junction 16 is adjacent to Lavan Sands SPA (0.3km/north); the qualifying features of these internationally designated sites are summarised below.

**Table 1: Designated Site Details**

Qualifying Features	Feature Type	% of Population
<b>Liverpool Bay SPA</b>		
Red-throated Diver <i>Gavia stellata</i> (non-breeding)	Annex I species	6.89% GB
Little Gull <i>Hydrocoloeus minutus</i> (non-breeding)	Annex I species	N/A
Common Scoter <i>Melanitta nigra</i> (non-breeding)	Regularly occurring migratory species	10.31% of NW European
Waterbird assemblage <sup>1</sup>	Assemblage	N/A
Little Tern <i>Sternula albifrons</i> (breeding)	Annex I species	6.84% GB
Common Tern <i>Sterna hirundo</i> (breeding season)	Annex I species	1.80% GB
<b>Lavan Sands SPA</b>		
Oystercatcher <i>Haematopus ostralegus</i> (in non-breeding season)	Regularly occurring migratory species	0.5% Europe & Northern/Western Africa

<sup>1</sup> Red-throated Diver, Common Scoter, Little Gull, Red-breasted Merganser *Mergus serrator*, Cormorant *Phalacrocorax carbo*; (less than 1% GB or less than 2000 Individuals) Black-headed Gull *Chroicocephalus ridibundus*, Common Gull *Larus canus*, Eider *Somateria mollissima*, Fulmar *Fulmarus glacialis*, Great Black-backed Gull *Larus marinus*, Great Crested Grebe *Podiceps cristatus*, Guilimot *Uria aalge*, Gannet *Morus bassanus*, Puffin *Fratercula arctica*, Herring Gull *Larus argentatus*, Kittiwake *Rissa tridactyla*, Lesser Black-backed Gull *Larus fuscus*, Great Northern Diver *Gavia immer*, Shag *Phalacrocorax aristotelis*, Razorbill *Alca torda*, Velvet Scoter *Melanitta fusca*.

## **2. METHODOLOGY**

### **2.1 Study Areas**

The study areas (Figure 1) included all areas that will be subject to direct impact during the proposed works and where disturbance to qualifying features could occur (including the adjacent inter-tidal areas) as a consequence of the proposed works.

### **2.2 Scoping Survey**

To assess usage by SPA/Ramsar qualifying features of areas in the vicinity of the proposed junction upgrades, surveys of the inter-tidal area and areas inland which could support qualifying features where disturbance could occur were completed.

To ensure appropriate coverage of the required survey areas, an initial scoping visit was completed in October 2017. During this scoping visit all accessible parts of the two survey areas were reviewed, and habitats with the potential to support qualifying features of the adjacent designated sites identified. A number of viewpoints and transects were then determined (Figure 2), which afforded appropriate coverage of all relevant areas.

### **2.3 Through the Tide Surveys**

A total of six Through The Tide Count (TTTC) surveys of each of the two survey areas was completed, with monthly surveys between October 2017 and March 2018 (inclusive). This survey was based upon the Wetland Bird Survey (WeBS) low-tide count method<sup>2</sup>, although extended to encompass the period from low to high tide, or vice-versa.

Each survey encompassed one complete tidal cycle during daylight hours, starting at either high or low tide. During each survey, three full counts were completed (i.e. counts around low, mid and high tide). To achieve coverage of all required areas a combination of viewpoints and transects were employed (Figure 2). Full scans of the viewable areas from each viewpoint were completed using telescopes and/or binoculars. Where visibility of areas was not possible from viewpoints, transects were walked and all observations logged.

Surveys took place utilising vehicles or vegetation/structures (e.g. hedgerows, buildings, sea walls etc.) as a hide or screen to avoid unnecessary disturbance to waders as far as possible

All waders and wildfowl were recorded, with their locations recorded on a map.

All fieldwork was completed by an experienced bird surveyor, Martyn Owen MCIEEM (Biome Consulting).

---

<sup>2</sup> BTO (2020) *Westland Bird Survey; Low Tide Counts Methods* [online] available at: <https://www.bto.org/our-science/projects/wetland-bird-survey/taking-part/low-tide-counts-methods>

**Table 1: Survey details**

<b>Date</b>	<b>Tide Times</b>	<b>Survey Times</b>	<b>Weather Conditions</b>
<b>Junction 15</b>			
13/10/2017	LT: 11:44 (2.05m) HT: 17:49 (6.36m)	11:44 - 17:49	Cloud(Oktas): 7/8-8/8 Temp(°C): 13-14 Wind: 2-3 SW Precip.: Occasional heavy rain
09/11/2017	LT: 08:21 (1.20m) HT: 14:11 (7.32m)	08:21 - 14:11	Cloud (Oktas): 3/8 - 8/8 Temp(°C): 12 - 16 Wind: 1-2 W Precip.: Occasional light rain
15/12/2017	HT: 08:52 (6.88m) L: 15:22 (1.55m)	08:50 - 15:22	Cloud (Oktas): 6/8-8/8 Temp(°C): 5-7 Wind: 2-4N Precip.: Nil
23/01/2018	LT: 08:40 (1.50m) HT: 14:29 (7.00m)	08:35 - 14:30	Cloud (Oktas): 8/8 Temp(°C): 9-10 Wind: 4-5 SW Precip.: Rain
21/02/2018	LT: 08:13 (1.08m) HT: 14:03 (7.30m)	08:10 - 14:04	Cloud (Oktas): 5/8-7/8 Temp(°C): 6-10 Wind: 0-1 E Precip.: Nil
15/03/2018	HT: 09:39 (6.92m) LT: 16:14 (1.10m)	09:30 - 16:15	Cloud (Oktas): 7/8-8/8 Temp(°C): 8-11 Wind: 1-3 SE Precip.: Light rain
<b>Junction 16</b>			
12/10/2017	LT: 10:31 (1.66m) HT: 16:26 (6.66m)	10:31 - 16:26	Cloud (Oktas): 1/8-5/8 Temp (°C): 15-16 Wind: 1-2W Precip.: Nil
08/11/2017	LT: 07:29 (0.75m) HT: 13:16 (7.74m)	07:29 - 13:16	Cloud (Oktas): 1/8-7/8 Temp(°C): Wind: 1-2 SW Precip.: Nil
14/12/2017	HT: 08:04 (6.64m) LT: 14:35 (1.78m)	08:00 - 14:35	Cloud (Oktas): 4/8-8/8 Temp(°C):4-7 Wind: 3-5 W Precip.: Occasional light rain
22/01/2018	LT: 08:00 (1.30m) HT: 13:48 (7.20m)	08:00 - 14:00	Cloud (Oktas): 6/8 Temp(°C): 7-8 Wind: 6/8-8/8 Precip.: Nil
22/02/2018	LT: 08:58 (1.34m) HT: 14:50 (6.98m)	08:50 - 14:50	Cloud (Oktas): 7/8 - 8/8 Temp: 3-6 Wind: 1-2 SE Precip.: Nil
14/03/2018	HT: 09:01 (6.52m) LT: 15:37 (1.49m)	09:00 - 15:37	Cloud (Oktas): 7/8-8/8 Temp: 8-9 Wind: 3-4 SE Precip.: Occasional light rain

## **2.4 Limitations**

The findings presented in this study represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of animals, such as the time of year, migration patterns and behaviour.

Although efforts were made to avoid double counting, due to the size of the survey area it is possible that, if birds moved within the survey area during a tidal state survey, double-counting may have occasionally occurred.

### 3. RESULTS

Survey results in relation to SPA qualifying features (refer to Table 1) recorded during surveys of Junction 15 are presented in Figures 3 to 9, with Figures 10 to 18 illustrating the results in relation to Junction 16.

Figures 3 (Junction 15) and 10 (Junction 16) present a combined summary of the survey results during all surveys in relation to Oystercatcher (as this was the sole SPA qualifying feature recorded in sufficient numbers to make data/analysis presentation in this manner worthwhile as the number/density of observations of other species across the survey period was too low). The remaining figures present the survey results by month, split by tidal state for SPA qualifying species only.

The below tables (Table 2 and Table 3) present the total counts of all wildfowl and waders within each survey area during each survey month, split by tidal state.

**Table 2: Junction 15 Survey Results**

	2017			2018		
	October	November	December	January	February	March
<b>Mute Swan <i>Cygnus olor</i></b>						
High	2	2	7		2	2
Mid	2	2	7		2	
Low	2		7		2	
<b>Greater Scaup <i>Aythya marila</i></b>						
High						1
Mid						1
Low						
<b>Mallard <i>Anas platyrhynchos</i></b>						
High	68	53	31	42	40	14
Mid	57	33	37	38	40	38
Low	5	31	31	43	35	32
<b>Goosander <i>Mergus merganser</i></b>						
High				1		
Mid						
Low						
<b>Great Crested Grebe<sup>^</sup></b>						
High		1		2		
Mid		1		1	1	1
Low						
<b>Red-breasted Merganser<sup>^</sup></b>						
High						
Mid	1					
Low	1					
<b>Cormorant<sup>^</sup></b>						
High						
Mid						
Low	1					
<b>Bar-tailed Godwit <i>Limosa lapponica</i></b>						

	2017			2018		
	October	November	December	January	February	March
High						
Mid	1		19			
Low	1		1			
<b>Curlew <i>Numenius arquata</i>*</b>						
High			3	27		
Mid	6		1	28		
Low	6	2		1	4	1
<b>Oystercatcher*</b>						
High	28	7	97	105	10	13
Mid	85	65	425	181	28	68
Low	1322	68	226	225	147	163
<b>Redshank <i>Tringa totanus</i>*</b>						
High				11	12	
Mid	1	1	1	9		1
Low	5	1	5	2		
<b>Ringed Plover <i>Charadrius hiaticula</i></b>						
High	1					
Mid						
Low	3					
<b>Turnstone <i>Arenaria interpres</i></b>						
High	23	5	22		22	
Mid	4	23		1	16	
Low	1	2	1			

**Key:**

\* Lavan Sands SPA Qualifying Feature

^ Liverpool Bay SPA waterbird assemblage species

**Table 3: Junction 16 Survey Results**

	2017			2018		
	October	November	December	January	February	March
<b>Eider<sup>^</sup></b>						
High						
Mid	3	10				
Low					1	
<b>Red-throated Diver<sup>#^</sup></b>						
High	1	7				
Mid	2	2				
Low						
<b>Great Crested Grebe<sup>^</sup></b>						
High	2	9				3
Mid	4			1		
Low						
<b>Red-breasted Merganser<sup>^</sup></b>						

	2017			2018		
	October	November	December	January	February	March
High						
Mid		3				
Low						
<b>Curlew</b>						
High			12	34		
Mid	1	42	24	40		
Low		2	32	1		
<b>Oystercatcher*</b>						
High	39	82	137	40	16	19
Mid	85	117	118	120	20	15
Low	40	34	94	70	38	28
<b>Ringed Plover</b>						
High	10					
Mid		6				
Low						
<b>Turnstone</b>						
High	3				3	
Mid	10					
Low						

**Key:**

\* Lavan Sands SPA Qualifying Feature

# Liverpool Bay SPA Qualifying Feature

^ Liverpool Bay SPA wintering bird assemblage species

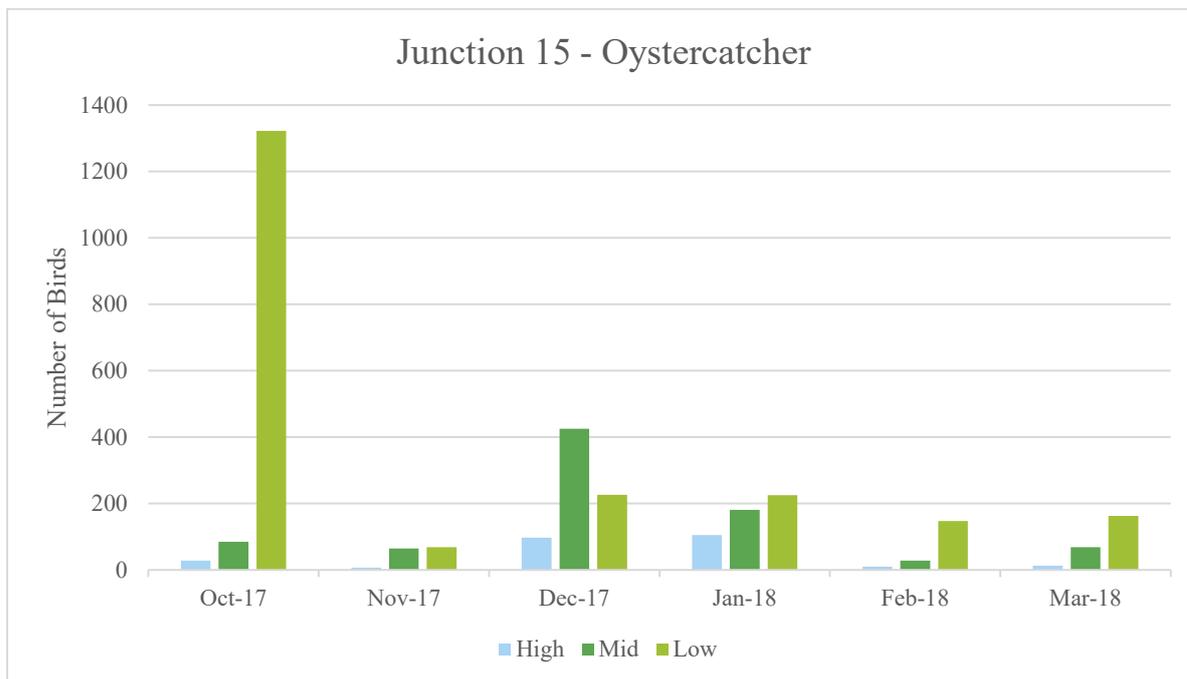
**3.1 Junction 15**

The results in relation to SPA qualifying species logged within the Junction 15 survey area as well as other waders/wildfowl are discussed in this section.

**Oystercatcher**

Chart 1 illustrates the survey results in relation to Oystercatcher. As illustrated by this graph and Figure 3, Oystercatcher were most abundant within the survey area during low tide, when a maximum of 1,322 were present (October 2017), predominantly foraging within the intertidal area to the west of Junction 15. Numbers within the survey area reduced as the tide flooded and birds left to forage/roost elsewhere with a maximum of 105 birds present at high tide (January 2018). During high tide, Oystercatcher were recorded using the recreational amenity grassland areas to the north of the A55 and Penmaen Park to the south. Only a small percentage of birds were recorded in areas which would be affected by the scheme (up to 25 individuals as shown on Figure 7).

**Chart 1: Junction 15- Oystercatcher Survey Results**



**Other Species**

**Mute Swan** was recorded during five of six surveys (no records during January 2018), with a maximum count of seven which occurred during each tidal state in December. This species was solely logged on the sailing lake within the recreational area in the west of the survey area.

A single female **Greater Scaup** was recorded during high and mid tide surveys, on the sailing lake within the recreational area, in March 2018.

**Mallard** were logged during each survey and each tidal state. A maximum survey count of 68 birds was made at high tide in October 2017. This species favoured the stream and sailing lake in the west of the survey area.

A single **Goosander** was logged on the sailing lake in the west of the survey area at high tide in January 2018.

**Great Crested Grebe** were recorded foraging on the sea during four survey months, with a maximum of two birds present (high tide, January 2018).

Single **Red-breasted Merganser** were recorded during mid and low tide surveys in October 2017.

One **Cormorant** was logged in flight during the low tide survey in October 2017.

**Bar-tailed Godwit** were logged at the stream outflow, and adjacent inter-tidal areas during surveys in October 2017 (one bird) and December 2017 (maximum of 19 birds).

**Curlew** were recorded during each survey, predominantly at low tide foraging in the inter-tidal area. However, the maximum number of birds occurred in January 2018 (28) when Curlew were recorded foraging at mid and low tide within Penmaen Park.

**Redshank** were recorded during each survey month, predominantly foraging in the inter-tidal area near the stream outflow in the west of the survey area. A maximum of

12 birds were observed during any survey, roosting just above the high tide line on the beach in the west of the survey area in February 2018 (at high tide).

**Ringed Plover** were observed at high and low tide in the west of the survey area near the stream outflow in October 2017 (maximum of three birds).

**Turnstone** were logged during five of six survey months, with up to 23 birds observed (high tide in October 2017 and mid-tide in November 2017). This species favoured the intertidal area in the west of the survey area.

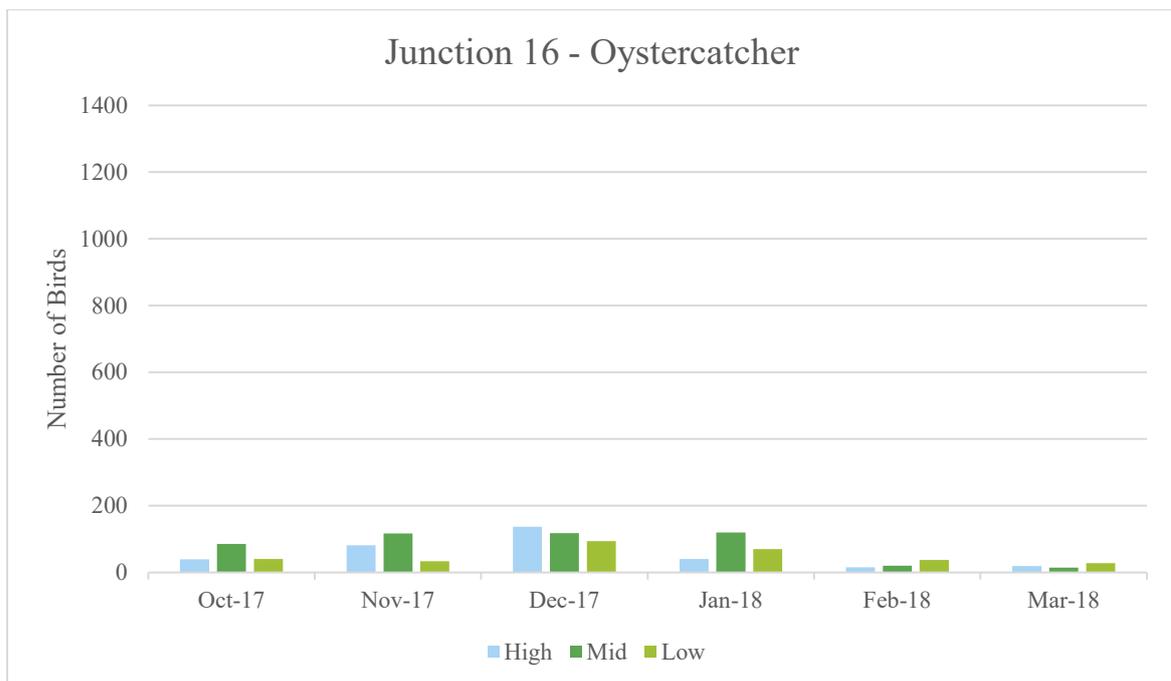
### 3.2 Junction 16

The results in relation to SPA qualifying species logged within the Junction 16 survey area as well as other waders/wildfowl are discussed in this section.

#### Oystercatcher

A maximum of 120 Oystercatcher were recording within the Junction 16 survey area, occurring during the mid-tide survey in January 2018 (Figure 14). Numbers within the survey area were typically fairly consistent during each survey during each month. At high tide Oystercatcher moved from the intertidal area to forage within nearby pasture and recreational areas. Only a small percentage of birds were recorded within these areas which would be affected by the scheme up to 41 individuals (Figs 13 and 14).

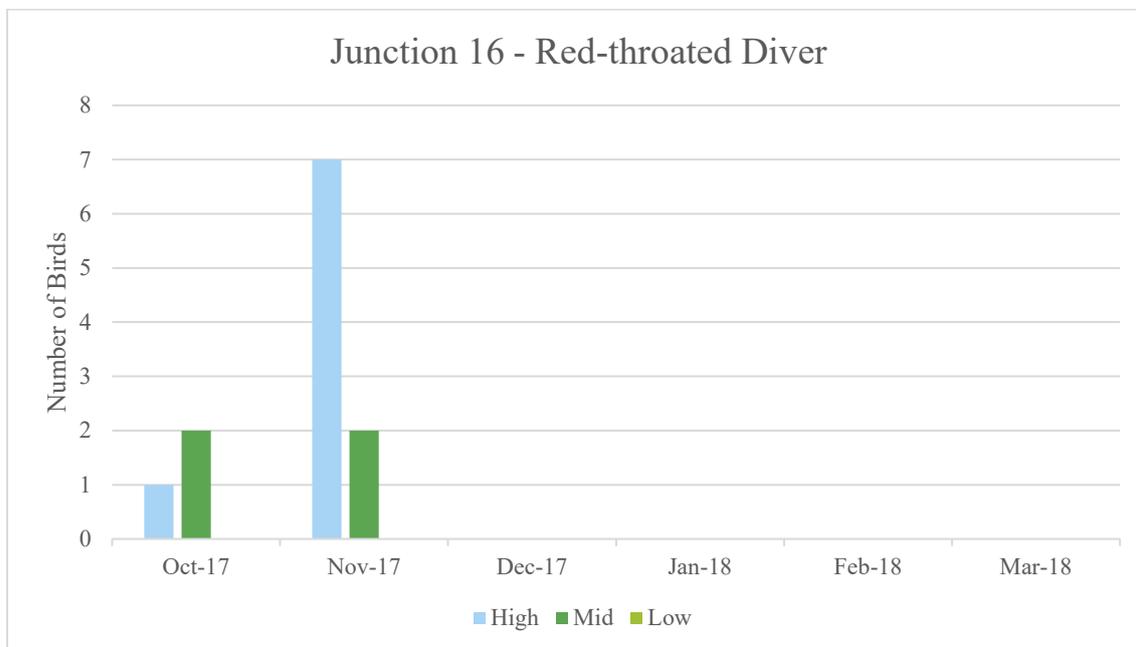
**Chart 2: Junction 16- Oystercatcher Survey Results**



### Red-throated Diver

Recorded during two survey months (October (Figure 17) and November 2017 (Figure 18)), with a maximum of seven birds recorded during any survey (high tide, November 2017).

**Chart 3: Junction 16- Red-throated Diver Survey Results**



### Other Species

**Eider** was recorded on the sea during three survey months (October 2017, November 2017 and February 2018), with a maximum of ten birds present (mid-tide, November 2018).

**Great Crested Grebe** were logged on the sea during four of six surveys (no records in December 2017 and February 2018), with a maximum of nine birds present at high tide in November 2018.

**Red-breasted Merganser** were solely recorded at mid-tide in November 2017, when three birds were present in the west of the survey area.

**Curlew** were logged during four of six surveys (no records in February or March 2018). A maximum of 40 birds were observed at mid-tide in January 2018, just to the east of the survey area within pasture.

**Ringed Plover** were logged in October 2017 (ten birds at high tide) and November 2017 (six birds at mid-tide).

**Turnstone** were logged at high tide (three birds) and mid-tide (ten birds) in October 2017 just above the high-tide line in the centre of the survey area. Three birds were also observed at high tide in February 2018.

## **APPENDIX A**

### **FIGURES**

**Figure 1: Site Locations**

**Figure 2: Study Areas and Survey Routes**

**Figure 3: Cumulative Oystercatcher Distribution J15 (Oct-Mar)**

**Figure 4: Oystercatcher Distribution J15 (Oct)**

**Figure 5: Oystercatcher Distribution J15 (Nov)**

**Figure 6: Oystercatcher Distribution J15 (Dec)**

**Figure 7: Oystercatcher Distribution J15 (Jan)**

**Figure 8: Oystercatcher Distribution J15 (Feb)**

**Figure 9: Oystercatcher Distribution J15 (Mar)**

**Figure 10: Cumulative Oystercatcher Distribution J16 (Oct-Mar)**

**Figure 10: Oystercatcher Distribution J15 (Oct)**

**Figure 12: Oystercatcher Distribution J15 (Nov)**

**Figure 13: Oystercatcher Distribution J15 (Dec)**

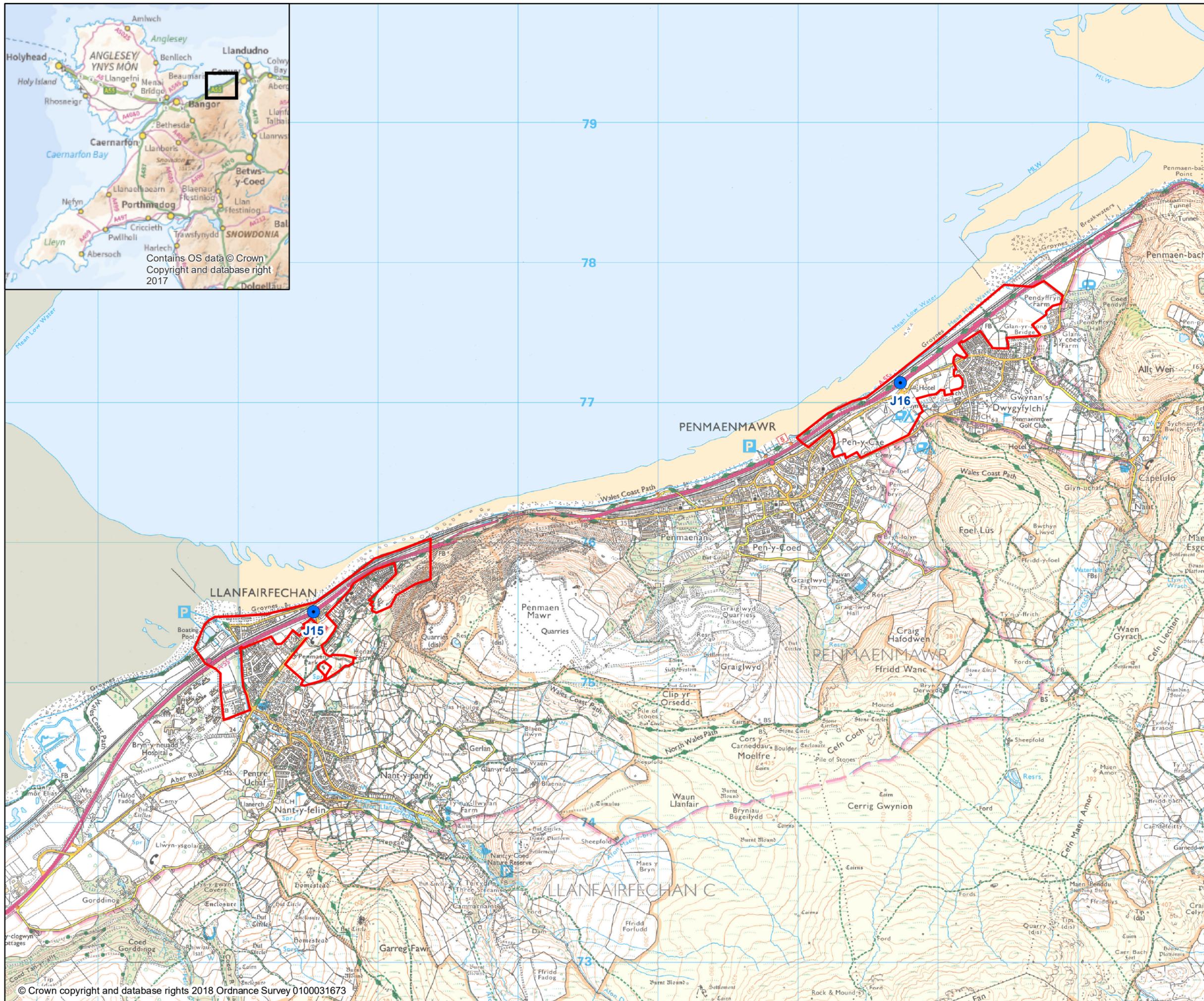
**Figure 14: Oystercatcher Distribution J15 (Jan)**

**Figure 15: Oystercatcher Distribution J15 (Feb)**

**Figure 16: Oystercatcher Distribution J15 (Mar)**

**Figure 17: Red-throated Diver Distribution J15 (Oct)**

**Figure 18: Red-throated Diver Distribution J15 (Nov)**



- A55 Junctions
- Study Area Boundaries

**A55 Junctions 15 & 16;  
Wintering  
Bird Survey 2017/2018**



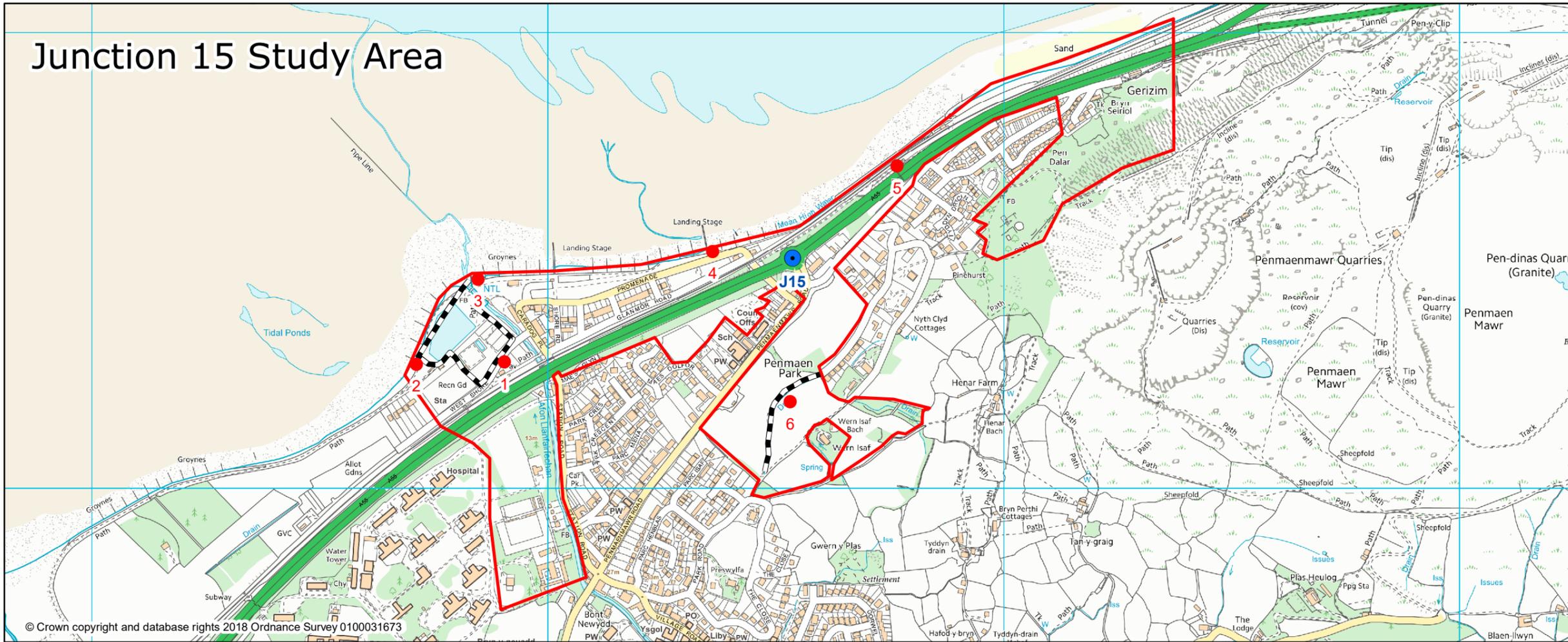
tel 01224 652 200 fax 01224 652 244  
info@altra.co.uk  
www.ramboll.co.uk



**Fig 1 Site Location**

Drawn: JG	Scale (@A3): 1:25,000	Date: 18/07/2018
Drawing No: 1	Rev:	

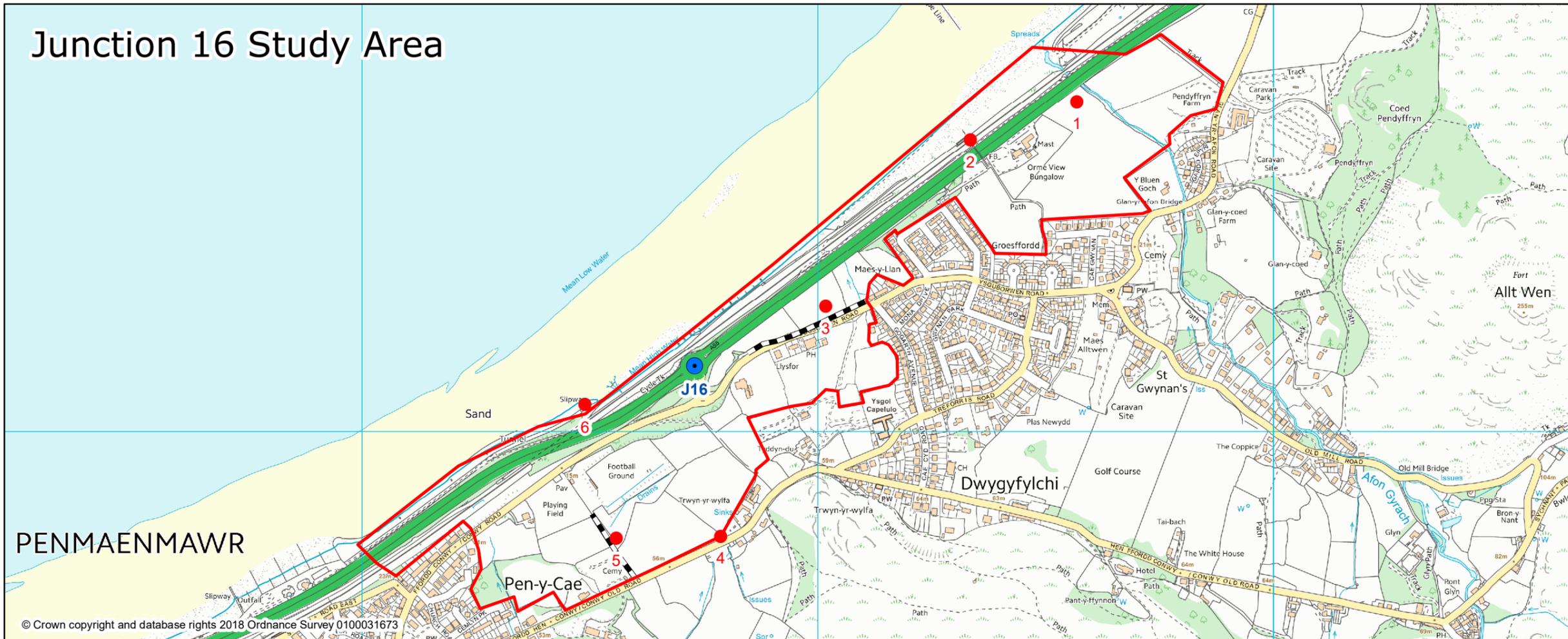
# Junction 15 Study Area



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- A55 Junctions
- Study Area Boundary
- Viewpoint
- Transects

# Junction 16 Study Area



A55 Junctions 15 & 16;  
Wintering  
Bird Survey 2017/2018



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Fig 2 Study areas and Survey Routes

Drawn: JG	Scale (@A3): 1:10,000	Date: 18/07/2018
Drawing No: 2		Rev:

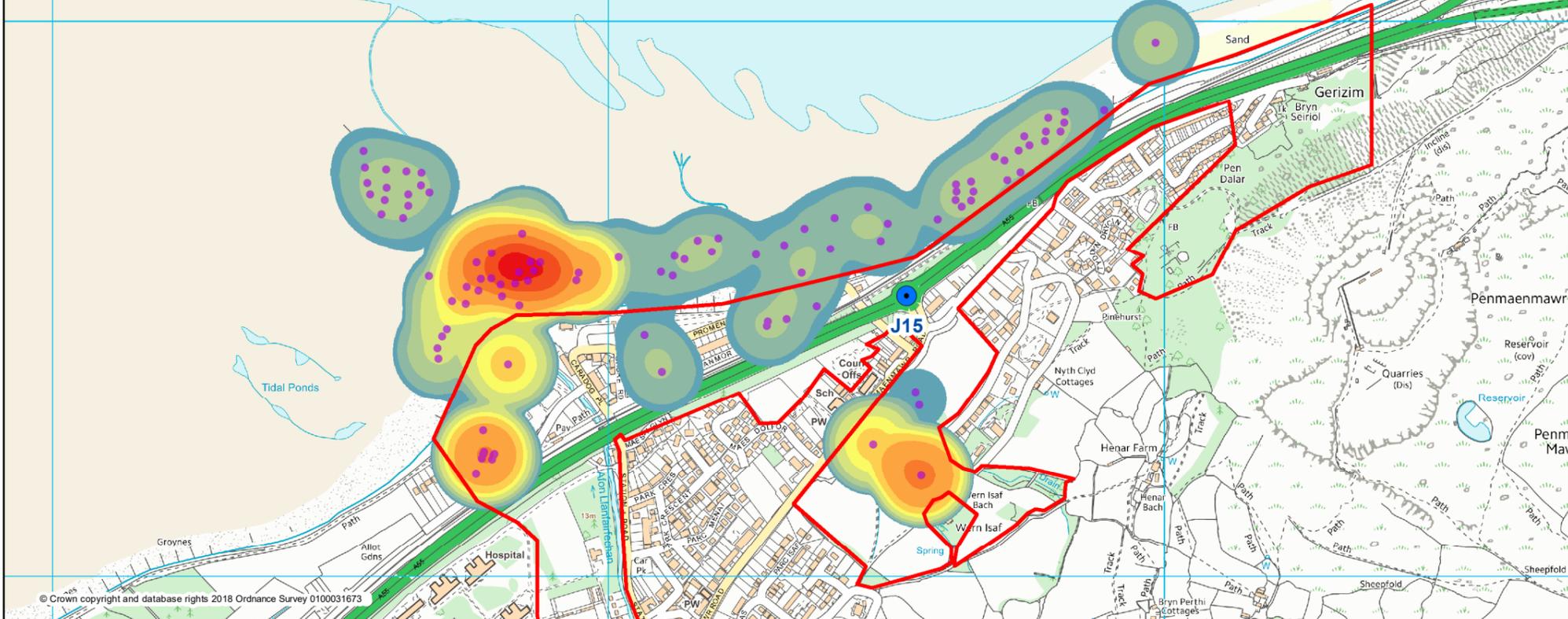
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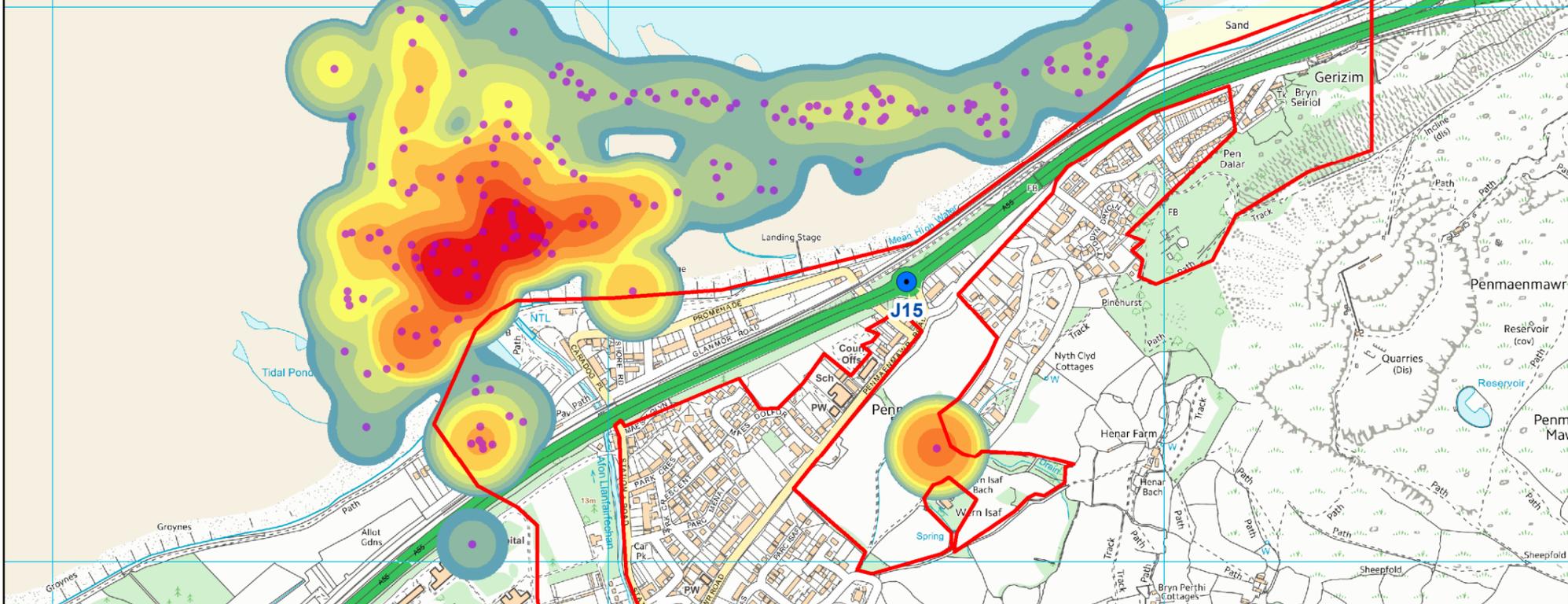
# Junction 15 - High Tide



# Junction 15 - Mid Tide



# Junction 15 - Low Tide



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Fig 3 Cumulative Oystercatcher Distribution J15 (Oct-Mar)

Drawn: JG Scale (@A3): 1:10,000 Date: 18/07/2018 Drawing No: 3 Rev:

### Oystercatcher Cumulative Counts

- 1 - 2
- 3 - 5
- 6 - 10
- 11 - 20
- 21 - 30

- 31 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 550

● A55 Junctions

□ Study Area Boundary

● Bird Observations



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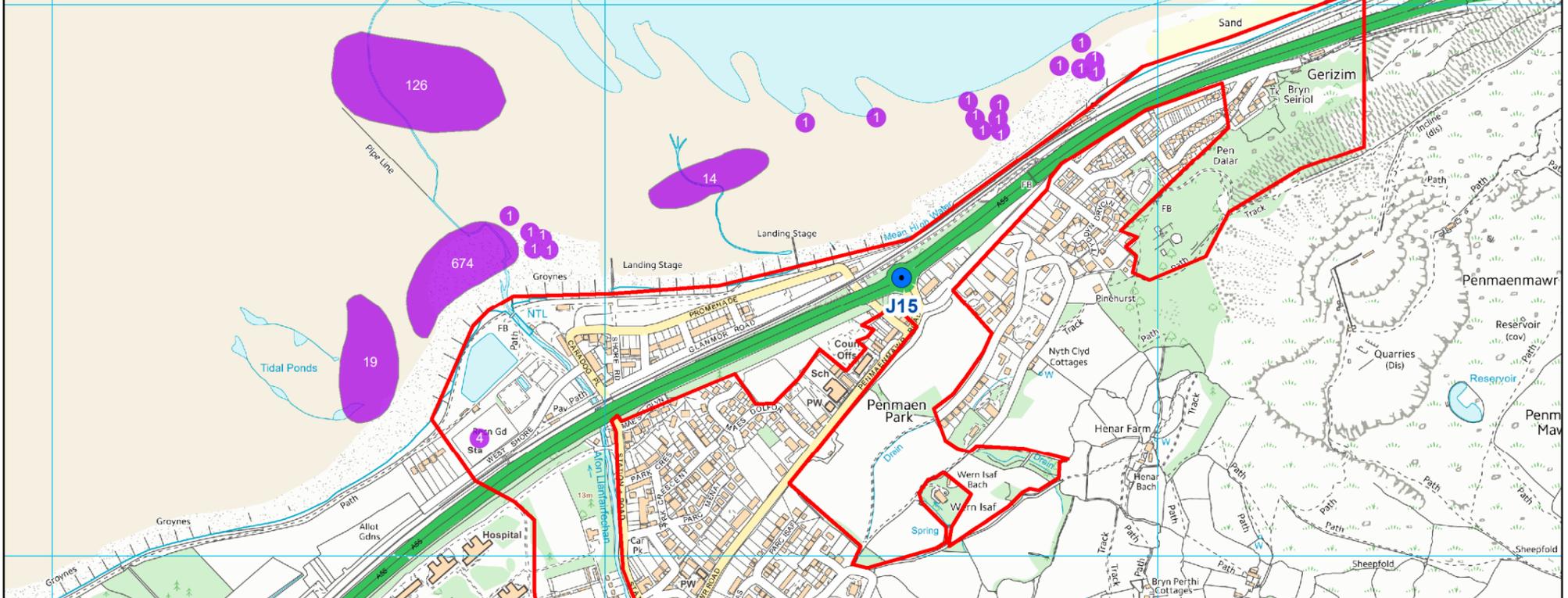
# Junction 15 - High Tide



# Junction 15 - Mid Tide



# Junction 15 - Low Tide



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A55 Junctions 15 & 16;  
Wintering Bird Survey  
2017/2018

Fig 4  
Oystercatcher  
Distribution J15 (Oct)

Drawn: JG Scale (@A3): 1:10,000 Date: 18/07/2018  
Drawing No: 4 Rev:

- Bird Observations
- A55 Junctions
- Study Area Boundary



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# Junction 15 - High Tide



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Fig 5  
Oystercatcher  
Distribution J15 (Nov)

Drawn: JG Scale (@A3): Date: 1:10,000 18/07/2018

Drawing No: 5 Rev:

- Bird Observations
- A55 Junctions
- Study Area Boundary

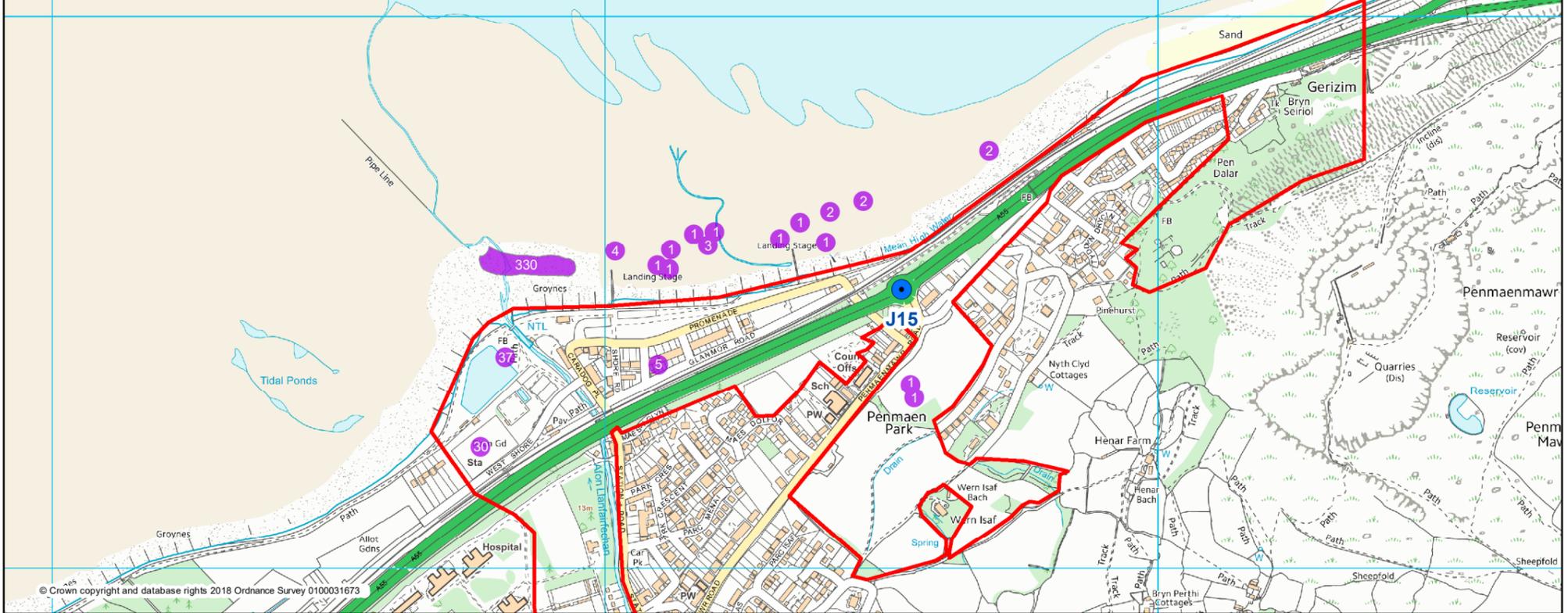


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Fig 6  
Oystercatcher  
Distribution J15 (Dec)

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Drawing No: 6 Rev:

- Bird Observations
- A55 Junctions
- Study Area Boundary



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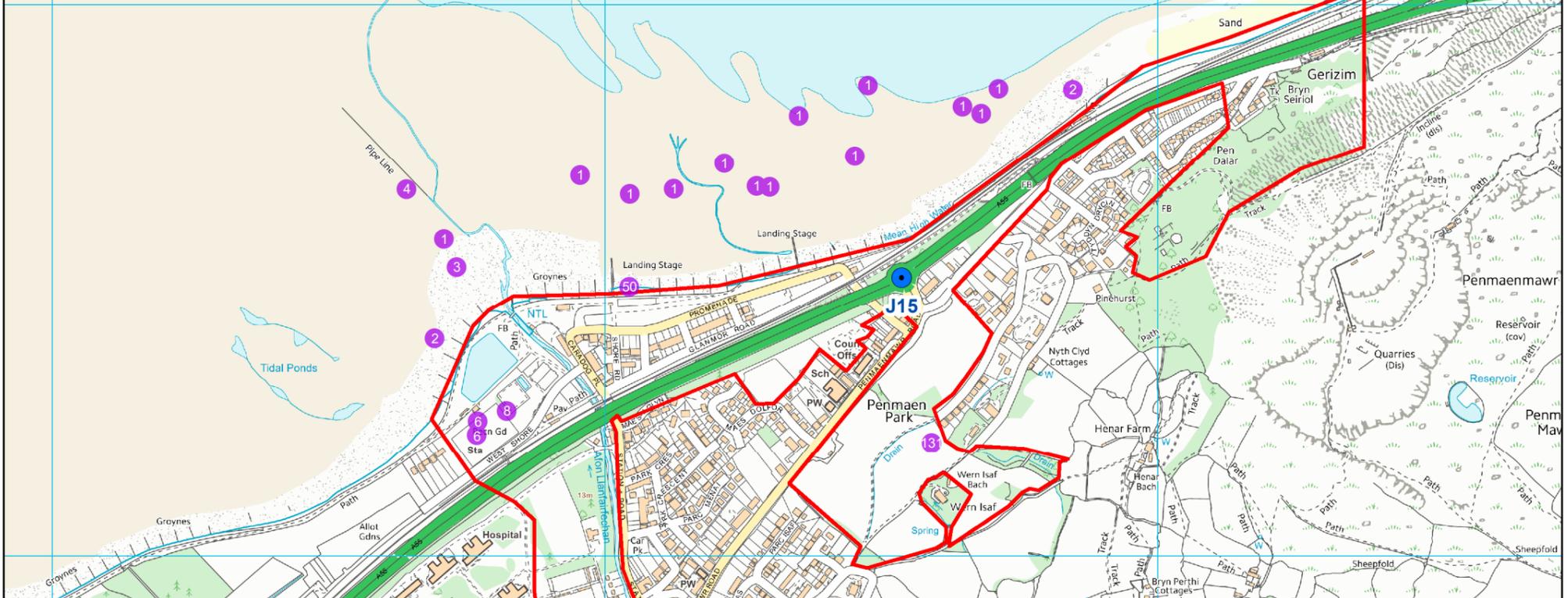
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Fig 7  
Oystercatcher  
Distribution J15 (Jan)

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- Bird Observations
- A55 Junctions
- Study Area Boundary



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Fig 8  
Oystercatcher  
Distribution J15 (Feb)

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Drawing No: 8 Rev:

- Bird Observations
- A55 Junctions
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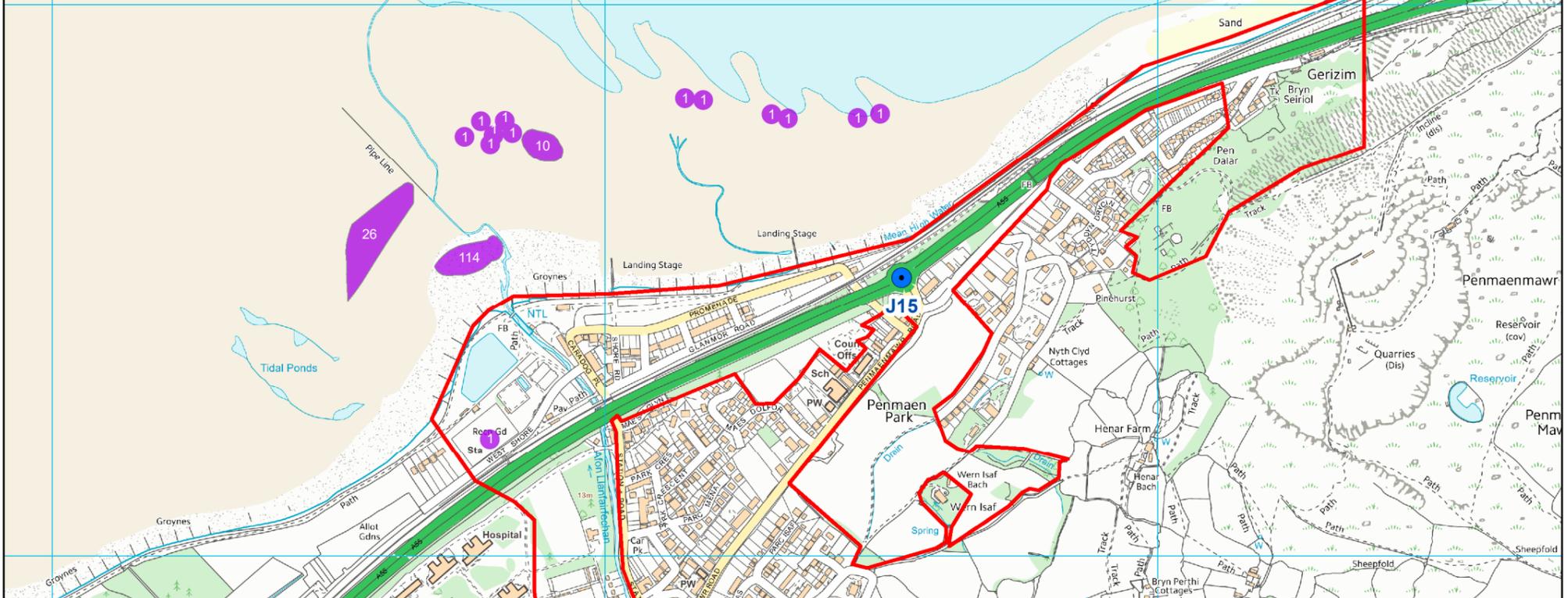
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Fig 9 Oystercatcher Distribution J15 (Mar)

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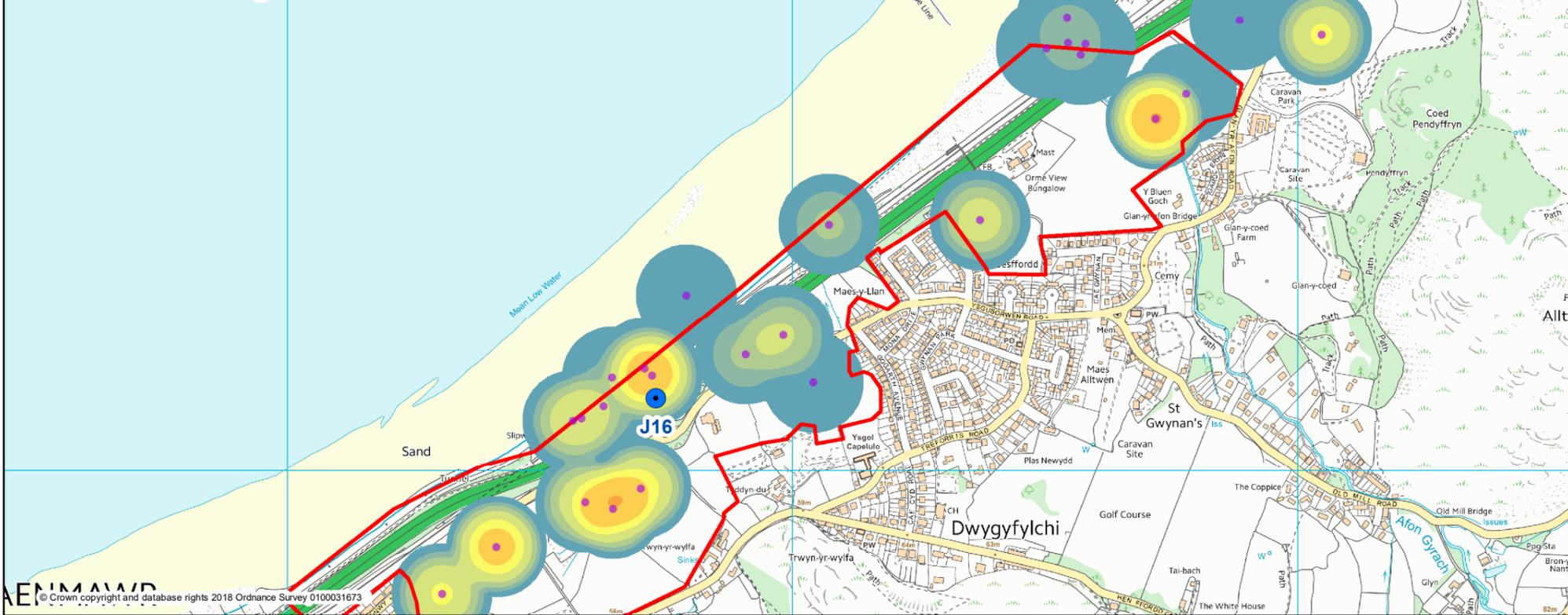
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- Bird Observations
- A55 Junctions
- Study Area Boundary

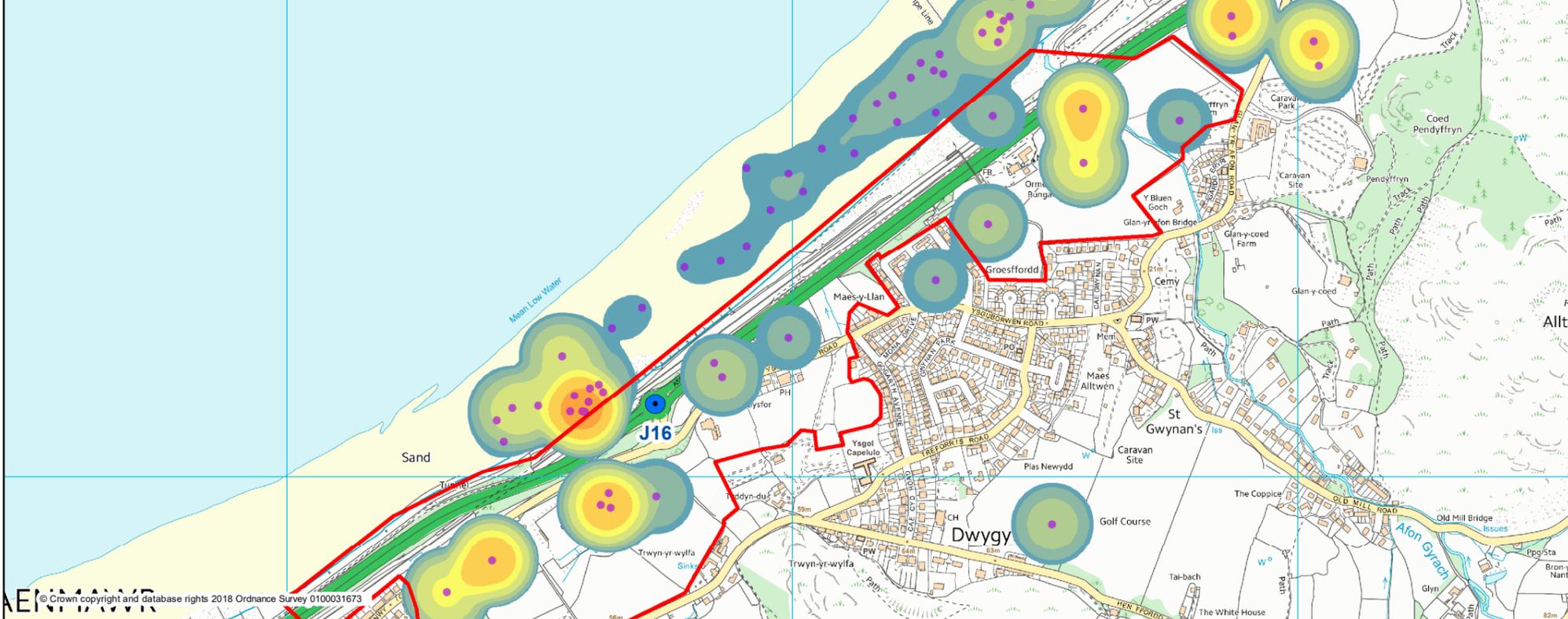


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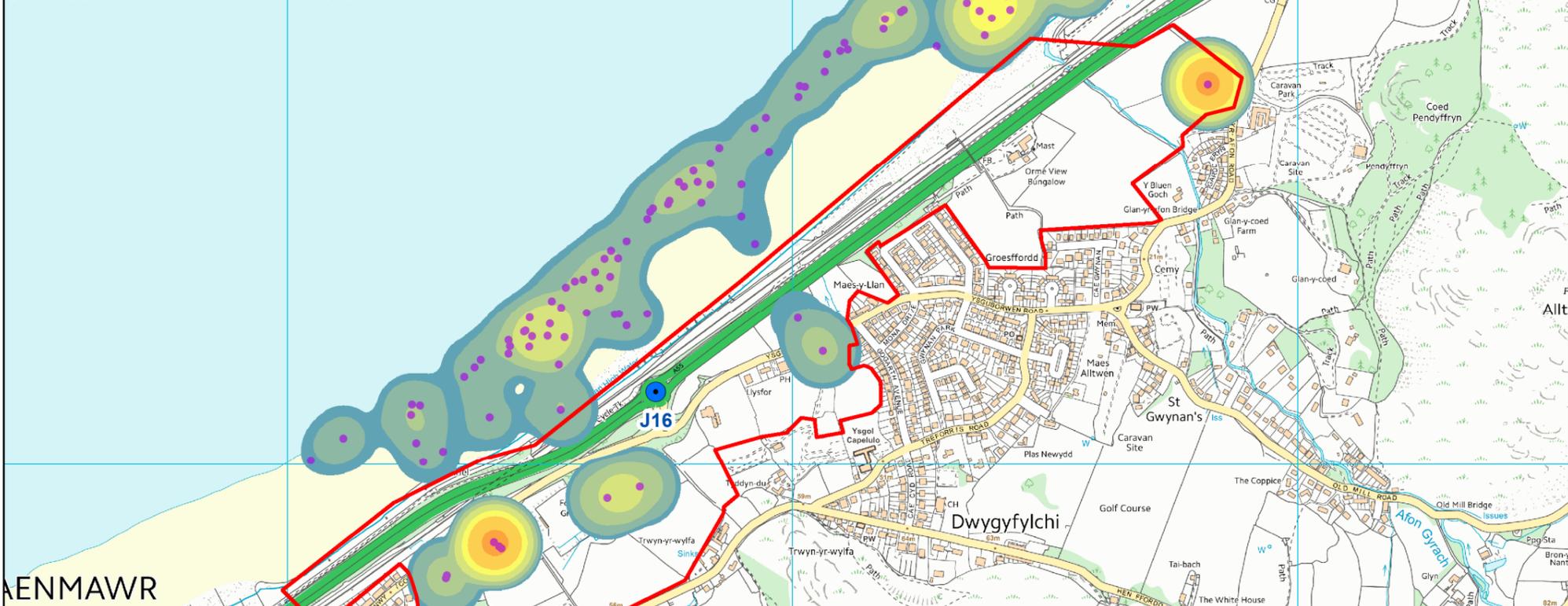
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Fig 10 Cumulative Oystercatcher Distribution J16 (Oct-Mar)

Drawn: JG Scale (@A3): 1:11,000 Date: 18/07/2018

Drawing No: 10 Rev:

### Oystercatcher Cumulative Counts

- 1 - 2
- 3 - 5
- 6 - 10
- 11 - 20
- 21 - 30

- 31 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 550

● A55 Junctions

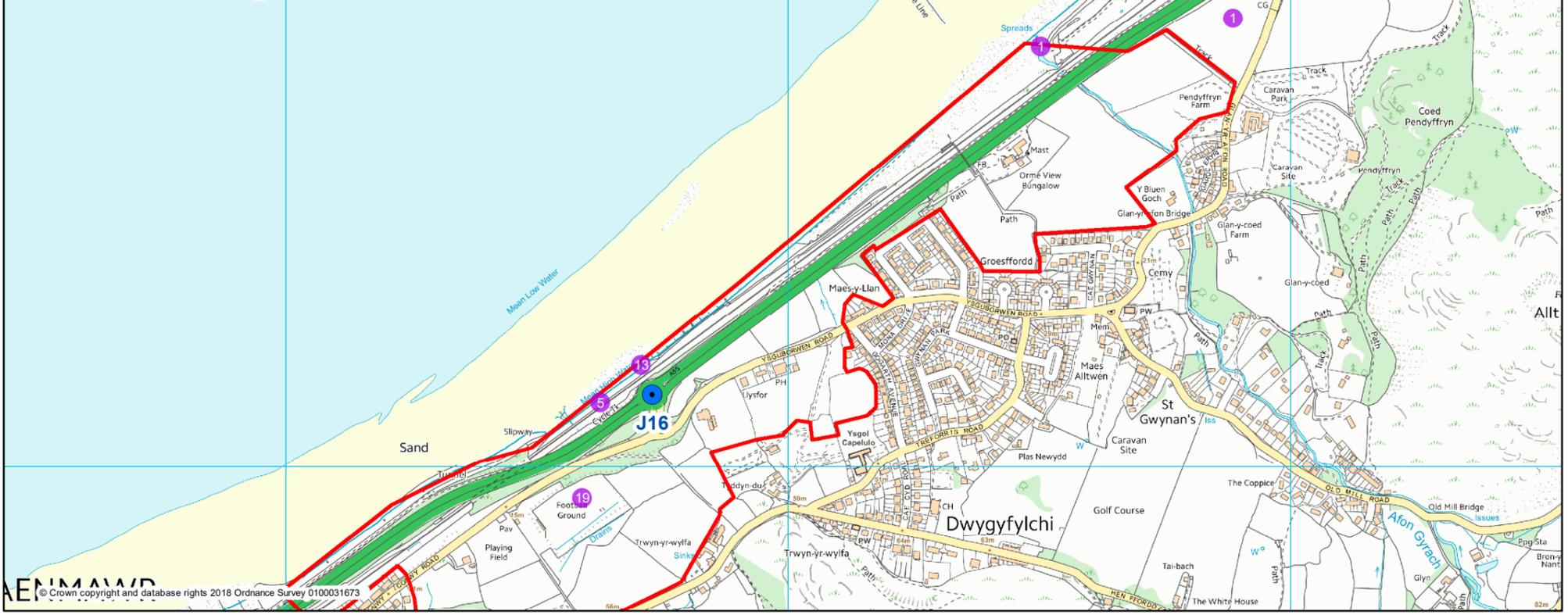
▭ Study Area Boundary

● Bird Observations

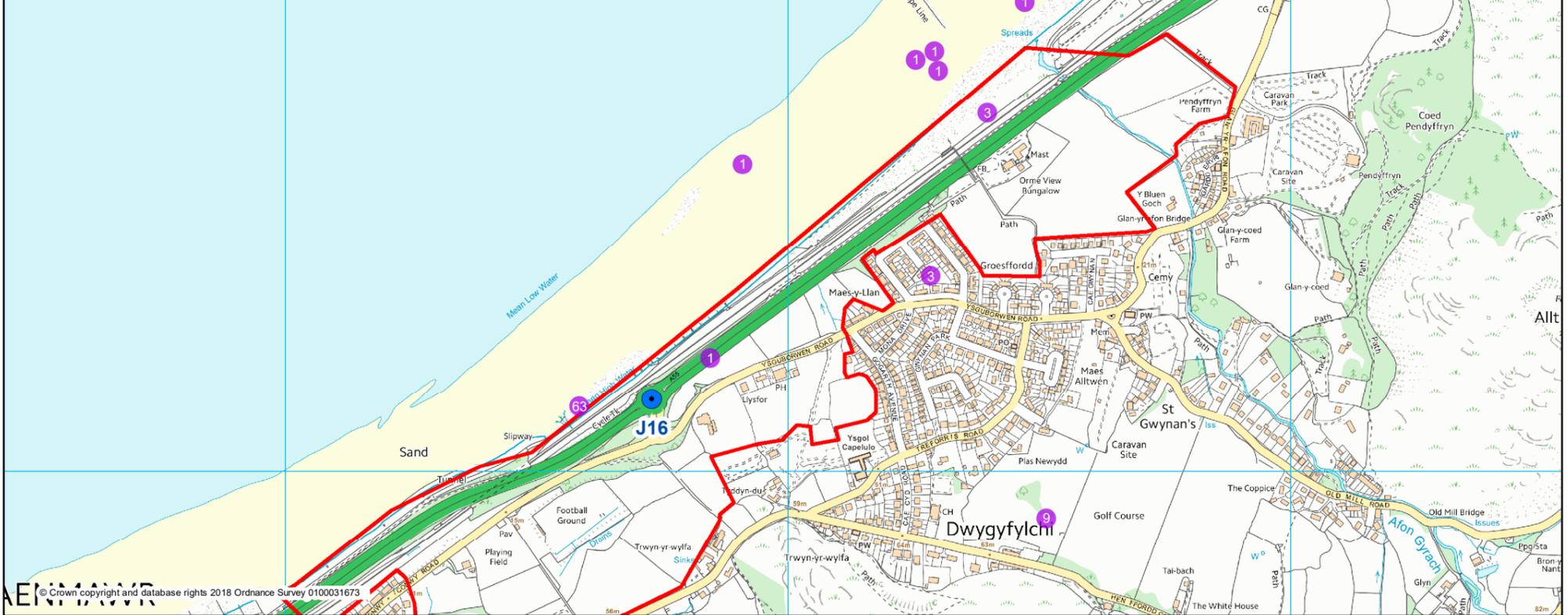


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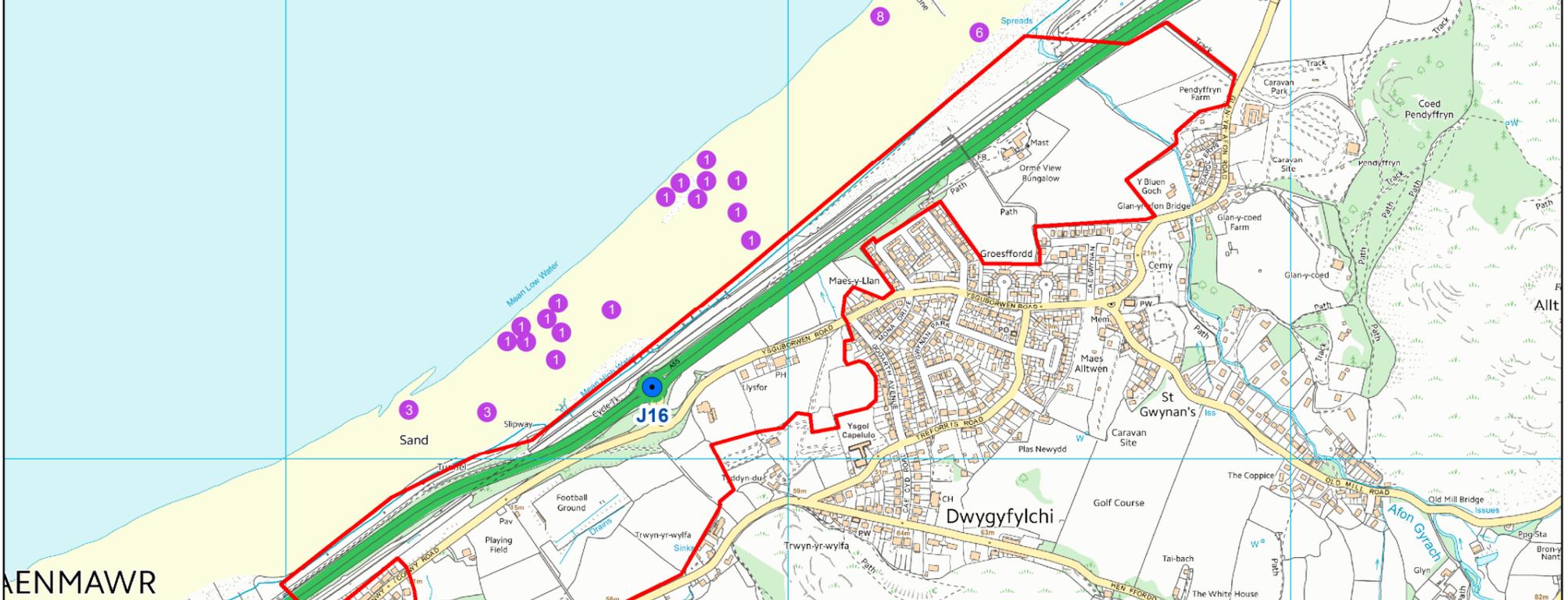
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Fig 11  
Oystercatcher  
Distribution J16 (Oct)

Drawn: JG Scale (@A3): Date: 1:11,000 18/07/2018

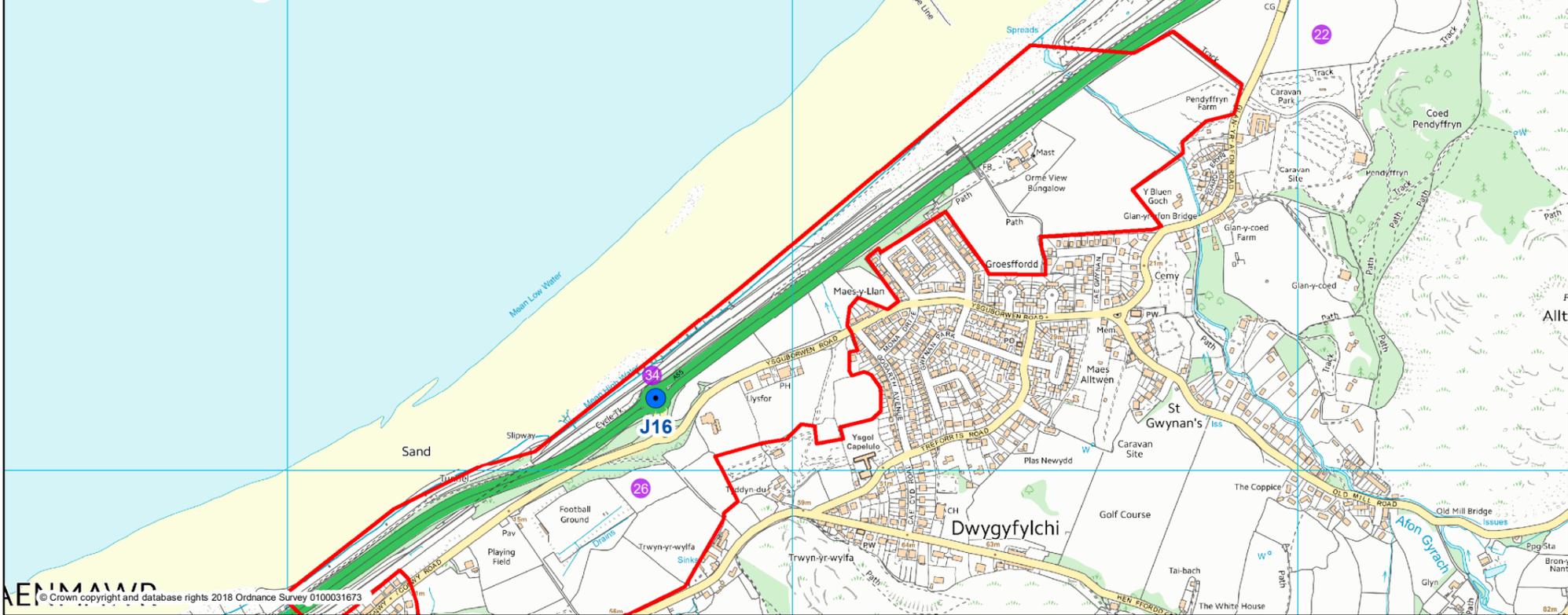
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- Bird Observations
- A55 Junctions
- Study Area Boundary

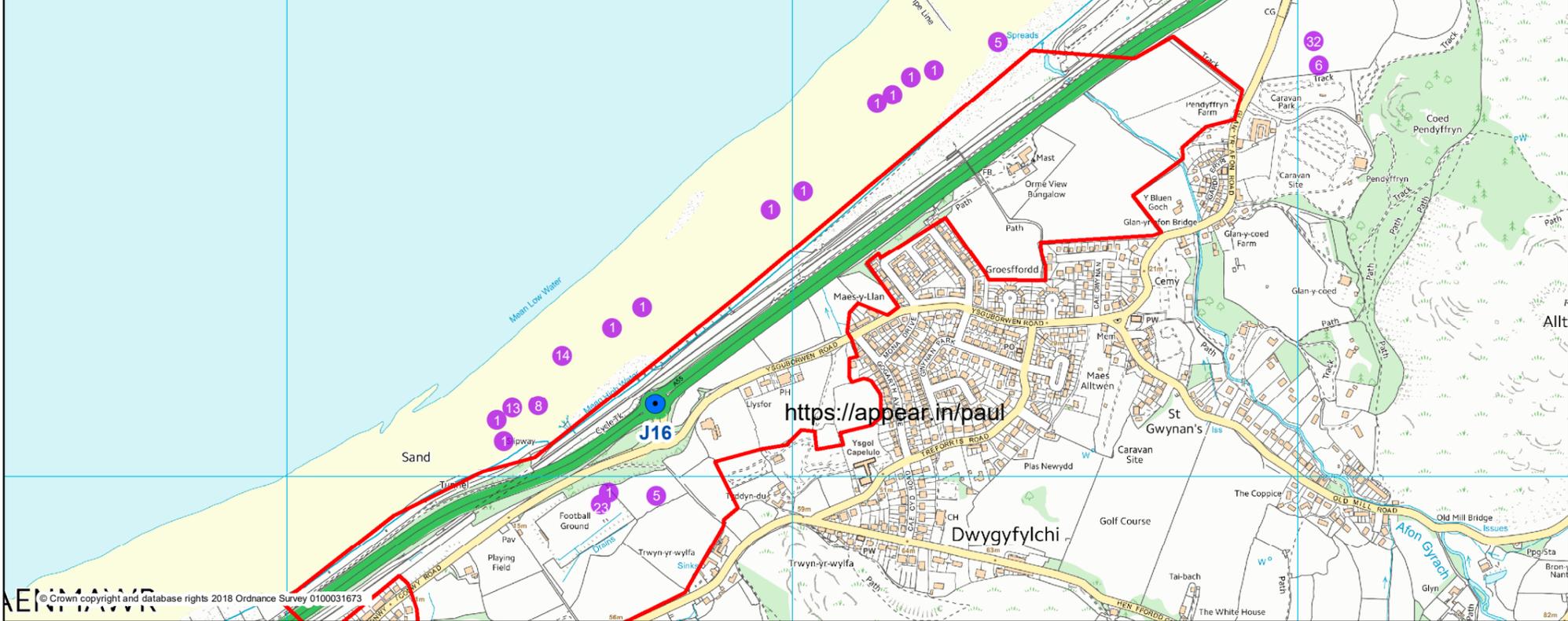


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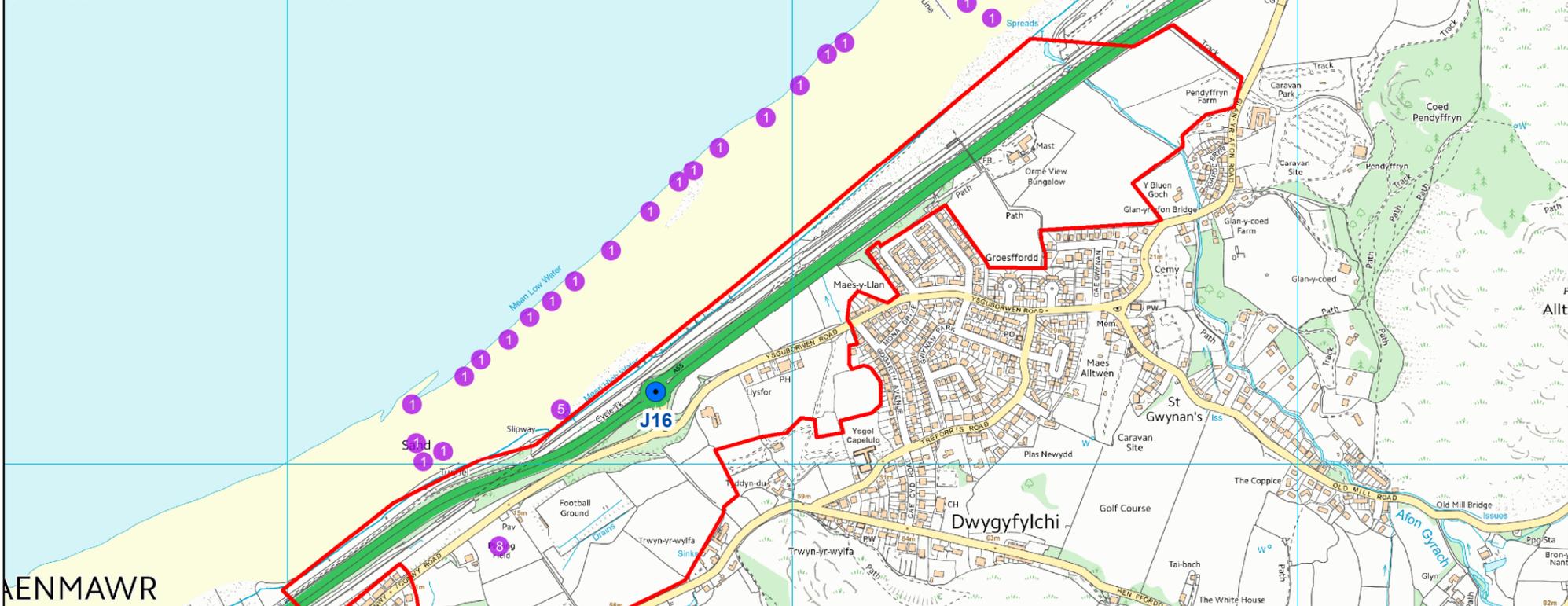
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Fig 12  
Oystercatcher  
Distribution J16 (Nov)

Drawn: JG Scale (A3): Date:  
1:11,000 18/07/2018

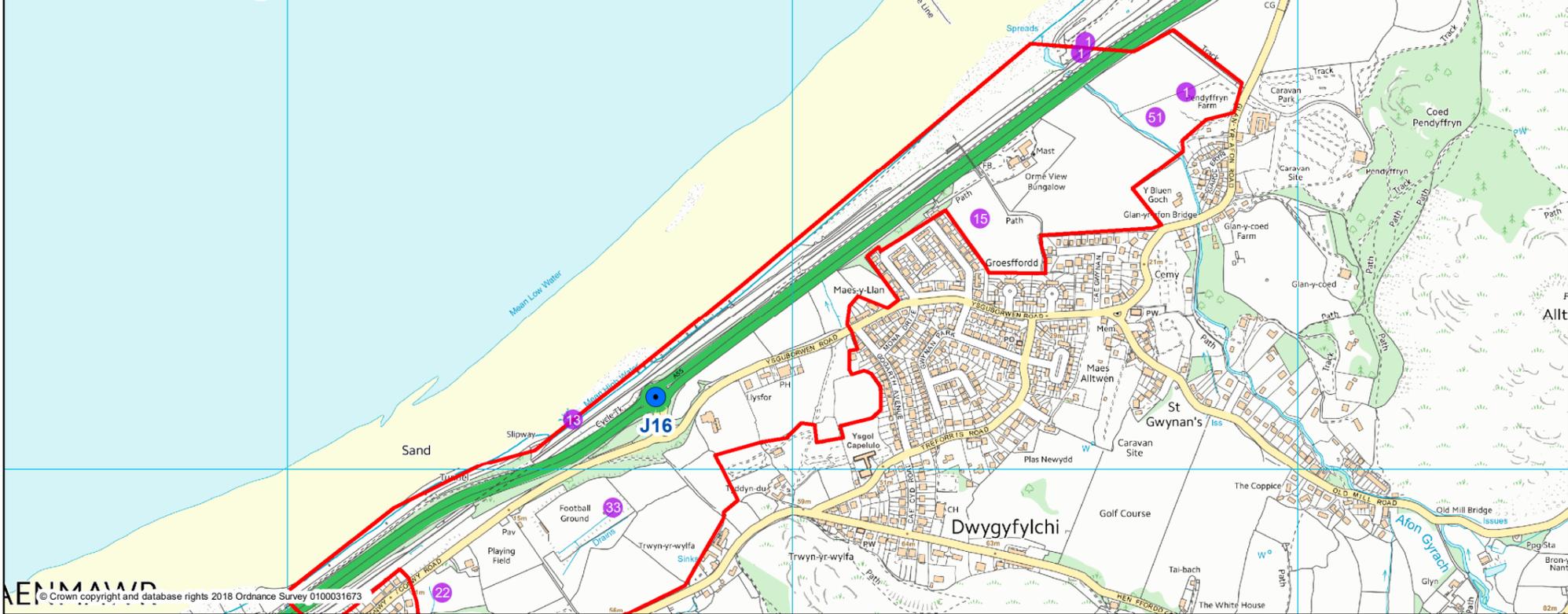
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- Bird Observations
- A55 Junctions
- Study Area Boundary

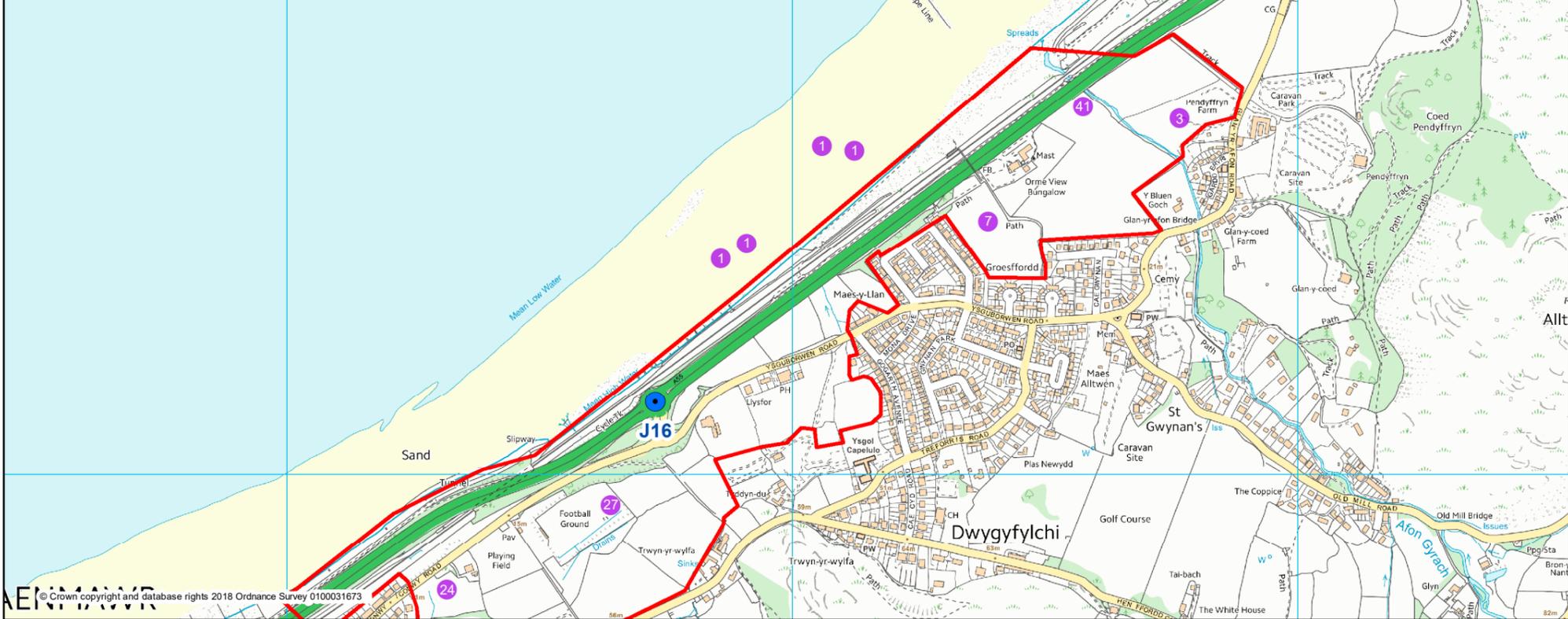


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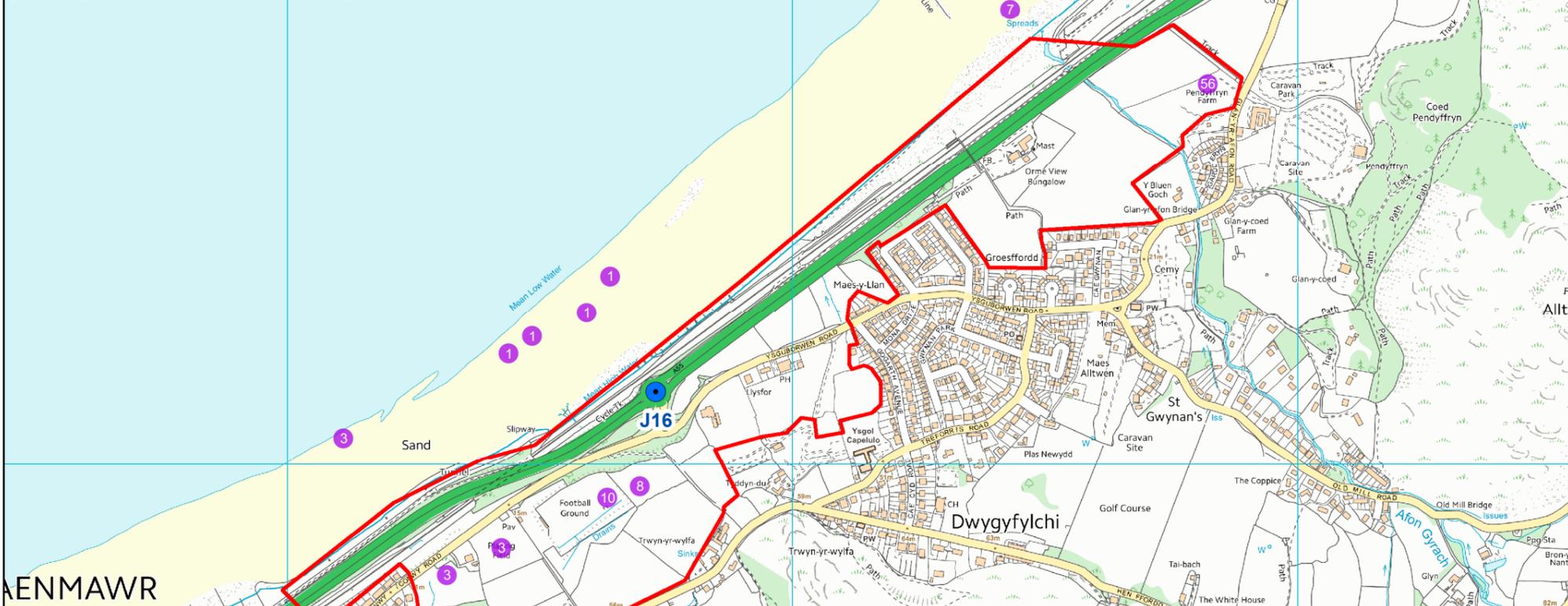
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Fig 13  
Oystercatcher  
Distribution J16 (Dec)

Drawn: JG Scale (@A3): Date: 1:11,000 18/07/2018

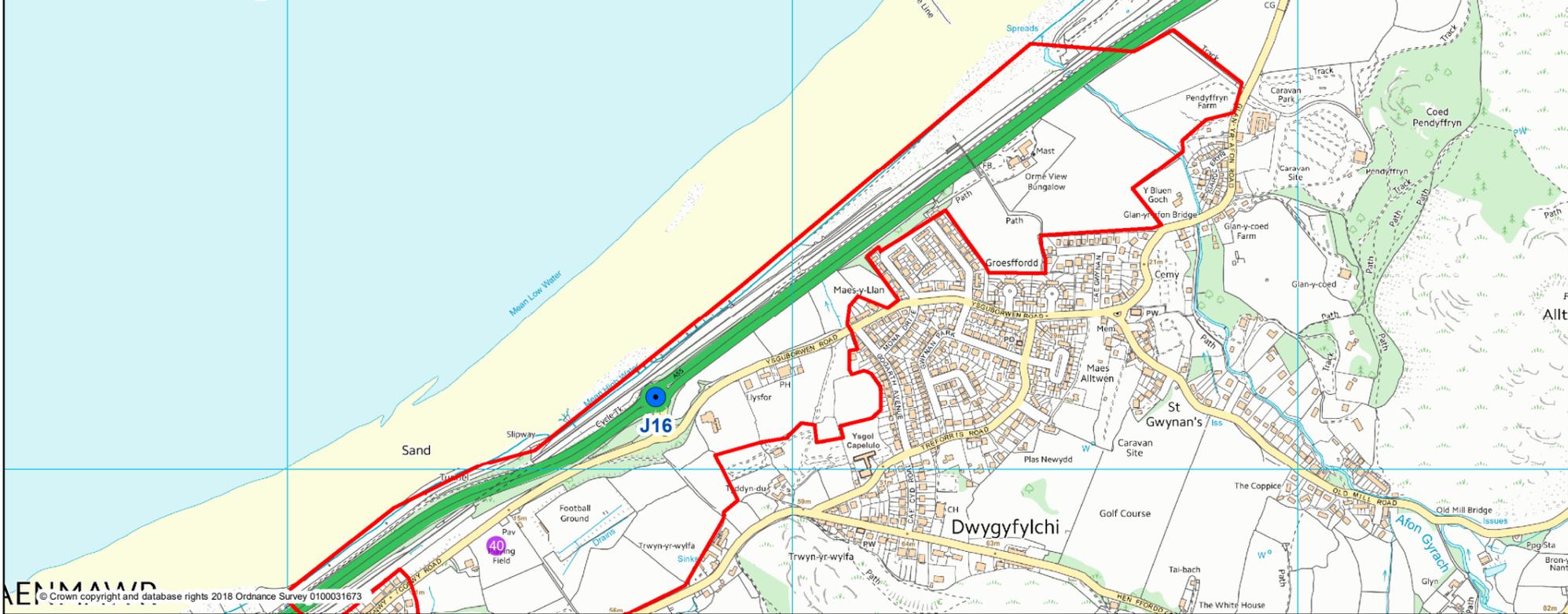
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- Bird Observations
- A55 Junctions
- Study Area Boundary

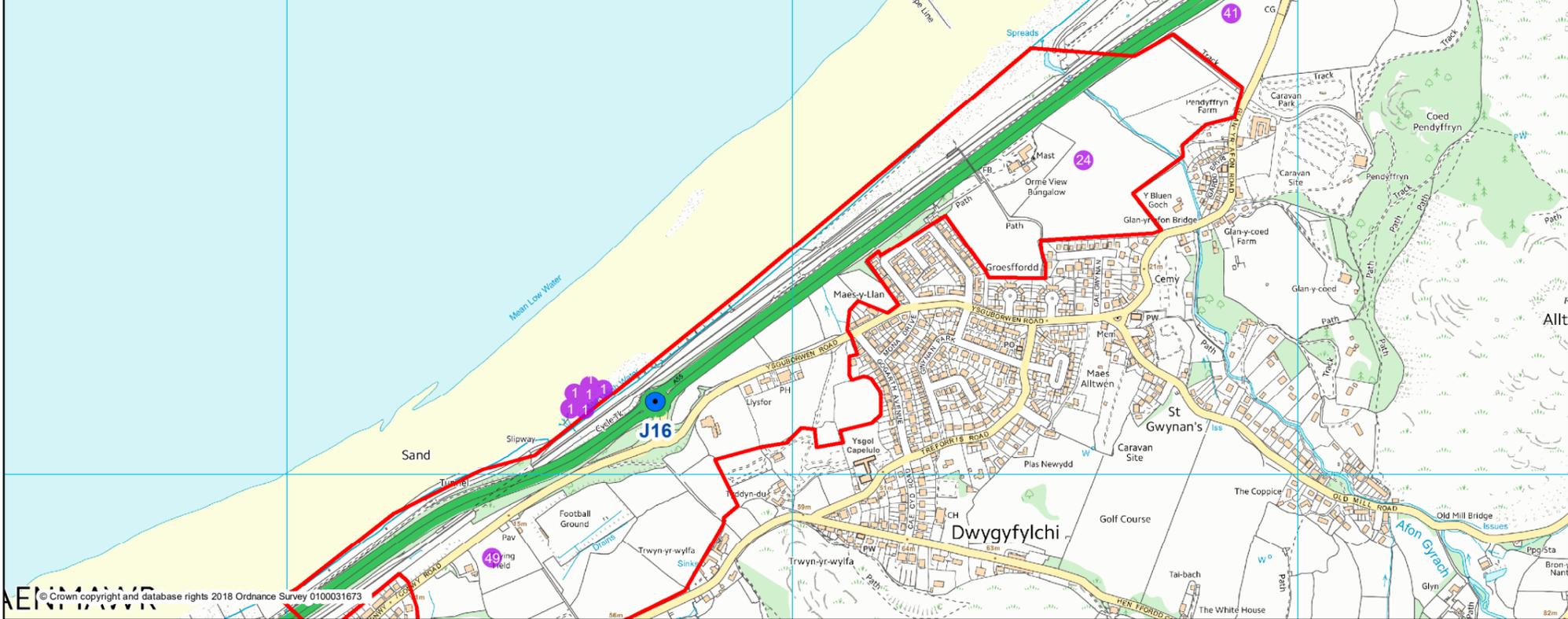


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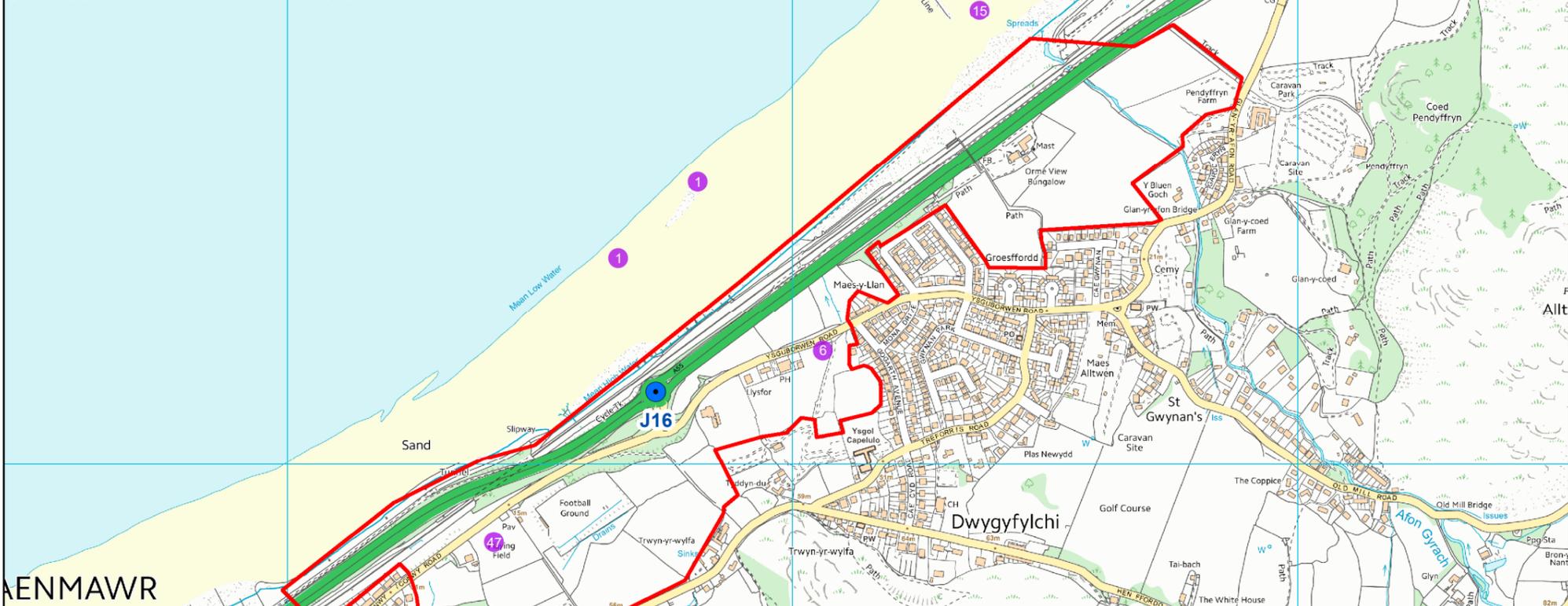
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Fig 14 Oystercatcher Distribution J16 (Jan)

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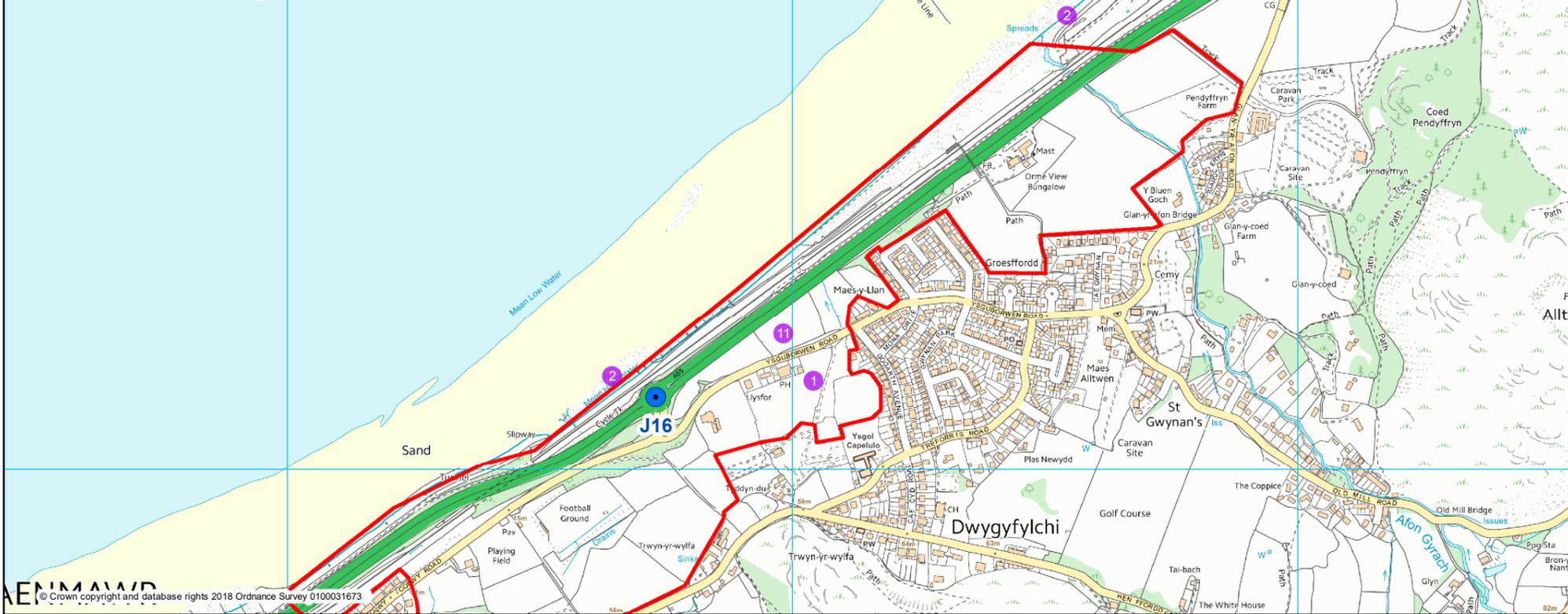
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- Bird Observations
- A55 Junctions
- Study Area Boundary

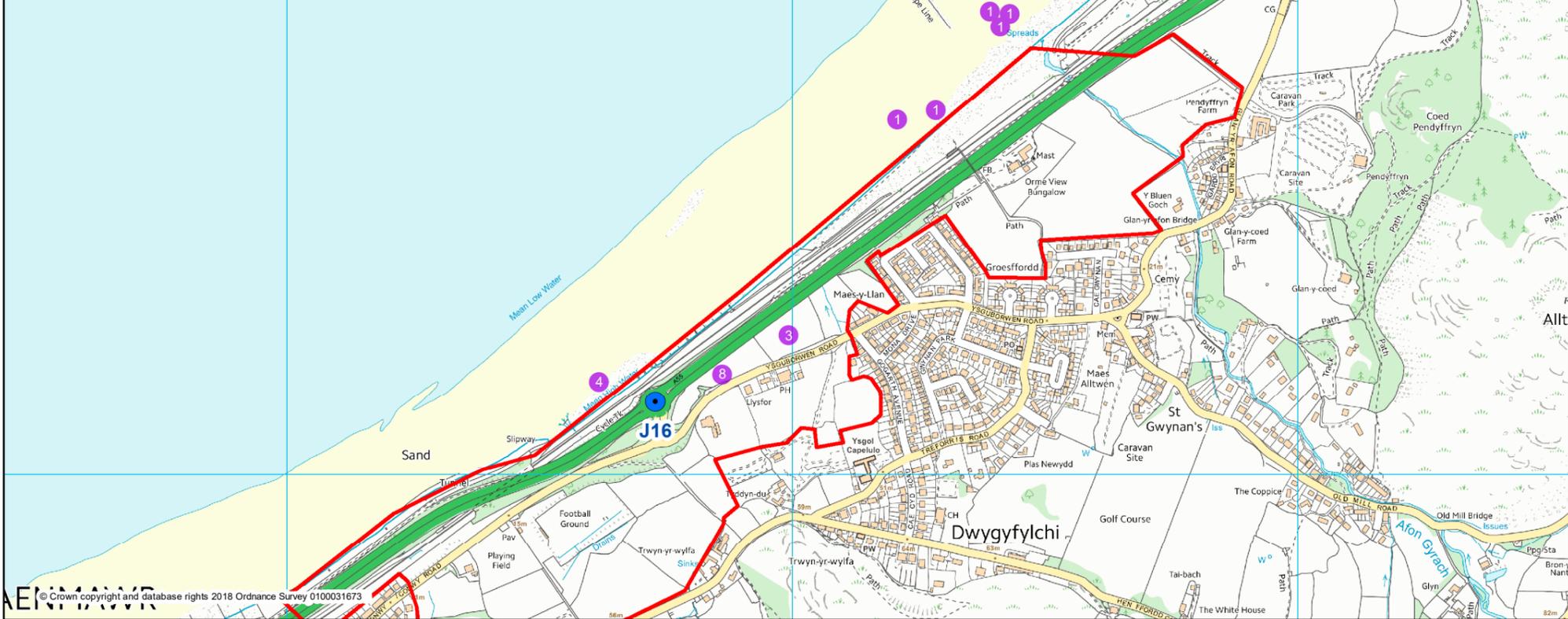


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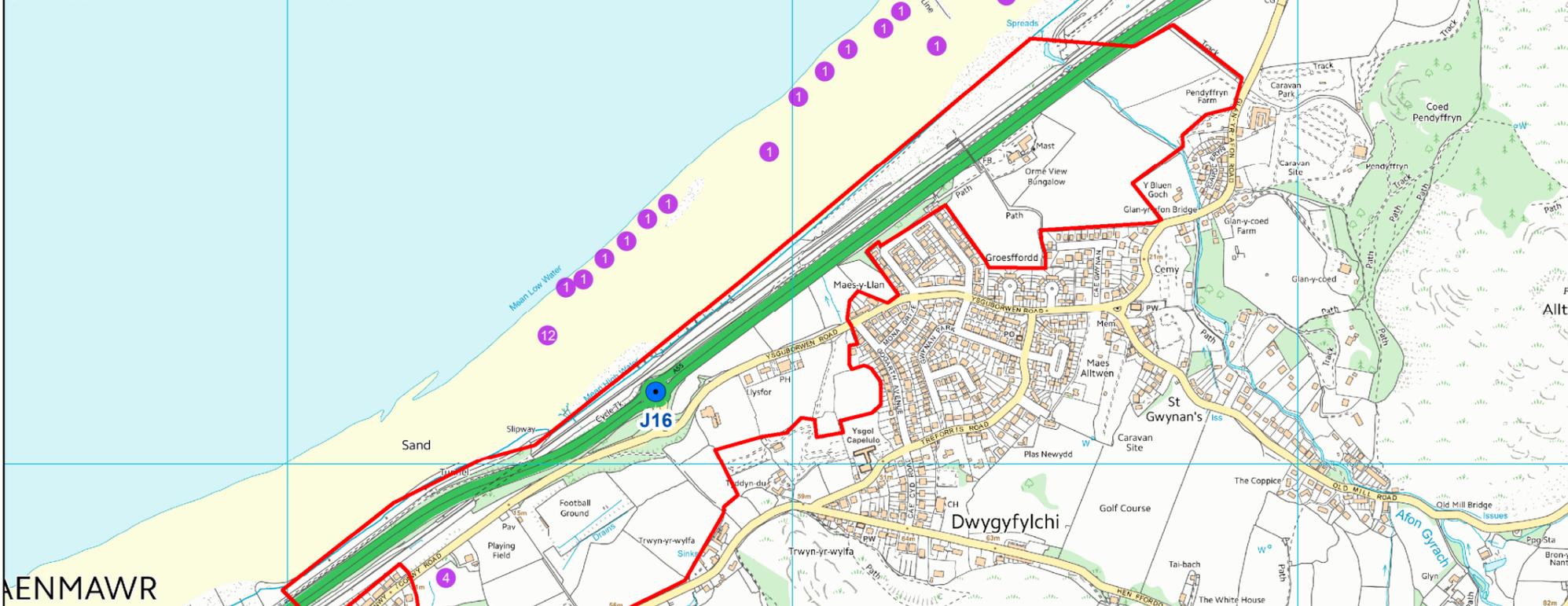
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Fig 15  
Oystercatcher  
Distribution J16 (Feb)

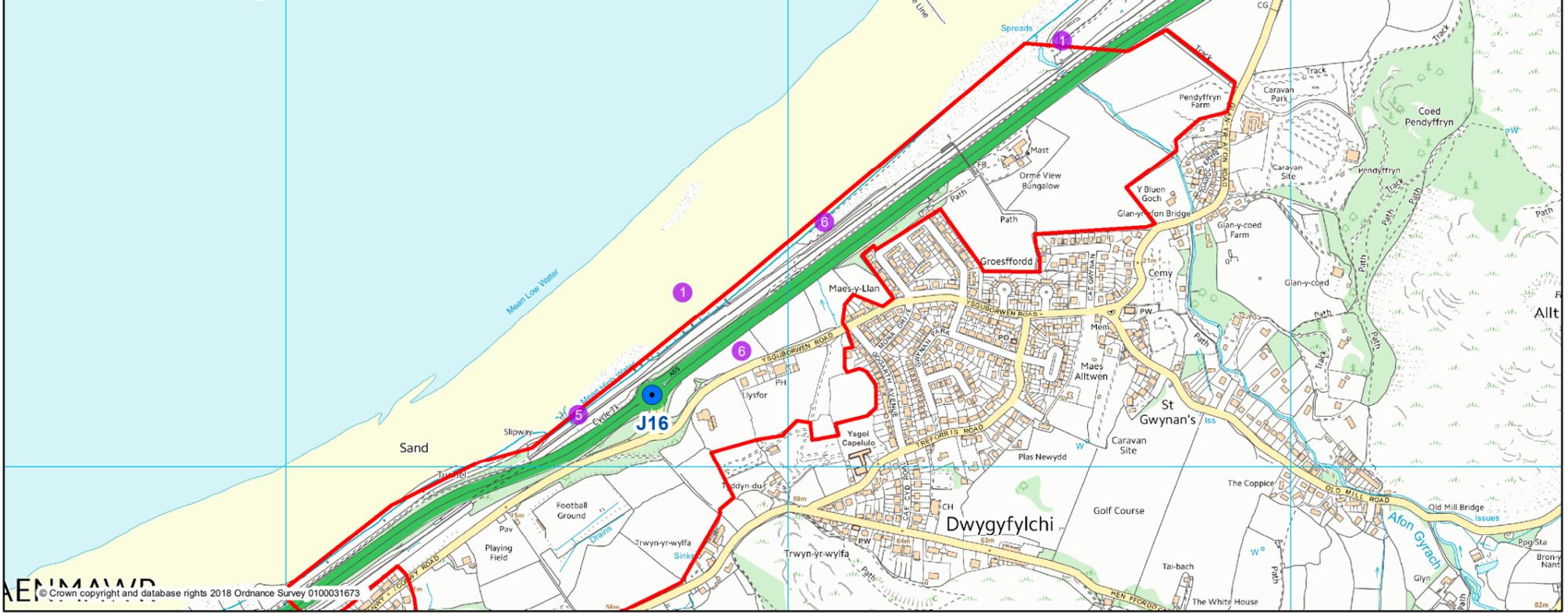
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- Bird Observations
- A55 Junctions
- Study Area Boundary

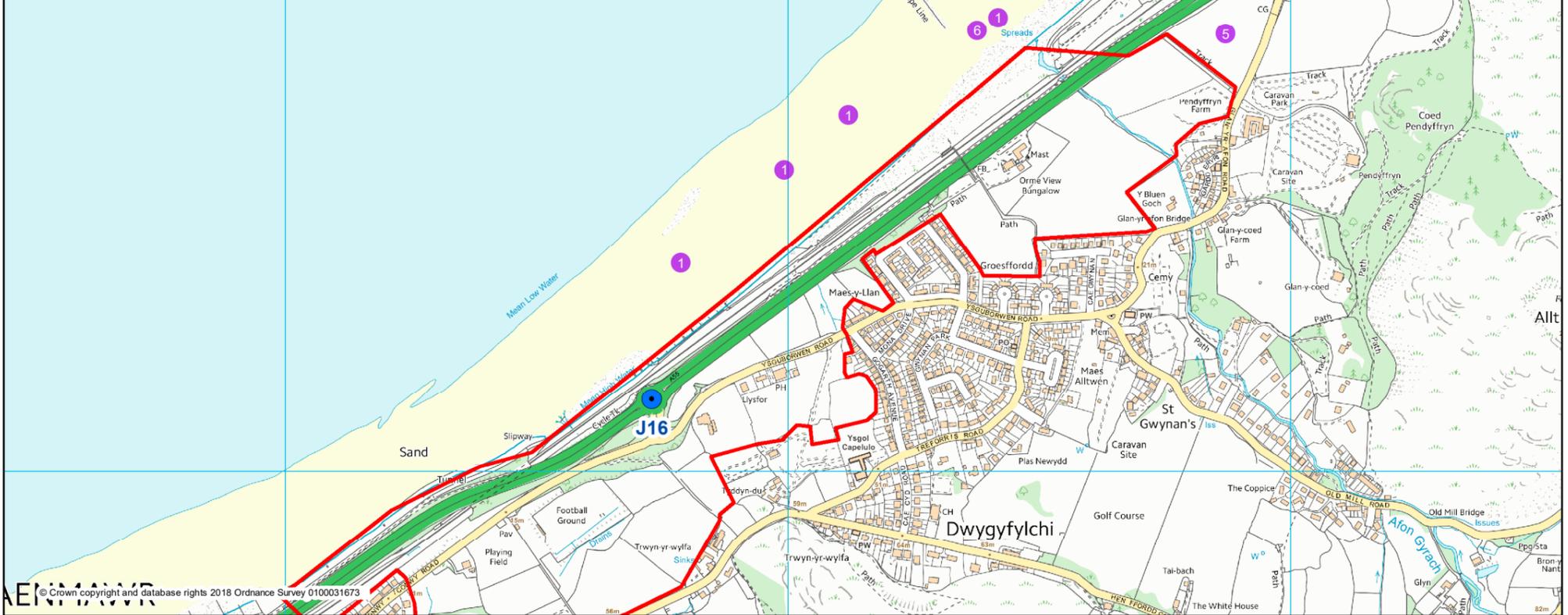


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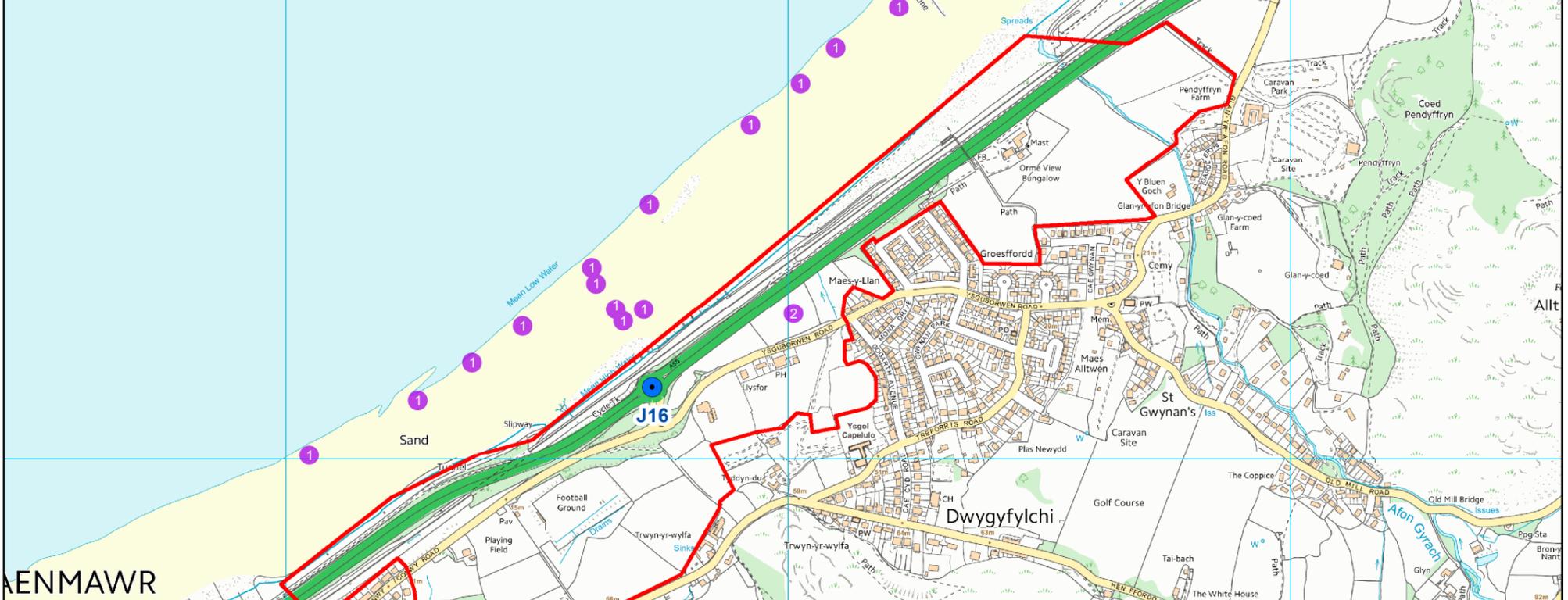
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Fig 16  
Oystercatcher  
Distribution J16 (Mar)

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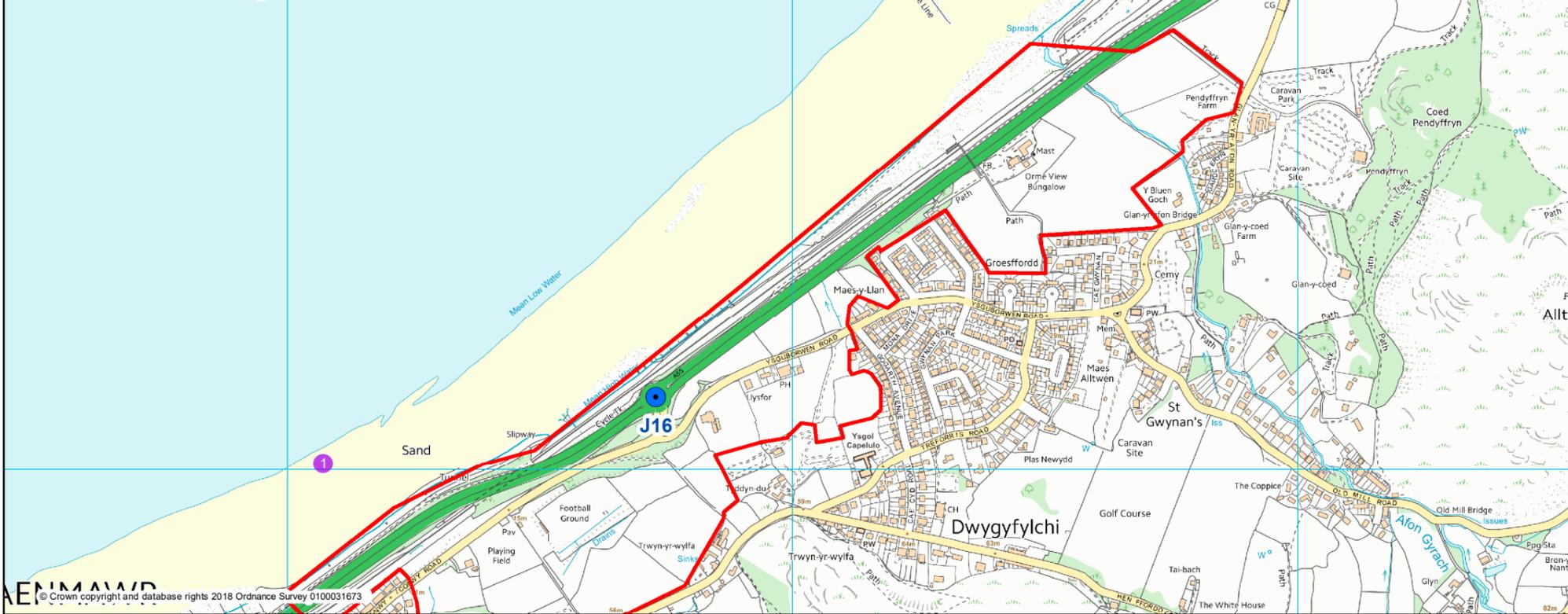
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- Study Area Boundary

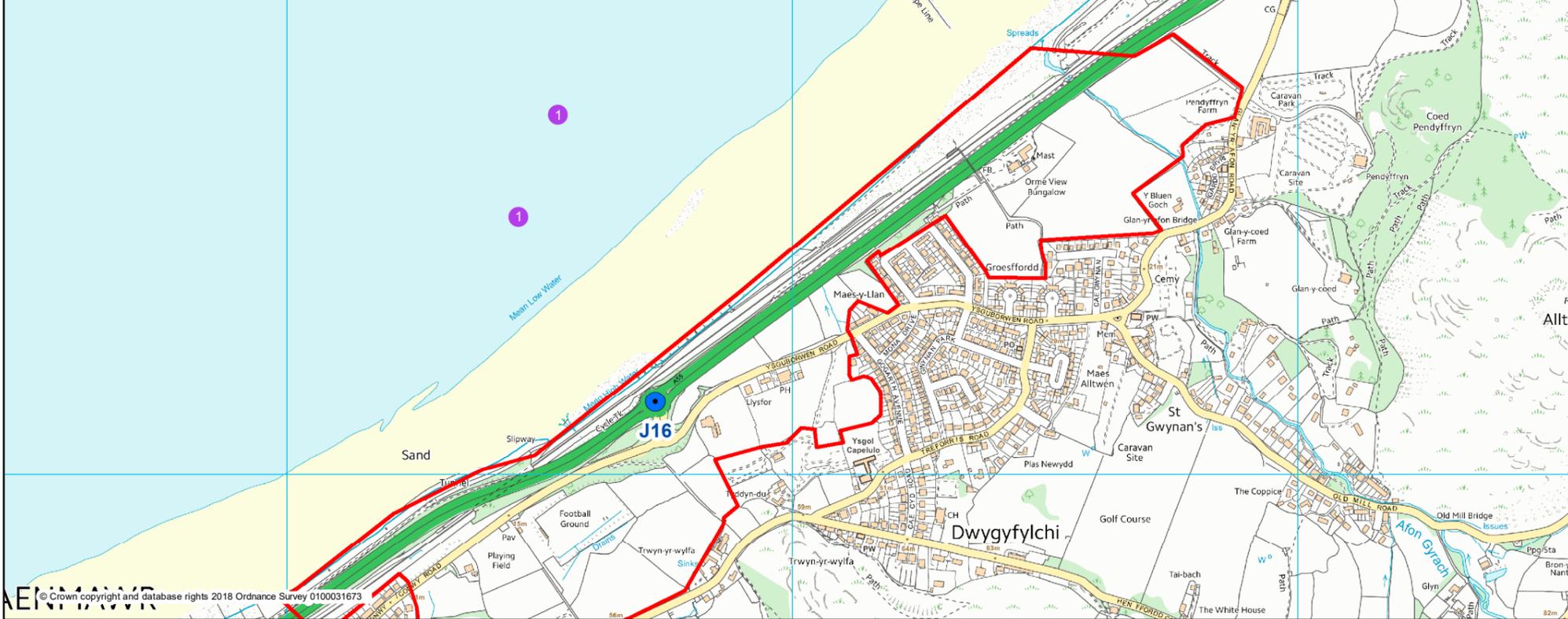


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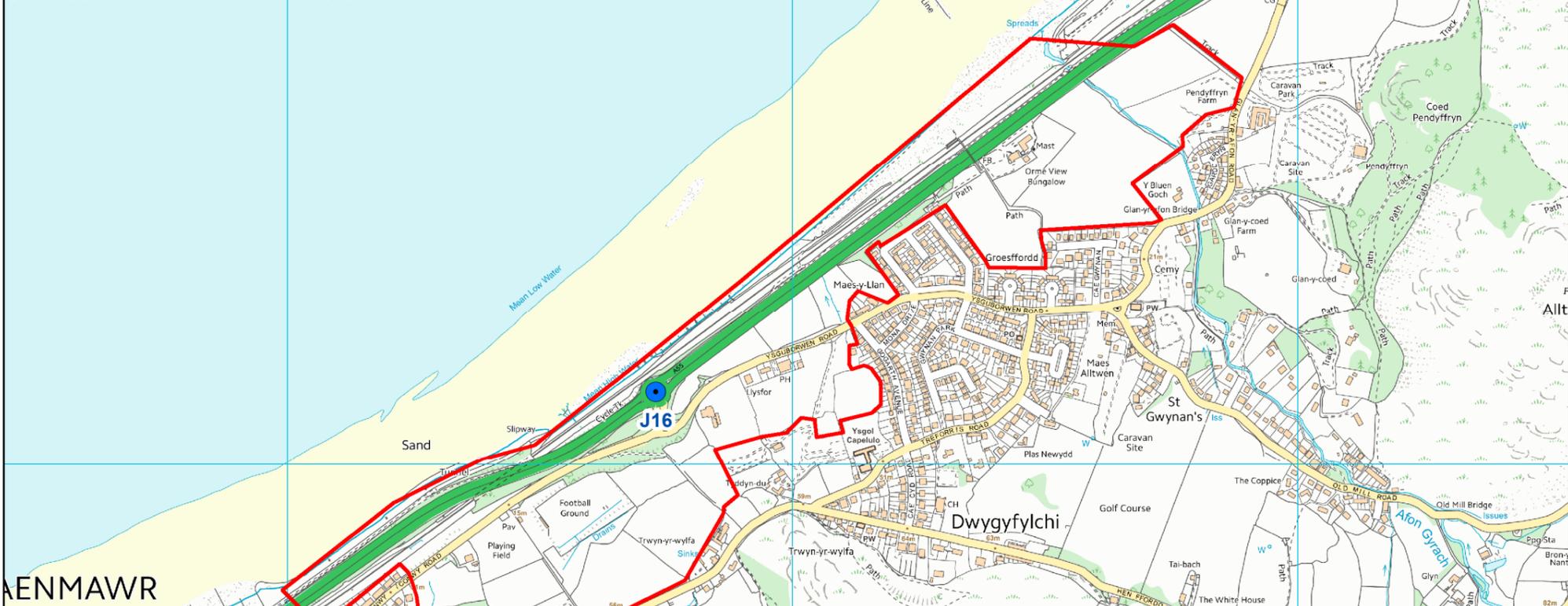
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Fig 17 Red-throated Diver Distribution J16 (Oct)

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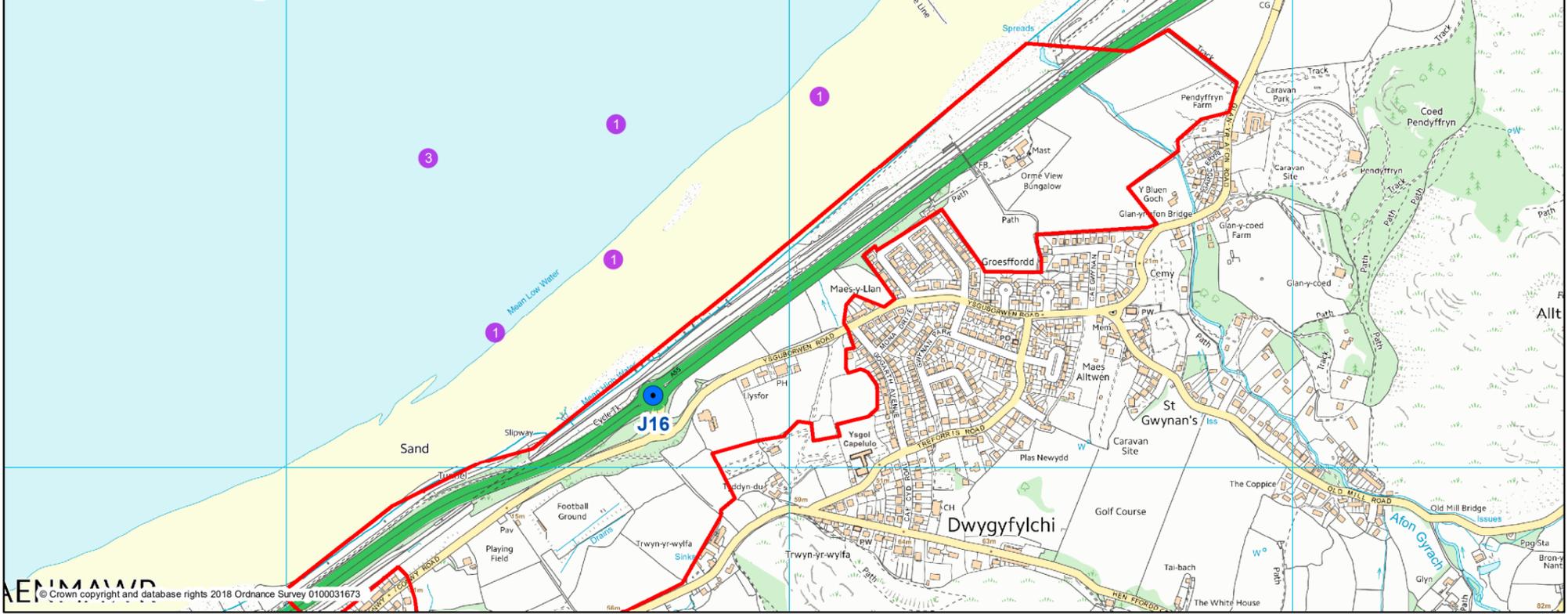
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- A55 Junctions
- Study Area Boundary

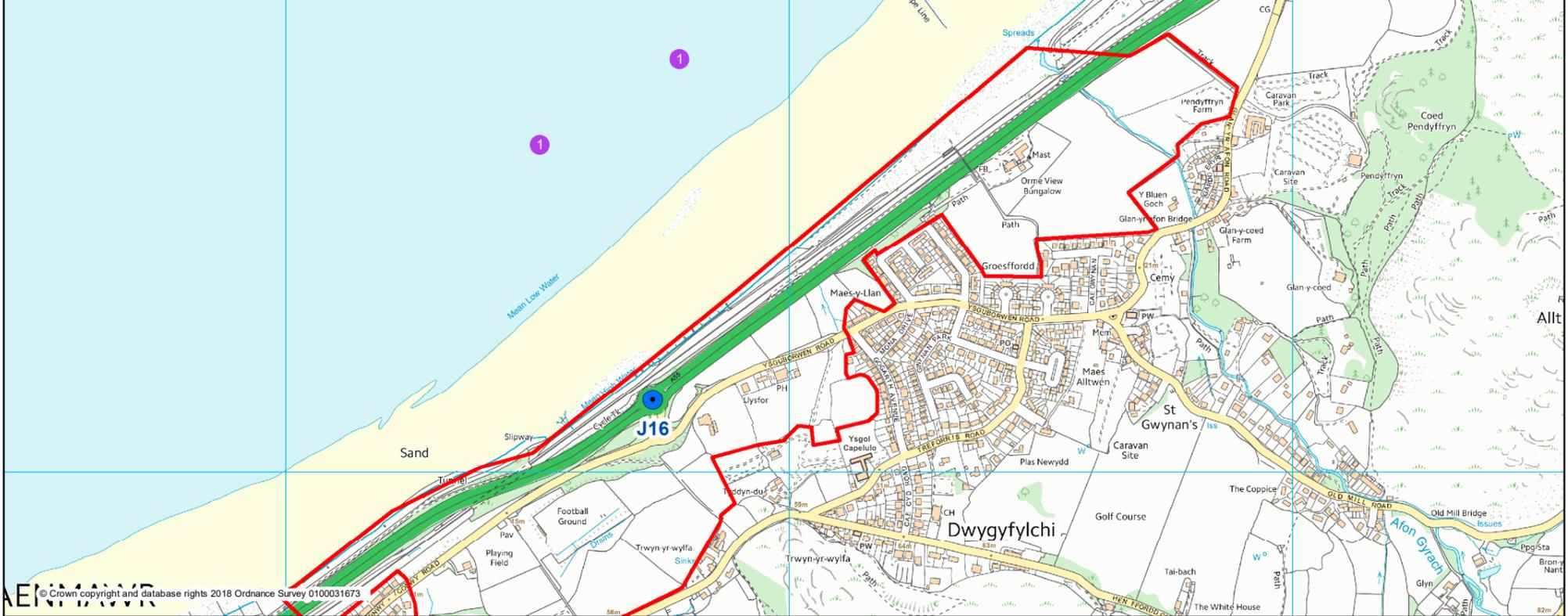


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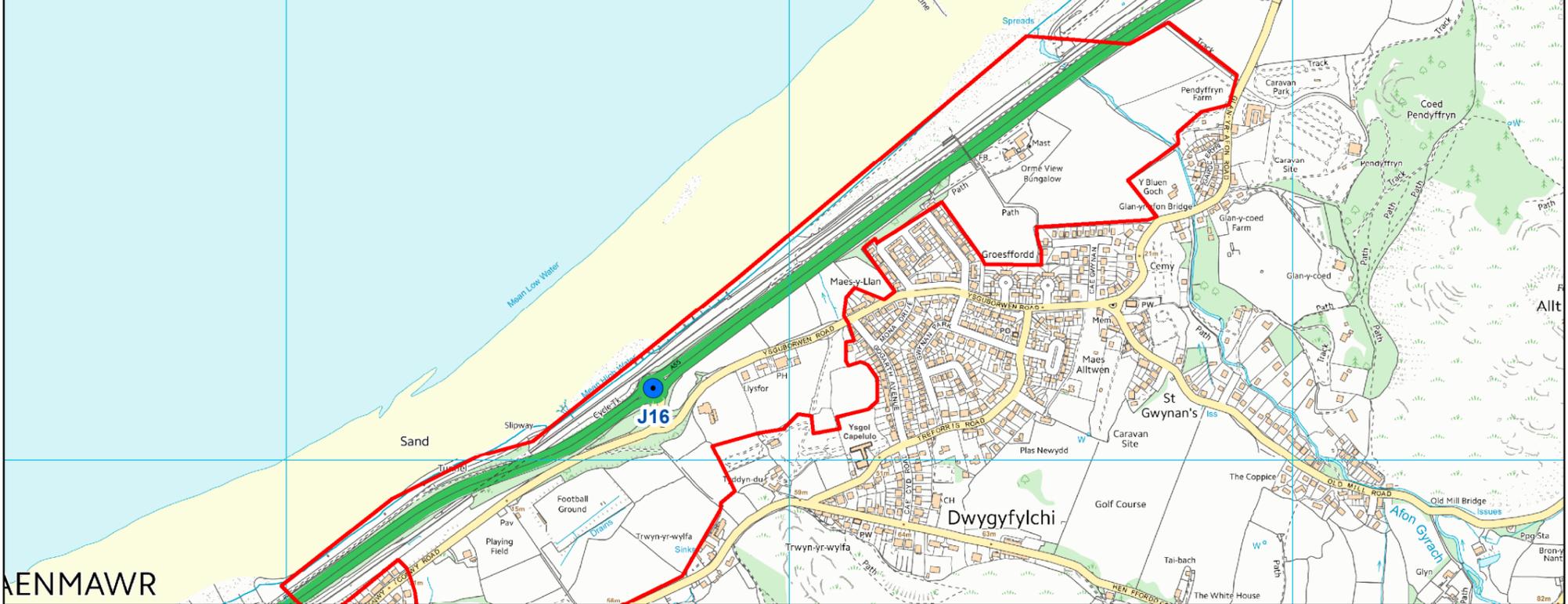
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Fig 18  
Red-throated Diver  
Distribution J16 (Nov)

Drawn: JG Scale (@A3): 1:11,000 Date: 18/07/2018  
Drawing No: 18 Rev:

- Bird Observations
- A55 Junctions
- Study Area Boundary



RICHARD YGC  
PLANNING LANDSCAPE ENVIRONMENT



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<b>ES Chapter 9 Appendices</b>	
9.1	Landscape and Visual Impact Assessment Methodology
9.2	Photographic Methodology
9.3	Landscape Character Area Descriptions
9.4	Representative Viewpoints
9.5	Visual Effects Schedules

## **APPENDIX 9.1**

### **LANDSCAPE AND VISUAL IMPACT ASSESSMENT METHODOLOGY**

## **1.0 Appendix 9.1 Landscape and Visual Assessment - Methodology**

### **1.1 Introduction**

1.1.1 This methodology has been undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) and Interim Advice Note 135/10(W). The DMRB guidance was withdrawn on 30<sup>th</sup> May 2017. In August 2019 Highways England began the replacement of the DMRB Volume 11. The new guidance (DMRB 2019) has been published in sections commencing August 2019. The new guidance for Landscape and visual effects (LA 107) was published in September 2019 and replaces DMRB Volume 11 Section 3 Part 5 and IAN 135/10. The guidance does not state explicitly that this replaces IAN 135/10 (W) but it is assumed that this will be the case.

1.1.2 Work on the screening and scoping stages of the EIA for this Scheme began in 2018 and all of the assessments were well advanced by August 2019 and the landscape and visual assessment substantially completed by September 2019. Therefore, the decision was made to continue using the DMRB 2008 guidance, rather adopting the 2019 version, because of the advanced state of the EIA.

#### *Relevant Guidance*

1.1.3 The assessment of landscape and visual effects has been carried out in accordance with the methodology described within Interim Advice Note 135/10 (W), 'Landscape and Visual Effects - Wales Only (Welsh Government, 2014), which replaces guidance in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 5 (Highways Agency, 1993). IAN 135/10 (W) refers to Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3), published by the Landscape Institute and the Institute of Environmental Management and Assessment, 2013.

1.1.4 In addition to the methodology set out in IAN 135/10 (W), the following documents have also been referred to;

- a. Guidelines for Landscape and Visual Impact Assessment. (GLVIA3);
- b. Design Manual for Roads and Bridges (DMRB) Volume 10 Environmental Design;
- c. Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment;
- d. Interim Advice Note (IAN) 125/09 (W) Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment';
- e. DMRB Volume 11 Section 2 HA 201/08: General principles and guidance of environmental impact assessment;
- f. Interim Advice Note (IAN) 135/10 (W): Landscape and Visual Effects Assessment (Wales Only).
- g. Design guides produced by the Welsh Government, e.g. 'Roads in Lowland Areas' (Welsh Office, 1993).
- h. Natural Resources Wales guidance notes on LANDMAP including Guidance Note 3 - 'Landscape and Visual Impact Assessment for onshore windfarms', (Natural Resources Wales, 2013a) and Guidance Note 4 - 'LANDMAP and the Cultural Landscape' (Natural Resources Wales, 2013b).
- i. TAG Unit A3 - Environmental Impact Appraisal - December 2015 Department for Transport

- j. IEMA: Environmental Impact Assessment - Guide to Delivering Quality Development
- k. Photography and Photomontage in Landscape and Visual Impact Assessment Advice Note 01/11 (Landscape Institute, 2011).

- 1.1.5 During the LVIA process, consultation has taken place with stakeholders and Statutory Environmental Bodies. Consultation includes the agreement of LVIA methodology, the extent of the LVIA study area, the identification of visual receptors, location of representative viewpoints and photomontages, and the requirements for mitigation.
- 1.1.6 Landscape and Visual Impact Assessment (LVIA) is defined in the (GLVIA)<sup>1</sup> as a;  
*"tool used to identify and assess the significance of and effects of change resulting from development on both the landscape as an environmental resource in its own right and on people's views and visual amenity".*
- 1.1.7 The GLVIA guidance and IAN 135/10 (W) refer to the European Landscape Convention (ELC) and its definition of landscape as;  
*"Landscape is an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors".<sup>2</sup>*
- 1.1.8 The ELC also acknowledges *"that the landscape is an important part of the quality of life for people everywhere: in urban areas and in the countryside, in degraded areas as well as in areas of high quality, in areas recognised as being of outstanding beauty as well as in everyday areas".*
- Simple and detailed assessments*
- 1.1.9 IAN 135/10 refers to simple and detailed assessment levels. A simple assessment should be used if it is considered unlikely that the proposed scheme(s) would have any significant landscape or visual effects. A detailed assessment is required if significant effects are anticipated, the two levels are differentiated in the table below<sup>3</sup>;

**Table 1 – Simple and detailed assessment**

Simple Assessment		Detailed Assessment	
Landscape	Visual	Landscape	Visual
When the landscape is in a poor or degraded condition	Where there are no sensitive receptors (e.g. an industrial area)	When the landscape resource is of distinctive quality with a range of landscape elements in good condition	Where there are sensitive receptors in the immediate vicinity (e.g. a recreational path or residential properties)
When impacts are temporary or minor in scale ie. addition of new signage to an existing road or minor improvements to an existing junction	Where there are no nearby receptors (e.g. residential properties some distance away)	When impacts are significant in terms of duration and scale (e.g. major new road improvements, road widening projects, major lighting schemes)	Where there are large numbers of sensitive receptors (e.g. a residential suburb which overlooks the project)

1 Guidelines for Landscape and Visual Impact Assessment Third Edition by the Landscape Institute and Institute of Environmental Management and Assessment 2013 para 1.1

2 European Landscape Convention (2002)

3 Extracted from IAN 135/10 paras 3.3 – 3.8

### *Simple Level of Assessment*

- 1.1.10 A simple level of assessment is usually undertaken to<sup>4</sup>;
- a. address potential aspects identified at the Scoping level;
  - b. reach an understanding of the likely environmental effects to inform the final design and assessment; or
  - c. reach an understanding of the likely environmental effects that identifies the need for a Detailed Assessment.

- 1.1.11 DMRB Volume 11 Section 2 HA 201/08 states that a "*Simple assessment would be sufficient if it established confidently that the forecast environmental effect would not be a fundamental issue in the decision-making process*".<sup>5</sup> The simple level of assessment would typically use desk-based information and previous studies to inform the assessment. If more detailed field surveys or modelling is required to assess the potential effects, this would require a more detailed assessment.

### *Detailed Level of Assessment*

- 1.1.12 The objective of detailed levels of assessment is to gain a thorough understanding of any significant beneficial or adverse effects as a result of the scheme on environmental resources (e.g. landscape) and receptors (e.g. residential areas). Detailed assessments will be required where there are likely to be any potential for significant landscape and visual effects. Any mitigation to avoid or reduce adverse effects will be addressed in the assessment process.

### *Stages in the Assessment*

- 1.1.13 The stages in the assessment process be it for scoping, simple or detailed assessments are to:
- a. Define the study area;
  - b. Collect and collate information on the landscape;
  - c. Assess the character and value of the landscape through consultation and desk study;
  - d. Carry out the site survey to assess landscape character and condition and augment the desk study;
  - e. Assess the magnitude of impact or degree of change caused by the project;
  - f. Assess the sensitivity of the landscape to accommodate change arising from the project;
  - g. Identify and develop mitigation as a component of the iterative design process to avoid, reduce or where possible remedy adverse effects;
  - h. Assess the significance of the residual landscape effects;
  - i. Assess cumulative impacts if appropriate

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<sup>4</sup> Extracted from HA 201/08 para 2.14

<sup>5</sup> HA 201/08 para 2.15

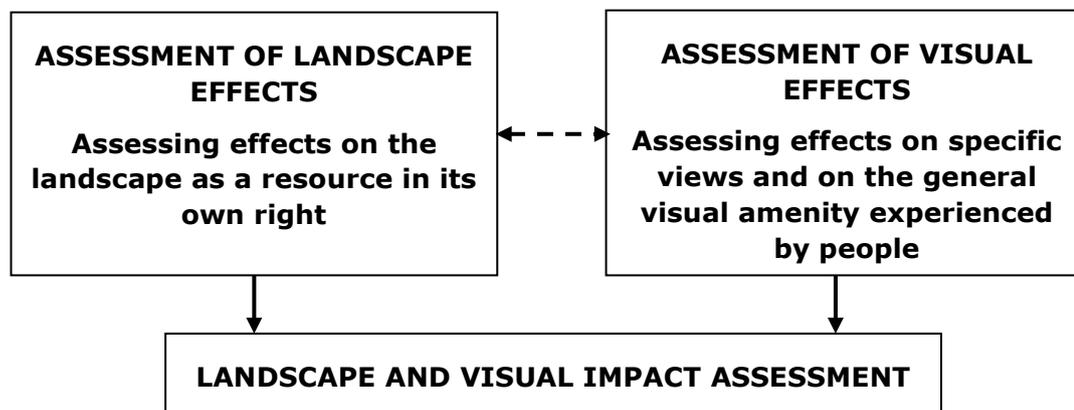
1.1.14 Guidance in IAN 135/10 suggests that the two stages of assessment should not be sequential as if the assessment indicates that significant effects are unlikely, further detailed work may not be required. For the purposes of this methodology, it is assumed that a detailed level of assessment would be required.

*Landscape and Visual Assessment*

1.1.15 The assessment of landscape and visual effects are two separate but related processes. Landscape and visual assessments address two separate but related issues and should be clearly distinguished between each other as highlighted below;

- Assessment of Landscape Effects: assessing effects on the landscape as a resource as resource in its own right; and
- Assessment of Visual Effects: assessing visual effects on specific views and on the general visual amenity experienced by people<sup>6</sup>.

**Figure 1: Assessment of landscape and visual effects**



1.1.16 To summarise with guidance from IAN 135/10<sup>7</sup>;

*"The assessment of landscape and visual effects must address both effects on landscape as a resource in its own right as well as effects on views and visual amenity".*

1.1.17 The stages and processes in undertaking the landscape assessment are set out in Figure 2 below and will be described in more detail in the following text.

1.1.18 For both the landscape and visual assessment, it is assumed that the project characteristics are defined within other sections of the environmental statement and that generic landscape and visual impacts are described in the landscape and visual assessment.

6 Interim Advice Note 135/10 (W) para 2.4  
7 Interim Advice Note 135/10 (W) para 2.4

## 1.2 Landscape Assessment

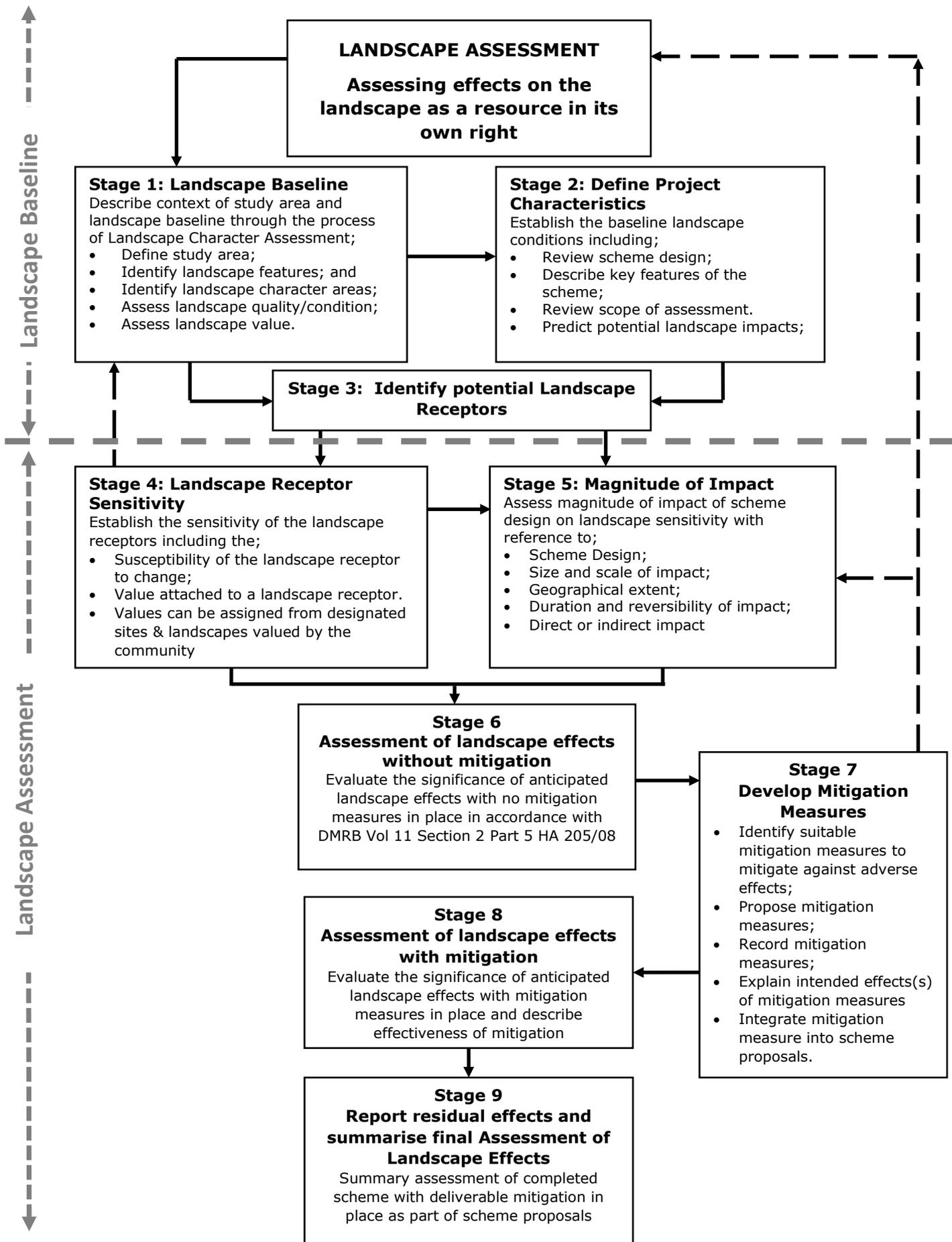
### *Stage 1 – Define Scope of the Landscape Assessment*

- 1.2.1 The study area covers the area of scheme (s) proposals and the full extent of the wider landscape that may be significantly influenced or affected as a result of the scheme proposals. This is based on the extent of the Landscape Character Areas that may be significantly affected either directly or indirectly. The study area has also been defined by preparing a Zone of Theoretical Visibility that will establish areas from which the scheme may be visible.
- 1.2.2 A study area was identified for the assessment of landscape and visual effects that included the whole area from which the Scheme with traffic would theoretically be visible. This initial study area was based on a digital Zone of Theoretical Visibility (ZTV) created using GIS software and Ordnance Survey (OS) Terrain 50 height data, based on a 50m resolution digital terrain model (DTM).
- 1.2.3 IAN 135/10 (W)<sup>8</sup> states that the study area should also include "*the full extent of any neighbouring features of special value*" including designated landscapes such National Parks, Areas of Outstanding Natural Beauty (AONB's), Sites of Special Scientific Interest (SSSI's) Special Areas of Conservation (SAC's) and Scheduled Ancient Monuments (SAM's). There are several neighbouring features of special value such as Snowdonia National Park and Menai Strait and Conwy Bay SAC, but the full extent of these designated sites have not been included in the study area as they are extensive and stretch far beyond the extent and potential influence of the Scheme proposals.
- 1.2.4 A review of the landscape resource and topography within the study area was carried out as part of the desk study with reference to the following relevant published sources to establish the national and regional landscape character:
- a) Landscape Character Map for Wales (Countryside Council for Wales and Land Use Consultants);
  - b) LANDMAP data system published by Countryside Council for Wales and maintained by Natural Resources Wales;
  - c) National and Local Planning Policy as outlined in Section 9.2;
  - d) Ordnance Survey 1:25,000 and 1:50,000 scale maps;
  - e) Aerial photography.
- 1.2.5 Site based assessments were carried out during summer of 2019 to validate the findings of the desk study.

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<sup>8</sup> IAN 135/10 (W) para 2.2

**Figure 2: Stages and processes followed for undertaking the assessment of landscape effects.**



### *Stage 1 - Landscape Baseline*

- 1.2.6 The initial process in undertaking the assessment of landscape and visual effects is to establish the baseline landscape conditions. The information collated will form the basis for the assessment of landscape effects as a result of the scheme proposals. The landscape baseline has been prepared using a mix of desk study and fieldwork to establish and record the character of the landscape and the elements that contribute to that character. In rural locations the baseline will establish the characteristics of the landscape. In more urban areas there is a requirement to undertake the same exercise but to establish the baseline for the townscape.
- 1.2.7 The assessment of the landscape baseline within the study area has considered the following:
- a) National landscape designations such as National Parks, Areas of Outstanding Natural Beauty (AONB's), Heritage Coasts, Historic Parks and Gardens
  - b) Ecological and historic designations such as SSSI's, RAMSAR Sites, Special Areas of Conservation, World Heritage Sites, Scheduled Ancient Monuments;
  - c) Other designations such as Landscapes of Historic Interest in Wales, Conservation Areas, tranquil areas, dark sky reserves;
  - d) Protected hedgerows, veteran trees and Tree Preservation Orders;
  - e) Review of National and Local Authority Character Areas and Assessments including LANDMAP;
  - f) A description of the existing landscape elements that contribute to the landscape character including physical components of the landscape such as man-made features, topography, watercourses, existing vegetation and field patterns;
  - g) Establishing the value of the existing landscape including references to statutory and non-statutory designations, landscape quality, amenity and recreational value;
  - h) Identification of landscape receptors that could potentially be affected by the scheme proposals.
- 1.2.8 The landscape baseline has initially used data from LANDMAP Information System first published by Countryside Council for Wales and now maintained by Natural Resources Wales (NRW). LANDMAP is a GIS based system that contains five, nationally consistent, quality assured spatial datasets:
- a) Geological Landscape;
  - b) Landscape Habitats;
  - c) Visual and Sensory;
  - d) Historic Landscape;
  - e) Cultural Landscape
- 1.2.9 For each of these datasets the landscape is divided into "aspect areas" that can be interrogated via an interactive map that links to details of each aspect area. The most relevant aspect for the LVIA is the Visual and Sensory dataset that describes the topography, land cover and form of the landscape that helps define landscape character areas within the study area.

- 1.2.10 LANDMAP is a useful source of baseline information but has been reviewed for relevance this particular LVIA. As a result of the review, primarily the Visual and Sensory dataset, the study area may be further divided into local Landscape Character Areas (LCA's).
- 1.2.11 Local Landscape character areas (LCAs) within the study area have been identified by:
- a) Organizing the landscape into areas of distinct, consistent and recognisable character;
  - b) Describing the key characteristics in accordance with IAN 135/10 (W) (paras 2.13 & 2.14) such as;
    - i. Physical Characteristics (built environment, landform and landcover);
    - ii. Perceptual Characteristics (scale, scenic quality, tranquillity, intrusive features and night-time light sources);
    - iii. Cultural and Social Characteristics (historic features and elements and human interaction);
    - iv. Designations (National Parks, AONB's SSSI's etc)
  - c) Assessing their condition, scenic quality and overall landscape value taking into account any landscape, ecological or cultural designations and any assets of local significance without designation that may be valued by local communities.
- 1.2.12 Each LCA is described and assigned a landscape value using the criteria<sup>9</sup> set out in Table 2 below adapted from DMRB HA 205/08;

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<sup>9</sup> Source: Adapted from DMRB Volume 11 Section 2 Part 5 HA 205/08 Table 2.1 Environmental Value

**Table 2: Landscape Value**

Value	Typical Descriptors
Very High (Outstanding)	Internationally recognised value and importance, e.g World Heritage Site, RAMSAR Site, National Park. Nationally recognised value and importance e.g. Area of Outstanding Natural Beauty. Aesthetically pleasing areas with a strong sense of place and may be rare in terms of character type. Usually containing sites of historic, cultural, geological or natural habitat importance. These areas may be important tourist destinations.
High	Regionally recognised value and importance as defined by local authority designations, e.g. Special Landscape Area or Historic Landscape Area. Some picturesque attributes that are aesthetically pleasing, and some features that are fragmented and/or spoilt. The area may be associated with tourism although it would not be the main destination.
Moderate	Non-designated landscape with some features of value or a distinguishable landscape structure. The areas are unlikely to contain a coherent and aesthetically pleasing composition but may be appreciated locally.
Low (Ordinary)	Non-designated landscape with limited aesthetically pleasing scenery, where characteristics are fragmented and/or spoilt. The areas are unlikely to contain tourist attractions and are unlikely to be rare in character type. Not likely to contain sites of local importance as defined by local authority designations.
Poor (Negligible)	Degraded or damaged landscape structure. Contains one or more detracting elements. Very low importance and rarity, local scale

### *Stage 2 - : Define Project Characteristics*

- 1.2.13 Defining the project characteristics is an opportunity to review the scheme proposals in light of any route selection process or following the announcement of a preferred route. More design work may have been undertaken that enables a better understanding of the scheme proposals and likely Zone of Influence. Key features of the scheme can be described along with the potential sites identified for site compounds and accommodation works that may influence the scope of the assessment.

### *Stage 3 – Potential Landscape Receptors*

- 1.2.14 In preparing the landscape baseline, a preliminary assessment on the likely landscape receptors affected by the Scheme proposals can be made. This may entail a review of the study area to ensure any potential landscape receptors are captured in the assessment process. It also allows potential landscape receptors to be scoped out of the assessment process should it be proven that there is likely to be no significant effects due to physical factors such as distance or topography.

### *Stage 4 – Landscape Receptor Sensitivity*

- 1.2.15 Landscape receptors need to be assessed firstly in terms of their **susceptibility** and secondly **value**. The level of sensitivity is a judgement combining the two factors, **susceptibility to change** as a result of the specific development or scheme (in this case a new highway junction within an existing transport corridor) and the **value** attached to the landscape.<sup>10</sup>
- 1.2.16 The term “susceptibility” is not used in DMRB or referenced in IAN 135/10 (W) but is used in GLVIA3 and means “*the ability of the landscape receptor to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*”.<sup>11</sup> The guidance<sup>12</sup> recommends that judgements about susceptibility of landscape receptors to change should be set out on a verbal scale and these are set out below in Table 3.

**Table 3 - Landscape susceptibility to change**

- 1.2.17 The sensitivity of a landscape is a combination of judgements of a landscape receptor’s ability to accommodate change of the type proposed and the value of the landscape receptor established during the baseline assessment.

<b>High</b>	Effects from the type of scheme proposed are likely to cause a major change to the baseline landscape
<b>Medium</b>	Effects from the type of scheme proposed are likely to lead to a moderate change in the baseline landscape
<b>Low</b>	Effects from the type of scheme proposed can be accommodated with only a minor, or no, change to the baseline landscape

<sup>10</sup> Adapted from GLVIA para 5.39

<sup>11</sup> GLVIA3 – para 5.40

<sup>12</sup> GLVIA3 – para 5.43

**Table 4 - Landscape Sensitivity Matrix – Susceptibility x Value**

Landscape Sensitivity Matrix		Landscape Value				
Susceptibility to Change		Very High	High	Moderate	Low	Poor
	High	High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Low
	Low	Medium	Medium	Low	Low	None

1.2.18 Taking into consideration the susceptibility and landscape value, the criteria to assess the landscape sensitivity is used to inform the assessment of Construction Effects and Operational Effects in a response to the nature of change caused by the Scheme. These have been derived from the methodology and examples in IAN 135/10 (W), Annex 1, Table 2, which are presented in Table 5 below;

**Table 5: Landscape Receptor Sensitivity**

Sensitivity	Typical Descriptors and Examples
<b>High</b>	Landscapes which by nature of their character would be unable to accommodate change of the type proposed. Typically, these would be: <ul style="list-style-type: none"> <li>• Of high quality with distinctive elements and features making a positive contribution to character and sense of place;</li> <li>• Likely to be designated, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale;</li> <li>• Areas of special recognised value through use, perception or historic and cultural associations;</li> <li>• Likely to contain features and elements that are rare and could not be replaced.</li> </ul>
<b>Medium</b>	Landscapes which by nature of their character would be able to partly accommodate change of the type proposed. Typically, these would be: <ul style="list-style-type: none"> <li>• Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place;</li> <li>• Locally designated, or their value may be expressed through non- statutory local publications;</li> <li>• Containing some features of value through use, perception or historic and cultural associations;</li> <li>• Likely to contain some features and elements that could not be replaced.</li> </ul>
<b>Low</b>	Landscapes which by nature of their character would be able to accommodate change of the type proposed. Typically, these would be: <ul style="list-style-type: none"> <li>• Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place;</li> <li>• Not designated;</li> <li>• Containing few, if any, features of value through use, perception or historic and cultural associations.</li> <li>• Likely to contain few, if any, features and elements that could not be replaced.</li> </ul>

*Stage 5: Magnitude of Impact*

1.2.19 For the purpose of both landscape and visual impact assessment, impacts have been graded according to their scale and magnitude. The following aspects are used to determine the magnitude of impact.

- a) The size or scale of the impact, i.e. the quantity of landscape elements that would be affected and the proportion that this represents within the character area or the extent of views that would be changed, and whether the changes affect key characteristics of the landscape or views;
- b) Geographical extent, i.e. the area which the Scheme would influence;
- c) Duration and reversibility of impact, i.e. whether the impact is short term to long term and whether the impact is permanent or can be reversed to its original condition;
- d) Consider if the impacts are direct or indirect.

- 1.2.20 Terms used to describe the magnitude of landscape impacts are derived from IAN 135/10 (W), Annex 1, Table 1, and presented in Table 6.
- 1.2.21 Criteria applies to both negative (adverse), and positive (beneficial), due to the nature of the change according to their scale or magnitude. Where the Scheme, or a part of it, would become a detracting feature or focal point of the view, this is assessed as negative. Where the Scheme, or part of it, would result in an improvement in the view, this is assessed as a positive.

**Table 6: Magnitude and Nature of Landscape Impact and Typical Descriptors**

<b>Magnitude</b>	<b>Typical descriptors</b>
<b>Major Adverse</b>	Total loss or large-scale damage to existing character or distinctive features and elements, and/or the addition of new and uncharacteristic conspicuous feature and elements.
<b>Moderate Adverse</b>	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new and uncharacteristic features and elements.
<b>Minor Adverse</b>	Slight loss or damage to existing character or features and elements, and/or the addition of new and uncharacteristic features and elements.
<b>Negligible Adverse</b>	Barely noticeable loss or damage to existing character or features and elements, and/or the addition of new and uncharacteristic features and elements.
<b>No Change</b>	No noticeable loss, damage or alteration to character or features or elements.
<b>Negligible Beneficial</b>	Barely noticeable improvement in 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.
<b>Minor Beneficial</b>	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 features.
<b>Moderate Beneficial</b>	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.
<b>Major Beneficial</b>	Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous elements, or by the addition of new distinctive features.

1.2.22 The magnitude of impact and the sensitivity of the receptor are combined to establish the significance of effect, which is expressed as a scale ranging from neutral to very large. The scale can be positive and negative. This is in accordance with IAN 135/10 (W). The matrix used to determine the Significance of Effect is the same for both Landscape and Visual Impact. Derived from IAN 135/10 (W), Annex 1, Table 3; and Annex 2, Table 3, the Significance of effect matrix is presented in Table 7.

**Table 7: Significance of Landscape Effects**

		Magnitude of Impact				
		No change	Negligible	Minor	Moderate	Major
Sensitivity	High	Neutral	Slight	Moderate	Large	Very Large
	Medium	Neutral	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Neutral	Slight	Moderate

1.2.23 Effects falling within the categories moderate to very large are considered to be significant for the purpose of this assessment.

1.2.24 The terms used to describe the landscape and visual impact significance of effect categories are presented in Table 8 that is extracted from IAN/135/10 (W), Annex 1, Table 4.

1.2.25 The effects on the landscape character will be undertaken by considering the components that *"define character and their sensitivity to the type, scale and duration of the proposed change, taking into account any mitigation measures. In Wales, the assignment of significance before the before the consideration of the effectiveness of the design and committed mitigation measures should also be undertaken, allowing for the case or reason for and the effectiveness of mitigation to be described"*.<sup>13</sup>

1.2.26 The stage at which the Scheme proposals are assessed without mitigation is not clearly defined in the DMRB. For the purposes of this methodology, the Scheme proposals were assessed without mitigation following the announcement of the preferred route ie. the Scheme and at the commencement of the Environmental Impact Assessment process. This enabled the proposed mitigation proposals to be captured and integrated into the design process.

1.2.27 The potential effects on individual landscape elements and on the physical, perceptual and cultural/social characteristics of the landscape will be undertaken and recorded.

**Table 8: Typical Descriptors of Significance of Effect**

<sup>13</sup> IAN 135/10 (W) Annex 1 para 3.4

Effects	Descriptors
<b>Very Large Beneficial Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Greatly enhance the character (including quality and value), of the landscape;</li> <li>• Create an iconic, high quality feature and/or series of elements;</li> <li>• Enable a sense of place to be created or greatly enhanced.</li> </ul>
<b>Large Beneficial Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Enhance the character (including quality and value), of the landscape;</li> <li>• Enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development;</li> <li>• Enable a sense of place to be enhanced.</li> </ul>
<b>Moderate Beneficial Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Improve the character (including quality and value), of the landscape;</li> <li>• Enable the restoration of characteristic features and elements lost or diminished as a result of changes from inappropriate management or development;</li> <li>• Enable a sense of place to be restored.</li> </ul>
<b>Slight Beneficial Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Complement the character (including quality and value), of the landscape;</li> <li>• Maintain or enhance characteristic features and elements;</li> <li>• Enable a sense of place to be retained.</li> </ul>
<b>Neutral Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Maintain the character (including quality and value), of the landscape;</li> <li>• Blend in with characteristic features and elements;</li> <li>• Enable a sense of place to be retained.</li> </ul>
<b>Slight Adverse Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Not quite fit the character (including quality and value), of the landscape;</li> <li>• Be at variance with characteristic features and elements;</li> <li>• Detract from a sense of place.</li> </ul>
<b>Moderate Adverse Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Conflict with the character (including quality and value), of the landscape;</li> <li>• Have an adverse impact on characteristic features and elements;</li> <li>• Diminish from a sense of place.</li> </ul>
<b>Large Adverse Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Be at considerable variance with the character (including quality and value), of the landscape;</li> <li>• Degrade or diminish the integrity of a range of characteristic features and elements;</li> <li>• Damage a sense of place.</li> </ul>
<b>Very Large Adverse Effect</b>	The Scheme would: <ul style="list-style-type: none"> <li>• Be at complete variance with the character (including quality and value), of the landscape;</li> <li>• Cause the integrity of characteristic features and elements to be lost;</li> <li>• Cause a sense of place to be lost.</li> </ul>

*Stage 7: Develop Mitigation Measures*

- 1.2.28 The mitigation design aims to avoid or reduce the impacts on the landscape and the visual effects on views, while also integrating the other physical mitigation measures that are proposed by other environmental disciplines within the project team. The purpose of this mitigation stage is to;
- Identify suitable mitigation measures to mitigate against adverse effects;
  - Propose mitigation measures;
  - Record mitigation measures;
  - Explain intended effects(s) of mitigation measures
  - Integrate mitigation measure into scheme proposals.
- 1.2.29 The DMRB<sup>14</sup> identifies two types of mitigation; essential or desirable and defines them as follows<sup>15</sup>.

**Table 9: Essential and Desirable Mitigation**

Essential Mitigation	Desirable Mitigation
Mitigation which the Overseeing Organisation has the statutory power to achieve	A measure considered to be environmentally beneficial but that cannot usually be achieved using statutory powers. For example, third party agreement may be required: Eg Off Site planting

- 1.2.30 Determining whether mitigation is essential or desirable is recognised in the DMRB as being reliant on professional judgement of the topic specialist<sup>16</sup>. If mitigation is defined as essential, it can be provided for under the relevant legislation ie. The Highways Act 1980 (as amended) and acquired under Compulsory Purchase Order usually subject to Public Local Inquiry.
- 1.2.31 Essential mitigation can therefore be guaranteed as part of the Scheme proposals and is taken into consideration during the assessment process. The assessment process will define how significant the impact of the Scheme is and can be either beneficial or adverse. Significance is therefore assigned with mitigation in place *"allowing for the positive contribution of all mitigation that is deliverable and committed"*<sup>17</sup>. However, DMRB also requires that (in Wales) *"the assignment of significance before the consideration of the effectiveness of the design and mitigation measures should also be undertaken, allowing for the case or reason for the effectiveness of mitigation to be described"*<sup>10</sup>. Therefore an assessment of significance is required without mitigation in place and also with mitigation that can be delivered and justified as part of the Scheme proposals (Stage 8)

<sup>14</sup> DMRB Volume 11 Section 2 Part 5 HA 205/08 para 1.64

<sup>15</sup> DMRB Volume 11 Section 2 Part 7 HA 218/08 Glossary of Terms

<sup>16</sup> DMRB Volume 11 Section 2 Part 5 HA 205/08 para 1.64

<sup>17</sup> DMRB Volume 11 Section 2 Part 5 HA 205/08 para 2.9

- 1.2.32 Land identified in the Draft Orders will include areas required for essential mitigation including land for various engineering purposes and some further land required for environmental mitigation. Where possible mitigation has been provided within that permanent land take and is therefore within the Compulsory Purchase Order as 'Title'. All of the mitigation provided on land taken as 'Title' is essential for mitigation for landscape integration, visual screening or ecological purposes.

*Stage 8: Assessment of Landscape Effects with mitigation*

- 1.2.33 An assessment of the effects on the landscape resource will be undertaken with the mitigation measures in place. Again, the potential effects on individual landscape elements and on the physical, perceptual and cultural/social characteristics of the landscape will be undertaken and recorded.

*Stage 9: Report residual effects and summarise final assessment of landscape effects*

- 1.2.33 The final stage of the landscape assessment is to report any significant impacts that the scheme proposals will have on the landscape receptors. There may be residual impacts that cannot be mitigated against and the final assessment should report on why these cannot be mitigated and what impact there will remain for the lifetime of the project.

### 1.3 Visual Assessment

#### *Stage 1 – Define Scope of the Visual Assessment*

- 1.3.1 The visual baseline assessment describes and analyses people that may have specific or general views of the study area, which may be changed by the Scheme. The scope of the visual assessment was initially undertaken using desktop data and later verified in the field during the preparation of the visual baseline.
- 1.3.2 IAN 135/10 states that for visual effects, *"the study area will extend to the whole of the area from which the project could be visible"*. This guidance has not been followed as the Scheme proposals fall within or close to the existing road corridor that is visible from some considerable distance, particularly to the north, north-west and north-east where there are distant views across the sea to distant landmarks. Therefore a 2-kilometre radius was taken from the centre line of the proposed scheme as a basis for the initial study area.
- 1.3.2 A desk study was carried out, with reference to the following technical sources:
- Ordnance Survey 1:25,000 and 1:50,000 small scale maps;
  - Ordnance Survey 1:1,250 and 1:2,500 large scale maps;
  - Aerial photography;
- 1.3.3 A Zone of Theoretical Visibility (ZTV) was plotted using Natural Resources Wales LiDAR digital terrain model that does not include surface features such as buildings and vegetation such as woodland or plantations, hedgerows and individual trees. The ZTV is now the recommended process since *"it makes clear that the area so defined only shows land from which the proposal may theoretically be visible. That is, it treats the world as 'bare earth' and does not take into account of potential screening by vegetation or buildings"*<sup>18</sup>. These potential screening features lie outside the scope of the scheme proposals and could be subject to removal or alteration by other parties. The bare earth ZTV indicated potential views of;
- The road surface;
  - High sided vehicles;
  - Views of lighting columns.
- 1.3.4 Heights of the major components of the Scheme taken from a 3D model of the scheme proposals were combined to generate the ZTV. This provided a broad overview of the likely visual extents and was used as a basis for the visual baseline.

#### *Consultations*

- 1.3.5 During the LVIA process, consultation has taken place with stakeholders. Consultation includes the agreement of LVIA methodology, the extent of the LVIA study area, the identification of visual receptors, location of representative viewpoints and photomontages, and the requirements for mitigation.
- 1.3.6 During the consultation period no request for specific viewpoints were received. All viewpoint locations were based on professional judgment and are at locations accessible to the public.

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<sup>18</sup> GLVIA3 – Para 6.8

- 1.3.7 The visual baseline was prepared using the ZTV as a general overview of potential visibility within a 2-kilometre radius.
- 1.3.8 Potential visual receptors were identified using the ZTV and verified on site during fieldwork.
- 1.3.9 Fieldwork was carried out during summer 2019 following the announcement of the preferred route on 5<sup>th</sup> April 2019.
- 1.3.10 The following aspects concerning potential inter-visibility were considered during the fieldwork including;
- a) Potential screening features, including substantial vegetation, buildings and urban areas;
  - b) Potential visual receptors such as residential properties, business properties, Public Rights of Way and recreation areas;
  - c) Extent of long-distance views and likely significance;
  - d) Perceptual characteristics such as scale and appearance, scenic quality, tranquillity, discordant and intrusive features and night-time light sources that also influence the landscape character areas.

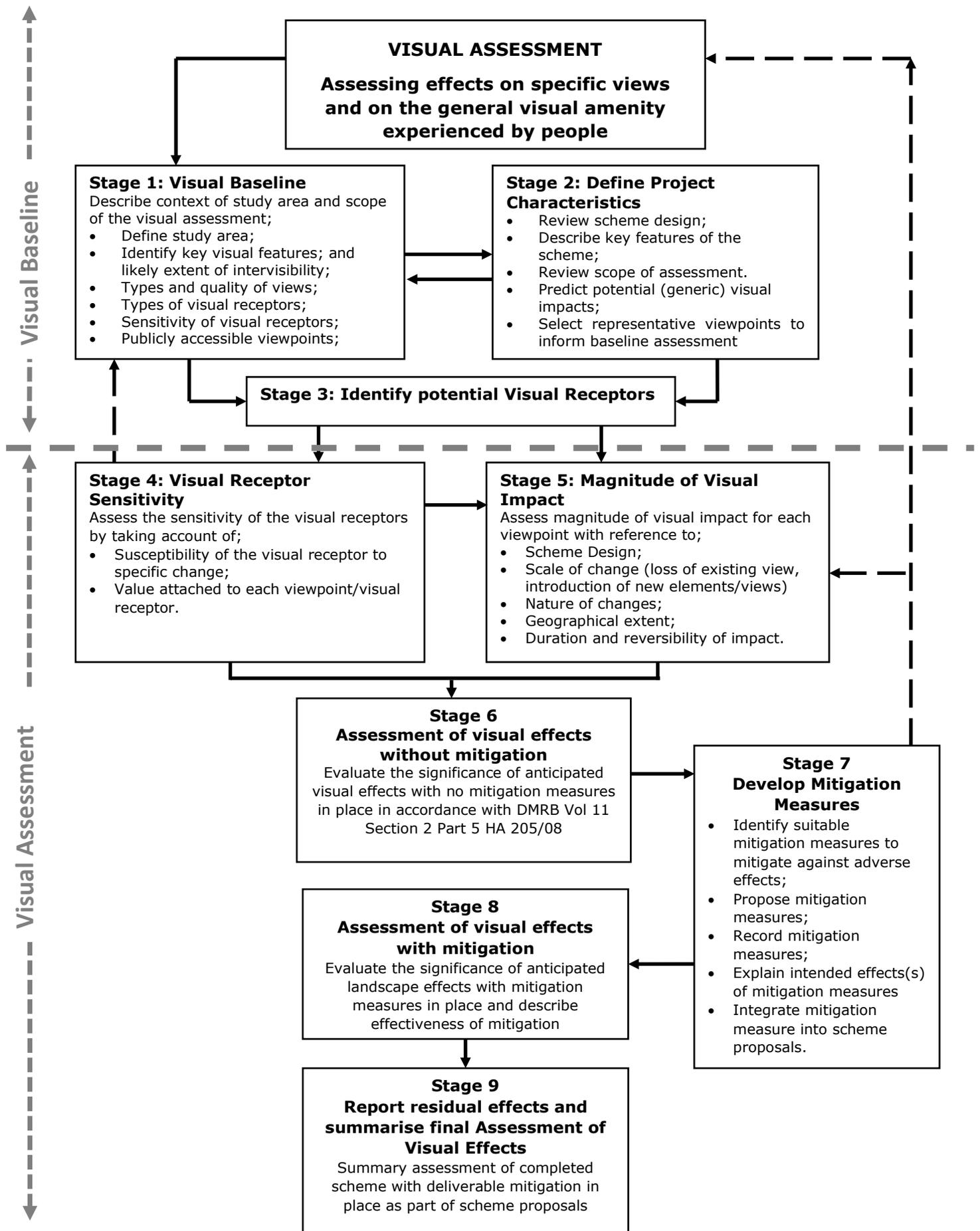
*Stage 2 - Define Project Characteristics*

- 1.3.11 Defining the project characteristics is an opportunity to review the scheme proposals in light of any route selection process or following the announcement of a preferred route. More design work may have been undertaken that enables a better understanding of the scheme proposals and likely Zone of Influence. Key features of the scheme can be described along with the potential sites identified for site compounds and accommodation works that may influence the scope of the assessment.

*Stage 3: Identify potential Visual Receptors*

- 1.3.12 The visual baseline will establish the potential visual receptors that will experience a change in view as a result of the scheme proposals". In preparing the visual baseline, a preliminary assessment on the likely visual receptors affected by the Scheme proposals can be made. This may entail a review of the study area to ensure any potential visual receptors are captured in the assessment process. It also allows potential visual receptors to be scoped out of the assessment process should it be proven that there is likely to be no significant effects due to physical factors such as distance or topography. The extent of the area affected by the Scheme proposals and that is the focus of the assessment process is referred to as the Zone of Influence (ZOI).
- 1.3.13 Representative viewpoints were selected to assess the impact of the scheme proposals from typical visual receptors within the Zone of Influence.

Figure 3: Stages and processes followed for undertaking the assessment of visual effects



*Stage 4: Sensitivity of Visual Receptors*

- 1.3.13 The sensitivity of the visual receptor is a judgement of the type of change to views and visual amenity brought about by the Scheme and the activity of the viewer.
- 1.3.14 Visual amenity receptors are identified during the desk study and verified during field survey work. The extent and nature of their views are described, and the sensitivity of the receptors defined.
- 1.3.15 Criteria used to assess the visual sensitivity are derived from IAN 135/10 (W), Annex 2, Table 1, which are presented in Table 10;

Table 10: Receptor Sensitivity and Typical Descriptors

<b>Sensitivity</b>	<b>Type of visual receptor</b>
<b>High</b>	<ul style="list-style-type: none"> <li>- Permanent residential properties;</li> <li>- Users of Public Rights of Way or other long-distance recreational trails (e.g. Coastal Paths, Cycle Routes, footpaths, bridleways etc)</li> <li>- Users of Public Open Space (e.g Promenade and Beach areas) for general amenity (e.g dog walking, picnicking, bird watching)</li> <li>- Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Open access land)</li> <li>- Visitors to Scheduled Ancient Monuments and areas of historic interest and value.</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>- Caravan Parks and temporary accommodation;</li> <li>- Users of outdoor recreational facilities and tourist attractions (eg golf courses)</li> <li>- Outdoor workers such as farmers;</li> <li>- Users of scenic roads, railways or waterways or users of designated tourist routes;</li> <li>- Schools and other institutional buildings, and their outdoor spaces;</li> <li>- Sailors, mariners and users of private watercraft</li> </ul>
<b>Low</b>	<ul style="list-style-type: none"> <li>- Indoor workers</li> <li>- Users of main roads (e.g. trunk roads), or passengers in public transport on main arterial routes.</li> <li>- Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities).</li> </ul>

*Stage 5: Magnitude of Visual Impact*

- 1.3.16 For the purpose of both the landscape and visual impact assessment, impacts were graded according to their scale and magnitude. In determining the magnitude of impact or degree of change, the following should be considered;<sup>19</sup>
- a) Scale of change;
  - b) Nature of change;
  - c) Duration of change;

<sup>19</sup> IAN 135/10 (W) para 3.9

- d) Distance;
- e) Screening;
- f) The direction and focus of view;
- g) Removal of past mitigation or existing vegetation;
- h) Whether the receptor is static or moving;
- i) Numbers and types of receptors potentially affected at a viewpoint.

1.3.17 In accordance with IAN 135/10 (W), impacts are rated to a five-point scale of major, moderate, minor, negligible (adverse or beneficial), and no change.

1.3.18 Terms used to describe the magnitude of visual impacts are derived from IAN 135/10 (W), Annex 2, Table 2, and presented in Table 11.

Table 11: Magnitude of Visual Impact and Typical Descriptors

<b>Magnitude</b>	<b>Typical descriptors</b>
<b>Major</b>	The Scheme, or a part of it, would become the dominant feature or focal point of the view.
<b>Moderate</b>	The Scheme, or a part of it, would form a noticeable feature or element of the view, which is readily apparent to the receptor
<b>Minor</b>	The Scheme, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
<b>Negligible</b>	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.
<b>No Change</b>	No part of the project, or work or activity associated with it is discernible.

1.3.19 Criteria applies to both negative (adverse), and positive (beneficial), due to the nature of the change according to their scale or magnitude. Where the Scheme, or a part of it, would become a detracting feature or focal point of the view, this is assessed as negative. Where the Scheme, or part of it, would result in an improvement in the view, this is assessed as a positive.

*Stage 6: Significance of Visual Effects without mitigation*

- 1.3.20 It is a requirement of the DMRM to undertake an assessment of the significance of landscape and visual effects without mitigation. *"In Wales, the assignment of significance before the before the consideration of the effectiveness of the design and committed mitigation measures should also be undertaken, allowing for the case or reason for and the effectiveness of mitigation to be described".<sup>20</sup>*
- 1.3.21 As stated in the landscape assessment methodology, the stage at which the Scheme proposals are assessed without mitigation is not clearly defined in the DMRB. For the purposes of this methodology, the Scheme proposals were assessed without mitigation following the announcement of the preferred route ie. the Scheme and at the commencement of the Environmental Impact Assessment process. This is when the Scheme had been progressed to a sufficient level of detail to enable a preliminary assessment to be undertaken. This enabled the proposed mitigation proposals to be captured and integrated into the design process.
- 1.3.22 IAN 135/10<sup>21</sup> recommends that the assessment of visual effects should be undertaken for three scenarios, the construction period, the first day of opening (in the winter) and during the summer 15 years after opening. This full assessment will be undertaken when mitigation measures are in place rather than during the preliminary assessment prior to mitigation.

*Stage 7: Develop Mitigation Measures*

- 1.3.23 The development of mitigation measures has previously been described in section 1.2.27 of the landscape assessment and also apply to the visual assessment. Visual mitigation measures may be solid barriers, such as fences or earth mounds which would be effective from the date of implementation. They may also have a dual purpose and mitigate against other forms of impact such as air quality or noise. Mitigation measures such as these may also have an adverse visual effect by blocking open views or by having an adverse effect on levels of visual amenity.
- 1.3.24 As stated in the landscape assessment methodology, the purpose of this mitigation stage is to;
- Identify suitable mitigation measures to mitigate against adverse effects;
  - Propose mitigation measures;
  - Record mitigation measures;
  - Explain intended effects(s) of mitigation measures
  - Integrate mitigation measure into scheme proposals.

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<sup>20</sup> IAN 135/10 (W) Annex 1 para 3.4

<sup>21</sup> IAN 135/10 Annex 2 para 3.1

*Stage 8: Significance of Visual Effects with Mitigation*

1.3.25 With mitigation measures now in place and committed as part of the scheme proposals, IAN 135/10<sup>22</sup> recommends that the assessment of visual effects should be undertaken for three scenarios as follows;

Table 11: Scenarios for assessment of visual effects

<b>Construction Period</b>	Assuming maximum visibility or maximum perceived change situation (ie. when construction activity is at its peak for any given view) and noting how long that period is likely to last
<b>Winters Day 1 Open to Traffic</b>	A winter's day in the year that the project would be open to traffic or be fully operational (i.e with noise/visual screens and mounds in place but before any planted mitigation has begun to take effect). This is usually a reflection of the operationally non-fully mitigated/maximum visibility scenario.
<b>Summers Day in 15<sup>th</sup> Year</b>	A summer's day in the fifteenth year after opening (ie. when planted mitigation measures can be assumed to be substantially effective). This is usually a reflection of the near fully mitigated scenario under normal conditions.

*Significance of Effect*

1.3.26 The magnitude of impact and the sensitivity of the receptor are combined to establish the significance of effect, which is expressed as a scale ranging from neutral to very large. The scale can be positive and negative. This is in accordance with IAN 135/10 (W). The matrix used to determine the Significance of Effect is the same for both Landscape and Visual Impact. Derived from IAN 135/10 (W), Annex 1, Table 3; and Annex 2, Table 3, the Significance of effect matrix is presented in Table 12.

Table 12: Significance of Visual Effects

		<b>Magnitude of Impact</b>				
		<b>No change</b>	<b>Negligible</b>	<b>Minor</b>	<b>Moderate</b>	<b>Major</b>
<b>Visual Sensitivity</b>	<b>High</b>	Neutral	Slight	Slight/ Moderate	Moderate/ Large	Large/ Very Large
	<b>Medium</b>	Neutral	Neutral/ Slight	Slight	Moderate	Moderate/ Large
	<b>Low</b>	Neutral	Neutral/ Slight	Neutral/ Slight	Slight	Slight/ Moderate

<sup>22</sup> IAN 135/10 Annex 2 para 3.1

- 1.3.27 The terms used to describe the landscape and visual impact significance of effect categories are presented in Table 13. They are derived from IAN/135/10 (W), Annex 2, Table 4.

Table 13: Typical Descriptors of Visual Impact Significance of Effects Criteria

<b>Effects</b>	<b>Descriptors</b>
Very Large Beneficial Effect	The Scheme would create an iconic new feature that would greatly enhance the view.
Large Beneficial Effect	The Scheme would lead to a major improvement in a view from a receptor of high sensitivity.
Moderate Beneficial Effect	The Scheme would cause obvious improvement to a view from a receptor of medium sensitivity, or perceptible improvement to a view from a receptor of high sensitivity.
Slight Beneficial Effect	The Scheme would cause limited improvement to a view from a receptor of medium sensitivity or would cause greater improvement to a view from a receptor of low sensitivity.
Neutral Effect	No perceptible change in view.
Slight Adverse Effect	The Scheme would cause limited deterioration to a view from a receptor of medium sensitivity or would cause greater deterioration to a view from a receptor of low sensitivity.
Moderate Adverse Effect	The Scheme would cause obvious deterioration to a view from a receptor of medium sensitivity, or perceptible to a view from a receptor of high sensitivity.
Large Adverse Effect	The Scheme would lead to a major deterioration to a view from a receptor of high sensitivity and would constitute a major discordant feature in the view.
Very Large Adverse Effect	The Scheme would cause the loss of views from a receptor of high sensitivity and would constitute a dominant discordant feature in the view.

*Stage 9: Report residual effects and summarise final assessment of visual effects*

- 1.3.28 The final stage of the landscape assessment is to report any significant impacts that the scheme proposals will have on the landscape receptors. There may be residual impacts that cannot be mitigated against and the final assessment should report on why these cannot be mitigated and what impact there will remain for the lifetime of the project.

## **APPENDIX 9.2**

### **PHOTOGRAPHIC METHODOLOGY**

## **Appendix 9.2 - Photographic Methodology**

1.1 The following camera setup was used on site to carry out the photography:

- Digital SLR Camera with full frame sensor: Canon EOS 5D Mk II
- Fixed focal length prime lens: Canon EF 50mm - f/1.4 USM Lens
- Hoya 58mm Pro-1 Digital UV Screw in filter
- Remote Shutter release cable
- Tripod - Manfrotto 190xDB/496RC2
- Panoramic Tripod Head - Manfrotto 303SPH Multi Row
- Tripod Leveller - Manfrotto 338 Levelling base
- Digital camera (for recording the location of the photograph taken)
- Tape measure (for 1.5m height accuracy)
- Compass (for calculating viewing angle)

1.2 At each receptor point, the following procedure was carried out in sequence:

- Camera time/ date set and images set to RAW and JPEG format.
- Camera height set 1.5m above ground (from centre of lens) and tripod levelled through 360 degrees using the tripod mounted levelling base. Panoramic head of the tripod set to 20 degree fixed increments.
- Remote shutter release cable attached to camera.
- Camera pointed towards the centre of the site and a compass bearing taken to record the angle of view.
- Apply camera settings (Manual setting, aperture f/14, ISO 100 or 200 if cloudy).
- Camera is manually focused and fixed for all subsequence shots in the panoramic sequence.
- Shutter speed is set making sure the exposure bar is +/- is set on 0.
- Time of photograph recorded and a full 360 degree panoramic sequence of 18No shots taken (clockwise).
- Camera setup and location photographed.
- GPS reading taken.

1.3 At each of the viewpoints the following details are recorded:

- Record location of the camera using onsite measurements from fixed features
- The grid reference of the viewpoint
- The horizontal field of view of the viewpoint
- The approximate altitude at viewpoint
- The viewer height at 1.5m (measured to the centre of the camera lens)

- The date, time and weather conditions the photo was taken
- The viewing angle/ direction of view to the development
- The distance to the development from the viewpoint (nearest visible feature)
- GPS reading taken.

#### *Single Frame Image*

- 1.4 Images were downloaded from the camera in RAW and JPEG format. The jpeg images have a resolution of 5616 x 3744 pixel dimensions. For each of the viewpoints single frame images have been included to show the central view towards the proposed site.
- 1.5 According to the Landscape Institute Advise note 01/11 the viewing distance for hand held photographs should be between 300mm and 500mm. The LI advice note (which cross refers to the Scottish Natural Heritage Visual Representation of Wind Farms Good Practice Guidance March 2006) recommends that for a 50mm lens on a 35mm camera printed to an image size of 360 x 240mm, the correct viewing distance to provide a realistic view would be 500mm.
- 1.6 The overall print size can also be determined by combining the viewing distance and the horizontal field of view. On a 50mm fixed focal lens the horizontal field of view is 39.6 °, however it is usual for a prime lens focal length to vary depending on the manufacturer of the lens. In order to calculate the exact horizontal field of view, the lens focal length for the camera was obtained using PTGui Software and then input into the below formula, which generated a field of view of 38.95 °
- Horizontal Field of View ° =  $2 \arctan [\text{width of image mm (36mm)} \div 2 \times \text{Lens Focal Length}]$
- The correct viewing distance is calculated using the following formula
- Correct viewing distance =  $\text{width of image} \div 2 \tan [\text{horizontal field of view} \div 2]$
- 1.7 The viewpoints have been represented on an A3 sheet at 360mm x 240mm and are to be viewed at 500mm, whilst holding them in a flat plane. The LI Advise Note 01/11 recommends the minimum resolution for a 500mm viewing distance is 180 pixels per inch.

#### *Panoramic Photographs*

- 1.8 In order to represent a wider context for each of the viewpoints single frame images are required to be stitched together. The Jpeg images (18No) were automatically merged together using PTGui Software, to produce a 360° cylindrical panorama (36000pixel image size). As the image is cylindrical it is to be viewed with one eye at the correct viewing distance whilst curving the image in a 90° arc around the viewer. The viewing distance is therefore represented as a radius dimension.
- 1.9 We have chosen to create a panorama using 3.75 images stitched together which gives a 75° field of view. The viewing distance can be calculated using the formula below:

Correct viewing distance =  $180 \times \text{width of image} \div \pi \times \text{horizontal field of view}$

- 1.10 Therefore, the correct viewing distance for the panoramic at 390mm width on an A3 sheet is 300mm radius. The LI Advise Note 01/11 recommends the minimum resolution for a 300mm viewing distance is 300 pixels per inch.

*Viewpoint Locations*

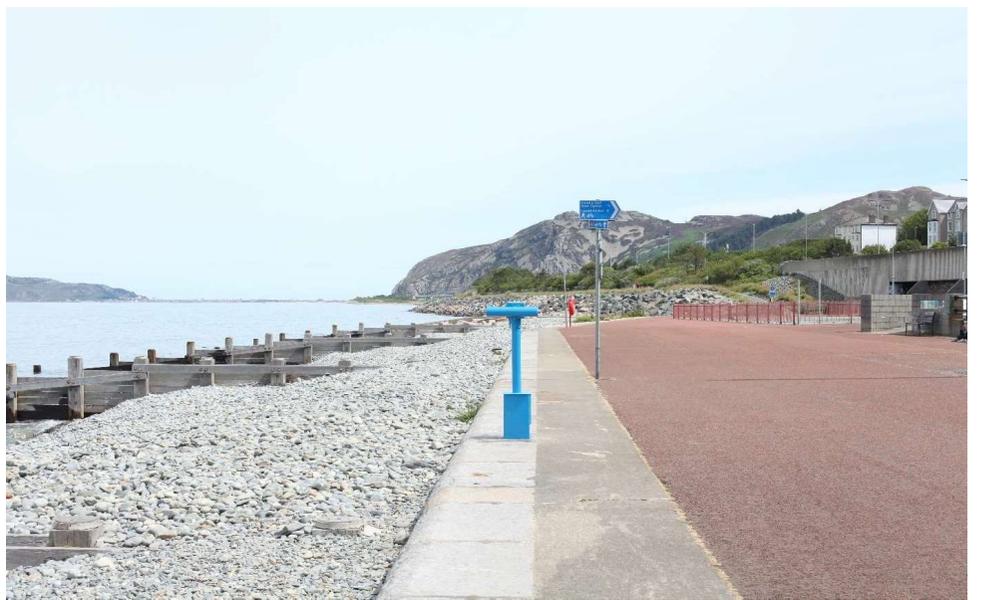
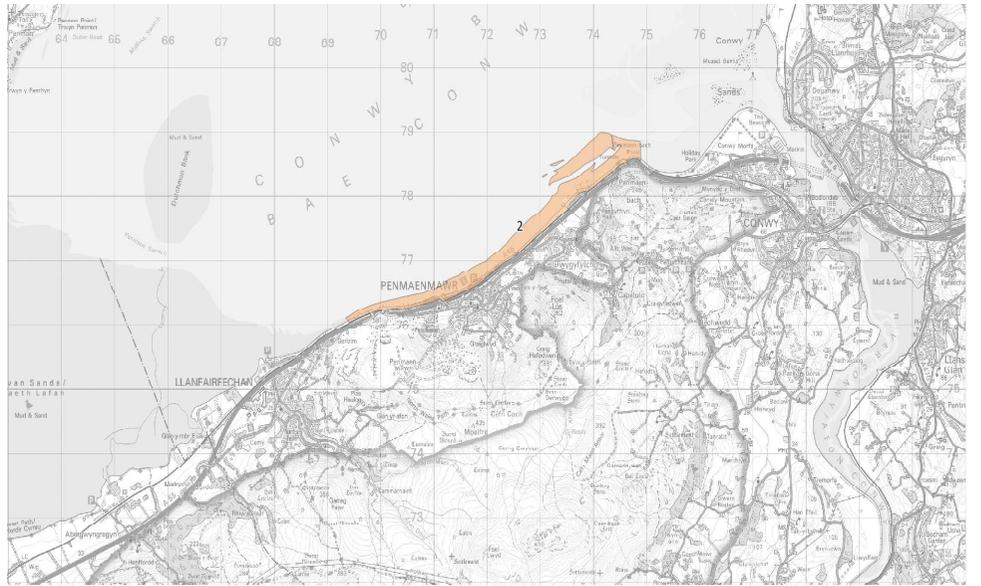
- 1.11 The GPS coordinates accurate to within 10m, were recorded on site for the location of each camera viewpoint. More accurate coordinates to within a metre, were obtained using Ordnance Survey raster mapping, overlaid with the proposed scheme. Survey station photographs, taken during the survey with a compact camera, were used to locate the viewpoint locations accurately.
- 1.12 Accurate bearing of the single frame images, representing the centre of the proposed development, were obtained from the OS base. Locatable features clearly represented in both the photographs and OS base were used to cross reference and verify the horizontal bearing of the camera and accurate coordinate location of the viewpoint.”

## **APPENDIX 9.3**

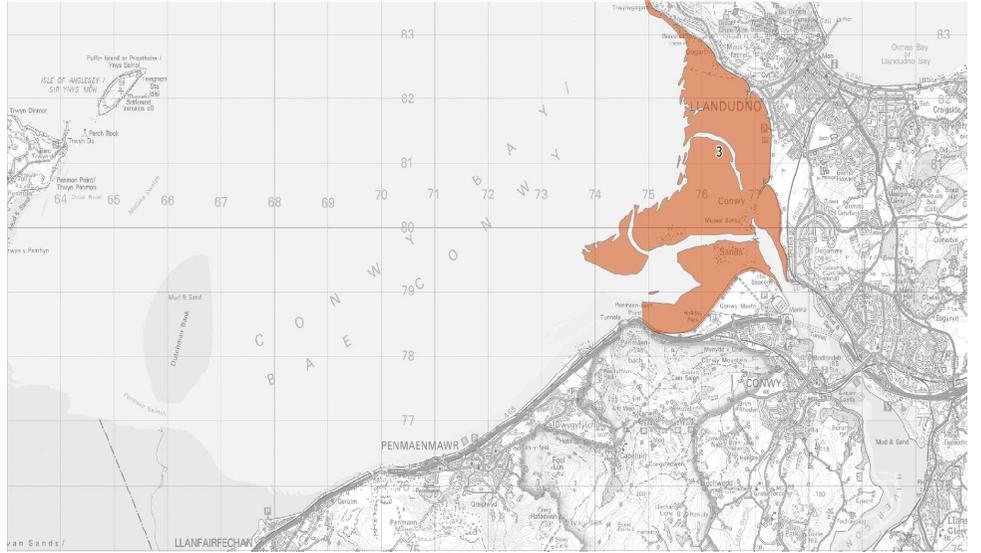
### **LANDSCAPE CHARACTER AREA DESCRIPTIONS**

<b>LCA1 – Traeth Lafan and Dutchman Bank</b>		<b>Map inset</b>
Category:	Coastal	
LANDMAP Aspect Areas Overlap	Visual and Sensory: GWNDDVS001 - Traeth Lafan	
<b>General Description and Designations</b>		
General Description	An extensive marine and coastal zone covering the inter-tidal area of Conwy Bay north and west of the town Llanfairfechan. The coastal zone is a popular destination for local residents and seasonal tourists and provides a spectacular coastal setting with the mountains of Snowdonia rising steeply to the south. The area is a valuable resource for nature conservation and contains designations of international and national importance primarily as an important maritime habitat for marine birds.	
Designations	Traeth Lafan SSSI; Menai Strait and Conwy SAC; Liverpool Bay SPA; Traeth Lafan Local Nature Reserve; North Arlechwedd Historic Landscape	
<b>Physical Characteristics</b>		
Built environment	Parade of houses along promenade define the coastal zone. Timber groynes and sea defence walls at Llanfairfechan Promenade.	
Landform, geology and hydrology	Mudflats and beaches comprising of mud, sand and shingle.	
Landcover and vegetation	Open mudflats and beach. Little vegetation.	
<b>Perceptual Characteristics</b>		<b>Representative photograph</b>
Scale and Appearance	Large scale, flat and open. Appearance varies considerably with tides and weather conditions.	
Scenic quality	High scenic quality with expansive views across sea to Anglesey and Great Orme. Views inland to coastal town and promenade of Llanfairfechan.	
Tranquillity	Largely tranquil with calls of Lapwing and Curlew on mudflats at low tide contributing to feeling of remoteness and peacefulness. Occasional noise of train on mainline railway.	
Discordant/intrusive features	None	
Night-time light sources	A55 road corridor is lit and the dominant light source during night-time.	
<b>Cultural/Social</b>		
Historic features and elements	Penmaen Swatch, a post medieval anchorage, (NPRN 518960) a deep channel that runs between Traeth Lafan and Dutchman Bank, only perceptible at periods of low tide.	
Human Interaction	The coastal zone is used for coastal and maritime recreation such as sailing, kayaking and angling. Bait digging is also undertaken at periods of low tide.	
<b>Landscape Value</b>		
Highly scenic and picturesque area with backdrop of mountains descending to coastal plain. Contains several designations primarily for marine and coastal nature conservation and has features of historic interest. Valued as a resource by the local community and as a venue for tourism.		
<b>Quality</b>	<b>Condition</b>	
Excellent	Good, intact and unspoilt	Very High

<b>LCA2 – Penmaenmawr Beach</b>		
Category	Coastal	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/Penmanemawr	
<b>General Description and Designations</b>		
General Description	Extensive coastal and intertidal area stretching from Penmaenmawr east to Penmaen-bach headland with mainline Holyhead to Chester railway and A55 road corridor defining the southern edge. Area of intertidal level ground made up of beaches of sand and shingle on the coast of the community of Penmaenmawr (Penmaenan, Pant-yr-afon and Capelulo). Large scale landscape with an open and exposed aspect. Organised pattern determined by tide levels with a moderate texture.	
Designations:	Aber Afon Conwy SSSI: Menai Strai and Conwy Bay SAC: Liverpool Bay SPA: Traeth Lafan LNR	
<b>Physical Characteristics</b>		
Built environment	Buildings are clustered at the promenade. Sea defence walls, railway embankment and concrete retaining walls form a southern boundary, groynes and slipways split the beach.	
Landform, geology and hydrology	Flat area of beach and mudflats that changes with tidal conditions.	
Landcover and vegetation	Beach and promenade area. Some ornamental planting along promenade in raised planters.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Expansive area to the north stretching across intertidal areas to the east and west.	
Scenic quality	Excellent scenic quality looking north across seascape of Conwy Bay to Anglesey, Penmon Lighthouse, Puffin Island and Great Orme. Backdrop of villages Penmaenmawr and Dwygyfylch with mountains and quarries above.	
Tranquillity	A55 road and rail corridor prevent any levels of tranquillity due to noise and visual intrusion.	
Discordant/intrusive features	A55 road and rail corridor intrusive visual elements. Sewage Treatment works on coastal strip near Penmaen-bach Point.	
Night-time light sources	A55 road corridor lit along full length.	
<b>Cultural/Social</b>		
Historic features and elements	None recorded	
Human Interaction	Popular promenade area with beach café and outdoor play area. Beach is used by sailing club, kayakers, anglers and bait diggers at low tide.	
<b>Landscape Value</b>		
Penmaenmawr beach and promenade are highly valued by the local community and used for general amenity and recreation. Tourism use during the summer months with beach café and play areas popular venues. The inter-tidal area is valued as a recreational and designated for nature conservation. The area is of good scenic quality and well maintained. Overall landscape value is detracted by proximity of road and rail corridor.		
Quality	Condition	Overall Landscape Value
Good	Good	High



<b>LCA3 – Conwy Estuary</b>		
Category:	Coastal	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	CNWVS051 – Conwy Sands	
<b>General Description and Designations</b>		
General Description	Conwy Sands is an extensive inter-tidal area encompassing Conwy Estuary as it enters into Conwy Bay. The area is a dynamic environment with high tidal range with exposed sand banks and mussel banks at low tide. The setting of the area is open with a backdrop of hills to the south and West Shore and the Great Orme to the north and east. Distant views across open sea west towards Anglesey and Puffin Island. The estuary contains international ecological and maritime designations.	
Designations	Aber Afon Conwy SSSI: Menai Strait and Conwy SAC: Liverpool Bay SPA: Great Orme Heritage Coast: Local Nature Reserve: Conwy and Creuddyn Historic Landscape: Deganwy Castle SAM (setting).	
<b>Physical Characteristics</b>		
Built environment	Coastal defences at Conwy Morfa and West Shore. Marker buoys at entrance to estuary.	
Landform, geology and hydrology	Coastal with high tidal range, sand dunes at Conwy Morfa and West Shore.	
Landcover and vegetation	Sandbanks, beaches and mudflats.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Open, expansive and consistent, constantly changing with tide.	
Scenic quality	High scenic quality with open sea, beaches and estuary with backdrop of mountains.	
Tranquillity	Quite tranquil but Conwy Estuary used frequently by boats and sailing craft particularly during the summer months.	
Discordant/intrusive features	No significant discordant features.	
Night-time light sources	Residential area of West Shore and Deganwy lit at night.	
<b>Cultural/Social</b>		
Historic features and elements	Submerged peat deposits and fish weirs.	
Human Interaction	Mouth of Conwy Estuary navigable and a popular venue for maritime recreation.	
<b>Landscape Value</b>		
Very high landscape value with several marine habitats designated as international importance. Overall a dynamic and scenic landscape with spectacular coastal setting. Valued for its maritime recreational use together with long distance coastal path and cycle route along coast. Conwy Golf Course on southern boundary and adjacent marina and holiday park popular seasonal attractions.		
Quality	Condition	Overall Landscape Value
Excellent	High	Very High



**LCA4 – Aber and Felin-fach Salt Marsh**

Category:	Coastal
LANDMAP Aspect Areas Overlap (Visual and Sensory)	GWNDDVS004 Wig, SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	Area of coastal wild land at the mouths of Afon Aber and Nant-y-Felin-Fach watercourses. It spans a part of the coastal strip of Aber and Llanfairfechan (Bryn). The landscape is of medium scale with an open aspect. It consists of a mixture of scrub-woodland, salt-marsh, rough-grassland, waterbodies, sand and mud, with a moderate texture.
Designations	Aber Afon Conwy SSSI: Menai Strait and Conwy SAC and Traeth Lavan SPA: Morfa Aber and Morfa Madryn Glan-y-Mor Elias LNR: North Arllechwedd Historic Landscape.

**Physical Characteristics**

Built environment	Scattered individual dwellings are located near to the railway line, which forms a southern boundary to this character area. Boundaries are a mixture of stone walls and stock-proof fences.
Landform, geology and hydrology	Flat and generally even ground. Some wetland areas.
Landcover and vegetation	Rough grassland and scrub.

**Perceptual Characteristics**

Scale and Appearance	Open and expansive to the north with good views over the nature reserve out towards the Menai Strait and Anglesey, and inland towards the Pen-y-clip promontory and northern foothills of the Carneddau uplands.
Scenic quality	Good scenic quality with attractive coastal elements.
Tranquillity	The tranquillity of the area is affected by the frequent passing trains on the Chester to Holyhead railway line.
Discordant/intrusive features	No discordant features.
Night-time light sources	Trains on adjacent Chester Holyhead mainline.

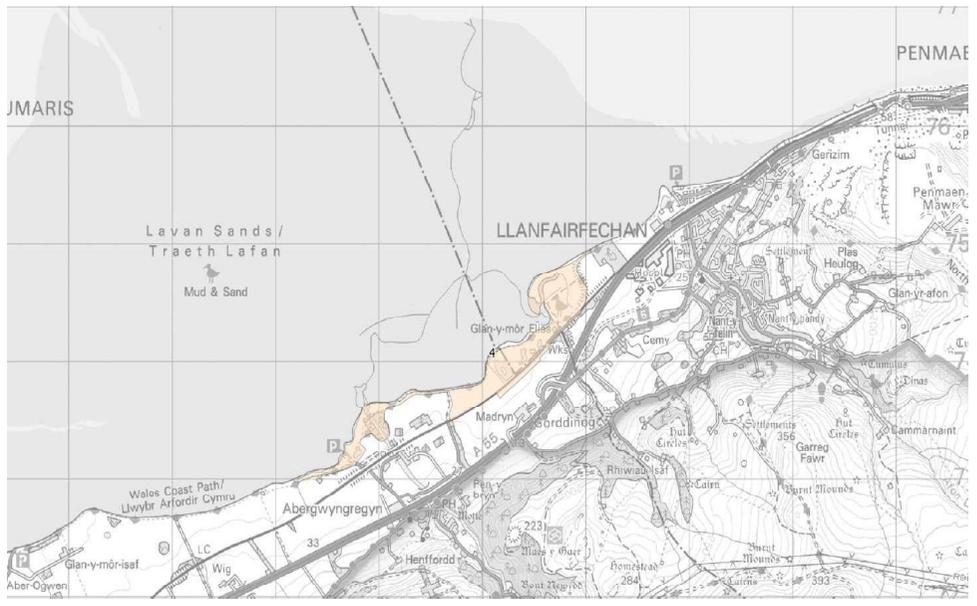
**Cultural/Social**

Historic features and elements	Pair of cottages north of railway - Grade II Listed
Human Interaction	The Wales Coast Path follows the coastline with circular routes to follow within the nature reserve. A popular area for local walks.

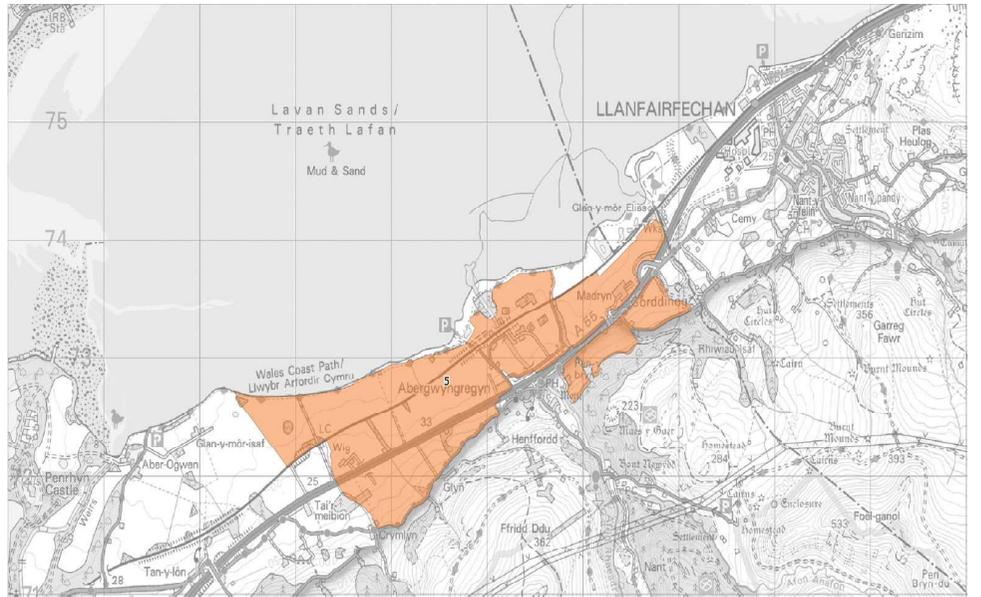
**Landscape Value**

The area has several designations primarily for its bird life and is valued by the local community for circular walks and for its wildlife interest. The landscape is scenic and coastal with a rural backdrop and of good quality. It lies on the edge of internationally recognised ecological designations but is more renowned locally as an area for birds and the Glan-y-Mor Elias Local Nature Reserve.

Quality	Condition	Overall Landscape Value
Good	Good	Very High



<b>LCA5 – Aber Farmland</b>		
Category:	Flat Lowland	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	GWNDDVS0004 – Wig; GWNDDVS008 Abergwyngregyn	
<b>General Description and Designations</b>		
General Description	The character area is a coastal strip of low-lying farmland located between the busy A55 road corridor and the quiet coast of the Lavan Sands. The landscape is of medium scale locally but open and expansive to the north. The landcover is predominantly pasture with small pockets of restored ancient woodland.	
Designations:	North Arllechwedd Historic Landscape	
<b>Physical Characteristics</b>		
Built environment	Settlement is limited within the area with a few scattered farms, a University Farm Training Centre and Sewage Works	
Landform, geology and hydrology	Low lying with Afon Rhaeadr discharging into Traeth Lafan.	
Landcover and vegetation	Plantation woodlands possibly as trials as part of University College Farm. Otherwise open grassland set to pasture. Restored Ancient Woodland site in adjacent LCA4.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Predominantly rural in appearance and moderate in scale. More expansive area of Lafan Sands to the north.	
Tranquillity	Mainly peaceful coastal area but passing trains audible and lessens feeling of tranquillity. A55 not readily audible during fieldwork.	
Discordant/intrusive features	Farm buildings and silage towers.	
Night-time light sources	No significant night-time light sources – traffic on A55.	
<b>Cultural/Social</b>		
Historic features and elements	Non known	
Human Interaction	Car parking area popular with walkers and bird spotters. Wales Coast Path.	
<b>Landscape Value</b>		
The landscape is considered to be generally of good quality and in good condition, well managed as farmland and with some scenic qualities. The A55 detracts from its' overall amenity value, especially east of Abergwyngregyn where the road corridor defines the southern boundary of the area. The coastal strip north of the railway is high landscape value as it lies adjacent to internationally designated area Traeth Lafan Sands and a popular amenity area set within an area of high scenic quality that could not be easily substituted. This area is also tranquil but disturbed by the railway line (noise) and traffic on the A55 (visual).		
Quality	Condition	Overall Landscape Value
Good	Good	High



<b>LCA6 – Tyddyn-y-coed Mosaic</b>		
Category:	Flat lowland	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPV5074 – Llanfairfechan/Penmaenmawr	
<b>General Description and Designations</b>		
General Description	An area of coastal plain on the western fringe of Llanfairfechan Town and promenade and north of the Holyhead Chester mainline and A55 road corridor. The area is of mixed use, predominantly grassland with wooded plantation, allotments and some residential properties off West Shore Road.	
Designations:	Grade II Listed Buildings off Shore Road. Area lies adjacent to Aber Afon Conwy SSSI: Menai Strait and Conwy SAC.	
<b>Physical Characteristics</b>		
Built environment	Sea defence walls and promenade: Grade II Listed cottages along Shore Road with attractive garden frontages in arts and craft style. Allotment gardens to the south-west adjacent to railway line. Sewage treatment works at south-western boundary of the area.	
Landform, geology and hydrology	Flat low lying – geology unknown but lies on the coastal plain	
Landcover and vegetation	Mixed land use and cover. Open low-lying grassland inland from beach frontage with hedgerow/scrub boundaries. Some blocks of mixed woodland plantation.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Open coastal area set mainly to grassland with woodland plantation and allotments on the western fringe of Llanfairfechan	
Scenic quality	The area has some scenic quality particularly to the north, west and east. South, the area is contained by shore Road and Holyhead Chester mainline.	
Tranquillity	The area is generally a peaceful landscape but exposed to the north and influenced by the rail and road corridor to the south.	
Discordant/intrusive features	Sea defence walls in poor repair. Sewage Pumping Station adjacent to railway and at end of West Shore road detracts visually from the area.	
Night-time light sources	A55 and trains on Holyhead Chester mainline	
<b>Cultural/Social</b>		
Historic features and elements	Grade II Listed properties on Shore Road (Arts and Crafts)	
Human Interaction	The area lies on the western fringe of Llanfairfechan and is a popular amenity area for general activities such as rambling and dog walking.	
<b>Landscape Value</b>		
This is a small scale but complex landscape with a variety of land uses and landscape receptors. The coastal zone is highly scenic and a popular amenity area valued by the local community. The Grade II Listed buildings are key features and are attractive features in view from the coastal path. Inland from the coast the landscape quality deteriorates into a more fragmented condition and is increasingly influenced by the road and rail transport corridor of the A55.		
Quality	Condition	Overall Landscape Value
Medium	Medium	Moderate



**LCA7 – A55 Abergwyngregyn to Llanfairfechan**

Category:	Transport Corridor
LANDMAP Aspect Areas Overlap (Visual and Sensory)	GWNDVVS004 – WIG, SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	This section of the A55 and North Wales Coast Railway transport corridor runs through low-lying level ground from Abergwyngregyn to Afon Llanfairfechan in the east. There is roadside mitigation planting crossing the pastoral and parkland landscape of Aber and Llanfairfechan-Bryn communities. Boundaries are a mixture of metal and concrete barriers, timber fences, stone walls, plantations and managed hedges. The road corridor contains a number of structures such as overbridges and signage. The landscape is of medium scale, well maintained and for the majority enclosed by vegetation.
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Designations	Snowdonia National Park boundary runs along the southern verge of the road corridor between Abergwyngregyn (Junction 13) and Llanfairfechan (Madryn) (Junction 14). Some plantations between road and railway, and between road and parkland area restored ancient woodland sites.
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**Physical Characteristics**

Built environment	Road corridor containing typical roadside infrastructure of acoustic barrier fences, concrete parapets, vehicle restraint systems, VMS signs and lighting columns in central reserve at junctions.
Landform, geology and hydrology	The road corridor is effectively a linear plateau set amongst gently sloping land as it meets the coastal plain. Drainage is
Landcover and vegetation	The road corridor is well vegetated with well-established soft estate along both east and west bound verges.

**Perceptual Characteristics**

Scale and Appearance	A road corridor set within a highly scenic coastal and rural setting
Scenic quality	Good scenic quality with open views to the north across coastal plain to Lafan Sand and Conwy Bay. Eastbound views eclipsed by Pen-y-clip promontory, westbound Carneddau uplands and surrounding pastoral landscape.
Tranquillity	The road corridor is set within a largely peaceful landscape but moving traffic is a highly disruptive element.
Discordant/intrusive features	Concrete parapets and junctions detract from what is otherwise a road corridor within a scenic setting.
Night-time light sources	Road corridor is lit at junctions. Road traffic headlights at night.

**Cultural/Social**

Historic features and elements	Llanfairfechan Railway Station is the only building within this area. Lies within the <i>North Arllechwedd</i> Historic Landscape
Human Interaction	The transport corridors carry a significant amount of traffic which affects the visual tranquillity with constant movement of traffic and numerous high sided vehicles.

**Landscape Value**

The road corridor is set within an area of generally high scenic quality with the upland areas of Snowdonia National Park to the south and coastal plain to the north. Attractive views out both east and westbound. Well established soft estate clearly defines road corridor and creates green corridor. Some discordant features such as concrete parapets and acoustic barrier fencing on approaches to Llanfairfechan. Moving traffic major detractor, especially high sided vehicles.

Quality	Condition	Overall Landscape Value
Good	Good	Moderate



**LCAS – A55 Llanfairfechan to Pen-y-Clip**

Category:	Transport Network
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/ Penmaenmawr, SNPVS075 – Penmaen Mawr Quarry

**General Description and Designations**

**General Description**  
 This section of the A55 and North Wales Coast Railway transport corridor runs from Llanfairfechan to Pen-y-clip tunnel, crossing Llanfairfechan-Lafan community. This is a busy transport corridor which provides access to the nearby settlement of Llanfairfechan from the A55 Llanfairfechan roundabout (Junction 15). This area is a flat, narrow low-lying corridor with some mature roadside plantations. Boundaries are a mixture of metal barriers, concrete barriers, timber fences and stone walls. Within this section of the A55 are pedestrian overbridges, signage and lighting. The landscape is of medium scale and open and well maintained.

**Designations:**  
 Buildings near to Junction 15 (outside the character area) are within the *Llanfairfechan Town Centre Conservation Area*.  
 Section of railway retaining wall to east of Promenade Road in Llanfairfechan forms a boundary to *Aber Afon Conwy SSSI, Menai Strait and Conwy SAC, Traeth Lavan SPA and Traeth Lafan LNR*.

**Physical Characteristics**

<b>Built environment</b>	Road corridor containing typical roadside infrastructure of acoustic barrier fences, concrete parapets, vehicle restraint systems, VMS signs and lighting columns in central reserve at junctions. Road corridor at split level east of J15 with high retaining wall and soil nails and cyclepath overbridge.
<b>Landform, geology and hydrology</b>	Urban landform with numerous structures.
<b>Landcover and vegetation</b>	Limited soft estate due to topography and constrained nature of road corridor. Established plantations adjacent to Junction 15.

**Perceptual Characteristics**

<b>Scale and Appearance</b>	Harsh urban landscape within coastal setting
<b>Scenic quality</b>	Very poor scenic quality with structure within road corridor detracting from coastal setting
<b>Tranquillity</b>	None. Roads traffic loud and threatening within road corridor and areas immediately adjacent (verges) and on overbridges
<b>Discordant/intrusive features</b>	Overhead gantries. Pedestrian footbridge and ramped approaches east of J15 and yellow rumble strips on approaches to junction. Large engineering structures
<b>Night-time light sources</b>	Road corridor is lit at junctions. Road traffic headlights at night.

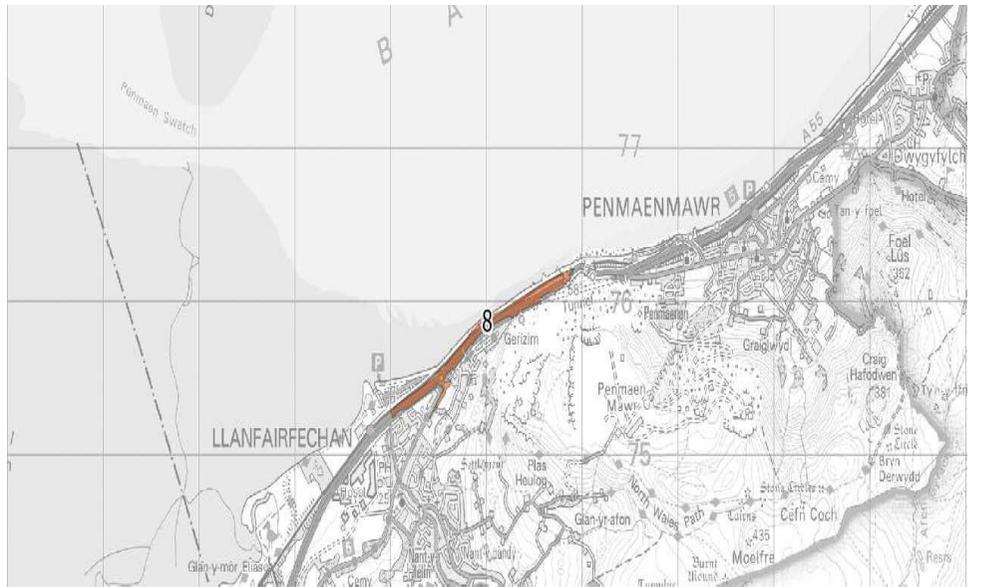
**Cultural/Social**

<b>Historic features and elements</b>	Pen-y-clip tunnel and headland
<b>Human Interaction</b>	Users of road corridor and adjacent footpath/cyclepath links

**Landscape Value**

The road corridor within this LCA is highly urban in character with some significant engineering features and structures such as overbridges, signs and gantries. The road corridor together with the railway line, effectively divides the town of Llanfairfechan in two and truncates connectivity with the promenade and beach area. The road corridor is well used and supports over XXXX vehicles per day. The soft estate either side of Junction 15 is a significant landscape feature that provides visual screening of the road corridor from nearby properties. The eastbound approaches towards Pen-y-Clip headland are dominated by large scale engineering structures. Although the A55 may be valued by the local community as a transport corridor and commuting route, the overall landscape value is considered low due to the number of detracting elements.

Quality	Condition	Overall Landscape Value
Poor	Moderate	Low



**LCA9 – A55 Trunk Road and Railway (Pen-y-clip to Penmaenbach)**

Category	Transport Route
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS075 – Penmaen Mawr Quarry, SNPVS074 Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	This medium scale, low-lying section of the A55 and North Wales Coast Railway transport corridor runs from Pen-y-clip tunnel to the Penmaenbach tunnel. There is mitigation planting crossing the coastal landscape of Penmaenmawr communities. Boundaries comprises mixture of metal barriers, concrete barriers, timber fences and stone walls. Access to the settlements of Penmaenmawr and Dwygyfylchi are provided from the A55 Puffin Roundabout (Junction 16). Penmaenmawr can also be accessed off the A55 east bound carriageway via a vehicular overbridge and Dwygyfylchi via a junction off the westbound carriageway. The Puffin Café and Shell garage can be accessed via the westbound carriageway.
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Designations:	Eastern limits adjoin Snowdonia National Park boundary at Penmaenbach Tunnel. Small area at western end crosses <i>North Arllechwedd</i> Historic Landscape.
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**Physical Characteristics**

Built environment	Western portal of Pen-y-Clip Tunnel dominated by reinforced rock face and overbridge of cyclepath. Overbridge at Junction 15A. Quarry buildings and associated structures west of Junction 16.
Landform, geology and hydrology	Rocky headland at Pen-y-Clip with road corridor urban in character with numerous structures.
Landcover and vegetation	Well established soft estate largely along southern verge with some at Junction 15A on the northern verge.

**Perceptual Characteristics**

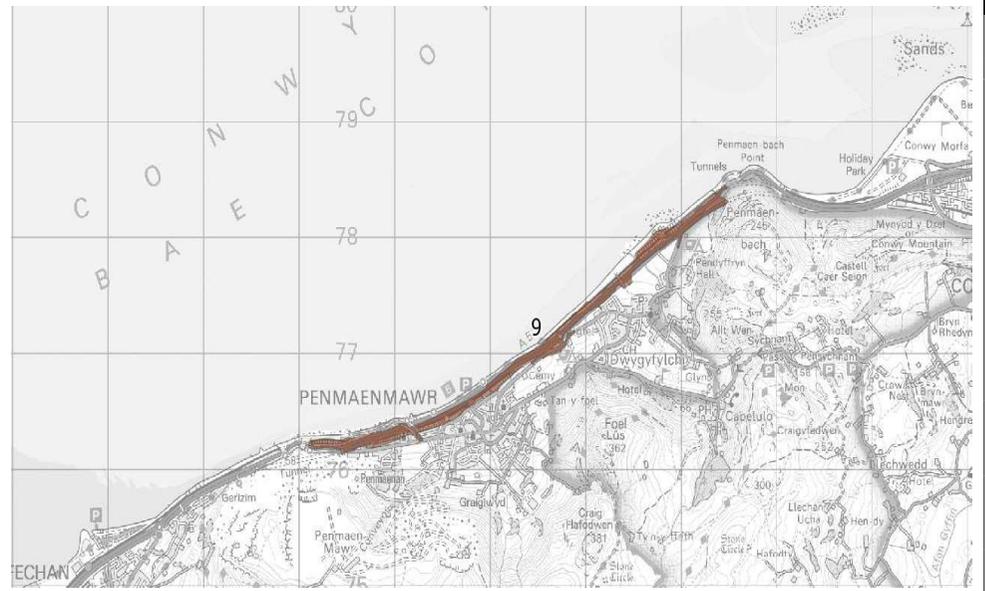
Scale and Appearance	Harsh urban landscape within coastal setting
Scenic quality	The road corridor itself is generally of low scenic quality, there are however good outward views across Conwy Bay to the Great Orme from elevated sections of road (eastbound) west of Penmaenmawr and inland towards the Penmaenbach and Pen-y-Clip headlands and Penmaenmawr Quarries.
Tranquillity	The transport corridors carry a significant amount of traffic which affects the visual tranquillity with constant movement of traffic and numerous high sided vehicles. Traffic headlights also cause light pollution within the character area. The audible tranquillity is very low.
Discordant/intrusive features	Overbridges and overhead gantries. Pedestrian footbridge and ramped approaches west of J15A and yellow rumble strips on approaches to junction. Large engineering structures
Night-time light sources	Road corridor is lit at junctions. Road traffic headlights at night.

**Cultural/Social**

Historic features and elements	Pen-y-Clip Tunnel
Human Interaction	Users of road corridor and adjacent footpath/cyclepath links

**Landscape Value**  
 The road corridor within this LCA is highly urban in character with some significant engineering features and structures such as overbridges, signs and gantries. The road corridor sits within the context of Penmaenmawr, a former quarry town with clear evidence of quarrying as a previous industry. The road corridor is elevated and is a dominant element above the Penmaenmawr beach frontage that is highly valued by the local community as an area for amenity and recreation. East of Junction 16 roundabout and towards Penmaenbach headland, the road corridor is at a more even level as it runs parallel to the railway across the coastal plain.

Quality	Condition	Overall Landscape Value
Medium	Medium	Low



**LCA10 – Pendyffryn Pasture and Parkland**

Category:	Rolling lowland
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 Llanfairfechan/ Penmaenmawr; SNPVS078 Penmaenbala

**General Description and Designations**

General Description	This character area lies to the north of Dwygyfylchi and south of the A55 and Junction 16A(Dwygyfylchi) to the west of Penmaenbach headland. Glan-Yr-Afon road runs in a southwest direction from the A55 flanked by hedgerows towards Dwygyfylchi. The area is predominantly open lowland set to pasture with seasonal caravan and camping land uses and a field used for events such as circuses and fairgrounds.
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Designations:	Adjoins Snowdonia National Park
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**Physical Characteristics**

Built environment	Pendyffryn Hall and caravan site accessed off Glan-Yr-Afon road. Residential development has encroached on open pastureland to the north-west.
Landform, geology and hydrology	Low lying area with Afon Gyrach the main watercourse draining northwards beneath the A55 via a culvert before discharging into the sea. The river sits within a small and wooded river valley that dissects the coastal plain.
Landcover and vegetation	Landcover comprises pasture, temporary amenity fields and some blocks of woodland (Coed Pendyffryn) at the foothills of Allt Wen. Field boundaries are of medium scale and are enclosed by well-established hedgerows and mature trees. Natural stone boundary walls on approaches to village of Dwygyfylchi either side of narrow Glan-Yr-Afon road.

**Perceptual Characteristics**

Scale and Appearance	Views east are contained by the hillsides of Penmaen-bach and Allt Wen and to the south by Foel Lus. Views from the western part of the character area overlook the A55 and out towards the coast.
Scenic quality	The backdrop to this LCA is dramatic with the rocky scree slopes of Penmaenbach and Allt-Wen rising steeply above lower heavily wooded slopes. The lowland area itself has moderate scenic quality that is diminished by proximity of the A55 road corridor and expanding residential fringes of the village further to the south-west.
Tranquillity	Tranquillity particularly along the northern part of the character area is low.
Discordant/intrusive features	Few discordant elements but presence of A55 and proximity of Shell Garage and overbridge noticeable detractors.
Night-time light sources	A55 road corridor and settlements of Dwygyfylchi and eastern perimeter of Penmaenmawr.

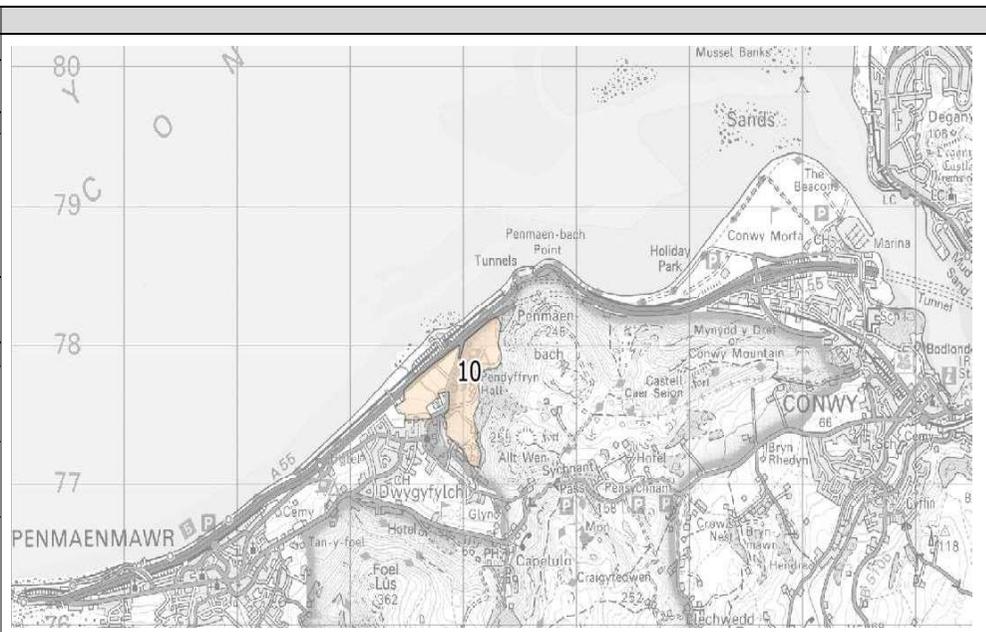
**Cultural / Social**

Historic features and elements	None known
Human Interaction	Pendyffryn Hall caravan site for statics and seasonal pitches with another field used for seasonal camping pitches. Adjacent field is used for circuses and fairs. Regular seasonal visitors occupy static caravans during summer months and highly valued.

**Landscape Value**

The overall landscape value of Pendyffryn pasture and parkland is considered to be medium due to its lack of cohesiveness and the erosion of its rural character due to the encroachment of residential development. The proximity of the A55 road corridor, although concealed by localised topography and hedgerow boundaries in some place, is a detractor with noise of passing vehicles and lighting a detractor. However, the setting to the south and east still remains of good scenic quality.

Quality	Condition	Overall Landscape Value
Medium	Medium	Moderate



**LCA11 – Llanfairfechan Promenade**

Category:	Built land
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	The promenade is the original sea frontage to the Victorian seaside resort of Llanfairfechan, a wide area of public realm with a parade of three storey residential properties painted in a pastiche of seaside colours. The promenade has several facilities ranging from cafes and restaurants to toilets, play area, skatepark and boating pool. The promenade can be accessed via Shore Road East to the east and Station Road to the west both of which have to pass beneath the railway line with height restrictions of 1.8 and 3.0 metres respectively.
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Designations	Sea defence wall forms the boundary to Aber Afon Conwy SSSI, Menai Strait and Conwy SAC, Traeth Lavan SPA and Traeth Lafan LNR.
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**Physical Characteristics**

Built environment	Wide area of public realm with parade of three-story townhouses defining southern edge. Sea defences and slipways, car parking and and toilet facilities
Landform, geology and hydrology	Wide flat area of public realm with sea defences.
Landcover and vegetation	Ornamental planting areas within park areas and mown grassland.

**Perceptual Characteristics**

Scale and Appearance	A coastal promenade with attractive beach frontage that sweeps in a gentle arc eastward towards Penmaenmawr where the rocky headland descends steeply to the sea.
Scenic quality	Spectacular scenic quality that varies considerably due to tidal and weather conditions.
Tranquillity	The coastal zone and inter-tidal area has some tranquil qualities but the busy promenade area is also heavily influenced by the A55 and rail transport corridor that diminishes feeling of peacefulness.
Discordant/intrusive features	No significant detractors. Coastal defence wall is a functional structure but with little aesthetic quality.
Night-time light sources	Properties along frontage of promenade and A55/Rail corridor.

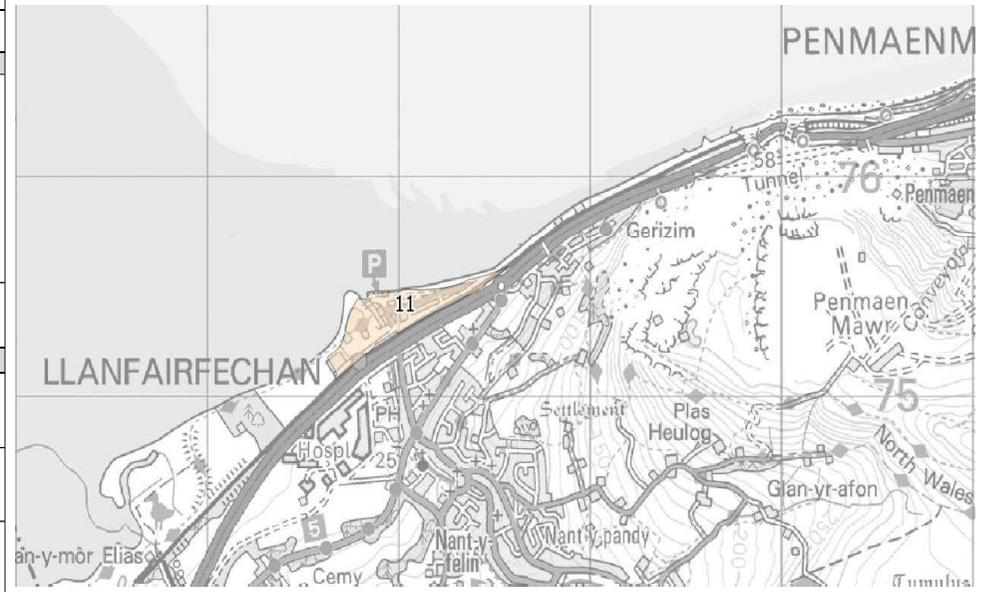
**Cultural/Social**

Historic features and elements	Established as holiday resort in the 19 <sup>th</sup> Century taking advantage of improved connectivity with the arrival of Telford’s road and Stevenson’s railway. There are two Grade II listed buildings within the promenade area, ‘The Towers’ and ‘Gwynfor’. The buildings that form the main parade are not listed and do not fall within a Conservation Area
Human Interaction	There is a significant amount of human interaction within the promenade area with a wide range of activities undertaken by the local community and visitors to the area. There is also a wide range of interest groups that use the promenade from casual ramblers and dog walkers to bird spotters and anglers and local sailing club. The beach has blue flag status.

**Landscape Value**

The promenade is highly valued by the local community and is a significant seaside attraction for visitors and day trippers. It is a popular venue for day trippers and less able-bodied people as the space is flat, hard surfaced and with open access and free car parking. The promenade has a spectacular coastal and mountainous setting at the foothills of Snowdonia.

Quality	Condition	Overall Landscape Value
Good	Good	Moderate



**LCA12 – Llanfairfechan Town Centre**

Category: Built land

LANDMAP Aspect Areas Overlap (Visual and Sensory) SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

**General Description**  
The area lies between the A55 road corridor and Penmaenmawr Road to the east of Llanfairfechan Town Centre. Penmaenmawr Road is one of the two principal routes in and out of Llanfairfechan from the east and the existing Junction 15 roundabout. The area is principally urban with a number of community facilities such as the local school (former Ysgol Canol now Ysgol Pant y Rhedyn), former council buildings (Infrastructure Services at the Heath) and church/chapel. The road is generally well used with bus stops either side. There are several residential properties in the eastern section that overlook the A55 road corridor and beyond towards Anglesey and Puffin Island. The soft estate of the A55 provides screening of the road from these properties and the school grounds of Ysgol Pant y Rhedyn.

**Designations:**  
Llanfairfechan Town Centre Conservation Area that runs along south-west of Shore Road East and includes buildings along the north side of Penmaenmawr Road towards the town centre and east off Station Road.

**Physical Characteristics**

**Built environment**  
Eastern edge of town centre with variety of stone and rendered buildings along Penmaenmawr lying within Llanfairfechan Town Centre Conservation Area.

**Landform, geology and hydrology**  
Open and gently sloping streetscape with road drainage.

**Landcover and vegetation**  
Streetscape with some grass verges and some significant roadside trees and within curtilage of properties. Some street trees and ornamental planting within public realm close to Junction 15 roundabout and junction.

**Perceptual Characteristics**

**Scale and Appearance**  
Orderly streetscape with some attractive stone buildings set within the Conservation Area

**Scenic quality**  
Largely pleasant streetscene with wide carriageway that once formed part of the A55 North Wales Coast road, hence the more than average width.

**Tranquillity**  
A busy main road into the town centre and therefore no tranquil qualities.

**Discordant/intrusive features**  
The A55 road corridor is a physical barrier and disconnects the area from the promenade. The only remaining connection is via Shore Road East

**Night-time light sources**  
Street lighting and passing cars and other vehicles

**Cultural/Social**

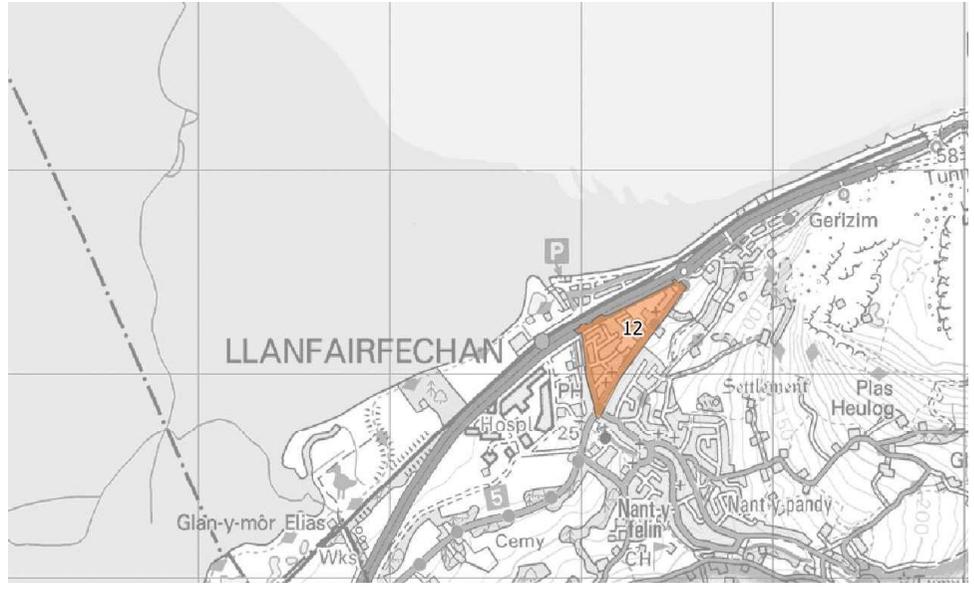
**Historic features and elements**  
Route of old A55, Historic buildings in Conservation Area.

**Human Interaction**  
Penmaenmawr Road is a busy road with several community and private assets including residential properties close to the existing A55 with others overlooking the road corridor to the north from rear of properties.

**Landscape Value**

The area is designated as a Conservation Area and has some distinctive qualities notably in the range and quality of building types although none are listed. The building frontages are focussed along the streetscape of Penmaenmawr Road, the rear of the properties overlook the A55 road corridor and soft estate and beyond to open sea and the shores of Anglesey and Puffin Island. The mixed woodland plantations of the soft estate to the rear of the residential properties provide good screening of the road corridor and have matured since being planted circa 1990 to also obscure views of the sea. The area is generally of good quality, but the general setting is eroded by the presence of the road corridor and condition poor.

Quality	Condition	Overall Landscape Value
Good	Medium	Moderate



**LCA13 – Llanfairfechan Drycin**

Category:	Built land
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/ Penmaenmawr; SNPVS073 Abergwynnregyn

**General Description and Designations**

General Description	The land-use is residential set on steeply sided and elevated land above the A55 road corridor. Properties are set out along roads primarily in an east to west linear pattern and inter-connected by steeply sloping roads. Elements and spaces are of a moderate scale with an open aspect. The Wales Coastal Long-distance footpath and cycle route passes within the character area along Penmaenmawr road.
Designations	Southern outskirts are located within North Arllechwedd Historic Landscape.

**Physical Characteristics**

Built environment	The houses types are a mix of 20 <sup>th</sup> century semi-detached properties of varying styles and 19 <sup>th</sup> century terraced stone-built properties. Boundaries are a mixture of traditional stone and modern materials. A55 road corridor has significant retaining walls, overbridges and overhead gantries, signs and lighting.
Landform, geology and hydrology	Set on steep sided hillside and scree at foot of Penmaenmawr mountain and above A55 road corridor. The west and eastbound carriageways are set at different levels and separated by a large retaining wall.
Landcover and vegetation	Residential land with limited vegetation. Some areas of soft estate adjacent to A55 road corridor.

**Perceptual Characteristics**

Scale and Appearance	Small scale and compact residential area perched on lower mountainside.
Scenic quality	Low scenic quality. Dense mass of roofscapes set within context of road corridor with retaining walls, overhead gantries and footbridge.
Tranquillity	The area is exposed to onshore winds and constant noise from traffic on A55.
Discordant/intrusive features	Structures within A55 road corridor are prominent and discordant elements
Night-time light sources	A55 road corridor is lit with residential properties above.

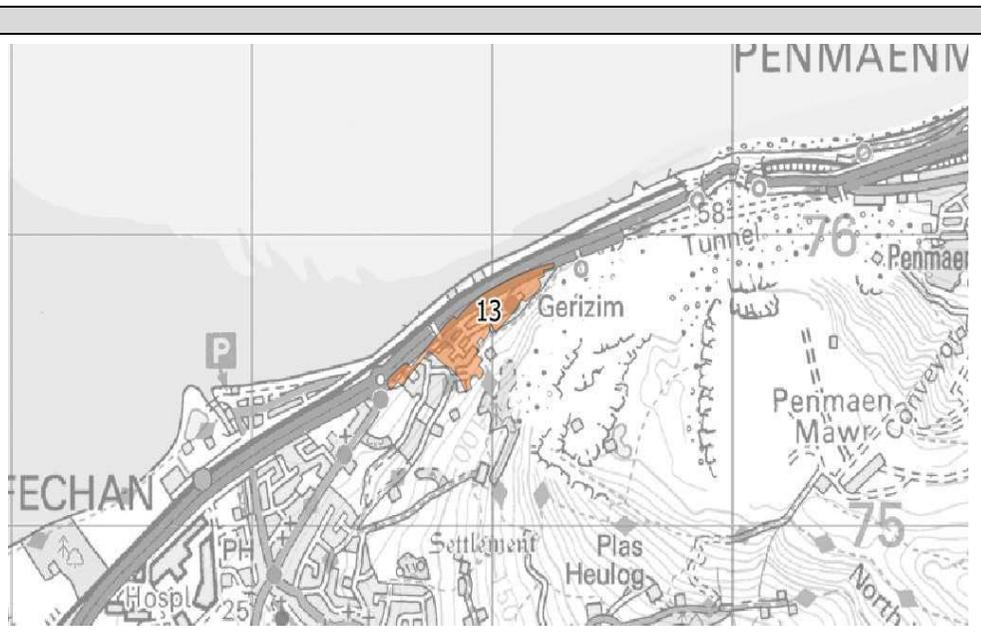
**Cultural/Social**

Historic features and elements	Historic features of former quarrying activity on hillside above
Human Interaction	Established residential area with cycle path passing through lower section.

**Landscape Value**

This is an established residential area with an open aspect to the north and with far reaching open views out to sea towards Anglesey and the Great Orme. There are few landscape elements of individual value that contribute to the landscape character. The limited areas of soft estate do mitigate some of the adverse effects of the A55 on some of the nearby properties. The A55 road corridor is a major discordant feature in this particular section of the route as it approaches the Penmaenmawr headland and tunnel with split level carriageways, significant retaining wall structures and overbridges. The residential area overlooks this section and is heavily influenced by the noise, appearance and operational aspects of the road corridor. Above the residential area, rock scree rises towards the rock outcrop of Penmaenmawr headland with naturally regenerating woodland scrub scattered across the slopes. This area has been seriously affected by the construction of the A55 in the 1990's and any legibility and unity that once may have existed has been lost.

Quality	Condition	Overall Landscape Value
Poor	Poor	Poor



**LCA14 – Llanfairfechan Uchaf**

Category: Built land

LANDMAP Aspect Areas Overlap (Visual and Sensory) SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

**General Description**  
The town of Llanfairfechan continues east off Penmaenmawr Road onto Village Road where there are facilities such as shops, post office, public house, church and school. The Close is a Conservation area designated for its collection of residential properties built in the art and craft style by Herbert Luck North. The remaining areas are largely 20<sup>th</sup> century residential development consisting of bungalows, semi-detached properties and terraced housing. Boundaries predominantly stone walls, but brick and concrete block used for modern developments. Elements are of small scale with an enclosed aspect.

**Designations**  
Llanfairfechan Town Centre Conservation Area; and The Close Conservation Area. Numerous listed buildings in Arts and Crafts style set within the Close.

**Physical Characteristics**

**Built environment**  
Centre of Llanfairfechan village clustered around Village Road and adjoining streets. Collection of attractive and historic buildings with some new development

**Landform, geology and hydrology**  
Village centre set within wooded river valley of the Afon Llanfairfechan.

**Landcover and vegetation**  
Wooded river valley of the Afon Llanfairfechan is an important landscape element that contributes to the townscape character.

**Perceptual Characteristics**

**Scale and Appearance**  
An attractive town centre, rural in character and buildings of good aesthetic value.

**Scenic quality**  
Attractive town centre along Village Road with enclosed aspect.

**Tranquillity**  
An attractive and safe environment with village atmosphere but not tranquil due to busy town centre location.

**Discordant/intrusive features**  
Some modern development detracts from aesthetics of adjoining Conservation Area.

**Night-time light sources**  
Town centre location, street lighting.

**Cultural/Social**

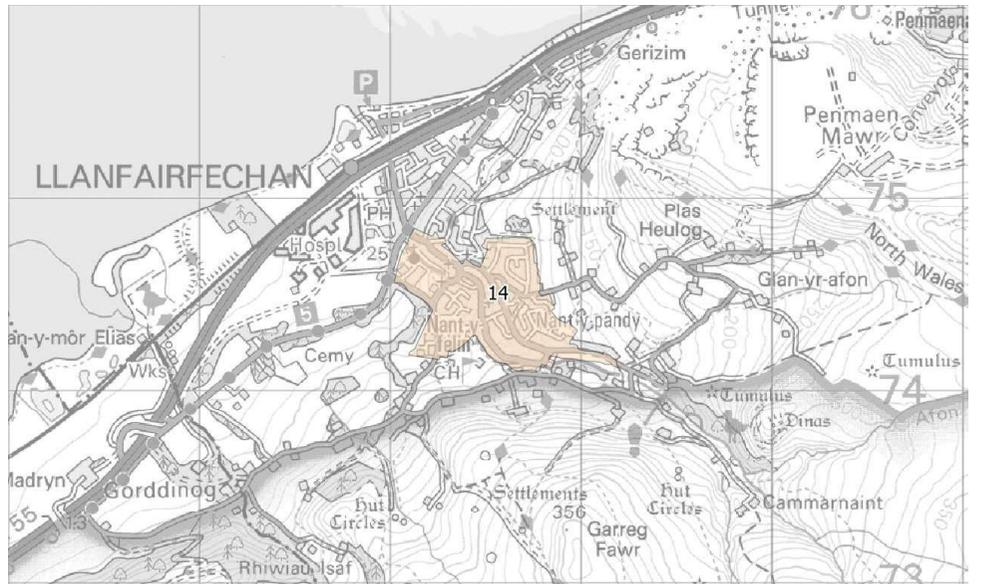
**Historic features and elements**  
There are several listed buildings within the town centre, primarily Grade II Listed for a variety of reasons but primarily associated with the Close. The Close is an estate of houses designed by the Arts and Crafts architect Herbert Luck North (1871-1941), who lived and worked in Llanfairfechan from c.1901.

**Human Interaction**  
Town centre location with several shops and facilities leading to high degree of human activity, a bustling town centre location with a village atmosphere.

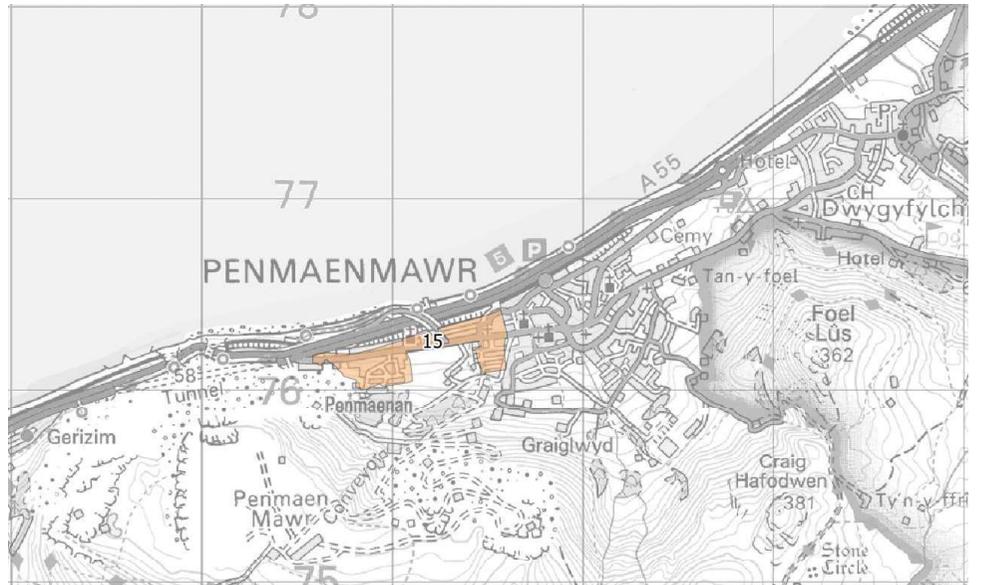
**Landscape Value**

This area is a highly valued townscape constantly used by the local community and an attractive environment with many high-quality buildings set within the wooded valley of the Afon Llanfairfechan. There are few elements that are significant detractors from the feeling of unity and cohesiveness.

Quality	Condition	Overall Landscape Value
Good	Good	Moderate



<b>LCA15 – Penmaenmawr Penmaenan</b>		
Category:	Built land	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/ Penmaenmawr	
<b>General Description and Designations</b>		
General Description	Penmaenan is a residential area west of Penmaenmawr set on a series of streets above the High Street and on the lower slopes of Penmaenmawr mountain. The area lies to the south of the A55 road and rail corridor and either side of the High Street, a wide road and formerly the main A55 coast road. Pen-y-Clip Tunnel lies to the west of Penmaenan with steep rock and scree rising above the eastern portal. To the east is Penmaenmawr Town Centre. The High Street forms the spine of the character area and runs parallel and above the railway and A55. Located on the High Street are several businesses including a garage, hotel and St Paul's Church. Residential areas are interconnected by steep roads and boundaries are predominantly constructed of traditional stone.	
Designations:	The area includes three Conservation Areas in part or in whole namely; Penmaenmawr Town Centre; Penmaenmawr, St Davids Road/Bell Cottages and Penmaenan.	
<b>Physical Characteristics</b>		
Built environment	Built environment either side of the High Street with residential properties, a combination of stone and pebble dash two storey properties. The A55 road corridor has had a significant impact on the area elevated on concrete structures. Elements and spaces at a small scale with an open aspect north.	
Landform, geology and hydrology	The steep sided landform has been developed over time into a series of linear plateaus or terraces in order to build residential properties and highway infrastructure.	
Landcover and vegetation	Existing woodland lies on the hillside above the A55 road and rail corridor to the north, the hillside that rises above the High Street is also largely wooded.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	A western arm of Penmaenmawr set against the wooded lower slopes of Penmaenmawr mountain with open views across the sea to the north. The southern aspect is enclosed by woodland and steeply rising ground of rock and scree.	
Scenic quality	Scenic quality of the area has been significantly affected by the A55 road corridor and now remains fragmented. A combination of quarrying activities and engineering of the A55 has eroded the scenic quality.	
Tranquillity	The area is heavily influenced by the noise and presence of the A55 road and rail corridor and current quarrying activity with quarry wagons using the High Street to access the A55 (westbound). Access to the quarry is off the High Street.	
Discordant/intrusive features	Quarrying activities and the engineering legacy from the A55 remain discordant and intrusive features.	
Night-time light sources	A55 and street lighting along the High Street.	
<b>Cultural/Social</b>		
Historic features and elements	Conservation Areas and traditional quarrymen's cottages set on steep sided hillside.	
Human Interaction	Primarily a residential area either side of the High Street that is also used for commercial traffic.	
<b>Landscape Value</b>		
Overall the landscape value of this area is low. There are some important landscape elements, the steep sided mountainside is a significant feature with scars of former quarrying activity. The lower slopes are heavily wooded and help to screen the road and rail corridor from sections of the High Street. The A55 road and rail corridor is a significant detractor from the area and ongoing quarrying activity and traffic also detractors.		
Quality	Condition	Overall Landscape Value
Medium/Poor	Medium	Moderate



**LCA16 – Penmaenmawr Pant-yr-afon**

Category:	Built Land
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	Penmaenmawr town centre is centred around Conwy Road, the former north Wales Coast Road prior to the A55 being constructed in the 1990's. This is the hub of the town with several shops and community facilities lining the street, some have been refurbished with ornate glass canopies contributing to the streetscene and public realm. Station Road runs north and downhill to Penmaenmawr train station and an underpass beneath the A55 road corridor connects to the promenade. South of Conwy Road, a series of roads lead to residential areas and beyond to a caravan park and isolated farms.
Designations	There are three Conservation Areas; Penmaenmawr Town Centre, Pen-y-Cae and St David's Road Conservation Areas. Several Grade II Listed buildings including Penmaenmawr Railway Station and Gladstone Monument. Section south of Graiglwyd Road is located within North Arlechweidd Historic Landscape.

**Physical Characteristics**

Built environment	Urban core with linear development radiating from village centre along Bangor Road (eastern part of Penmaenmawr). 19 <sup>th</sup> century stone built and 20 <sup>th</sup> century pebble dashed terraced housing is located on steeper slopes nearest to Penmaenmawr quarries. Less densely spaced 20 <sup>th</sup> century detached dwellings in the south-eastern half of the area.
Landform, geology and hydrology	Town centre set on steeply sloping land that descends towards the coastal plain.
Landcover and vegetation	Woodland and scrub vegetation colonise the steep banks between development plateaus and road network within the town centre.

**Perceptual Characteristics**

Scale and Appearance	Medium scale with some open areas. Properties of varying periods and appearance and condition.
Scenic quality	Area itself is not particularly scenic but from certain locations within such as Station Road East the scenic quality is very good with open elevated views across railway line and A55 towards the open sea and beyond to Anglesey and Puffin Island.
Tranquillity	Not a tranquil area, frequent activity in town centre location.
Discordant/intrusive features	No significant discordant features
Night-time light sources	General street lighting and residential properties.

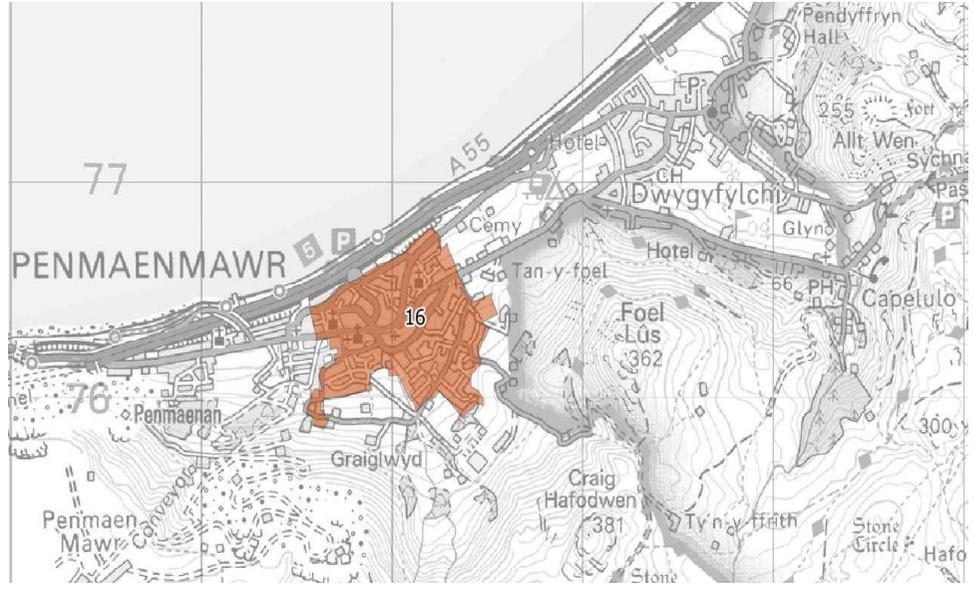
**Cultural/Social**

Historic features and elements	The Grade II Gladstone Monument is located on an island at the cross-roads with Paradise Road, immediately north of the main street, Pant-yr-Afon/Conwy Road. It is a bronze bust of a polished granite obelisk, erected in 1899 in memory of W E Gladstone, Prime Minister who was, a frequent visitor to the town due to his friendship with the quarry-owning Derbyshire family.
Human Interaction	Town centre with frequent human interaction.

**Landscape Value**

The town centre is composed of many smaller areas defined as cul-de-sacs or closes that vary in quality and condition. The overall quality of the town centre is medium with some areas of historic interest and some valued by the local community. The overall landscape rating is therefore considered to be of medium value.

Quality	Condition	Overall Landscape Value
Medium	Medium/Poor	Moderate



**LCA17 – Dwygyfylchi**

Category:	Built land
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	Village of Dwygyfylchi set on coastal plain at foothills of Allt Wen and Foel Lus in Snowdonia National Park with A55 road corridor to the north and north west. The village is predominantly residential with caravan sites and a golf course on land to the west and south. The centre of the village lies St Gwynan’s Church, an attractive church with an elegant spire and a local landmark. Adjacent to the church lies a cemetery of Commonwealth War Graves.
Designations:	Snowdonia National Park lies immediately to the south and east. Horeb Capel is a 19 <sup>th</sup> century Grade II listed building located off Conwy Old Road.

**Physical Characteristics**

Built environment	The village contains a variety of largely residential building types and a mixture of stone, rendered and more recently brick-built properties.
Landform, geology and hydrology	The Afon Gyrach flows along the eastern boundary of the village and has been prone to some flooding in the past (Flood Zone 2). The river crosses the coastal plain before passing beneath the A55 and railway in a culvert and discharging out to sea.
Landcover and vegetation	Varied. Lower slopes of Allt Wen wooded with heather and scree. Golf course and caravan sites intensely managed close mown grassland.

**Perceptual Characteristics**

Scale and Appearance	The historic core of the village around St Gwynan’s Church is small scale and intimate with the outskirts having as more fragmented and open appearance.
Scenic quality	The area is set within the context of surrounding high scenic quality. From more elevated parts of the village there are open views across the sea to Anglesey and Puffin Island.
Tranquillity	The area is generally peaceful but not tranquil with frequent activity along the local road network and distant audible hum of the A55.
Discordant/intrusive features	The nearby Shell Garage and Puffin Café appear as discordant elements together with some elements of the A55 road corridor but these are not significant.
Night-time light sources	Local residential properties and road network. A55 road corridor lit at night.

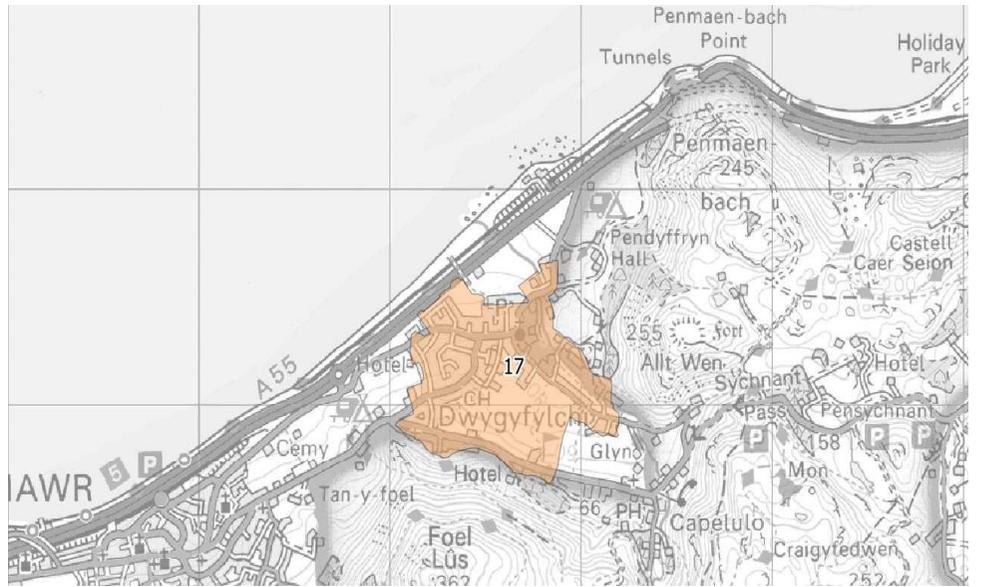
**Cultural/Social**

Historic features and elements	Few historic features and elements. The Parish Church of St Gwynan’s stands on the crossroads of ancient trackways and has been the site of a church since the 18 <sup>th</sup> century.
Human Interaction	Human interaction is complex. There are permanent residences and also permanent seasonal pitches within the caravan parks. There are also seasonal visitors using nearby recreational facilities and the local public footpath network.

**Landscape Value**

The landscape within this area varies in quality but is generally in good condition. There are no designations, but it is located adjacent to the Snowdonia National Park and the surrounding areas is highly scenic. There are elements of the landscape that are valued by the local community and some visitors have long associations with the area through use of the caravan parks. Recent development has led to fragmentation of settlement edge.

Quality	Condition	Overall Landscape Value
Medium	Good	Moderate



**LCA18 – Llanfairfechan Parkland**

Category: Developed land

LANDMAP Aspect Areas Overlap (Visual and Sensory) SNPVS074 – Llanfairfechan/ Penmaenmawr

**General Description and Designations**

**General Description**  
The area lies to the west of Llanfairfechan town centre either side of Aber Road, the former A55 coast road prior to the construction of the A55 Llanfairfechan By-Pass that opened in 1989. Remnants of the parkland remain, with mature parkland trees and woodland copses. Some areas of parkland are now grazed and used for horsiculture. Part of the remaining parkland south of Aber Road is now a strategic site in the emerging CCBC Local Development Plan for residential and mixed-use development.

**Designations:**  
Bryn – y – Neuadd Grade II Historic Park and Garden;  
Grade II Listed Buildings within the grounds of Bryn-y-Neuadd;  
Llanfairfechan Conservation Area adjoins area to the east;  
Snowdonia National Park boundary adjoins area to the south.

**Physical Characteristics**

**Built environment**  
Bryn-y-Neuadd Hospital remains an operational hospital, the original park lodge remains at the entrance. Stone boundary walls remain alongside Aber Road. The A55 road corridor defines the northern boundary of the area.

**Landform, geology and hydrology**  
The area slopes gently down towards Aber Road from the south and then evens out into the coastal plain. There are no significant watercourses but indications of poor drainage in places.

**Landcover and vegetation**  
Mature parkland landscape with mature trees and woodland. Plantation woodland forms the northern boundary adjacent to the A55.

**Perceptual Characteristics**

**Scale and Appearance**  
The area is typical parkland with mature parkland trees and woodland that restrict views. Aber Road is wide and belies its former status as the main North Wales coast road and now partly used for car parking.

**Scenic quality**  
Scenic quality is generally good with much of the parkland still intact and with views towards the hills of Snowdonia to the south. Tyne extent of the parkland is not readily perceived due to the mature vegetation and restricted access to the hospital.

**Tranquillity**  
Aber Road and the entrance to the hospital are frequently used by cars and pedestrians but generally quiet.

**Discordant/intrusive features**  
The sheltered accommodation of Llys y Coed off Caefwynn Road appears as an incongruous element within the trees in the southern half of the area.

**Night-time light sources**  
Aber Road and Bryn-y-Neuadd Hospital.

**Cultural/Social**

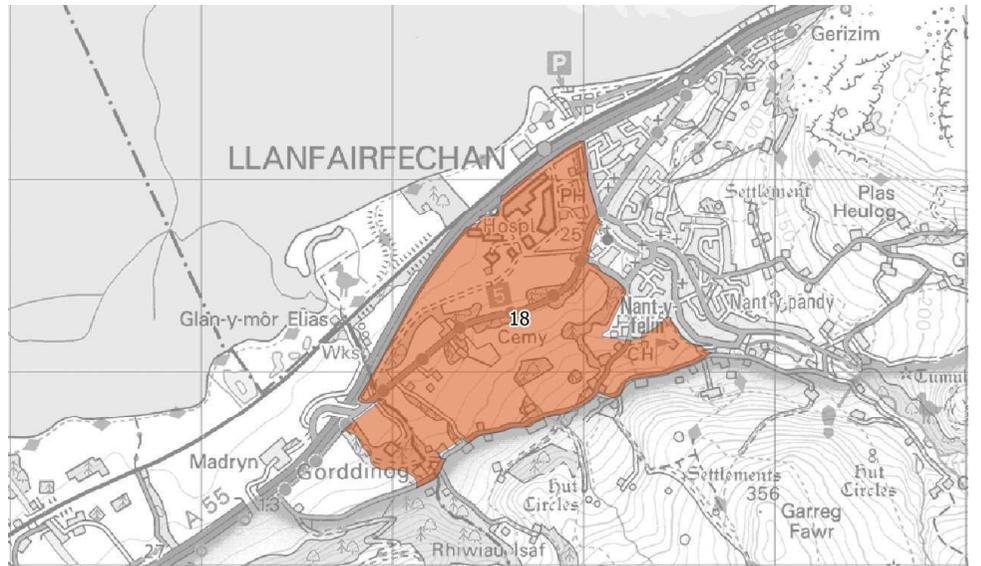
**Historic features and elements**  
The park and gardens of Bryn-y-Neuadd date back to the mid-19<sup>th</sup> century and in the 1960's became a hospital for people with learning difficulties with villa style accommodation that remains today.

**Human Interaction**  
Aber Road is the main entrance into Llanfairfechan from the west. Hospital grounds are private.

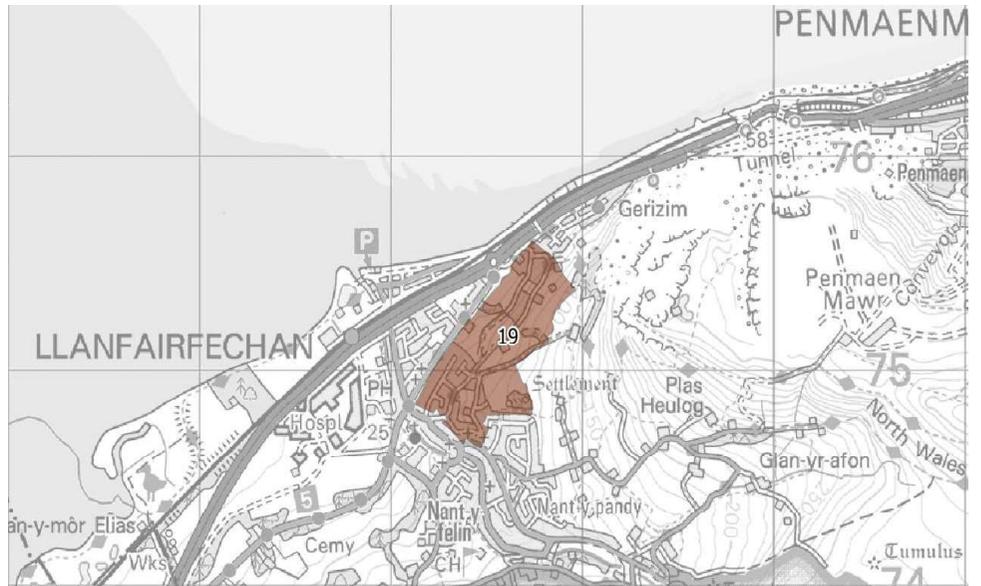
**Landscape Value**

The parkland area remains reasonably intact, but access is restricted and therefore amenity value also limited to hospital guests and visitors. Parkland areas south of Aber Road appear fragmented and poorly maintained with recent modern development detracting the parkland setting. The allocation of the southern half of the area as a strategic development site is likely to further erode the parkland landscape with the progressive encroachment of Llanfairfechan town centre to the west.

Quality	Condition	Overall Landscape Value
Good	Poor	Moderate



<b>LCA19 – Penmaen Park</b>		
Category:	Developed Land	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 Llanfairfechan/ Penmaenmawr	
<b>General Description and Designations</b>		
General Description	Penmaen Park lies on the eastern fringe of Llanfairfechan town centre on sloping land overlooking the A55 road corridor and Junction 15 roundabout. There are extensive views across the coastal strip to Anglesey and Puffin Island. The area partially includes two Conservation Areas and open parkland to the north-east with residential properties on the lower slopes. The remaining parkland has mature parkland trees and is set to rough grazing with public rights of way and the long-distance North Wales path crossing the side long ground.	
Designations:	Llanfairfechan Conservation Area; The Close Conservation Area; Grade II* Listed Building: Wern Isaf (formerly Rose Briars) Eastern part of character area lies within the North Arllechwedd Historic Landscape.	
<b>Physical Characteristics</b>		
Built environment	Buildings within Llanfairfechan town centre and The Close and the Grade II Listed arts and craft property of Wern Isaf. Residential properties on Penmaen Park.	
Landform, geology and hydrology	Steeply sloping land on the north west facing lower slopes of Penmaen Mawr. Indication of a spring at Wern Isaf with wells and sinks on hillside above.	
Landcover and vegetation	Mature parkland trees are key landscape elements in the area with small blocks of woodland along the south western and eastern boundaries of the park. Roadside plantations along southern verge of Penmaenmawr road west of Junction 15 roundabout junction form part of the wider A55 soft estate.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	The north west facing parkland is of a moderate scale, open in aspect with far reaching views to the north and north-west	
Scenic quality	The views from within the parkland are generally highly scenic with far reaching views to the north and north-west across Lafan Sands towards Anglesey and Puffin Island. Views are compromised in places by A55 road corridor and moving vehicles and, in particular, high sided commercial traffic a detracting element.	
Tranquillity	The parkland is generally a peaceful landscape compromised by the constant noise of traffic on the A55 and at the approaches and exit from the Junction 15 roundabout.	
Discordant/intrusive features	The A55 road corridor and associated traffic	
Night-time light sources	A55 road corridor and traffic	
<b>Cultural/Social</b>		
Historic features and elements	Wern Isaf a Grade II* Listed Building by Herbert Luck North, it has also been designated as a Historic Park and Garden (PGW (Gd) 9 (CON)).	
Human Interaction	Public rights of way and long-distance path well used routes. Popular with local residents and highly valued as an area for general amenity. The remaining parkland is currently allocated as a contingency housing site (for 45 dwellings) of 2.43 hectares in the emerging LDP.	
<b>Landscape Value</b>		
Penmaen Park is an area of remnant parkland on the outskirts of Llanfairfechan. It is used by the local community and visitors for general recreation and valued as an area of informal amenity. Wern Isaf is distinctive piece of domestic architecture and one of the most exceptional houses of its date and style in Wales. It has invaluable cultural connections through associations with the architect Herbert Luck North. The parkland is also an area of essential setting for Wern Isaf that encompasses the whole of the hillside.		
<b>Quality</b>	<b>Condition</b>	<b>Overall Landscape Value</b>
Good	Good	Moderate



**LCA20 – Penmaenmawr Quarries (active)**

Category	Developed land
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS075 Penmaen Mawr quarry, SNPVS074 Llanfairfechan/ Penmaenmawr

**General Description and Designations**

General Description	Penmaenmawr Quarry is an operational quarry managed by Hanson Aggregates. It is an extensive open cast quarry set on a series of levels and inclines that remain largely hidden from view from the town and surrounding area of Penmaenmawr. The most significant period of historical connections is seen to relate to quarrying activity and the development of the town during the 19 <sup>th</sup> century.
Designations:	No designations. Snowdonia National Park lies approximately 1 kilometre to the south of the quarry.

**Physical Characteristics**

Built environment	Operational quarry with associated buildings, processing plant and conveyor belts.
Landform, geology and hydrology	The landform resulting from the quarrying activity is spectacular in its scale and form. The excavation of granite has been undertaken as a series of levels with inclines formed for the transportation of the excavated rock.
Landcover and vegetation	There is little or no vegetation within the area of the operational quarry. Side slopes of the remaining mountain side are colonised with a combination of heath, scrub and woodland.

**Perceptual Characteristics**

Scale and Appearance	Large scale open cast quarry that has over time effectively removed the peak from the mountain and excavated down from within. The resulting shape and form has been likened to an extinct volcano.
Scenic quality	Poor scenic quality when confined within the quarry.
Tranquillity	An operational quarry with excavation and blasting activities.
Discordant/intrusive features	Operational quarry with heavy industrial scale quarrying activities.
Night-time light sources	None known but unlikely to be visible from town and lower levels.

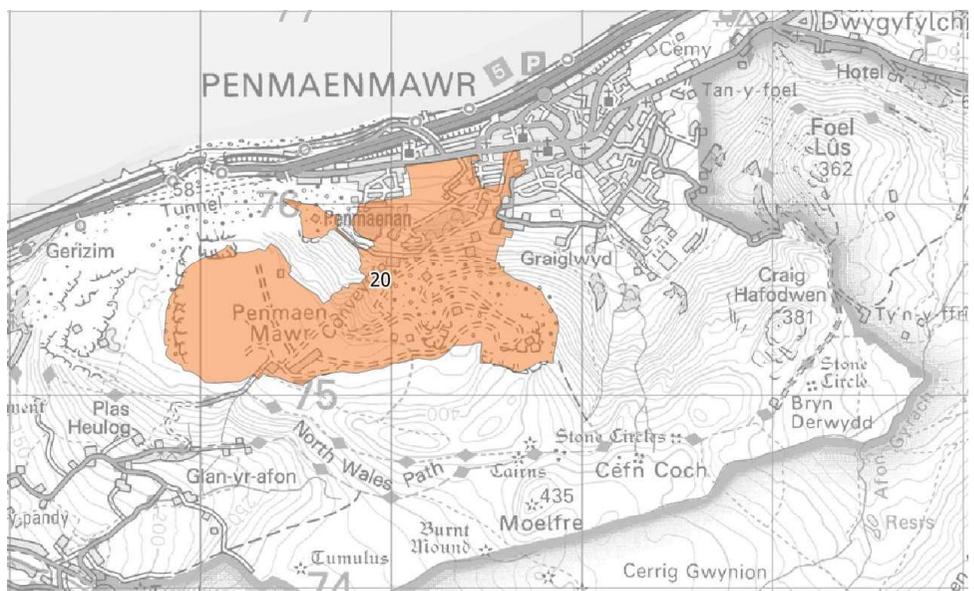
**Cultural/Social**

Historic features and elements	The quarry dates back to the 1830's to meet the growing demand for granite setts. However, granite axe heads have been found dating as far back as Neolithic times.
Human Interaction	The quarry is highly significant in the establishment and development of Penmaenmawr town centre. There are also significant cultural associations between the quarry and the town.

**Landscape Value**

The physical landscape value of the quarry is distinct to quarrying activities. The scale of the operation and the resultant landform is spectacular, an illustration of mans' interaction (or exploitation) with the natural environment. The social and cultural associations between the quarry and town are hugely significant and are important on both a local and regional scale. Therefore, the overall landscape value is considered to be low but with some important social and cultural associations.

Quality	Condition	Overall Landscape Value
Unique	Operational quarry	Low



**LCA21 – Penmaenmawr Quarries (disused)**

Category:	Hillside Slopes
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS075 Penmaen Mawr quarry, SNPVS073 Abergwyngregyn

**General Description and Designations**

General Description	The northern face of Penmaenmawr mountain rises precipitously above the sea and is a spectacular landmark on the North Wales coast. The bare rock face is light grey with scree on the lower slopes with woodland colonised on the lower slopes. The mountainside shows scars of previous quarrying activity with old quarry buildings and a series of inclines on the lower slopes above the former village of Garizim.
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Designations:	North Arllechwedd Registered Historic Landscape
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**Physical Characteristics**

Built environment	Former quarry buildings now derelict.
Landform, geology and hydrology	Igneous rock (diorite but more commonly referenced as granite) outcrop with scree on lower slopes.
Landcover and vegetation	Naturally colonised mixed woodland on lower slopes with areas of heath on upper slopes.

**Perceptual Characteristics**

Scale and Appearance	Extensive upland area, exposed with few features.
Scenic quality	High scenic quality with spectacular coastal views.
Tranquillity	A peaceful area, open and expansive but A55 road corridor audible and traffic visible. Movement of traffic detected by peripheral vision.
Discordant/intrusive features	A55 road corridor.
Night-time light sources	A55 road corridor.

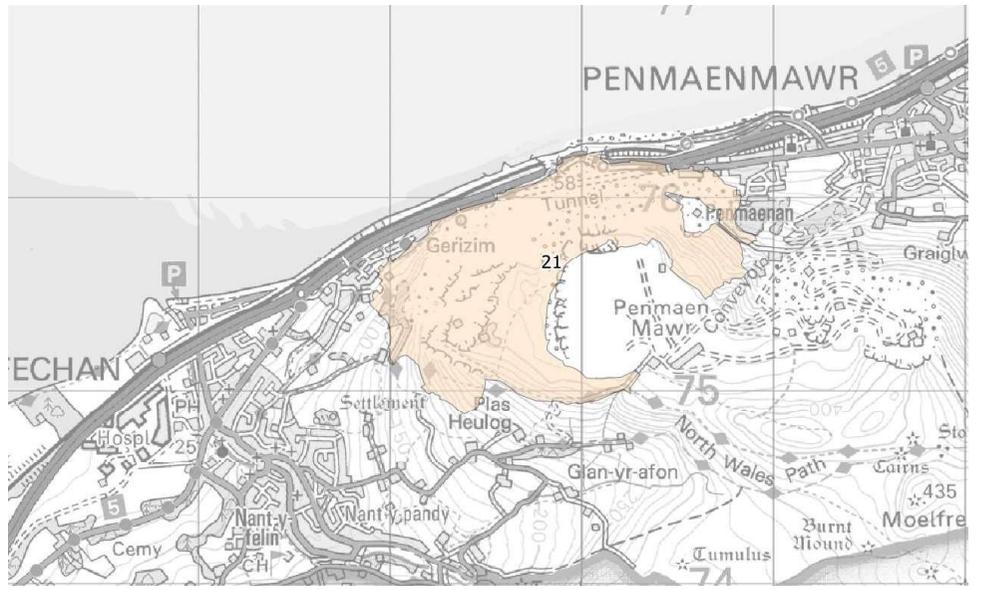
**Cultural/Social**

Historic features and elements	Former quarry building and inclines of historic interest.
Human Interaction	Penmaenmawr was a little collection of farms and houses supporting agriculture and herring fishing prior to the opening of its' quarries in the first half of the 19th century. Industrial quarrying of diorite at Penmaenan began in 1830 with the opening of the independent Penmaen Quarry. Now, the area is popular with ramblers and paragliders.

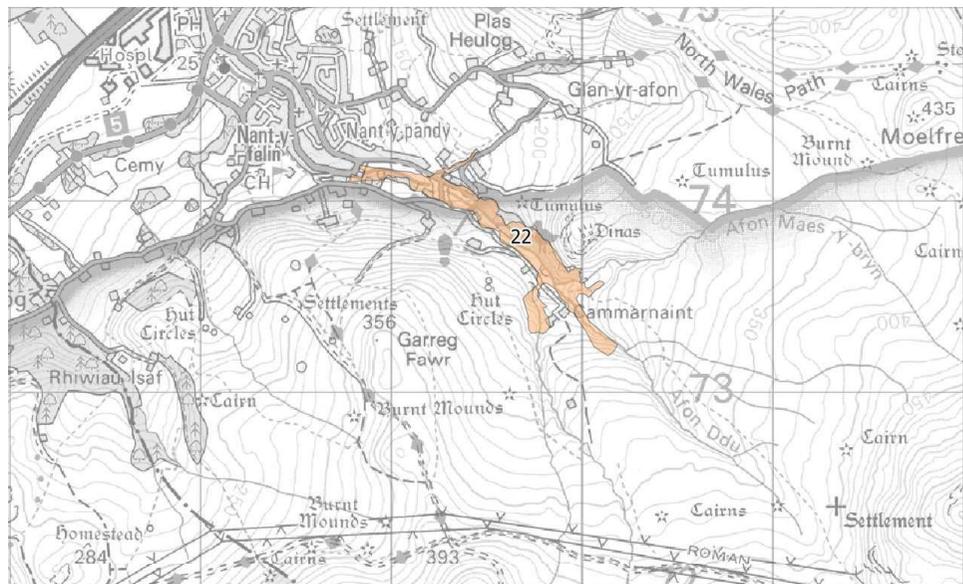
**Landscape Value**

The area contains significant evidence of the former quarrying activity at Penmaenmawr and is an attractive upland landscape with scenic views across the Snowdonia mountain range to the south and open sea to the north. It is valued by some for informal amenity and is reasonably tranquil, but value is lessened by proximity and influence of the existing A55 road corridor.

Quality	Condition	Overall Landscape Value
Good scenic quality	Good	Moderate



<b>LCA22 – Y Teiryd Valley</b>		
Category:	Upland Valley	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 Llanfairfechan/ Penmaenmawr, SNPVS073 Abergwyngregyn, SNPVS072 Carneddau uplands	
<b>General Description and Designations</b>		
General Description	The Y Teiryd valley is a narrow-wooded valley above and south-east of Llanfairfechan, it is now generally known as Nant-y-Coed Nature Reserve. The area covered by this Local Nature Reserve was once part of the Newry estate and leased to a local businessman who developed it for recreational purposes. The estate was sold in 1923 and is now owned and managed by Conwy County Borough Council. A network of paths and guided trails run through the woodland and ab towards to the upland areas around Foel Lwyd and Tal y Fan.	
Designations:	Snowdonia National Park Nant-y-Coed Local Nature Reserve	
<b>Physical Characteristics</b>		
Built environment	No built environment. Man-made elements include gates, stiles, interpretive panels and signs.	
Landform, geology and hydrology	The upper reaches of the Afon Llanfairfechan runs through the narrow valley.	
Landcover and vegetation	The river valley is densely wooded with deciduous trees. Ancient woodland of Nant-y-Coed.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Small scale and enclosed wooded river valley.	
Scenic quality	Highly scenic with views enclosed and restricted by surrounding woodland and topography.	
Tranquillity	A peaceful wooded valley with sound of river and bird life quite tranquil.	
Discordant/intrusive features	No discordant features	
Night-time light sources	None	
<b>Cultural/Social</b>		
Historic features and elements	There are several historic features on the hills above the valley such as hut circles, cairns and settlements.	
Human Interaction	There are a series of walks around the nature reserve of varying lengths. The public are encouraged to visit the nature reserve with a number of leaflets and self-guided walks available online.	
<b>Landscape Value</b>		
Nant-y-Coed is a local nature reserve set within a nationally valued landscape of Snowdonia National Park. It is a popular area for general amenity and wildlife related activities and visited generally by local people. The area is a small-scale landscape valued by the local community. It is a peaceful area with a high degree of tranquillity and is therefore considered to be of a high landscape value.		
Quality	Condition	Overall Landscape Value
Outstanding	Good	Very High



**LCA23 – Fairy Glen Valley**

Category:	Upland Valley
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS076 - Capelulo Valley

**General Description and Designations**

General Description	Fairy Glen Valley is a steep sided narrow wooded valley south of the village of Capelulo. The upper reaches of Afon Gyrach flow through the valley that is known for its waterfalls. The valley is popular with ramblers and walkers with a series of circular walks passing through the valley. The North Wales Path skirts the upland areas above the valley.
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Designations:	Snowdonia National Park The southern part of the character area is located in North Arllechwedd Historic Landscape.
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**Physical Characteristics**

Built environment	Residential dwellings in the form of detached properties and terraced cottages to the northern part of the character served by the Fairy Glen single track road Dry stone walls along field boundaries, footbridges across river.
Landform, geology and hydrology	Deeply incised river valley.
Landcover and vegetation	Heavily wooded river valley with mature oaks and mixed woodland. There are areas of restored ancient woodlands and plantations on ancient woodland sites.

**Perceptual Characteristics**

Scale and Appearance	Small scale and intimate river valley with contained views.
Scenic quality	High scenic quality and set within the foothills of Snowdonia National Park.
Tranquillity	Very peaceful valley with the sound of the river an attractive element. Very tranquil but can be popular with walkers and ramblers.
Discordant/intrusive features	None
Night-time light sources	None

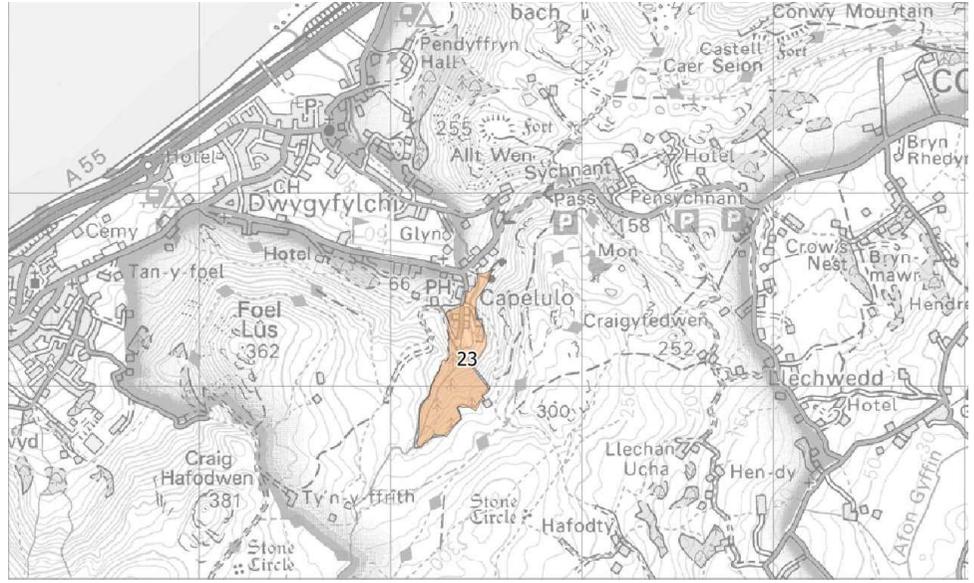
**Cultural/Social**

Historic features and elements	None known but the upper reaches of the valley contain evidence of former settlements.
Human Interaction	Popular area for walkers and ramblers. Circuitous walks take in village of Capelulo where there is a public house serving drinks and food and a local bus service.

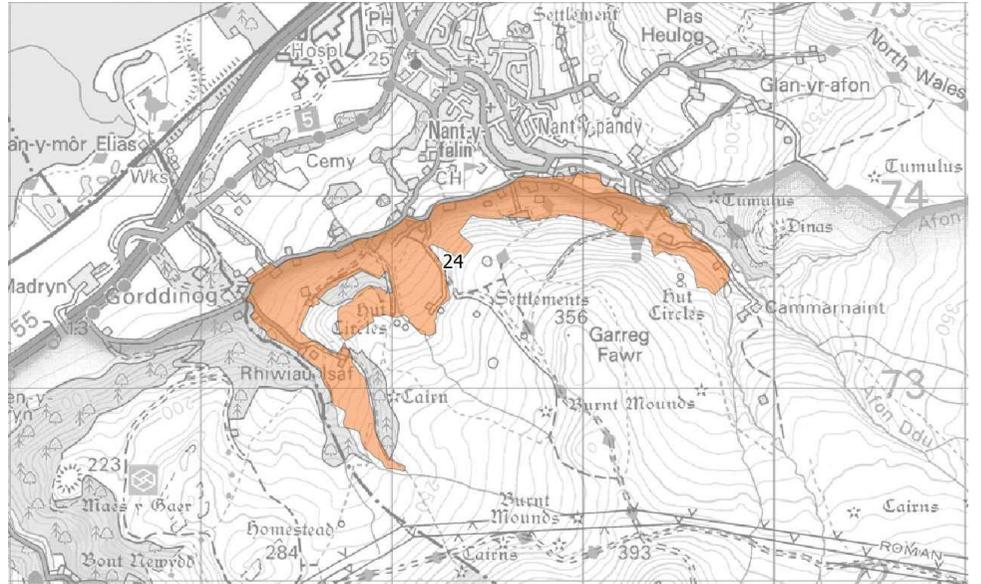
**Landscape Value**

The wooded valley of Fairy Glen is set within the foothills of Snowdonia National Park. It is a highly scenic area and popular with walkers and ramblers. The valley is sheltered and peaceful, enclosed and secluded but is popular during peak holiday periods.

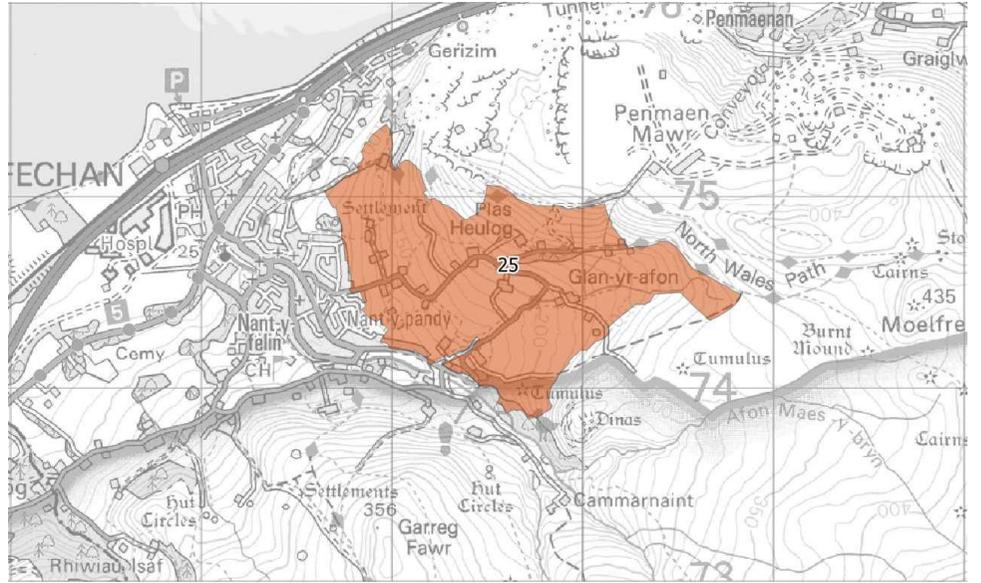
Quality	Condition	Overall Landscape Value
Good	Good	High



<b>LCA24 – Nant-y-Felin Pasture</b>		
Category:	Hillside slopes	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS073 – Abergwyngregyn, SNPVS072 Carneddau uplands	
<b>General Description and Designations</b>		
General Description	The landscape character area is located to the south of Llanfairfechan and along the hillside slopes of Garreg Fawr. Land cover is predominantly pasture. The western part of the character area towards Rhiwiau is enclosed by woodland plantations of Coed Gorrddinog to the west and Coed y Rhiwiau in the east. The north and eastern parts of the character area are open and exposed. Boundaries comprise stone walls and hedgerows.	
Designations:	The area lies just within the northern boundary of Snowdonia National Park. The area lies within the North Arllechwedd Historic Landscape. Tan yr Allt Isaf is a Grade II listed building located off Terrace Walk.	
<b>Physical Characteristics</b>		
Built environment	Within the character area are scattered residential properties comprising farms and cottages. The main roads within the character area are Gwyllt Road and Terrace Walk which are single track road with stone wall boundaries. There are several footpaths and the North Wales Path cuts across part of the character area.	
Landform, geology and hydrology	Steep sided northern slopes of Garreg Fawr.	
Landcover and vegetation	Open pasture	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Open north facing aspect	
Scenic quality	High scenic quality with open views north across coastal plain to Lafan Sands and the coast of Anglesey beyond.	
Tranquillity	The area is generally peaceful but the distant noise of the A55 road corridor a detractor.	
Discordant/intrusive features	No significant discordant or intrusive features.	
Night-time light sources	A55 road corridor	
<b>Cultural/Social</b>		
Historic features and elements	There are several sites of historic features nearby including hut circles, enclosures and homesteads in the upland areas to the south.	
Human Interaction	The area is crossed several public footpaths that lead to the higher ground and the North Wales Path.	
<b>Landscape Value</b>		
The area is set on elevated land south and above the western edge and parkland landscape of Llanfairfechan with open views north across Conwy Bay towards Anglesey. Views are restricted due to dense roadside vegetation and dry-stone walls along Gwyllt Road and Llanerch Road.		
Quality	Condition	Overall Landscape Value
Good	Good	High



<b>LCA25 – Nant-y-pandy Pasture</b>		
Category:	Hillside slopes	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 Llanfairfechan/ Penmaenmawr, SNPVS073 – Abergwyngregyn, SNPVS075 Penmaen Mawr quarry	
<b>General Description and Designations</b>		
General Description	Nant-y-Pandy pasture lies to the east of Llanfairfechan on the western and southern flanks of Penmaenmawr mountain and above the wooded river valley of the Afon Llanfairfechan and Y Teiryd Valley. The landscape is a patchwork of arable and rough grazing land with scattered farms served by local lanes and minor roads. Fields are defined by a network hedgerows and stone walls. There are blocks of mixed woodland often associated with farmsteads and settlements.	
Designations:	North Arllechwedd Historic Landscape. The Lodge and Glan-yr-Afon Farmhouse are Grade II Listed Buildings located off Glan-Yr-Afon Road.	
<b>Physical Characteristics</b>		
Built environment	Farms and individual properties.	
Landform, geology and hydrology	Gently sloping land descending from Penmaenmawr mountain with a west facing aspect. Land falls towards the river valley of the Afon Llanfairfechan.	
Landcover and vegetation	Blocks of mixed woodland with some plantations adjacent to farmsteads. Well established network of hedgerow field boundaries.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	The area appears as well managed farmland with an open aspect to the west.	
Scenic quality	Good scenic quality with an attractive patchwork of fields interspersed with woodland, mature hedgerows and hedgerow trees. Distant views across lower slopes and the town of Llanfairfechan to the west and beyond to Lafan Sands and the coast of Anglesey.	
Tranquillity	The area is generally peaceful and tranquil.	
Discordant/intrusive features	No significant discordant or intrusive features	
Night-time light sources	Individual farms and homesteads and the town of Llanfairfechan.	
<b>Cultural/Social</b>		
Historic features and elements	There is evidence of several historic features in the area including cairns, hut circles and settlements. Dinas Camp Scheduled Monument lies just outside the area to the east.	
Human Interaction	The area appears as well managed pastoral land and is a popular area for walking and rambling with both the North Wales Path and Wales Coast Path passing through the higher area near the properties Plas Heulog and Blaen Llwyn.	
<b>Landscape Value</b>		
The landscape is of good quality and appears well managed pastoral land. It has good scenic quality and lies outside but on the fringes of Snowdonia National Park. It is an interesting landscape with intact field boundaries and features of historic interest. The setting is peaceful and with open scenic views across the coastal plain towards the sea and beyond to Anglesey.		
Quality	Condition	Overall Landscape Value
Good	Good	High



**LCA26 – Pant-yr-Afon Pasture**

Category:	Hillside slopes
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS074 Llanfairfechan/ Penmaenmawr, SNPVS073 – Abergwyngregyn, SNPVS075 Penmaen Mawr quarry, SNPVS072 Carneddau uplands

**General Description and Designations**

**General Description**  
 The Pant-yr-Afon pasture lies between Penmaenmawr and Dwygyfylchi on the lower hillside slopes of Foel Lus and Craig Hafodwen and the coastal plain adjacent to the A55 road corridor. There are a variety of land uses in this area outside and on the fringes of the two settlement boundaries. Camping and caravan parks occupy the elevated ground and overlook the coastal plain and A55 road corridor. Other land uses include a cemetery, recreation and sports ground with some areas of rough grazing.

**Designations:**  
 North Arllechwedd registered Landscapes of Outstanding and of Special Interest in Wales.  
 Grade II Listed Farmhouse and Barn of Graiglwyd.

**Physical Characteristics**

**Built environment**  
 The northern part of the character area borders the A55. South of the A55 Junction 16 and Conwy Road are sports fields, The Gladstone Public House, cemetery and residential properties. Conwy Old Road runs parallel and on more elevated land and connects Penmaenmawr with Dwygyfylchi and provides access to the caravan parks.

**Landform, geology and hydrology**  
 Gently sloping land leading down towards the coastal plain

**Landcover and vegetation**  
 There is a variety of landcover that reflects the wide range of land uses. Plantations of the A55 soft estate are important landscape elements that screen the A55 road corridor from elevated land to the south. Elsewhere there are some mature trees along Ysguborwen Road that are significant local landscape elements

**Perceptual Characteristics**

**Scale and Appearance**  
 The area has a number of land uses that has led to the fragmentation of its landscape character.

**Scenic quality**  
 Generally poor scenic quality with some visual detractors such as the A55 road corridor.

**Tranquillity**  
 The area is not tranquil with traffic on the local road network and the influence of the A55 road corridor.

**Discordant/intrusive features**  
 The A55 road corridor is the most significant discordant and intrusive feature.

**Night-time light sources**  
 A55 road corridor plus traffic on local road network, residential areas on the fringes and caravan parks.

**Cultural/Social**

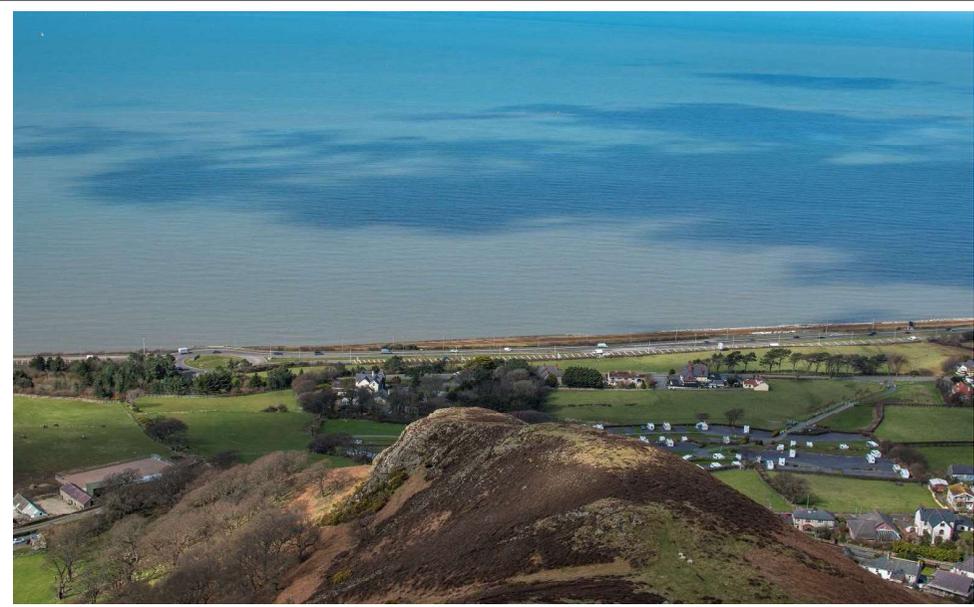
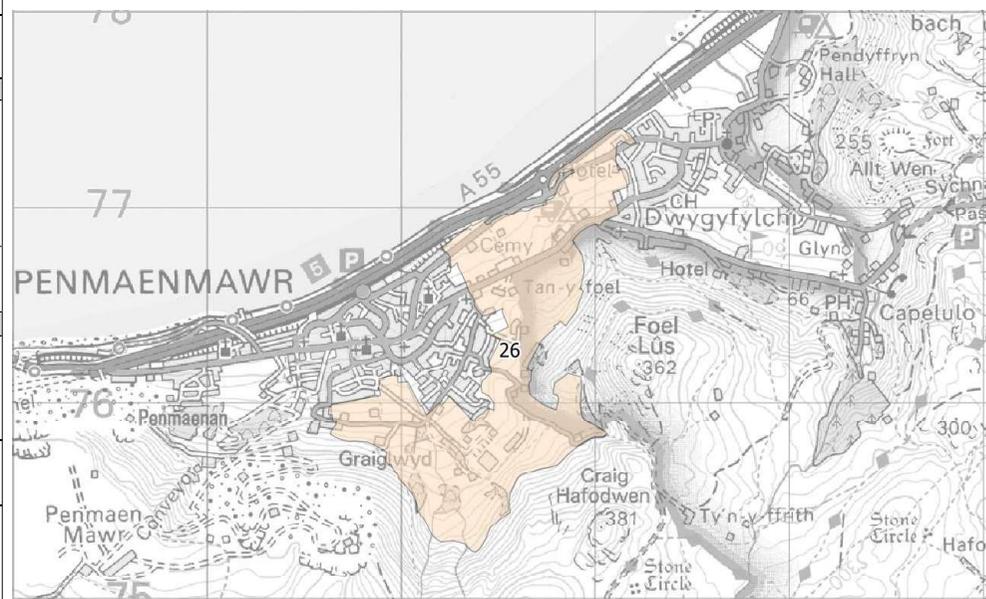
**Historic features and elements**  
 Grade II Listed Farm and Barn at Graiglwyd.

**Human Interaction**  
 There are several pathways of human interaction along the local road network that serves the settlements of Penmaenmawr and Dwygyfylchi and the seasonal land uses of the caravan parks.

**Landscape Value**

The landscape character of this area is fragmented with several different land uses falling between the two settlement boundaries of Penmaenmawr and Dwygyfylchi. While there are some open views across the coastal plain to the open sea, these are compromised and heavily influenced by the A55 road corridor. The area holds no statutory designations, but some landscape elements may be valued by the local community.

Quality	Condition	Overall Landscape Value
Poor	Poor	Moderate



**LCA27 – Capelulo Pasture**

Category: Hillside slopes and lowland plain

LANDMAP Aspect Areas Overlap (Visual and Sensory) SNPVS073 Abergwyngregyn

**General Description and Designations**

**General Description**  
The area lies adjacent to the village of Capelulo at the base of Sychnant Pass and forms part of the coastal plain that extends east from the village of Dwygyfylchi. The area is defined by Old mill Road to the north and Sychnant Pass Road to the south. The area is sheltered and heavily wooded alongside the valley of the Afon Gwyrach. The North Wales path runs alongside the river connecting the two roads to the north and south. Adjacent fields are small scale and used for grazing.

**Designations**  
Snowdonia National Park (part)  
North Arllechwedd Historic Landscape

**Physical Characteristics**

**Built environment**  
The village of Capelulo is a cluster of residential properties with a public house and restaurant. The property of Glyn lies in the central part of the area. A small play area is on the north side of Sychant Pass Road adjacent to the river.

**Landform, geology and hydrology**  
Lowland plain with Afon Gyrach descending from Fairy Glen valley and crossing the lowland plateau in a northerly direction.

**Landcover and vegetation**  
Plantation woodland on an ancient woodland site and Llys-y-gwynt covert is a restored ancient woodland.

**Perceptual Characteristics**

**Scale and Appearance**  
Small scale and sheltered with enclosed views.

**Scenic quality**  
Good scenic quality with river flowing through dense woodland. Scree slopes of Allt Wen rise to the north giving sense of enclosure and protection.

**Tranquillity**  
The area is generally peaceful with some tranquil qualities such as the sound of the river. Occasional noise of traffic on local road network.

**Discordant/intrusive features**  
No significant discordant or intrusive elements.

**Night-time light sources**  
Properties within village of Capelulo and vehicles on local road network.

**Cultural/Social**

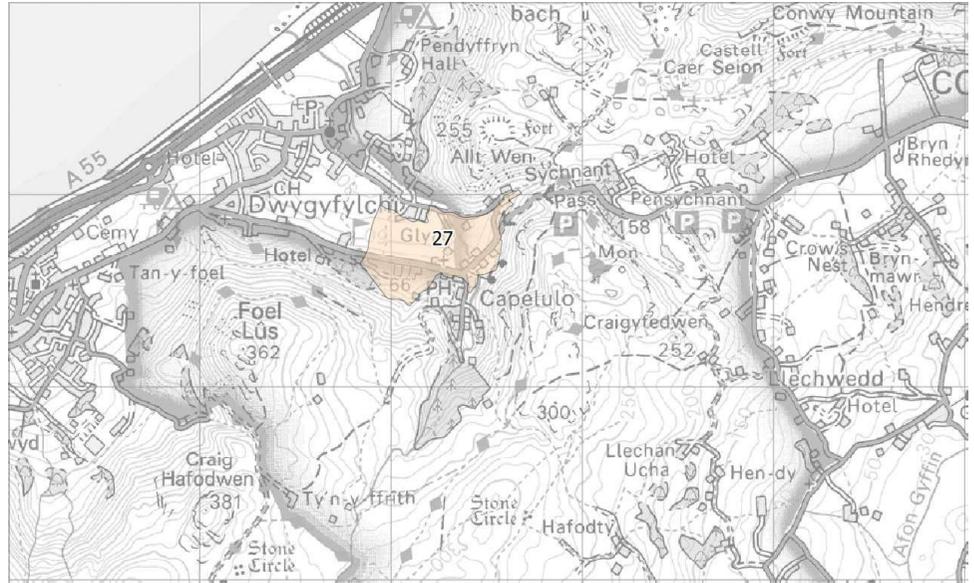
**Historic features and elements**  
None known.

**Human Interaction**  
The area is popular with walkers and ramblers with Capelulo the base for several circular walks. The Wales Coast Path passes through the area.

**Landscape Value**

The area and its' setting is highly scenic and lies (partly) within the Snowdonia National Park. It is a popular area for general amenity for both the local community and visitors to the area. The play area is valued by the local community. The landscape elements of the woodland and river combine to form an attractive landscape within a sheltered landscape setting at the eastern most part of the coastal plain.

Quality	Condition	Overall Landscape Value
Good	Good	High



**LCA28 – Coed y Rhiwiau**

Category:	Hillside slopes
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS073 Abergwyngregyn

General Description	Coed y Rhiwiau and Llys-y-Gwynt Covert are wooded areas on the lower north and west facing slopes of Garreg Fawr approximately 1-kilometre south-west of Llanfairfechan
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Designations:	Snowdonia National Park North Arllechwedd Historic Landscape.
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**Physical Characteristics**

Built environment	None
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Landform, geology and hydrology	Steep sided north and west facing slopes
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Landcover and vegetation	Mixed woodland plantations
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**Perceptual Characteristics**

Scale and Appearance	Small scale woodland plantations with open aspect to north and west.
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Scenic quality	Set within generally good scenic quality.
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Tranquillity	Moderate tranquillity. Peaceful but noise of A55 a detractor but not significant.
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Discordant/intrusive features	A55 as minor detractor
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Night-time light sources	A55 road traffic and local road network.
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**Cultural/Social**

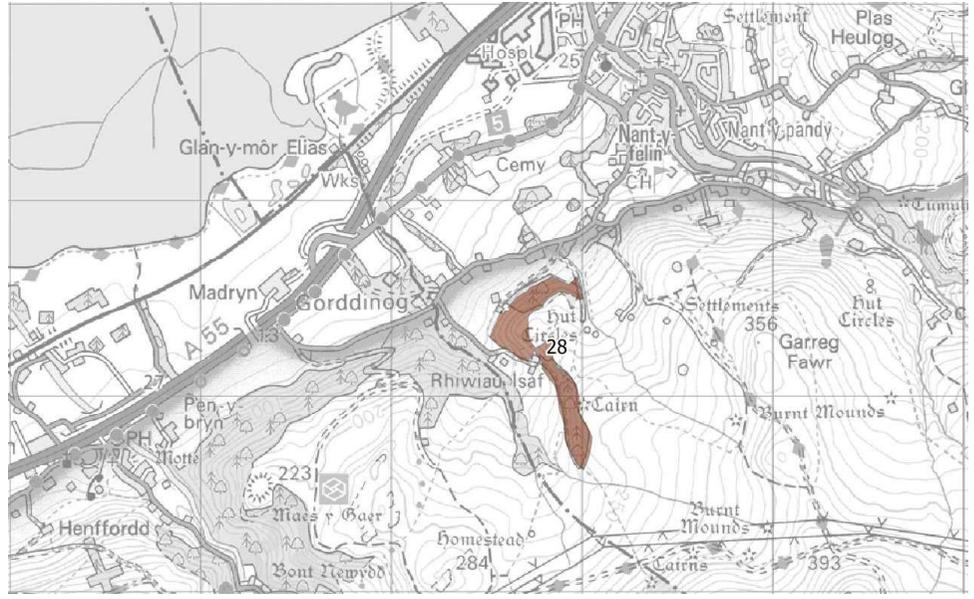
Historic features and elements	Coed – y Rhiwiau plantation on ancient woodland site. Llys y Gwynt restored ancient woodland site Hut circles and Cairns on upland area nearby.
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Human Interaction	Public rights of way pass alongside perimeter of woodlands.
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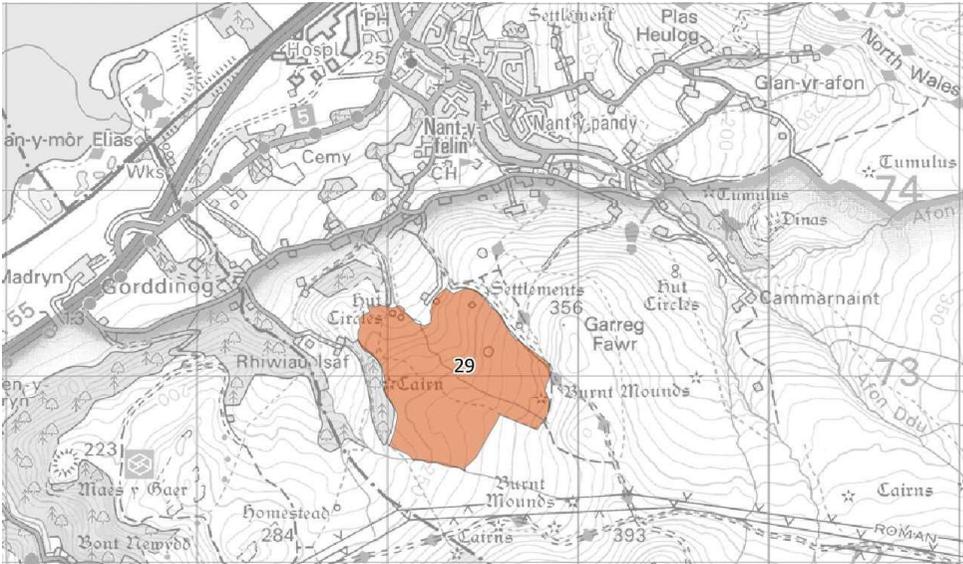
**Landscape Value**

The areas of woodland plantation are significant landscape elements occupying the lower slopes of Garreg Fawr. The plantations contribute to the wider landscape and setting together with the neighbouring woodland plantations of Coed Gorddinog and Coed Tan yr allt to the west.

Quality	Condition	Overall Landscape Value
Good	Good	High



<b>LCA29 – Cae'r Haidd Mountain Pasture</b>		
Category:	Hillside slopes	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS072 Carneddau uplands	
General Description	An upland area south of Llanfairfechan on the western slopes of Garreg Fawr and above the woodland plantations of Coed-y-Rhiwiau and Llys-y-Gwynt covert. Open aspect to the north-west with views across Lavan Sands towards Anglesey.	
Designations:	Snowdonia National Park. Lies within the North Arllechwedd Historic Landscape. Garreg Fawr Scheduled Ancient Monument which has been designated for its hut groups, ancient fields and Cairns is located towards the north eastern corner of the character area.	
<b>Physical Characteristics</b>		
Built environment	Evidence of ancient hut circles, dry stone walls.	
Landform, geology and hydrology	North-west facing slopes of Garreg Fawr.	
Landcover and vegetation	Open heath and rough grassland	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Open aspect, large scale, some expansive and unlimited views.	
Scenic quality	High scenic quality. Expansive views across Snowdonia to the south and west, spectacular coastal views across Lavan Sands.	
Tranquillity	Sense of remoteness and tranquillity	
Discordant/intrusive features	Pylons on horizon to the west. High sided vehicles and moving traffic on A55 to the north-west circa 2 kilometres distant.	
Night-time light sources	Views of traffic on of A55 road corridor.	
<b>Cultural/Social</b>		
Historic features and elements	Cae'r Haidd Deserted Rural Settlement Scheduled Monument is just one of many sites of historic interest in the area with several other hut circles, cairns and enclosures nearby.	
Human Interaction	The area is crossed by public right of way that connects to the North Wales Path.	
<b>Landscape Value</b>		
The area is part of a wider open and highly scenic landscape within the Snowdonia National Park. It contains several features of historic interest including the Scheduled Monument Cae'r Haidd Deserted Rural Settlement. The landscape is of high quality and in good condition and part of a nationally valued landscape. The overall landscape value is therefore considered to be high.		
Quality	Condition	Overall Landscape Value
Good	Good	Very High



**LCA30 – Y Teiryd Mountain Pasture**

Category:	Hillside slopes
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS072 Carneddau uplands; SNPVS073 Abergwyngregyn

**General Description**  
 Upland hillside slopes located to the south east of Llanfairfechan. There are several rivers running through the character area, most notably the Afon Ddu which has formed the Y Teiryd Valley. The topography slopes up towards the east and west along the valley sides. To the north of the character area is Dinas, a rounded hill fort with a flat top. The land use is predominantly upland grazing. The landscape is open and exposed with dry stone wall boundaries and some trees defining irregular shaped fields.

**Designations:**  
 Snowdonia National Park.  
 Lies within the North Arllechwedd Historic Landscape.  
 Scheduled Monuments of;  
 • Garreg Fawr Hut Groups, Ancient Fields and Cairns;  
 • Pont y Teiryd Hut Group and Ancient Fields; and  
 • Dinas Camp.

**Physical Characteristics**

**Built environment**  
 Evidence of ancient built environment appears as hut groups and ancient fields as evidenced by Scheduled Monuments

**Landform, geology and hydrology**  
 Upland landscape with a number of incised river valleys that confluence in the valley of the Afon Llanfairfechan to the north west and above the town.

**Landcover and vegetation**  
 Open and exposed rough grassland and heath.

**Perceptual Characteristics**

**Scale and Appearance**  
 Open and expansive, large scale.

**Scenic quality**  
 High scenic quality, barren and remote.

**Tranquillity**  
 Peaceful and remote. Sense of remoteness enhanced by barrenness; a spiritual landscape. High degree of tranquillity.

**Discordant/intrusive features**  
 Pylons on horizon to the south.

**Night-time light sources**  
 None

**Cultural/Social**

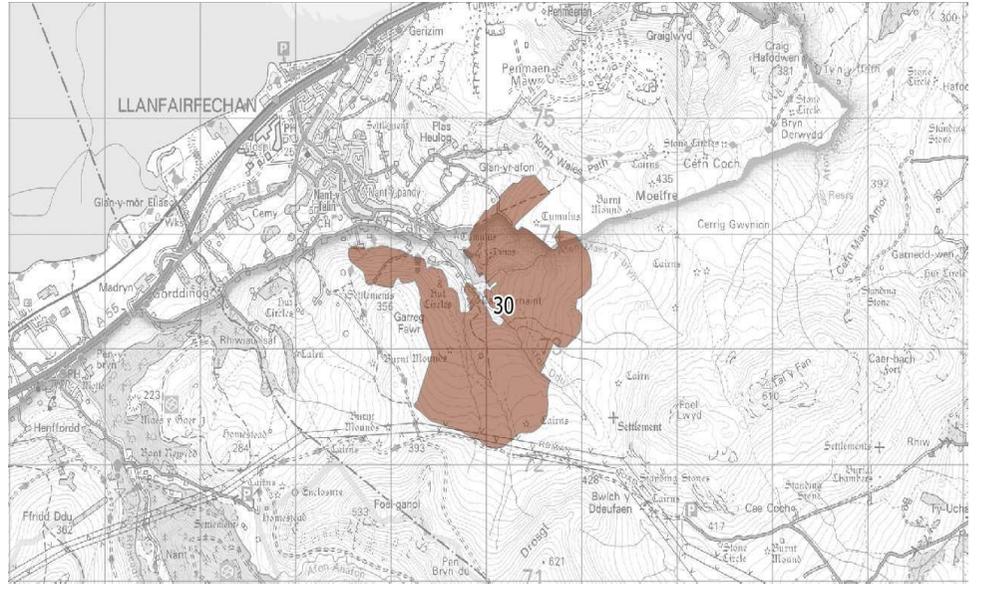
**Historic features and elements**  
 Scheduled Monuments and Roman Road

**Human Interaction**  
 Historic human influences. Public rights of way lead to open access land for informal recreation.

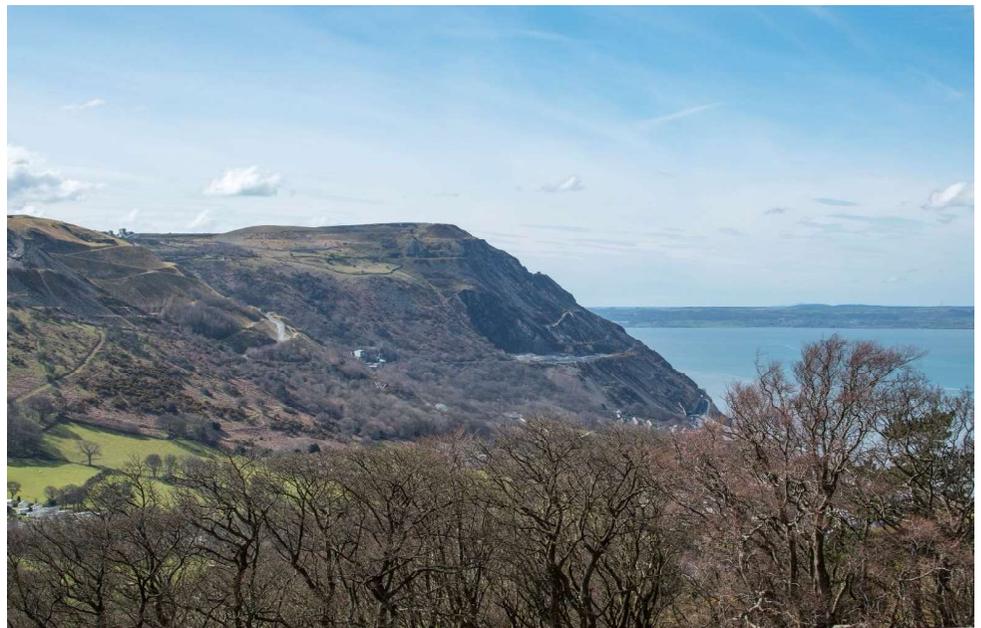
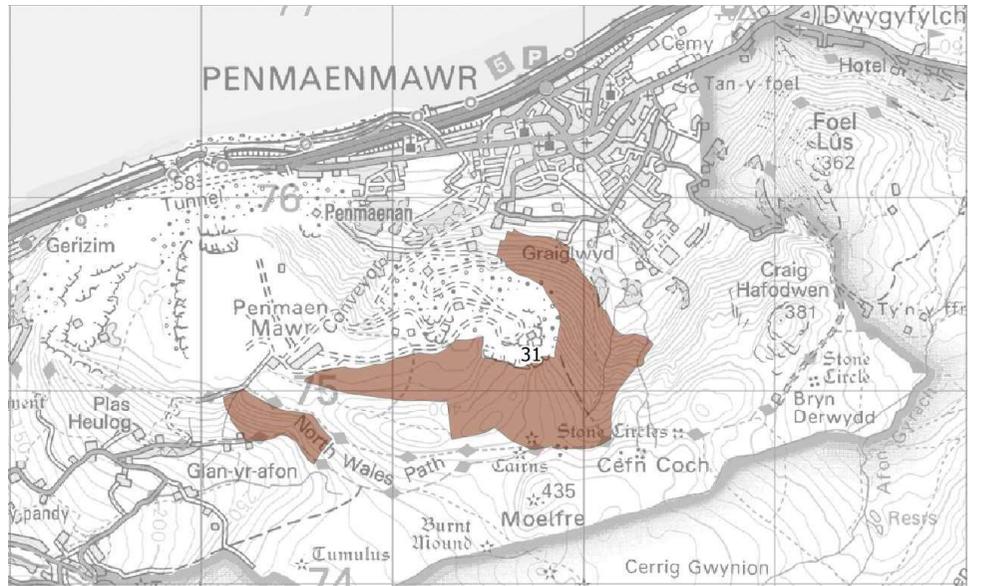
**Landscape Value**

The area lies within Snowdonia National Park and contains several Scheduled Monuments that catalogue man's association and interaction with the landscape. The area is highly scenic, a barren upland area with open access and popular with walkers and ramblers, the North Wales Path passes nearby and connects to several other public rights of way. The landscape is of high quality and in good condition and part of a nationally valued landscape. The overall landscape value is therefore considered to be high.

Quality	Condition	Overall Landscape Value
Good	Good	Very High



<b>LCA31 – Graig Lwyd Mountain Pasture</b>		
Category:	Hillside slopes	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS072 Carneddau uplands; SNPVS075 Penmaen Mawr quarry	
General Description	The area lies on the northern slopes of Moelfre above the town of Penmaenmawr and immediately east and adjacent to the active quarry. North Wales Path and Wales Coast Path pass along southern and upper reaches of area close to the peak of Moelfre.	
Designations:	Scheduled Monuments of; <ul style="list-style-type: none"> <li>Hut Circles at Clip yr Orsedd;</li> <li>Penmaenmawr Stone Circle;</li> <li>Grade II Listed Building: Sett makers hut at New Bank within disused Graiglwyd Quarry workings at top of incline just outside area to the west.</li> </ul>	
<b>Physical Characteristics</b>		
Built environment	Remnant stone walls of old field boundaries.	
Landform, geology and hydrology	Adjacent to operational quarry, some areas of scree	
Landcover and vegetation	Open grassland with areas of bracken and scattered scrub. Pockets of woodland on eastern slopes outside area to the east.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Open upland area.	
Scenic quality	Good scenic quality to south and Snowdonia but north is compromised by active quarry workings.	
Tranquillity	Sense of remoteness due to open aspect and exposed conditions but not tranquil due to presence of quarry.	
Discordant/intrusive features	Operational quarry.	
Night-time light sources	None	
<b>Cultural/Social</b>		
Historic features and elements	Scheduled Monuments of hut circles and stone circles.	
Human Interaction	Landscape heavily influenced by operational quarry. Craiglwyd Hall Caravan Park nearby.	
<b>Landscape Value</b>		
<p>The landscape value of this area is heavily influenced by the adjoining quarry, some of which remains operational, other parts are now disused. There remain signs of man's interaction with the area through the evidence of hut circles and stone circles. The area falls outside Snowdonia National Park and is considered to be of medium importance and rarity. The overall landscape value is therefore considered to be of good value.</p>		
Quality	Condition	Overall Landscape Value
Medium	Medium	Moderate



**LCA32 – Maen Crwn Mountain Pasture**

Category: Hillside slopes

LANDMAP Aspect Areas Overlap (Visual and Sensory) SNPVS072 Carneddau uplands

General Description: The area is composed of an upland plateau and western slopes of Foel Lus and Craig Hafodwen set above the town and village of Penmaenmawr and Dwygyfylchi. The Wales Coast Path traverses the mid slope of Foel Lus and passes through the area to the south.

- Designations:
- Snowdonia National Park (Partly)
  - Lies within the North Arllechwedd Historic Landscape
  - Scheduled Monuments thought to be from the Bronze age of;
    - Bryn Derwydd stone cirde
    - Maen Crwn standing stone

**Physical Characteristics**

Built environment: Isolated dwellings including farm of Ty'n-y-frith. Livestock Pens. Boundaries largely comprise dry stone walls.

Landform, geology and hydrology: Open hillside slopes

Landcover and vegetation: Rough grazing with woodland slopes

**Perceptual Characteristics**

Scale and Appearance: Open and barren moorland

Scenic quality: Highly scenic withy open views across sea towards Puffin Island and Anglesey

Tranquillity: Generally tranquil with some levels of traffic noise and other minor disturbance

Discordant/intrusive features: No significant discordant or intrusive features.

Night-time light sources: None apart from north west aspect overlooking Penmanenmawr and A55 road corridor.

**Cultural/Social**

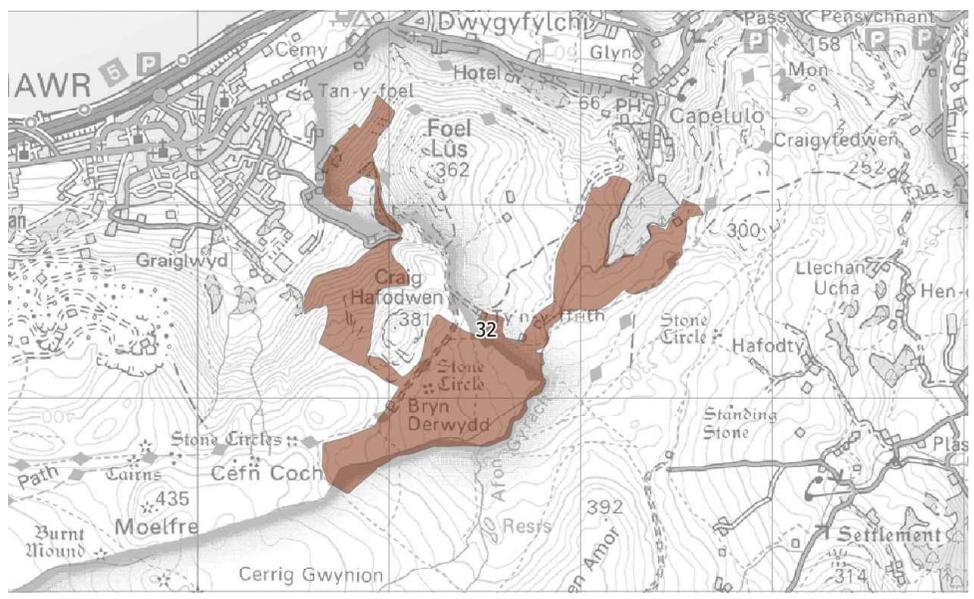
Historic features and elements: Scheduled Monuments dating back to Bronze Age.

Human Interaction: Isolated farms and homesteads. Long distance paths used for informal amenity.

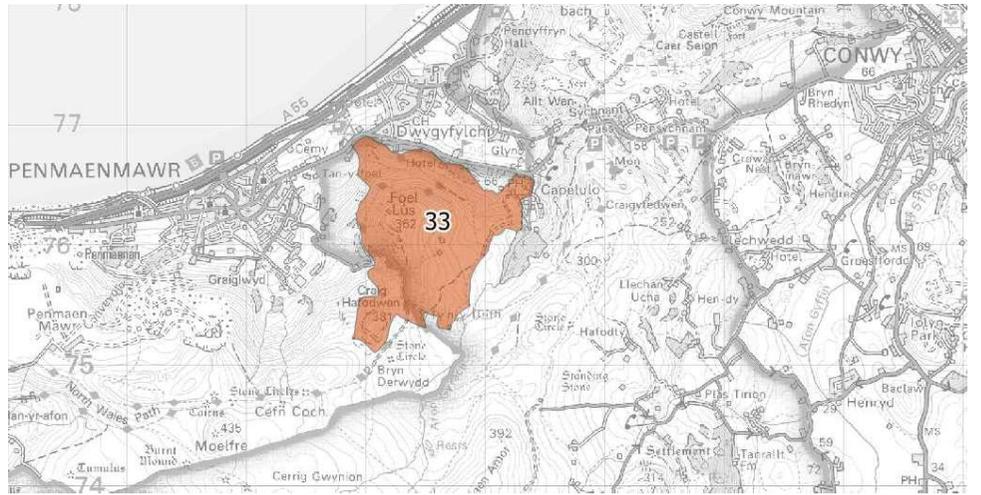
**Landscape Value**

This is generally a remote landscape that connects to the wider Carneddau uplands. The area is primarily of rough pasture and used for rough grazing sheep and ponies. It is a popular area for informal recreation and lies along the route of the Wales Coast Path that connects to several other public rights of way and open access land. The area lies within and on the fringes of Snowdonia National Park and is a high-quality upland landscape with qualities of remoteness and tranquillity.

Quality	Condition	Overall Landscape Value
High	Good	High



<b>LCA33 – Foel Wen Moorland</b>		
Category:	Exposed upland	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS072 Carneddau uplands	
General Description	Located on the Foel Lus hillside to the south of Dwygyfylchi and above the village of Capelulo. The landcover occupies an exposed upland position around the peak of Foel Lus with steeply side slopes with upland heath, grass, rocky outcrops, and scattered scrub and trees. The landscape is open and exposed with boundaries comprising drystone walls.	
Designations	Snowdonia National Park. North Arllechwedd Historic Landscape. Grade II Listed building of Horeb Capel on Conwy Old Road	
<b>Physical Characteristics</b>		
Built environment	Village of Capelulo lies along Sychnant Pass road that forms the northern boundary of the area.	
Landform, geology and hydrology	Peak of Foel Lus with open scree and rock outcrops.	
Landcover and vegetation	Heath and rough grassland	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Open upland of the northern Carneddau range.	
Scenic quality	Highly scenic uplands with extensive panoramic views across Carneddau mountain range to the south and coastal plain and open sea to the north.	
Tranquillity	Remote and tranquil. A spiritual landscape.	
Discordant/intrusive features	No significant detractors	
Night-time light sources	None.	
<b>Cultural/Social</b>		
Historic features and elements	Old farmsteads and settlements nearby.	
Human Interaction	Upland area with long distance footpath of Wales Coast Path encircling peak of Foel Lus.	
<b>Landscape Value</b>		
The area is part of the wider Carneddau upland landscape, a highly scenic area with expansive panoramic views across mountains and sea. The area is remote and tranquil and lies within Snowdonia National Park. This is a nationally valued landscape with no potential for substitution, it is therefore considered a landscape of high value.		
Quality	Condition	Overall Landscape Value
Outstanding	Good	Very High



**LCA34 – Allt Wen Moorland**

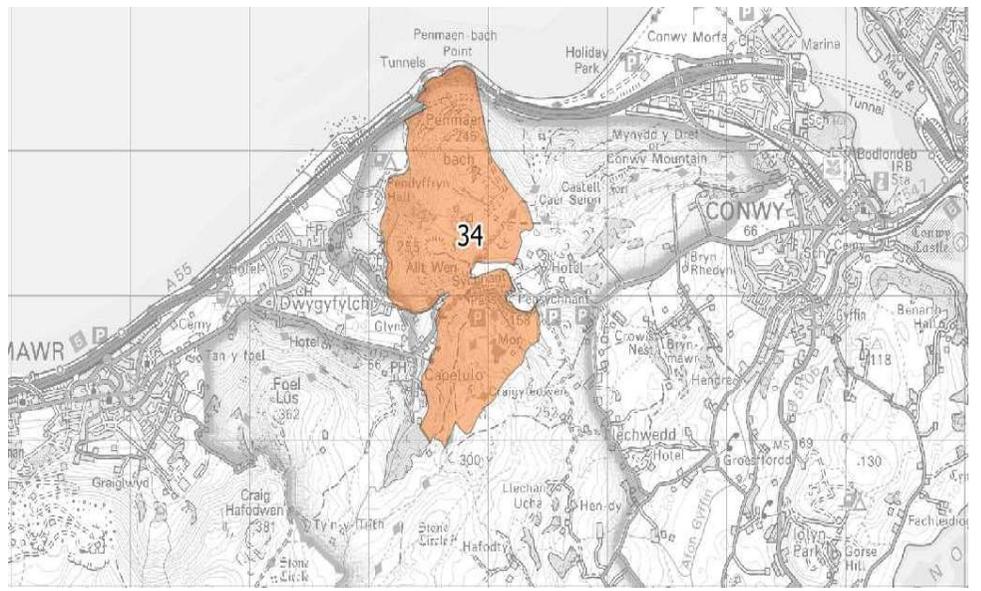
Category:	Exposed upland
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS078 Penmaenbala; SNPVS076 Capelulo valley; SNPVS072 Carneddau uplands

**General Description**  
The area extends from the rocky headland of Penmaenbach south to include the peak of Allt Wen, Sychnant Pass and the upland area of Maen Esgob above the village of Capelulo.

- Designations:**
- Snowdonia National Park.
  - North Arllechwedd Historic Landscape.
  - Scheduled Monuments of;
    - Gwern Engan Concentric Enclosed Hut Circle; and
    - Hut Circle Settlement at Gwern Engan south east of Sychnant Pass

**Physical Characteristics**

Built environment	Isolated farm buildings such as Pen-pyra with access tracks to local road network. Sychnant Pass road with stone estate boundary walls. Car parking areas at Sychnant Pass.
Landform, geology and hydrology	Rock outcrops with scree. Small lakes.
Landcover and vegetation	Rock, scree and heath with rough grassland. Some isolated trees along boundaries and around farmsteads.



**Perceptual Characteristics**

Scale and Appearance	Open and extensive area with extremely varied topography.
Scenic quality	Highly scenic with panoramic and framed vistas.
Tranquillity	Peaceful and remote. High degrees of tranquillity. Traffic audible on Sychnant Pass road slight detractors. A55 also audible from some vantage points.
Discordant/intrusive features	A55 road corridor from northern vantage points, not significant elsewhere.
Night-time light sources	A55 road corridor from northern vantage points.

**Cultural/Social**

Historic features and elements	Scheduled Monuments, stone wall field boundaries.
Human Interaction	Popular area for walkers and ramblers. Also, mountain bikers and paragliders.

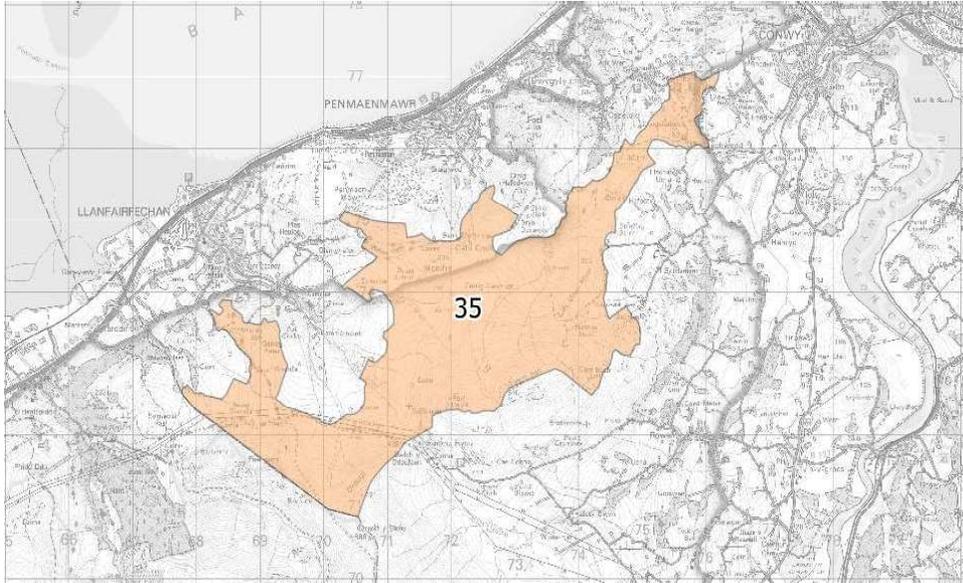
**Landscape Value**

The area is extremely scenic and of outstanding quality. It has a coastal setting and is also part of the wider Carneddau upland landscape, a highly scenic area with expansive panoramic views across mountains and sea. The area is remote and tranquil and lies within Snowdonia National Park. It is a popular area for residents and visitors enjoying walking and rambling activities. This is a nationally valued landscape with no potential for substitution, it is therefore considered a landscape of very high value.

Quality	Condition	Overall Landscape Value
Outstanding	Good	Very High



<b>LCA35 – Moelfre Upland Moorland</b>		
Category:	Exposed upland	
LANDMAP Aspect Areas Overlap (Visual and Sensory)	SNPVS072 Carneddau uplands	
<b>General Description</b>		
General Description	Vast area exposed upland area encompassing Garreg Fawr Moorland, Waun Llanfair Moorland, Waen Gyrach Moorland, Cefn Maen Amor and Cefn Llechan. Topography steadily rises towards the hillsides of Tal y Fan and Foel Lwyd in the south and Garreg Fawr in the west. There are a number of watercourses including the Afon Ddu, Afon Maes-y-bryn and Afon Gyrach. Land use is mainly upland grazing and is open and exposed, with boundaries comprising drystone walls.	
Designations:	Snowdonia National Park. There are several Scheduled Monuments including; Roman Road N of Llannerch Fedw; Bwlch y Ddeufaen Standing Stones; Cerrig Gwynion cairn. North Arllechwedd Historic Landscape and parts of the character area along the southern boundary are located within the Lower Conwy Valley Historic Landscape	
<b>Physical Characteristics</b>		
Built environment	Field boundaries of dry-stone walls; Pylons cross southern part of area.	
Landform, geology and hydrology	There are a number of watercourses including the Afon Ddu, Afon Maes-y-bryn and Afon Gyrach.	
Landcover and vegetation	Landcover comprises upland heath, grass, rocky outcrops, and scattered scrub and trees.	
<b>Perceptual Characteristics</b>		
Scale and Appearance	Extremely open and exposed area.	
Scenic quality	High scenic quality with some areas featureless and barren.	
Tranquillity	High level of tranquillity and feeling of remoteness.	
Discordant/intrusive features	Pylons are a discordant feature but not significant from some angles and vantage points.	
Night-time light sources	None	
<b>Cultural/Social</b>		
Historic features and elements	The area contains several features of historic interest dating back to the Bronze Age. Some are Scheduled Monuments and others remain undesignated with potential for further sites to be discovered.	
Human Interaction	Little human interaction apart from use of the area by walkers and ramblers for informal recreation.	
<b>Landscape Value</b>		
The area is part of the wider Carneddau upland landscape, a highly scenic area with expansive panoramic views across mountain range. The area is remote and tranquil and lies within Snowdonia National Park. There is a wealth of historic features and elements. This is a nationally valued landscape with no potential for substitution, it is therefore considered a landscape of high value.		
Quality	Condition	Overall Landscape Value
Outstanding	Good	Very High



## **APPENDIX 9.4 REPRESENTATIVE VIEWPOINTS**

# Viewpoint A

## Penmaenmawr Promenade



**National Grid Reference:** SH 71824, 76675  
**Date/ Time:** 4th July 2019 (12:40hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 2m  
**Viewing Angle** 75° E  
**Nearest Visible Proposed Feature:** 600m

**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

View from a well-used and popular section of the Penmaenmawr Promenade eastwards towards Penmaenbach headland and beyond to West Shore and the Great Orme. Representative of receptors using Public Open Space and Promenade area for general amenity.

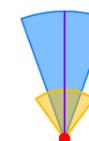
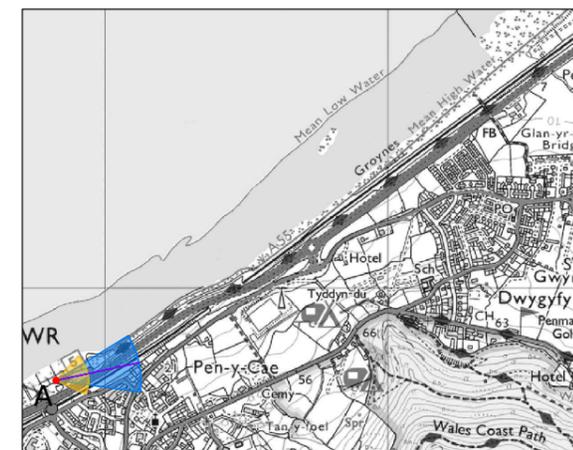
### Component of View

This section of the promenade contains several beach front facilities such as the beach café children's play area and skateboard park. The A55 runs to the south of and elevated above the promenade on concrete retaining structures visible in the middle distance. There is a nearby underpass that connects the promenade with Station Road East and the town centre. Roadside planting obscures the A55 on the eastern approaches to Junction 16 roundabout. Residential properties in Penmaenmawr (Conway Road) appear elevated above the A55 road and rail corridor with the mountainous backdrop of Foel Lus and Allt Wen beyond.

### Anticipated Change in View

There would be no change in the view as a result of the Scheme that commences approximately 600 metres further east from the viewpoint. The roadside vegetation to the north of the existing A55 and Junction 16 roundabout would be retained and remain in view. Some upper sections of the new footbridge may be visible above the roadside vegetation but will be largely obscured from view particularly during the summer months when the vegetation is in leaf.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint B

## Ysguborwen Road



**National Grid Reference:** SH 72957, 77222  
**Date/ Time:** 4th July 2019 (13:30hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 22m  
**Viewing Angle:** 31° NNE  
**Nearest Visible Proposed Feature:** 25m

**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height:** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

The view is from the public footpath that runs alongside Ysguborwen Road opposite the entrance to the Gladstone Hotel car park. Representative of receptors using the local road network and public footpath and residential properties Awel-y-Mor, Murital and Llysfor west of the Gladstone.

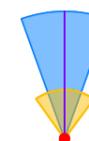
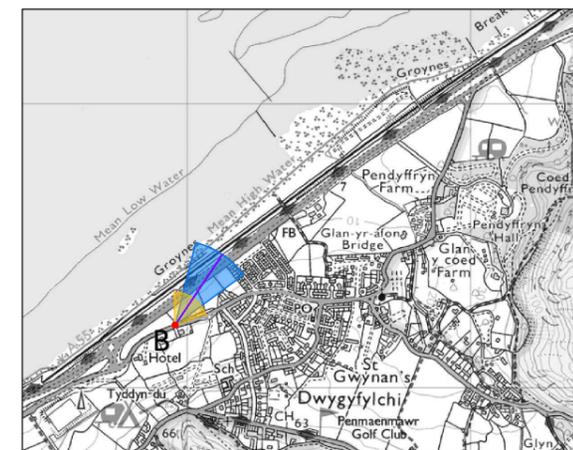
### Component of View

The view is north-east from Ysguborwen Road opposite the Gladstone public house across fields of rough grazing and the A55 road corridor Conwy Bay towards the Great Orme. The A55 appears in the middle distance characterised with lighting and signage and moving traffic. The road is partially obscured by roadside hedgerows and plantation adjacent to Maes-y-Llan residential area towards the east with the backdrop of Penmaen-bach headland rising above. Fields of rough grazing/pasture are visible in the foreground with remnant dry stone wall boundaries and fragmented hedgerows.

### Anticipated Change in View

The anticipated change in view would be significant during the construction period and would form a noticeable feature in the view. The new link road to the south of the A55 would run through the fields used for rough grazing but would be screened by a false cutting. The false cutting would be a significant earthwork in the middle distance but would screen the link road and A55 from the view while retaining views across the sea towards the Great Orme. The earthworks would be planted with ornamental shrubs to further screen traffic including high sided vehicles. The section of field in the immediate foreground would remain as existing.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint C

## Maes-y-Llan



A55 North Wales Coast Road

**National Grid Reference:** SH 73232, 77458  
**Date/ Time:** 4th July 2019 (13:50hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 21m  
**Viewing Angle:** 231° SW  
**Nearest Visible Proposed Feature:** 5m  
**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height:** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

The view is west along the residential street of Maes y Llan outside property number 33 towards properties 17 and 19 (centre in picture) with Penmaen Mawr mountain rising above in the distance (circa 3.5 km).

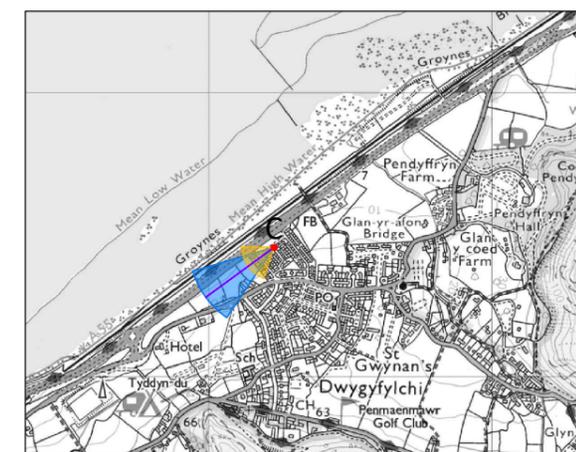
### Component of View

The residential properties of Maes-y-Llan lie immediately south of the A55 on elevated land overlooking the A55 road corridor with open views from first floors across Conwy Bay and open sea with the Great Orme to the north-east. From street level and the ground floor of properties, views of the A55 road corridor are screened by dense roadside plantations of mixed native and ornamental trees and shrubs. Gardens of the properties are defined by a number of different boundary treatments including close boarded fencing, hedges, chain link fencing and low concrete walls. The roadside verge is designated as public open space by Conwy County Borough Council with the post and three rail fence defining the highway boundary.

### Anticipated Change in View

It is anticipated that the view would change significantly. The existing roadside vegetation would be removed in order to construct the new link road that would pass at a lower level (circa 2 metres) than the existing residential street. Views would be open and exposed across the A55 road corridor during the construction period. New noise attenuation fencing would be erected and screen views of the new link road and A55 from street level and ground floor windows. The overall change in the view would revert to a similar aspect to the existing following completion of the Scheme. Shrub planting would be planted at a lower level at the base of the steep bank/retaining wall but would be obscured from the view by noise attenuation fencing.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint D

## Puffin Café pedestrian footbridge



**National Grid Reference:** SH 73361, 77602  
**Date/ Time:** 4th July 2019 (16:05hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 17m  
**Viewing Angle:** 66° ENE  
**Nearest Visible Proposed Feature:** 0m within scheme extents

**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height:** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

View east from the top of the existing Penmaenmawr footbridge of the A55 road and rail corridor west of the Shell Garage and Puffin Café. Road Footbridge. A representative view of non-motorised users such as pedestrians and cyclists. Note that the existing footbridge is not ramped and therefore use is limited. The new replacement footbridge will be ramped and provide improved access to a wider range of non-motorised users.

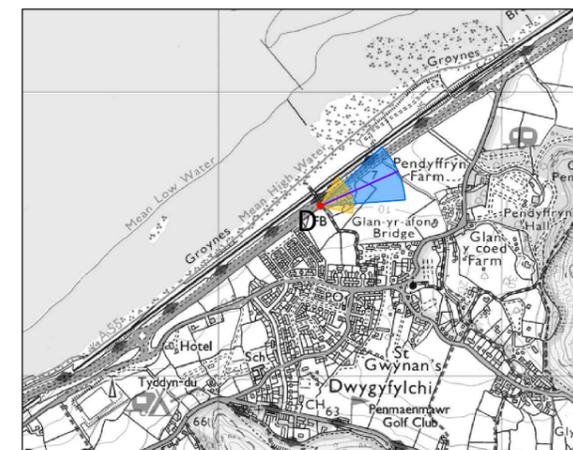
### Component of View

View east of the A55 dual carriageway appears as a wide corridor with a grassed central reserve characterised by moving traffic, lighting columns and signage. The Shell Garage and forecourt and car parking area of the Puffin Café lie adjacent to the A55 and are further detracting elements from the scenic views of Penmaen-bach and wooded mountainside of Allt Wen in the background. The lowland area of Pendyffryn farmland appears to the south (right in picture) of the A55 with the sewage treatment works visible to the north (left in picture) partially obscured by roadside scrub vegetation.

### Anticipated Change in View

The anticipated change in view would be significant and effectively widen the existing road corridor from circa 25 metres wide to 50 metres wide to include the link road parallel and south of the A55 road corridor. The new link road would pass to the south (right in picture) of the existing Shell Garage and a false cutting would take additional land to the south as mitigation. The false cutting would be planted to provide visual separation between the link road and main A55 carriageway. The new overbridge at Junction 16A would be visible but seen against the backdrop of Penmaen-bach headland approximately 1 kilometre to the east.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint E

## Gwel-y-mor public open space



**National Grid Reference:** SH 73365, 77439  
**Date/ Time:** 4th July 2019 (14:10hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 28m  
**Viewing Angle:** 10° N  
**Nearest Visible Proposed Feature:** 100m  
  
**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height:** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

View from end of Gwel-Yr-Aber cul-de-sac and the area of public open space adjacent to Gwel-y-Mor housing development. The view is due north across the area used for informal recreation towards the A55 and across Conwy Bay to the Great Orme.

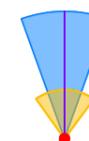
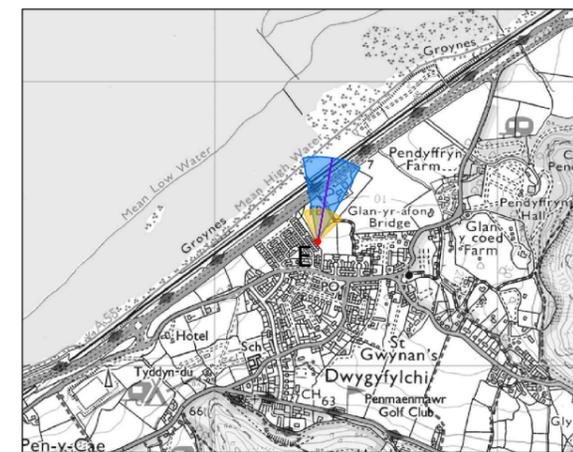
### Component of View

The view is north eastwards towards Conwy Bay and the Great Orme across an area of informal recreation adjacent to the residential area of Maes-y-Llan and the recent residential development of Gwel-y-Mor. The pedestrian footbridge that crosses the A55 road corridor west of Shell Garage is clearly visible with the A55 road corridor obscured by localised topography and roadside vegetation. Lighting columns along the A55 are visible together with signage at Puffin Café and fasciae of the Shell Garage.

### Anticipated Change in View

The view would change significantly during the initial site clearance and construction period. Earthmoving operations required for the construction of the new link road would be clearly visible close to the existing pedestrian footbridge. However, by Winter Year 1 the false cutting would be in place and views of the new link road and A55 would be screened by the earthworks that would subsequently be planted with trees and shrubs and seeded on the southern bank adjacent to the recreation ground. The pedestrian footbridge would remain visible retained at the existing location with improved and ramped approaches.

### Location Plan



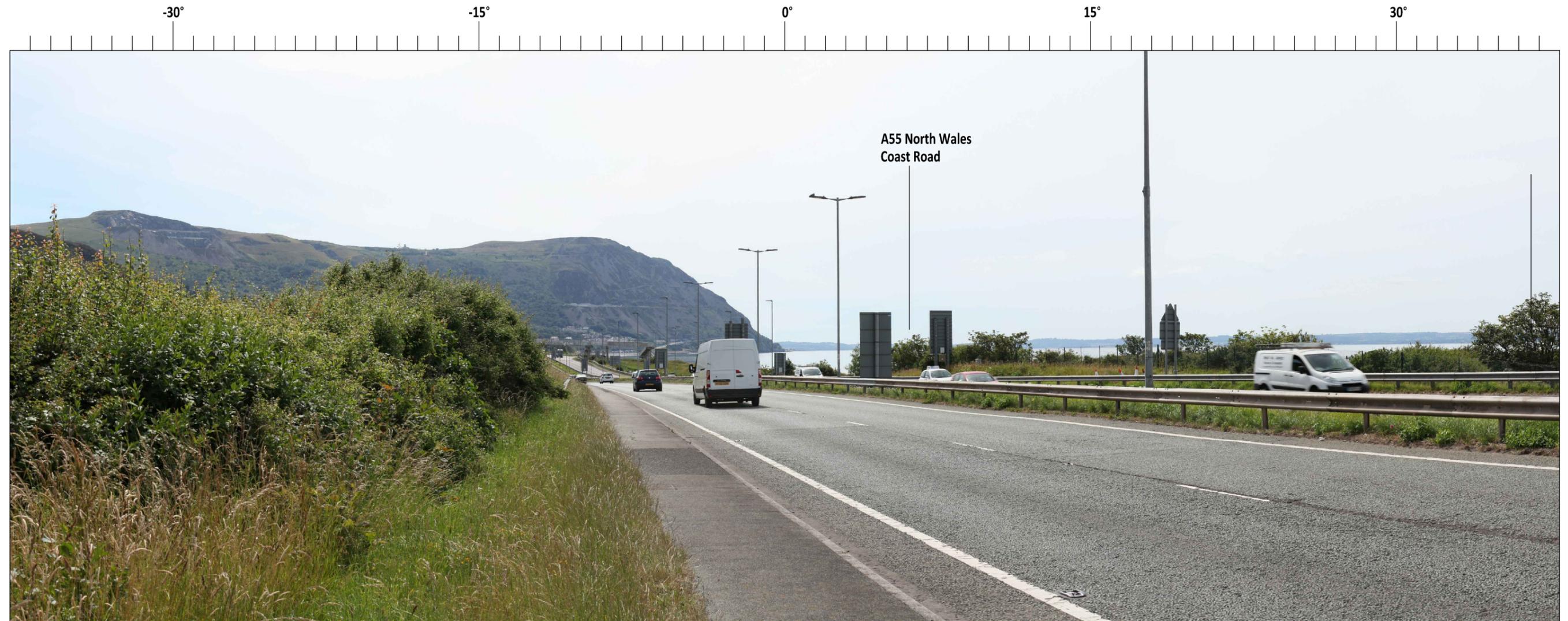
Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint F

## A55 road corridor west of junction 16A



**National Grid Reference:** SH 73738, 77876  
**Date/ Time:** 4th July 2019 (15:15hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 16m  
**Viewing Angle** 244° WSW  
**Nearest Visible Proposed Feature:** 0m within scheme extents

**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

View from verge and footpath west of Junction 16A along westbound carriageway of the A55.

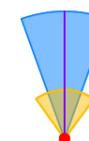
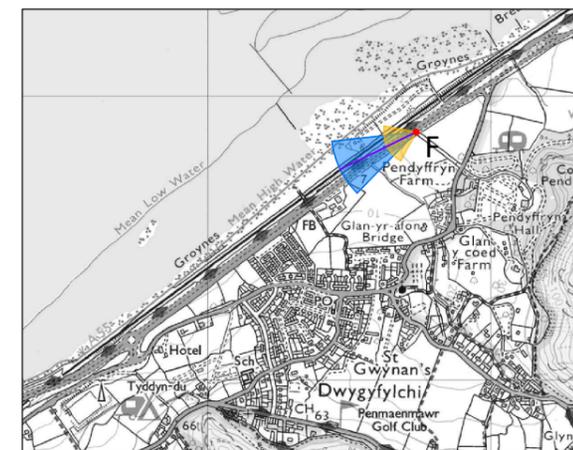
### Component of View

This viewpoint is west of Junction 16A and along the A55 road corridor towards the mountain of Penmaen Mawr. The road corridor is characterised by lighting, signage and vehicle restraint barriers, the footpath along the southern verge appears narrow and immediately adjacent to the carriageway. Roadside hedgerow planting defines the southern verge of the road corridor. The roadside environment is hostile for non-motorised users being exposed to fast moving traffic and high sided vehicles causing significant noise and sudden gusts of wind.

### Anticipated Change in View

The anticipated change in view would be major with the road corridor much wider in this area (circa 90 metres) compared to the existing (25-30 metres) due to the construction of the Junction 16A interchange that extends southwards to form the westbound slip road and also form a junction between the link road and Glan-yr-Afon Road. The existing roadside vegetation would be lost and the southern verge of the link road and new junction arrangement planted with trees, shrubs and hedgerows. Some of the verges would be sown with species rich grassland and some planted with scattered trees. Although the view would change significantly, it would be replaced with a similar scene of a wide road corridor with roadside elements such as lighting, signs, overhead gantries and vehicle restraint barriers.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint G

## Pendyffryn farmland



A55 North Wales Coast Road

**National Grid Reference:** SH 73750, 77861  
**Date/ Time:** 4th July 2019 (15:00hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 16m  
**Viewing Angle:** 225° SW  
**Nearest Visible Proposed Feature:** 0m within scheme extents

**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height:** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

The view is from the track that leads from Glan-yr-Afon Road towards the A55 and just before it joins the western verge towards the Puffin Café and the pedestrian overbridge. The route is often used by pedestrians and visitors from the caravan parks to gain access to the beach.

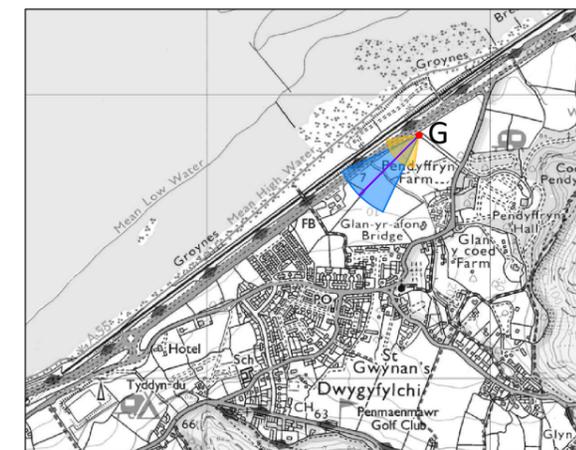
### Component of View

The viewpoint is in similar location and aspect to Viewpoint F but south of the A55 road corridor and roadside hedgerow. The view is across open pastoral fields towards the A55 road corridor with the pedestrian overbridge west of Puffin Café visible in the middle distance. The residential areas in Dwygyfylchi are clearly visible, most notably the areas of Cae Gwynan, Maes-y-Llan and Gwel-y-Mor on slightly elevated land overlooking the fields south of the A55. Properties on Conwy Old Road are also visible on the hillside at the foot of the mountain Foel Lûs. Beyond Dwygyfylchi and the town of Penmaenmawr, the Graig Lwyd Quarries and Penmaen Mawr rise to form a spectacular backdrop.

### Anticipated Change in View

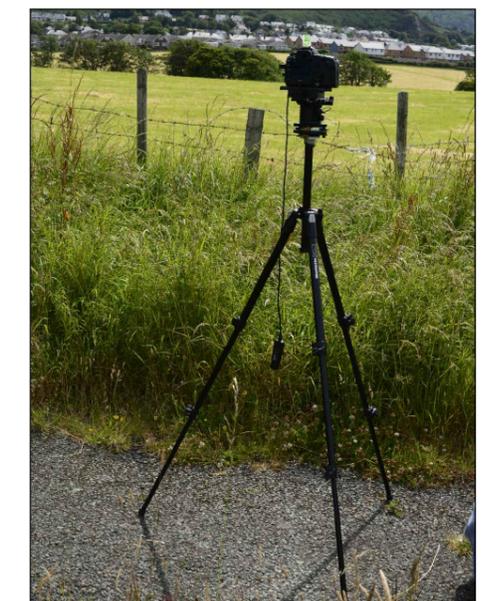
The position of the viewpoint would be located within the footprint of the new Scheme on the northern verge of the westbound on slip. The hedgerow (right in picture) would be removed and replaced with new to provide visual separation between the main carriageway and the link road. The link road would be 7.3 metres wide with a 2.5 metre shared use route along the southern verge. The southern verge and false cutting would be seeded on the north side and planted to the south Approximately 50 metres of the field in view would be lost left of the existing hedgerow with views towards the residential areas partially lost and screened by the false cutting as part of the Scheme.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint H

## Glan-yr-afon field



**National Grid Reference:** SH 73931, 77788  
**Date/ Time:** 4th July 2019 (14:30hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 16m  
**Viewing Angle:** 21° NNE  
**Nearest Visible Proposed Feature:** 0m within scheme extents

**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height:** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

The view is from the eastern verge of Glan yr Afon Road north east towards Penmaen-bach headland and tunnel and Junction 16A.

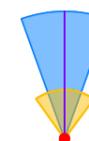
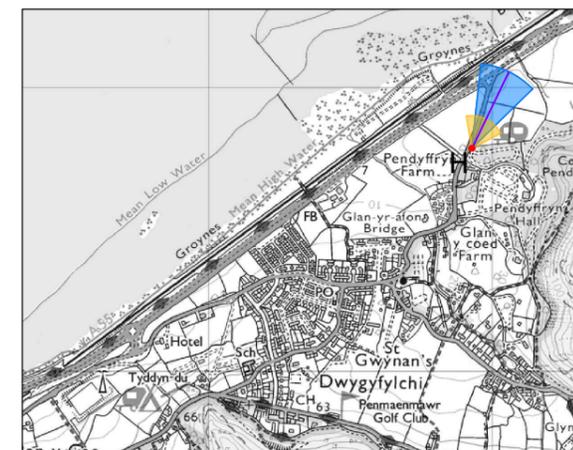
### Component of View

The view is across the fields of low lying coastal plain adjacent to Glan-y-Mor road towards Junction 16A and Penmaen-bach headland with distant views of the Great Orme. Elements of the A55 road corridor and railway are visible in the middle distance with a collection of lighting columns, roadside masts and signage and walls indicative features of the road corridor. Roadside vegetation obscures views of the carriageway with the woodland of Coed Pendyffryn running along the base of the scree and rocky hillsides of Penmaen-bach and Allt Wen. The field is used for seasonal events such as circuses and fairs.

### Anticipated Change in View

It is anticipated that the character of the view would not change significantly. Views of the sea would be lost due to the construction of the new junction elevated on embankment above the existing A55 to form the overbridge and associated slip roads. View towards the lower sections of the Great Orme would be lost but views to the upper sections would remain. Planting the embankments of the new junction would integrate the Scheme into the localised landscape and provide continuous tree cover from the foot of Penmaen-bach headland further west to the base of the new Junction 16A.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint I

## Allt Wen

-30°

-15°

0°

15°

30°



**National Grid Reference:** SH 74464, 77322  
**Date/ Time:** 2nd July 2019 (17:??hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 237m  
**Viewing Angle** 278° W  
**Nearest Visible Proposed Feature:** 1km  
**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

The view is from the peak of Allt Wen overlooking Dwygyfylchi and Penmaenmawr west towards Anglesey and Puffin Island.

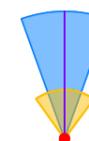
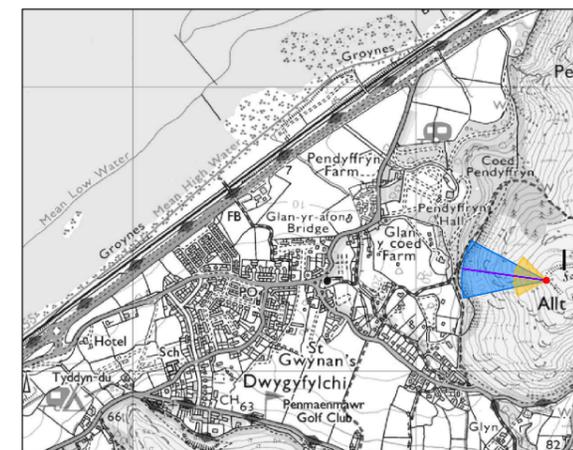
### Component of View

The view from Allt Wen is open and expansive across the coastal plain and village of Dwygyfylchi and Conwy Bay towards Beaumaris and Puffin Island and beyond to Point Lynas on the north-eastern coast of Anglesey. The view is representative of that experienced by walkers and ramblers and users of the North Wales Path although the viewpoint lies some distance off the official route. The viewpoint illustrates the context of the A55 road corridor and land use of Dwygyfylchi, Penmaenmawr and the surrounding area.

### Anticipated Change in View

The view would remain largely as it is now with the A55 road corridor appearing much as it is now albeit wider to the south with the link road running parallel. The combined distance of view from the A55 and landscape mitigation measures along the southern edge of the scheme would result in a negligible change in the view. Views during the construction period would be more discernible due to the extensive earthworks and plant and machinery operating in the area.

### Location Plan



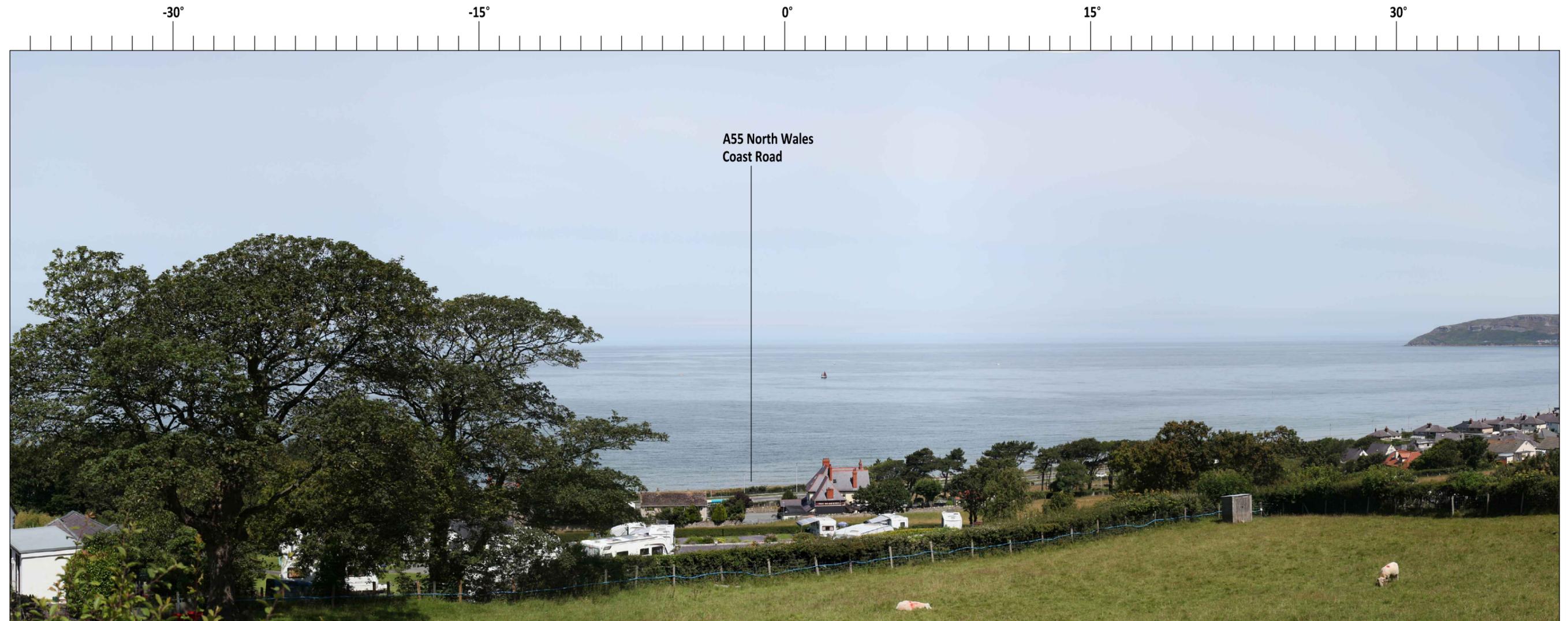
Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint J

## Treforris Road



**National Grid Reference:** SH 68249, 75493  
**Date/ Time:** 2nd July 2019 (17:??hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 59m  
**Viewing Angle** 337° NNW  
**Nearest Visible Proposed Feature:** 300m  
  
**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

View from junction of Treforris Road with Conwy Old Road looking north across A55 road corridor across Conwy Bay towards the Great Orme.

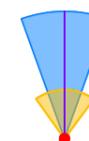
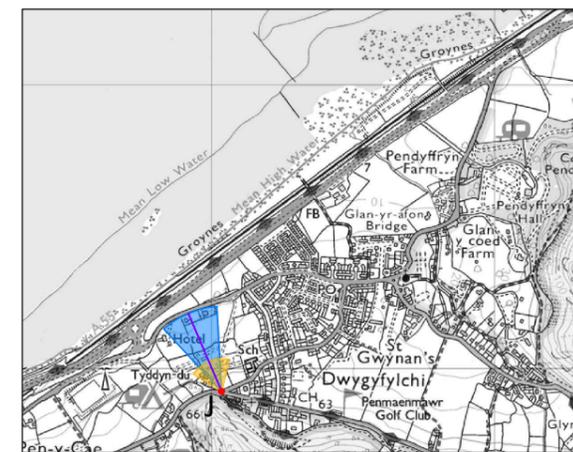
### Component of View

The viewpoint is located at the junction of Treforris Road with Conwy Old Road close to Ysgol Capelulo and overlooks Dwygyfylchi and the A55 road corridor with extensive open views beyond across Conwy Bay to the north and north east towards the Great Orme. The touring caravan park of Tyddyn Du appears in the middle distance together with the Gladstone public house that lies on Ysguborwen Road. Mature pines east of the Gladstone along Ysguborwen road are distinctive landscape features in the view.

### Anticipated Change in View

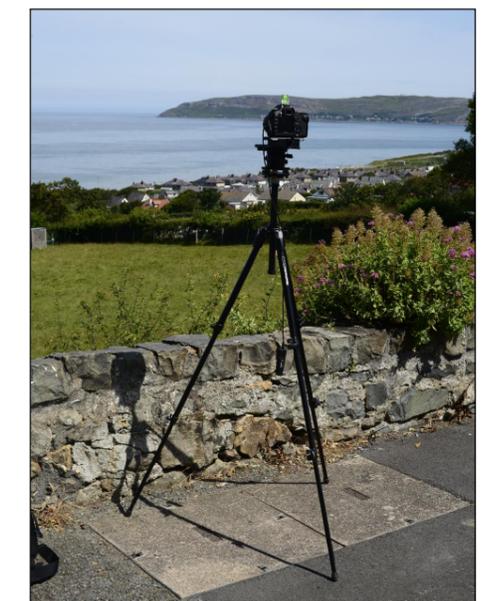
The view is not anticipated to change significantly due to the intervening topography and landscape elements. Existing trees in the view would remain and the link road would be in false cutting and southern embankment planted either side of the Gladstone Hotel. It is anticipated that there would be some additional screening of traffic on the A55 as part of the scheme and the link road would be hidden from view.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



# Viewpoint K

## Trwyn-yr-wylfa



**National Grid Reference:** SH 73344, 76751  
**Date/ Time:** 4th July 2019 (11:10hrs)  
**Weather Conditions/ Visibility:** Sunny/ Clear  
**Altitude:** 77m  
**Viewing Angle** 17° NNE  
**Nearest Visible Proposed Feature:** 1km  
  
**Camera & Lens:** Canon EOS 5D MKII - 50mm lens  
**Horizontal Field of View:** 75°  
**Camera Height** 1.5m  
**Recommended Viewing Distance:** 300mm

### Existing 75° Stitched Panoramic Image

#### Important Viewing Instructions

This is a composite image made up of 3.75No. 50mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

### Viewing Position

This representative viewpoint is from the public footpath network on the lower slopes of Foel Lûs that leads to the Wales Coast Path and Jubilee Walk.

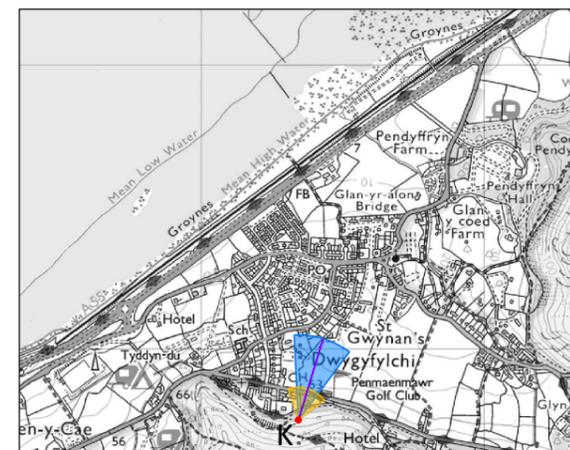
### Component of View

The view is across the residential area of Dwgyfylchi and Penmaenmawr Golf Course with the A55 road corridor visible north of the coastal plain towards the coastal strip. The road corridor disappears from view in places due to localised topography and roadside vegetation.

### Anticipated Change in View

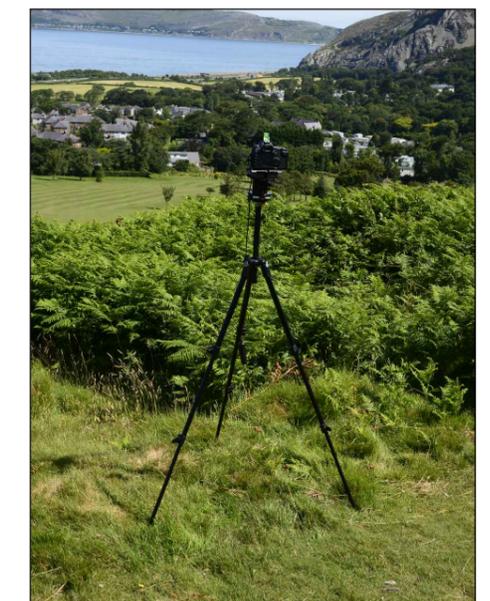
The view would not be anticipated to change significantly from this distance of circa 1 kilometre. The link road to the south of the A55 road corridor would be obscured by the false cutting as would traffic on the main east and westbound carriageways of the A55. Earthworks west of the Afon Gyrach and south of the link road would be visible during the construction period but would be seeded and planted within the first available season. Further east the trees and shrubs would also be planted along the southern verge. It is anticipated that high sided vehicles on the main A55 would be less visible in sections due to the false cutting and planting along the southern bank.

### Location Plan



Red dot - Viewpoint  
 Purple line - Single frame image bearing  
 Orange - Panoramic image field of view (75°)  
 Blue 50mm lens single image field of view (39.6°)

### Camera Location



**APPENDIX 9.5**  
**VISUAL EFFECTS SCHEDULES**

No/Ref	Residential Properties (RP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
RP01	<p>Properties north off Conway Road, (Ynys Las, Seiriol, Bryn Gwynedd, Bryn Menai, Grosvenor House, Springbank, Hilary, Cliffe Manor, Craig y Don, Llys Madoc) Conway Road, Penmaenmawr, Conwy LL34 6BH</p> <p>Sensitivity: Medium (oblique views) Distance from Scheme: 200m</p>	<p>The properties are three storey dwellings that are accessed off Conway Road. The line of properties effectively forms a continuous terrace, elevated above the A55 road corridor. Some properties no longer exist and appear as a gap to the road frontage. Two new properties are planned for currently vacant land to the east of Llys Madoc. (Planning App. Ref 0/45609)</p> <p>The rear of the properties have open and expansive views north across the A55 and promenade towards Anglesey and Puffin Island. To the front, views are contained along Conway Road by roadside vegetation along the southern verge.</p> <p>The northern verge of Conwy Road would be widened for the provision of a non-motorised way that will connect Conway Road with a proposed pedestrian footbridge across the A55 approximately 200 metres to the east.</p>	<p>Scrub vegetation along Conway Road would be cleared as part of the works for the non-motorised way. Roadside plantations to the south of the A55 would be partially lost as part of the A55 realignment. The realignment of the A55 and new Junction 16 lies approximately 35 metres and 200 metres further east of the overbridge, a total distance of approximately 235 metres from the new housing development.</p> <p>The aspect of the properties is largely north facing with access from the south. Views east along Conwy Road are oblique with the elevated section of the A55 increasingly visible east of the properties. The magnitude of change would be minor during the construction phase with the removal of some roadside vegetation leading to more exposed views of the A55 and new overbridge. However, this would not be a significant visual effect in the context if the existing road corridor.</p> <p>Magnitude: <b>Minor</b> Effect: <b>Slight Adverse</b></p>	<p>The new overbridge would be visible in Year 1 breaching the horizon line and would be silhouetted against the sky during the morning hours. However, this would be seen in the context of other elements of the road corridor such as lighting and overhead gantries.</p> <p>Views from the properties would remain largely unchanged and seen in the context of the wider road corridor.</p> <p>Magnitude: <b>Negligible</b> Effect: <b>Neutral/Slight</b></p>	<p>The Scheme affords no opportunity for mitigation due to the restricted space of the Scheme in relation to the existing road corridor. There would be no difference to the effects reported in Year 1.</p> <p>Magnitude: <b>Negligible</b> Effect: <b>Neutral/Slight</b></p>	<p>The easternmost properties of Llys Madoc and new dwellings submitted for planning, would be those likely to experience slight adverse visual effects. Due to the aspect and orientation of the properties. Construction activities may lead to noise and dust along Conway Road and some temporary loss of general amenity.</p>
RP02	<p>Properties south off Conway Road (Bryn Gwyn, Bryn Melyn Cottage, 1-4 Morllon Terrace, Min-y-Don, Plas-y-mor, Bodlwyfan, Cil-y-Coed Conway Road, Penmaenmawr, Conwy LL34 6BL</p> <p>Sensitivity: High Distance from Scheme: 230m</p>	<p>The properties are a collection of detached, semi-detached and terraced properties on elevated ground above Conway Road. The property types vary from traditional stone-faced dwellings to modern residential two storey properties. The properties lie elevated above Conway Road with well vegetated gardens containing several mature trees and shrubs that line and overhang the southern verge of Conway Road.</p>	<p>The easternmost (Bodlwyfan and Cil y Coed) properties would have the most potential for experiencing changes in the view. The new overbridge would be visible in views towards the north east. However, due to the context and setting of the view it is considered unlikely that the Scheme would have any significant adverse effects.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per Construction Phase. Existing vegetation outside the Scheme extents is likely to remain and grow unless managed otherwise. However, this cannot be classified as mitigation or guaranteed as a likely effect.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per Construction Phase and Year 1.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>Bodlwyfan and Cil y Coed are the easternmost properties south of Conway Road and set on elevated land. Views across the sea north east towards the Greta Orme are likely but not verified due to lack of access to public areas. There are views of Bodlwyfan in the reverse view from the A55 road corridor. The other properties in this area are highly unlikely to experience any change.</p>
RP03	<p>Bron Wylfa, Conway Road, Penmaenmawr, Conwy LL34 6PR</p> <p>Sensitivity: High Distance from Scheme: 110m</p>	<p>This is a detached two storey dwelling elevated above Conway Road and set in extensive grounds with mature trees surrounding the property.</p>	<p>Views to the Scheme are likely to be obscured by vegetation particularly during the summer months. Views to the property from the existing A55 are limited to the roof and chimney of the dwelling. It is therefore considered unlikely that the Scheme would have any significant adverse effects.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per Construction Phase.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per Construction Phase and Year 1</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>No access was gained to the property as it is in private ownership.</p>

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RP04	1-4 Cemlyn Close, Conwy Old Road, Penmaenmawr, Conwy LL34 6BU  Sensitivity: High Distance from Scheme: 320m	Cemlyn Close is a cluster of four properties at the end of the cul-de-sac Cemlyn Park on the eastern fringe of Penmaenmawr. The properties are semi-detached two storey dwellings set in an L shape overlooking a turning area with a north and west facing aspect. The properties are bounded to the north and east by mature trees.	Views to the Scheme would be obscured by mature trees and woodland particularly during the summer months. The views are also distant to the nearest element of the Scheme (overbridge west of Junction 16) and is therefore considered highly unlikely that the Scheme would have any significant adverse effects.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Construction Phase  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Winter Year 1  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
RP05	Cemlyn Park, Conwy Old Road, Penmaenmawr, Conwy LL34 6BW  Sensitivity: High Distance from Scheme: 350m	Cemlyn Park is a cluster of properties focussed around a cul-de-sac in the Pen-y-Cae area of Penmaenmawr. The properties are two storey semi-detached dwellings. The area is generally elevated above Conway Road with views limited to adjacent properties and mature trees. To the east is Cemlyn Close and beyond belts of existing woodland.	Views to the Scheme would be obscured by mature trees and woodland particularly during the summer months. The views are also distant to the nearest element of the Scheme (overbridge west of Junction 16) and is therefore considered highly unlikely that the Scheme would have any significant adverse effects.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Construction Phase  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Winter Year 1  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
RP06	Gwysfa and Trewen Conwy Old Road, Penmaenmawr, Conwy LL34 6YF  Sensitivity: High Distance from Scheme: 300 - 360m	Gwysfa and Trewen are large detached properties accessed off Conwy Old Road. The properties are set within extensive grounds with mature trees set above the A55 with far reaching views towards Anglesey and Puffin Island across the sea to the north and north-west.	Views to the Scheme would be obscured by mature trees and woodland particularly during the summer months. The views are also distant to the nearest element of the Scheme (overbridge west of Junction 16) and is therefore considered highly unlikely that the Scheme would have any significant adverse effects.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Construction Phase  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Winter Year 1  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
RP07	Trwyn y Wylfa and Cri'r Wylan, Conwy Old Road, Penmaenmawr, Conwy LL34 6SF  Sensitivity: High Distance from Scheme: 250m	These two properties are located along Conwy Old Road and have elevated views north across the coastal plain and A55 road corridor towards Anglesey and Puffin Island. The view of the existing road corridor is concealed by the existing roadside vegetation planted following completion of the A55. The planting lies south of the existing Junction 16 along the southern verges of Conway Road and Ysguborwen Road and immediately west of the existing roundabout. There is a high evergreen content within the plantation along the southern verge of Conwy Road including stands of mature pines that provides a dense visual screen of the A55 and Junction 16 roundabout.	The Scheme would remove the existing roadside plantations to the east and west of the existing roundabout but the roadside plantation to the south of Conwy Road would be retained and protected. The plantation provides a dense visual screen from elevated viewpoints to the south and south-east. The change in view would be slight with the A55 road corridor largely screened by the existing roadside plantation that would be retained but with some aspects of the view to the north affected with plant and machinery visible during the construction phase.  Magnitude: <b>Minor</b> Effect: <b>Slight Adverse</b>	The existing roadside plantations and other mature vegetation along Ysguborwen Road would mitigate views of the A55 much in the same way as the current baseline conditions and therefore would represent no significant change in the view following completion of the scheme.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	Summer Year 15 and it is anticipated that the existing roadside plantations would remain and provide the same level of screening as in the baseline conditions.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	Trwyn y Wylfa is also a seasonal camping site that extends south-west on elevated ground and a small caravan park that lies to the north of Conway Old Road.  It should be noted that the existing roadside vegetation is circa 30 years old and contains a high percentage of evergreen trees such as pines that provide a year round screen

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RP08	Tyddyn Du Farm and Caravan Park, Conwy Old Road, Dwygyfylchi, Conwy LL34 6RE  Sensitivity: High Distance from Scheme: 250m	Tyddyn Du Farmhouse is a two-storey dwelling on the western fringe of Dwygyfylchi. Views are open and expansive towards the north east with far reaching views across Dwygyfylchi and Pedyffryn farmland to Conwy Bay and the Great Orme. The existing A55 road corridor is largely hidden from view by intervening trees and buildings. Existing mature trees that surround the Oasis Christian Centre off Ysguborwen Road screen views of the A55 close to Junction 16. There is a high evergreen content within the plantation along the southern verge of Conwy Road including stands of mature pines that provides a dense visual screen of the A55 and Junction 16 roundabout.	The Scheme would remove the existing roadside plantations to the east and west of the existing roundabout but the roadside plantation to the south of Conwy Road would be retained and protected. The plantation provides a dense visual screen from elevated viewpoints to the south and south-east. The change in view would be slight with the A55 road corridor largely screened by the existing roadside plantation that would be retained but with some aspects of the view to the north affected with plant and machinery visible during the construction phase.  Magnitude: <b>Minor</b> Effect: <b>Slight Adverse</b>	The Scheme would be perceptible but only from within a limited field of vision towards the north. Much of the Scheme would be screened by trees around the curtilage of the Oasis Centre and the roadside plantation along the southern verge of Conwy Road. The false cutting would also screen the new link road to the north, but some high sided vehicles may be visible as is currently experienced. It is therefore considered that there would be a negligible change in the view.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	Summer Year 15 and the landscape mitigation would be established and grown to form an effective screen on the upper sections of the false cutting.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	Tyddyn Du is also a touring caravan park with a number of pitches set out on elevated fields to the east of the farm building and overlooking Ysguborwen Road and the A55 road corridor. Access to the touring park is off Ysguborwen Road. This assessment is of the visual impact to the property and not the visitors to the touring park.
RP09	Properties on Conwy Old Road (1-2 Tan-y-Graig, Bron-y-Graig, Y Bwytrhyn, Hafan, Hafod-y-rhiw, Menig Mair, Tysilio, Tan-y-bwlch, Cynlais, Curcreevy, Ashburn, Wingates, Cartref Hedd, Penmorfa, Llwyn, Bryn Gwynant), Dwygyfylchi, Conwy LL34 6RB  Sensitivity: High Distance from Scheme: 400 - 500m	A collection of residential properties elevated above Conwy Old Road. Some of the properties are set back from the road on the hillside and overlooking Dwygyfylchi and Pedyffryn farmland with open north-easterly views towards the Great Orme. Other properties are set closer to Conwy Old Road with views to the north-east restricted by adjacent properties on nearby streets such as Cae Cyd Road. Further east, some of the properties overlook Penmaenmawr Golf Club with views of the hills Allt Wen and Penmaenbach.	The properties lie approximately 500 metres from the Scheme, but views are largely contained by other properties and dwellings along Conwy Old Road. The main aspect of the view from the properties is towards the north-east and there would be some distant views of circa 1.5 kilometres towards the Scheme near to and west of Junction 16A. Construction activity would be a discernible element in the view to some properties with plant and machinery operating within the Pedyffryn farmland and close to the existing Junction 16A.  Magnitude: <b>Negligible</b> Effect: <b>Slight Adverse</b>	Winter Year 1 and construction activity would have ceased on completion of the works. With no plant and machinery in operation views of the Scheme would be barely discernible from this distance and therefore the magnitude of impact in the view would be no change.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
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RP10	Cae -glas Crescent, Conwy Old Road, Dwygyfylchi, Conwy LL34 6SN  Sensitivity: High Distance from Scheme: Circa 800m	Cae -glas Crescent is a row of six two storey properties on Conwy Old Road with a north facing aspect to the rear of the properties that overlook Penmaenmawr Golf Course towards the A55 road corridor and Pedyffryn parkland. The views are open and extensive across Conwy Bay to the Great Orme. The existing road corridor and associated traffic is visible from the rear of the properties. There are no similar views from the properties Tan'r-allt Cottages on the opposite and south side of the road.	The properties are located some 800 metres away from the Scheme with intervening visual features such as the existing trees and properties within Dwygyfylchi. There would be no significant change in the view as a result of the Scheme with the magnitude of change being negligible. Plant and machinery operating east of the existing Junction 16 would be visible during the Construction Phase.  Magnitude: <b>Negligible</b> Effect: <b>Slight Adverse</b>	The Scheme would be visible east of the existing Junction 16 where the false cutting would screen views of high sided vehicles, currently visible on the existing road corridor. This would however be barely discernible and at a significant distance from the receptor but would improve the overall view by screening the movement of high sided vehicles from the view.  Magnitude: <b>Negligible</b> Effect: <b>Slight Beneficial</b>	The landscape mitigation measures would be established but would not change the view significantly from this distance. The visual effects would remain as assessed under Winter Year 1.  Magnitude: <b>Negligible</b> Effect: <b>Slight Beneficial</b>	

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RP11	<p>Properties on Treforris Road (Cartref Melys, Bryn-Difyr, Hafod Hyfyrd, Gan Edrych, Plas Llewelyn, Gwelfryn, Bod Alaw, Cilcen, Glyn Hafon, Angorfa) Dwygyfylchi, Penmaenmawr, Conwy LL34 6RA</p> <p>Sensitivity: High Distance from Scheme: 400 - 500m</p>	<p>The properties on Treforris Road are a collection of detached and semi-detached two storey dwellings with some set back from the road. The properties have a north and north-west facing aspect with open views across Tyddyn Du Caravan park towards the existing A55 and beyond across Conwy Bay to open sea and the Great Orme. The avenue of pines along Ysguborwen Road are distinctive landscape elements in the view that break the shoreline. The pines would not be affected by the works.</p>	<p>Views are towards the A55 east of Junction 16 where the main carriageway will be widened, and a new link road constructed in parallel. Plant and machinery will be clearly visible during earthworks operations as will the earthworks themselves. Night-time works would also be clearly visible, but this is not considered a significant change due to the existing traffic and carriageway being existing and significant light sources. The change in view would be slight with the A55 road corridor largely screened by the existing roadside plantation that would be retained but with some aspects of the view to the north affected with plant and machinery visible during the construction phase.</p> <p>Magnitude: <b>Minor</b> Effect: <b>Slight Adverse</b></p>	<p>The formation of a false cutting along the southern side of the new link road approximately 7 metres high, would screen cars and HGV's from view in Year 1. The earthworks may appear as bare earth for some time until a grass sward is established. Lighting at night would also be reduced due to the headlights on vehicles being screened by the false cutting.</p> <p>Magnitude: <b>Moderate Positive</b> Effect: <b>Moderate Beneficial</b></p>	<p>The false cutting would be planted with trees and shrubs along the northern face and grass seeded along the south facing of the false cutting. By Year 15 the landscape would be well established, and the false cutting integrated into the adjacent landscape</p> <p>Magnitude: <b>Major Positive</b> Effect: <b>Large Beneficial</b></p>	<p>The earthworks referred to involve the construction of a false cutting as part of the embedded mitigation measures. This is a key feature of the Scheme designed to screen views of the new link road and re-aligned A55 from visual receptors to the south. Night-time visual effects of moving traffic along the existing A55 would also be reduced but lighting columns and VMS signs and overhead gantries would remain visible.</p>
RP12	<p>Properties on Gogarth Avenue (1-3, Sea Mount, Ingleby and Vardre), Dwygyfylchi, Penmaenmawr, Conwy LL34 6PY</p> <p>Sensitivity: High Distance from Scheme: 120m</p>	<p>There are few properties on Gogarth Avenue that will have views of the Scheme. The road lies on a north-south axis with the properties facing east/west onto the road. Some properties along the lower and more northern sections of the road would have some views of the scheme depending on the orientation and aspect of the property. The section of A55 most visible from the properties is east from Junction 16 to Maes y Llan and the Shell Garage and Puffin Café.</p>	<p>There would be views of the Scheme during the construction phase from the first floor of some properties such as Sea Mount and Vardre and from the ground floor and curtilage of No. 2. However, these would be partially obscured by other properties and the Scheme would not be the primary focus of the view. During the construction period there would be views of plant and machinery forming the earthworks east of Junction 16. The Scheme would form a noticeable feature in the view and be perceptible from a receptor of high sensitivity.</p> <p>Magnitude: <b>Moderate Negative</b> Effect: <b>Moderate Adverse</b></p>	<p>The formation of a false cutting along the southern side of the new link road approximately 7 metres high, would screen cars and HGV's from view in Year 1. The earthworks may appear as bare earth for some time until a grass sward is established. Lighting at night would also be reduced due to the headlights on vehicles being screened by the false cutting.</p> <p>Magnitude: <b>Moderate Positive</b> Effect: <b>Moderate Beneficial</b></p>	<p>The false cutting would be planted with trees and shrubs along the northern face and grass seeded along the south facing of the false cutting. By Year 15 the landscape would be well established and the false cutting integrated into the adjacent landscape. The planting would provide limited additional mitigation in the view and therefore the visual effect would remain as moderate beneficial.</p> <p>Magnitude: <b>Moderate Positive</b> Effect: <b>Moderate Beneficial</b></p>	

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RP13	Properties on Ysguborwen Road (south), (The Oasis, Llysfor, Muritai, Awel-y-Mor, Plas Arfon Cottage), Dwygyfylchi, Penmaenmawr, Conwy LL34 6PS  Sensitivity: High Distance from Scheme: 25m	The properties are detached and semi-detached two storey properties and are accessed directly off Ysguborwen Road. The properties have open views fields of rough grazing and the A55 road corridor towards Anglesey, Puffin Island, Conwy Bay and the Great Orme. The A55 appears in the middle distance characterised with lighting and signage and moving traffic. The road is partially obscured by roadside pines, hedgerows and plantation adjacent to Maes-y-Llan residential area towards the east with the backdrop of Penmaenbach headland rising above.	The residents of these properties would experience a major adverse change in the view and a very large adverse effect during the construction period. The properties would experience a major loss of visual amenity, views across the beach and coast to the Anglesey and The Great Orme would be temporarily lost. The existing view of the A55 would be interrupted by machinery and plant undertaking significant earthworks within circa 25 metres of the properties. Ysguborwen Road may also be used for construction traffic.  Magnitude: <b>Major Negative Effect: Very Large Adverse</b>	The Scheme would be substantially complete by Year 1. The lower sections of the field would be raised to screen views of the A55 and new link road, views across the sea to Anglesey, Puffin Island and the Great Orme would remain. There may be some loss of views to the beach frontage. The formation of a false cutting along the southern side of the new link road approximately 7 metres high, would screen cars and HGV's from view in Year 1. The earthworks may appear as bare earth for some time until a grass sward is established. Lighting at night would also be reduced due to the headlights on vehicles being screened by the false cutting. Magnitude: <b>Moderate Positive Effect: Moderate Beneficial</b>	The false cutting would be planted with trees and shrubs along the northern face and grass seeded along the south facing of the false cutting. By Year 15 the landscape would be well established and the false cutting integrated into the adjacent landscape  Magnitude: <b>Major Positive Effect: Large Beneficial</b>	Note – The assessment also applies to the Gladstone Public House that lies adjacent to the properties  Temporary hoardings could be erected along the northern verge of Ysguborwen Road during the construction period to screen/mitigate the properties from construction activity particularly at night.
RP14	Properties on Ysguborwen Road (north), (Bryn-y-Mor, Dolau, Dorlan, Brig-y-Don, Ffynnon Wen), Dwygyfylchi, Penmaenmawr, Conwy LL34 6PT  Sensitivity: High Distance from Scheme: 35-40m	The properties are detached and semi-detached two storey properties and are accessed directly off Ysguborwen Road. The properties have open views fields of rough grazing and the A55 road corridor towards Anglesey, Puffin Island, Conwy Bay and the Great Orme. The A55 appears in the middle distance characterised with lighting and signage and moving traffic. The road is partially obscured by roadside hedgerows and scrub south of the A55 and adjacent to Maes-y-Llan residential area. Vegetation surrounding the curtilage of the properties also provides a screen.	The residents of these properties would experience a major adverse change in the view and a very large adverse effect during the construction period. The properties would experience a major loss of visual amenity, views across the beach and coast to the Anglesey and The Great Orme would be temporarily lost. Vegetation that currently provides a partial screen of the A55 would be removed. The existing view of the A55 would be interrupted by machinery and plant undertaking significant earthworks within circa 35-40m of the properties and within 15-30m of the rear gardens.  Magnitude: <b>Major Negative Effect: Very Large Adverse</b>	The Scheme would be substantially complete by Year 1. The lower sections of the field would be raised to screen views of the A55 and new link road, views across the sea to Anglesey, Puffin Island and the Great Orme would remain. There may be some loss of views to the beach frontage. The formation of a false cutting along the southern side of the new link road approximately 7 metres high, would screen cars and HGV's from view in Year 1. The earthworks may appear as bare earth for some time until a grass sward is established. Lighting at night would also be reduced due to the headlights on vehicles being screened by the false cutting. Magnitude: <b>Moderate Positive Effect: Moderate Beneficial</b>	The false cutting would be planted with trees and shrubs along the northern face and grass seeded along the south facing of the false cutting. By Year 15 the landscape would be well established and the false cutting integrated into the adjacent landscape  Magnitude: <b>Major Positive Effect: Large Beneficial</b>	
RP15	Ysguborwen Road/Mona Drive (Orme View, Ty n Cae, Nordfene, Swn-y-Mor, Gwynet, Trelawny, Brinkir, Ashville), Dwygyfylchi, Penmaenmawr, Conwy LL34 6PU  Sensitivity: High Distance from Scheme: 80-110m	The properties are detached single and two storey dwellings overlooking Ysguborwen Road and with glimpsed views of the sea to the north across and between roofs of other adjacent properties also on Ysguborwen Road. It is anticipated that there would be some limited views from second floor or dormer windows.	Views of the Scheme during the construction phase would not be significant. Views would be glimpsed and the views towards the open sea would not be compromised by the Scheme at either the construction or operational stages.  Magnitude: <b>Negligible Effect: Neutral Effect</b>	As per the Construction Phase.  Magnitude: <b>Negligible Effect: Neutral Effect</b>	As per Construction Phase and Winter Year 1.  Magnitude: <b>Negligible Effect: Neutral Effect</b>	

No/Ref	Residential Properties (RP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
RP16	<p>1-20 Maes-y-Llan, Dwygyfylchi, Penmaenmawr, Conwy LL34 6SA</p> <p>Sensitivity: High Distance from Scheme: 10-70m</p>	<p>The properties are semi-detached two storey dwellings on the western side of Maes-y-Llan. The properties lie in a north south alignment with the rear of the properties facing west and the frontage facing on to the road. The dwellings are set on sloping ground that descends south to north. The properties (especially the more southerly and elevated properties) have an open aspect to the west and north west with views across fields and the A55 road corridor towards Penmaen Mawr Quarry, Anglesey and Puffin Island. The field to the west is allocated in the emerging LDP (Site 56) for housing (15 Dwellings) with fields further west towards Junction 16 as The Natural Environment (Policy NTE/1) and Green Wedge (Policy NTE/2).</p>	<p>The visual receptors occupying the properties would experience a moderate degree of change in the view towards the north and west and during the construction period. Removal of the existing roadside vegetation coupled with significant earthworks would be required to form the false cutting and link road that would be highly visible to the west and in the fields immediately to the west of the properties. Existing vegetation to the rear of properties on Ysguborwen Road would be protected and retained. Disturbance due to plant and machinery undertaking earthworks operations would be significant and cause a major deterioration in the view and a large adverse visual effect over the anticipated 18-24 month construction period.</p> <p>Magnitude: <b>Large Adverse Effect: Very Large Adverse</b></p>	<p>Winter Year 1 and the earthworks required to form the false cutting and the construction of the new link road would be complete. Disturbance due to earthworks operations would have ceased and the new landform would screen views of the link road and associated traffic from view. Views to the realigned A55 road corridor from less elevated properties (9, 11, 13 and 15) would be screened by the false cutting that rises approximately 6.0-7.5 metres higher than the link road. Views beyond and across the false cutting towards Penmaen Mawr mountain and quarry, Anglesey and Puffin Island would remain.</p> <p>Magnitude: <b>Moderate Beneficial Effect: Large Beneficial Effect</b></p>	<p>The false cutting would be seeded on the southern side and planted with ornamental trees and shrubs along the north. By Year 15 the planting would be established and afford some additional screening of high sided vehicles. Scattered tree planting along the upper sections of the false cutting would also be starting to establish and integrate the landform into adjacent vegetation patterns. The screening function of the false cutting would be enhanced slightly by the additional tree and shrub planting and would enhance the appearance of the false cutting. The overall visual effect would remain as large beneficial.</p> <p>Magnitude: <b>Moderate Beneficial Effect: Large Beneficial Effect</b></p>	<p>Property No.s 17 &amp; 19 Maes-y-Llan have a more direct northerly aspect due to their orientation facing due north across the A55 road corridor. Visual effects would be slightly different to the more westerly facing properties but the magnitude of effects similar. The main visual effects would be experienced from the first floor of the properties as opposed to the ground floor and within the curtilage of the properties. Properties 17 &amp; 19 would experience a less beneficial effect than more elevated properties due to the proximity to the Scheme and would experience a slight beneficial or neutral effect. Noise mitigation would reduce existing noise levels.</p>
RP17	<p>02-58 Maes-y-Llan, Dwygyfylchi, Penmaenmawr, Conwy LL34 6RY</p> <p>Sensitivity: High Distance from Scheme: Circa 10-15m</p>	<p>These properties form the central part of the Maes-y-Llan residential area and many are unaffected by the Scheme due to their aspect, orientation and adjacent properties that screen the Scheme from view. See Explanatory Notes/Comments.</p>	<p>The Scheme would remove the existing roadside vegetation to the north of Maes-y-Llan. The new link road and shared use route would be constructed at the base of the bank. Retaining walls would be constructed adjacent to properties 17&amp;19 and 37-38. A noise barrier 3.5 metres high would be installed along the top of the retaining wall/bank to reduce noise levels on the properties. This would effectively replace the visual barrier that is currently ornamental shrub planting and that screens views of the A55 road corridor while affording views across the sea to the north from first floor windows. The overall visual effect during the construction period would be very large adverse due to the proximity of the works and operations of plant and machinery over a 18-24-month construction period.</p> <p>Magnitude: <b>Large Adverse Effect: Very Large Adverse</b></p>	<p>Winter Year 1 and the new embankment and retaining walls to the north of Maes-y-Llan would be complete. Existing views of ornamental shrub planting would be replaced with that of a timber noise barrier 3.5 metres high. Views over the barrier from the first floor of the properties would remain much the same as existing. The barrier would be less visually appealing than the current shrub planting, but planting would be undertaken along the verge in front of the fence line. It is considered the Scheme would have a negligible change in the view on nearby receptors compared to the baseline conditions. However, the overall effects on general amenity should improve with reduced noise levels.</p> <p>Magnitude: <b>Negligible Effect: Slight Beneficial</b></p>	<p>As per Winter Year 1. The noise barrier fencing would screen the replanted cut face to the north of Maes-y-Llan and therefore the effects would remain the same as per the Winter Year 1 of opening. However, planting along the base of the noise barrier fence would improve the visual appearance of the barrier.</p> <p>Magnitude: <b>Negligible Effect: Slight Beneficial</b></p>	<p>Properties 14-22 and 33-36 would be significantly affected by the Scheme and are the subject of this assessment. These properties have a northerly aspect with the frontage of the properties overlooking the existing A55 road corridor. The existing view is largely contained to the north by existing roadside vegetation planted as mitigation as part of the A55 scheme. Views from the ground floor and street level are largely contained by this roadside vegetation with open and expansive views north from the first floor of the properties across the sea towards Anglesey, Puffin Island and the Great Orme.</p>

No/Ref	Residential Properties (RP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/ Comments
RP18	37-67 Maes-y-Llan, Dwygyfylchi, Penmaenmawr, Conwy LL34 6RY  Sensitivity: High Distance from Scheme: Circa 35-180m	These properties form the eastern edge of Maes-y-Llan and have views of a north-eastern and eastern aspect to the rear. The rear of the properties (39-62) is defined by fencing and gardens with an informal recreation ground (kick about pitch) beyond to the north-east. The rear of properties 63-67 back on to the new access road for the residential development Gwel-y-Mor. The first floor of the properties (39-62) have open views to the north-east across a recreation ground and the A55 road corridor and beyond towards the Great Orme.	The Scheme would be visible from the rear and first floor of the properties during the construction phase. The construction of the new link road and false cutting would become the dominant feature in the view, especially for properties nearby (39, 42, 43, 45, 47, 49, 51, 53, 55, 57, 59 and 60). The existing footbridge would remain with new ramped approaches. The Scheme would be a noticeable feature or element when viewed from the rear of the properties during the construction period. The formation of the false cutting would require extensive earthworks and operations by plant and machinery. The kickabout area would be re-positioned to accommodate the false cutting. There would be significance disturbance and loss of general amenity during the 18-24-month construction period.  Magnitude: <b>Moderate Adverse</b> Effect: <b>Large Adverse</b>	Winter Year 1 and the earthworks required to form the false cutting and the construction of the new link road would be complete. Disturbance due to earthworks operations would have ceased and the new landform would screen views of the link road and associated traffic from view. Views to the realigned A55 would be screened by the false cutting that rises approximately 4.0 metres higher than the link road. Views to the upper sections of the pedestrian footbridge would remain, the re-profiled kickabout area would be visible in the foreground with ball stop fencing along the western boundary. The overall visual effects would be the screening of traffic on the A55 and link road of views from the rear of the properties both during day and night time. Lighting along the A55 would remain visible at night.  Magnitude: <b>Moderate Beneficial</b> Effect: <b>Moderate Beneficial</b>	The false cutting would be seeded on the southern side and planted with ornamental trees and shrubs along the north. By Year 15 the planting would be established and afford some additional screening of high sided vehicles. The screening function of the false cutting would be enhanced slightly by the additional tree and shrub planting and would enhance the appearance of the false cutting. The overall visual effect would remain as moderate beneficial.  Magnitude: <b>Moderate Beneficial</b> Effect: <b>Moderate Beneficial</b>	There would be an improvement to the recreation/kickabout area with the informal pitch re-orientated to accommodate the false cutting. The false cutting would also provide more shelter from the prevailing winds.
RP19	68-78 Maes-y-Llan, Dwygyfylchi, Penmaenmawr, Conwy LL34 6RU  Sensitivity: High Distance from Scheme: Circa 95-165m	These properties at Maes-y-Llan have a south facing aspect and front on to Ysguborwen Road. The properties are distanced from the scheme by other properties in the Maes-y-Llan residential area and would not be significantly affected by the Scheme.	No Change to views from visual receptors during Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral Effect</b>	No Change to views from visual receptors during Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral Effect</b>	No Change to views from visual receptors during Summer Year 15.  Magnitude: <b>No Change</b> Effect: <b>Neutral Effect</b>	

No/Ref	Non-Residential Properties (NRP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
RP20	<p>Properties 1-40, Gwel-y-Mor, Dwygyfylchi, Conwy LL34 6SB</p> <p>Sensitivity: High Distance from Scheme: Circa 35 – 100m</p>	<p>These properties were constructed in 2017/18 and lie adjacent to and south of the recreation/kickaround area east of Maes-y-Llan. The properties occupy a slightly elevated position around three cul-de-sacs and are a combination of detached and semi-detached two and three-story dwellings and apartments. Some of the properties have direct views towards the existing A55 road corridor and the Scheme whereas others lie obscured from the view. Properties 5-6, 26-31 and 32-35 have the most significant views of the Scheme across open land towards the Shell Garage and Puffin Cafe with views across the road corridor towards the open sea and the Great Orme.</p>	<p>The residential area of Gwel-y-Mor overlooks the existing A55 road corridor with open views to the north and north-east across Conwy Bay towards the Great Orme. The Scheme would cause a significant change in this view during the construction period. Significant earthworks and construction activity would be undertaken close to (within circa 30 metres) of No.s 26-31 and a new area of public open space created just outside the curtilage of the properties (26-31), to mitigate loss of kick-about area to the west. The earthworks associated with the false cutting would also be visible from other receptors in Gwel-y-Mor but to a lesser degree of magnitude.</p> <p>Magnitude: <b>Moderate Adverse Effect: Moderate Adverse</b></p>	<p>Views to the realigned A55 road corridor and link road would be screened from the ground floor and curtilage of the properties by the false cutting (circa 4.0-4.5 metres high) with a masonry wall running along its crest. High-sided vehicles would be visible from the first floor of some of the properties. Views across the sea towards Conwy Bay and the Great Orme would remain. The overall visual effect as a result of the Scheme would screen passing vehicles from view while retaining open views across the sea. The magnitude of change would consequently be moderate beneficial as would the overall visual effect for the visual receptors in Gwel-y-Mor.</p> <p>Magnitude: <b>Moderate Beneficial Effect: Moderate Beneficial</b></p>	<p>The shrub planting on the northern face of the false cutting and grass seeding on the southern face would be established by Year 15. The planting would not increase the visual screening element afforded by the cutting due to its anticipated height that may not exceed the combined height of cutting and masonry wall. The magnitude and visual of effect would therefore remain as per Year 1.</p> <p>Magnitude: <b>Moderate Beneficial Effect: Moderate Beneficial</b></p>	<p>There is a children's play area sited on the northern edge of the residential area and a Public Right of Way that runs through the housing development and connects to the pedestrian footbridge west of Puffin Café.</p>
RP21	<p>Properties 1-38 Cae Gwynan, Ysguborwen Road, Dwygyfylchi, Conwy LL34 6TR</p> <p>Sensitivity: High Distance from Scheme: Circa 300m</p>	<p>The residential area of Cae Gwynan is located north off Ysguborwen Road and of one and two storey brick-built properties. Properties 19-28 have a north east facing aspect with open views across agricultural land towards the existing A55 road corridor and beyond to Conwy Bay and the Great Orme. Other properties within the area have less open views.</p>	<p>The residential properties 19-28 would have similar views to the existing view but the new link road would be closer. There would be significant changes to the view during the construction period with extensive earthworks required to form the new link road and areas for surface water attenuation. Plant and machinery would be highly visible and become the dominant feature in the view.</p> <p>Magnitude: <b>Major Adverse Effect: Large Adverse</b></p>	<p>In Year 1 the earthworks would be completed and the new link road and associated traffic clearly visible across the open fields. Existing vegetation along the Afon Gyrach and boundary of Y Bluen Goch would restrict views further east. The visual disturbance caused by plant and machinery would no longer be the dominant feature in the view.</p> <p>Magnitude: <b>Moderate Adverse Effect: Moderate Adverse</b></p>	<p>Mitigation planting of linear belts of trees and shrubs along the southern boundary of the Scheme adjacent to the link road would become established by Year 15. The planting would provide a visual screen and reduce the visual effects of the link road and some vehicles with some high sided vehicles remaining visible.</p> <p>Magnitude: <b>Negligible Effect: Slight Adverse</b></p>	
RP 22	<p>Properties on Glan-yr-afon Road (Hillside and Ael-y-Mor), Glan-yr-afon Road, Dwygyfylchi, Conwy LL34 6UD</p> <p>Sensitivity: High Distance from Scheme: Circa 400m</p>	<p>The properties are detached single and two storey dwellings east of Cae Gwynan off Glan-Yr-Afon Road. The properties have a north/north-west facing aspect across open agricultural land towards the A55 road corridor, Shell Garage and Puffin Café. To the north and east views are contained by existing trees along the boundary of Y Bluen Goch.</p>	<p>The Scheme would form a noticeable element in the view with plant and machinery undertaking earthworks and the construction of the link road south of the Shell Garage and Puffin Café.</p> <p>Magnitude: <b>Moderate Adverse Effect: Moderate Adverse</b></p>	<p>The Scheme would be visible in Year 1 with the link road and associated traffic visible east of the Shell Garage. The formation of the false cutting approximately 4.5 metres high plus the masonry wall would screen the link road and realigned A55 and vehicles further west towards Puffin Café.</p> <p>Magnitude: <b>Moderate Beneficial Effect: Moderate Beneficial</b></p>	<p>The mitigation planting would be well established by Year 15 and be of a sufficient height to form a screening element as part of the Scheme. The shrub planting is not likely to exceed the height of the false cutting and masonry wall by Year 15 so the visual effects would remain as moderate beneficial.</p> <p>Magnitude: <b>Moderate Beneficial Effect: Moderate Beneficial</b></p>	<p>Note that these properties and curtilages are not readily visible from publicly accessible areas and therefore the assessment has been undertaken using desktop information and aerial photographs.</p>

No/Ref	Non-Residential Properties (NRP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
RP 23	Y Bluen Goch, Glan-yr-afon Road, Dwygyfylchi, Conwy LL34 6UD  Sensitivity: High Distance from Scheme: Circa 150m	Y Bluen Goch is a detached property set in extensive gardens off Glan-yr-afon Road. Views from the property are contained by mature trees and shrubs. Refer to explanatory notes for information about proposed housing development within the grounds of Y Bluen Goch.	The existing view is contained by mature trees within the curtilage of the property that provide a dense screen. Therefore, it is anticipated that there would be no change to the existing view of the existing property.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase and Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	Planning permission has been granted (Ref 0/44685 and 0/44691) for a two-phase housing development of 18 detached properties within the grounds. The existing trees within the grounds are indicated as being retained and therefore the new housing development is unlikely to experience a change in view.
RP24	Gardd Eryri and The Gardene, Glan-yr-afon Road, Dwygyfylchi, Conwy LL34 6UE  Sensitivity: High Distance from Scheme: Circa 150m	Gardd Eryri is a cluster of properties set around two cul-de-sacs. The Gardene is a detached property adjacent to Gardd Eryri. The properties face internally to the cul-de-sac and are surrounded by mature trees and vegetation. The existing view is therefore contained and inward facing.	The existing view is contained by mature trees surrounding the within the curtilage of the property that provide a dense screen. Therefore, it is anticipated that there would be no change to the existing view of the existing properties.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase and Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	There are no publicly accessible views from the properties and therefore the assessment has been undertaken using desktop information and aerial photographs.
RP25	Pendyffryn Hall and Farm (Caravan Park and Country Club) Glan-yr-afon Road, Dwygyfylchi, Conwy LL34 6UF  Sensitivity: High/Medium Distance from Scheme: Circa 100m	Pendyffryn Hall Caravan Park and Country Club lies south east off Glan-yr-afon Road and to the south of Junction 16A. The park contains a number of static caravans and holiday homes some of which are understood to be occupied throughout most of the year. Pendyffryn Hall stands in an elevated position within the park to the south east. Pendyffryn Farm lies adjacent to Glan-yr-afon Road. Views from within the park vary but are generally open with views north across the coastal plain towards the A55 and beyond to the coast of Anglesey and Puffin Island.	The Scheme would not cause a significant degree of change in the view for most residents of the park. However, some holiday homes along the northern fringe of the park would have some views across an open field towards Junction 16A. (Note the field is used for seasonal events such as circuses). The Scheme would be a noticeable feature in the view during the construction of Junction 16A with significant structures and earthworks in views to the north. Plant and machinery would be clearly visible across the open field.  Magnitude: <b>Moderate</b> Effect: <b>Large Adverse</b>	The Scheme would be a noticeable element in the view following completion. Earthworks on the southern side of the new junction and overbridge and connection with Glan-yr-afon Road would represent a minor change in the view. Planting would not have had time to take effect by Year 1.  Magnitude: <b>Minor Adverse</b> Effect: <b>Moderate Adverse</b>	Tree and shrub planting on the earthworks would become established and integrate the Scheme into the localised landscape. The planting would screen some elements of the westbound off slip and junction. the main A55 carriageway would be hidden by the slip road.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	The park is marketed by Lyons Holiday Parks as an idyllic and serene site for a holiday home with stunning panoramic views overlooking the Menai Straits and Puffin Island.  There are no publicly accessible views from the park and therefore the assessment has been undertaken using desktop information and aerial photographs.

NRP	Non – Residential Properties (NRP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
NRP01	<p>Noddfa, Retreat Centre Conwy Old Road, Penmaenmawr, Conwy LL34 6YF</p> <p>Sensitivity: High Distance from Scheme: Circa 370m.</p>	<p>Noddfa is a large detached property accessed off Conwy Old Road. The properties are set within extensive grounds with mature trees set above the A55 with far reaching views towards Anglesey and Puffin Island across the sea to the north and north-west.</p>	<p>The Scheme would not be readily visible from the centre due to the intervening trees within the grounds of the property and along Conwy Old Road.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per during the Construction Phase.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per during the Construction Phase and Winter Year 1.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>Noddfa is a retreat centre run by the Sisters of the Sacred Heart of Mary for groups and individuals.</p>
NRP02	<p>Ysgol Capelulo, Treforris Road, Dwygyfylchi, Penmaenmawr Conwy LL34 6RA</p> <p>Sensitivity: High Distance from Scheme: Circa 350m.</p>	<p>Ysgol Capelulo is a primary school is a collection of single/two-storey buildings set on sloping ground on the western fringe of Dwygyfylchi. Views are open and expansive towards the north west and north east with far reaching views across the sea northwest towards Anglesey and Puffin Island Dwygyfylchi and northeast across Pedyffryn farmland to Conwy Bay and the Great Orme. The existing A55 road corridor is largely hidden from view by intervening trees and buildings. Existing mature trees that surround the Oasis Christian Centre off Ysguborwen Road screen views of the A55 close to Junction 16. Existing roadside vegetation south of Junction 16 and along the southern verge of Conwy Road provides a dense screen.</p>	<p>Removal of roadside vegetation south of Junction 16 would expose the view towards the road corridor but the plantation along the southern verge of Conwy Road would be retained. Elsewhere, views towards the existing A55 and the Scheme are largely screened by intervening trees, largely deciduous in nature. Views to the road corridor would be exposed, especially during the winter months when deciduous trees are not in leaf. The Scheme would form a noticeable feature to the receptor during construction that would lessen during the summer months when views become more obscured by tree cover.</p> <p>Magnitude: <b>Minor</b> Effect: <b>Slight Adverse</b></p>	<p>The Scheme would be perceptible but only from within a limited field of vision towards the north-west. Much of the Scheme would be screened by trees around the curtilage of the Oasis Centre, there would be views of the completed scheme further west close to the new Junction 16. To the north views of the link road and A55 would be screened by the false cutting.</p> <p>Magnitude: <b>Negligible</b> Effect: <b>Neutral</b></p>	<p>Summer Year 15 and the landscape mitigation would be established and grown to form an effective screen on the upper sections of the cut face and false cutting. Elsewhere and from other aspects towards the north-east, the visual impact of the Scheme would be negligible.</p> <p>Magnitude: <b>Negligible</b> Effect: <b>Neutral</b></p>	<p>The assessment was undertaken outside the school grounds and from Treforris Road.</p>
NRP03	<p>Shell Garage and Puffin Café, Conwy Road, Penmaenmawr, Conwy LL34 6UN</p> <p>Sensitivity: Low Distance from Scheme: Within the existing road corridor.</p>	<p>The Shell Garage and Puffin Café are well known landmarks along the A55 between Junction 16 and 16A. The two facilities are accessed from the westbound lane only and lie within the existing road corridor. The A55 is the dominant feature in the view along with the existing Dwygyfylchi pedestrian to the west. There are views across both carriageways north across the open sea to Puffin Island and the coast of Anglesey. There are no views from the south of the two facilities.</p>	<p>During construction of the Scheme there would be disruption to the existing views and general visual amenity. Views across the existing carriageway would be dominated by plant and machinery, temporary traffic signs and barriers. The overall visual effects on these receptors of low sensitivity would be slight adverse.</p> <p>Magnitude: <b>Moderate</b> Effect: <b>Slight Adverse</b></p>	<p>The completed Scheme would make no noticeable change in the view. The two facilities would remain within the road corridor. The new link road would be completed to the south of the properties but have no adverse effect to the existing view.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per Winter Year 1.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	

NRP	Non – Residential Properties (NRP) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
NRP04	<p>The Oasis Ysguborwen Road, Penmaenmawr, Conwy LL34 6PS</p> <p>Sensitivity: High Distance from Scheme: Adjacent to the Scheme existing road corridor.</p>	<p>The Oasis is located south east of the existing Junction 16 off Ysguborwen Road and set in extensive grounds above the existing A55 road corridor.</p>	<p>The property would be likely to experience some moderate adverse effects during the winter months with significant construction activities and operations close by on Ysguborwen Road. Existing mature trees within the grounds would screen most views during the summer months but in winter the Scheme would be a noticeable feature in the view.</p> <p>Magnitude: <b>Moderate Adverse</b> Effect: <b>Moderate Adverse</b></p>	<p>In Year 1 the construction activity would be complete and there would be less effects on general amenity with less noise and general disturbance caused by the visual effects of construction activities.</p> <p>Magnitude: <b>Minor Adverse</b> Effect: <b>Slight Adverse</b></p>	<p>Planting on the cutting adjacent to the centre would be established and would integrate the landform into the adjacent field thus lessening adverse effects and reducing the overall visual effect to Slight Adverse.</p> <p>Magnitude: <b>Negligible Adverse</b> Effect: <b>Slight Adverse</b></p>	<p>The Oasis is a Christian Centre The Centre is also the headquarters of two charities - International Gospel Outreach (IGO) and North Wales Gospel Outreach (NOWGO), has guest accommodation plus a holiday cottage and caravans (up to 30 people) and hosts small conferences and seminars.</p>
WCP and NCN5	<p>Wales Coast Path (WCP) and National Cycle Network (NCN) 5.</p> <p>Sensitivity: High Distance from Scheme: Circa 0-10m.</p>	<p>The existing view from the Wales Coast Path and NCN5 is generally constrained to within the existing A55 road corridor. Views to the north are generally contained by roadside planting with open views to the east and west. Views to the south are variable due to changes in level and existing roadside vegetation.</p>	<p>Access along the WCP and NCN5 would be retained during the Construction Phase and the path would be widened to 3 metres. The views from the WCP and NCN5 would be significantly affected during the 18-24 month Construction Phase.</p> <p>Magnitude: <b>Moderate</b> Effect: <b>Large Adverse</b></p>	<p>The views would not change significantly following completion of the Scheme as most of the works will occur to the south. There would be some localised changes in the vicinity of J16A where the route is realigned. The overall scenic quality and visual amenity of the route would not change significantly.</p> <p>Magnitude: <b>Negligible</b> Effect: <b>Slight Adverse</b></p>	<p>Landscape mitigation in the vicinity of J16A would integrate the Scheme into the localised landscape with heath scrub and shrub species planted on the embankments of the eastbound slip roads at the new junction.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>NCN Route 5 is a long-distance route for cycle tourists or bike-packers that runs from Reading to Holyhead, a distance of 381 miles. Refer to Chapter 14 All Travellers for more details.</p>
29/08	<p>Penmaenmawr Footpath 08</p> <p>Sensitivity: High Distance from Scheme: Circa 0m – Crosses the existing A55</p>	<p>Penmaenmawr Footpath 08 runs north from Ysguborwen Road and passes through the residential areas of Dwygyfylchi before crossing the existing A55 on a footbridge west of the Shell Garage and Puffin Café. The Scheme would improve the approaches to the footbridge and provide new DDA compliant ramped access on both sides. Access to the National Cycle Route Network 5 and Wales Coastal Path would therefore be improved. The footpath would be closed during periods of the Construction Period.</p>	<p>The views from the footpath would not change significantly as a result of the Scheme. However, there would be some temporary disruption to the view during the Construction Period when the footpath would be temporarily closed.</p> <p>Magnitude: <b>Moderate</b> Effect: <b>Large Adverse</b></p>	<p>The views from the footpath would not change significantly following completion of the Scheme. The Scheme would improve accessibility and therefore attract new user groups to the footpath where it crosses the A55. The new users would not have experienced the view previously and therefore the magnitude of change would be classified as No Change. To existing users, the views from the footpath would be of a similar nature to those that currently exist and therefore would be considered as being of negligible or no change in the vicinity of the A55 road corridor. Elsewhere, views from the footpath would not change significantly.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per Winter Year 1.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>Refer to Appendix 9.4 Representative Viewpoints - Viewpoint D Puffin Café Pedestrian Footbridge.</p>
29/09	<p>Penmaenmawr Footpath 09</p> <p>Sensitivity: High Distance from Scheme: Circa 350m</p>	<p>Penmaenmawr Footpath 09 runs from the centre of Dwygyfylchi and Glan-yr-afon Road south along the wooded river valley of the Afon Gyrach towards Capelulo.</p>	<p>The Scheme would not be visible from the users of the footpath at any points along its length.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per the Construction Phase.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	<p>As per the Construction Phase and Winter Year 1.</p> <p>Magnitude: <b>No Change</b> Effect: <b>Neutral</b></p>	

No/Ref	Public Rights of Way (PRoW) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
29/10	Penmaenmawr Footpath 10  Sensitivity: High Distance from Scheme: Circa 330m	Penmaenmawr Footpath 10 is a short length of footpath that runs from St Gwynan's Church east towards the Afon Gyrach river valley where it connects to footpath 29/09 (described above).	The footpath has limited views due to nearby woodland and trees and the Scheme would not be visible from the users of the footpath at any points along its length.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase and Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
29/13 & 29/52	Penmaenmawr Footpath 13 and 52 Pendyffryn Dwygyfylchi  Sensitivity: High Distance from Scheme: Circa 350m	Penmaenmawr Footpaths 13 and 52 connect to footpath 29/09 in the river valley of the Afon Gyrach and run north to join with the wider footpath network and upland areas of Snowdonia National Park.	The footpaths are sufficiently far enough away from the Scheme for users to be unaffected.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase and Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	

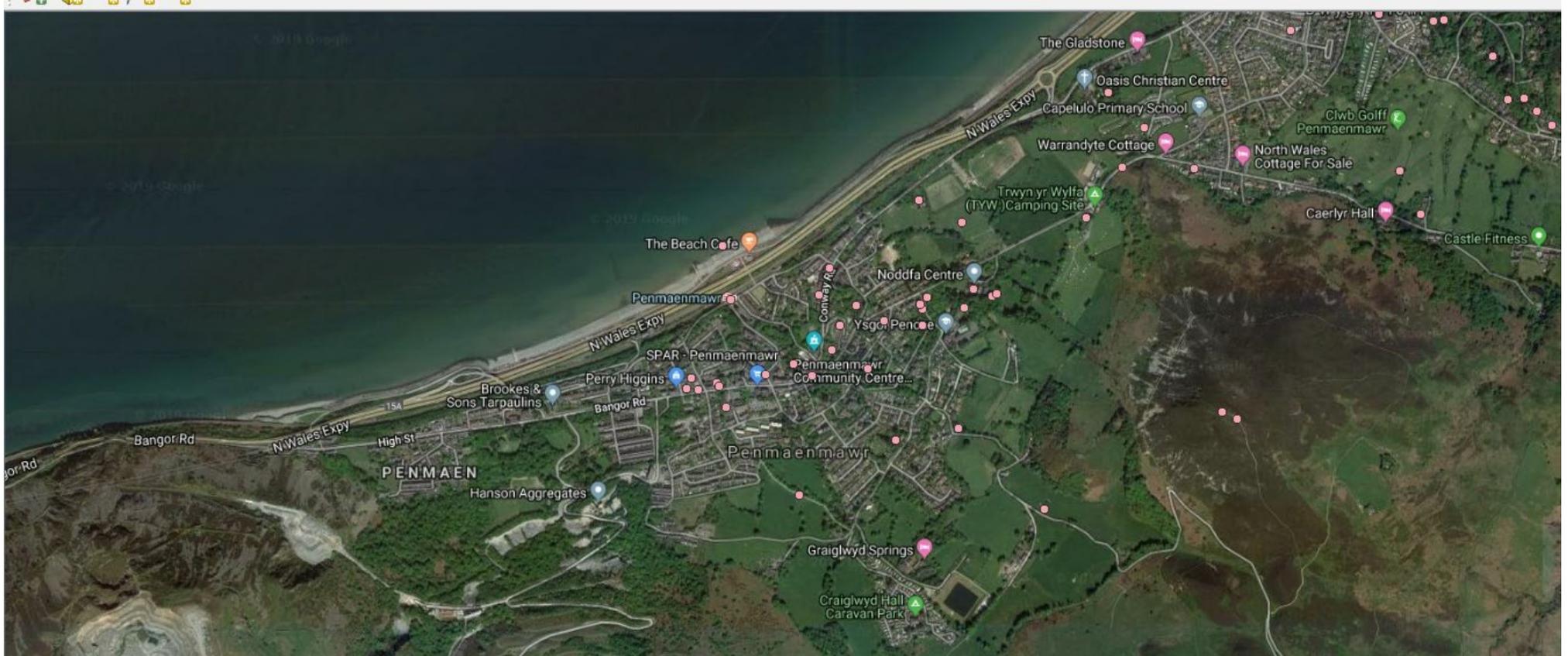
LPA	Land with Public Access (LPA) Description Sensitivity and Distance from Scheme	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/Comments
LPA1	Tan y Foel Cemetery  Sensitivity: Medium Distance from Scheme: Circa 300m	Tan y Foel Cemetery is located on the eastern fringes of Penmaenmawr and overlooks the existing A55 road corridor to the north. Views towards Junction 16 are largely screened by hedgerows and hedgerow trees and roadside vegetation south of Junction 16.	People attending the cemetery would experience no change due to the distance of the Scheme and intervening vegetation. The view would remain unaffected.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase and Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
LPA2	Football Pitches (Phoenix FC)  Sensitivity: Low Distance from Scheme: Circa 120m	The football pitches of Phoenix Football Club lie south east off Conwy Road and south-west of the existing Junction 16. Views to the A55 are currently screened by roadside vegetation planted as landscape mitigation in the 1990's.	Users of the football pitches would remain screened by the roadside vegetation that would be unaffected by the Scheme.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	As per the Construction Phase and Winter Year 1.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
LPA3	Maes y Llan Football Pitch  Sensitivity: Low Distance from Scheme: Within Scheme extents	Maes y Llan football pitch or kickabout area lies immediately adjacent to the residential areas of Maes-y-Llan and Gwel-y-Mor. There are glimpsed views north towards the road corridor and traffic is visible from certain locations within the area. The existing pedestrian footbridge is visible to the north where it crosses the A55.	The Scheme would have a direct impact on the view with significant earthworks to the north being undertaken within the kickabout area resulting in approximately one third of the area being lost. The change in the view would be major adverse during construction and the overall visual effects large adverse  Magnitude: <b>Major Negative</b> Effect: <b>Large Adverse</b>	In Year 1 of opening the false bund to the north of the area would be formed and screen views of passing traffic. There is likely to remain some adverse visual effects until the mitigation planting establishes but this is not considered to be significant as the users of the area would be focussed on recreational activity and the remaining views would remain largely the same. Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	By Year 15 the landscape mitigation would be established and return the view to a similar condition to the existing resulting in no change to users of the space for informal recreation.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	

LRN	Local Road Network and Bus Routes (LRN)	Existing View	Magnitude of Impact and Significance of effect during Construction Phase	Magnitude of Impact and Significance of effect Winter Year 1 (without mitigation)	Magnitude of Impact and Significance of effect Summer Year 15 (with mitigation)	Explanatory Notes/ Comments
LRN/1	Conwy Road  Sensitivity: Low Distance from Scheme: Within Scheme extents	Conwy Road is the main entrance and bus route into the town of Penmaenmawr from the east. Views from the road are largely contained by roadside vegetation with enclosed vistas west being eclipsed by the headland of Penmaen Mawr. The road gradually rises further west towards the town with increasingly open views to the north across the sea towards the coast of Anglesey and Puffin Island and north-east towards the Great Orme.	Views from users of Conwy Road would remain largely unaffected by the Scheme apart from in the vicinity of Junction 16. Here there would-be large-scale impacts and changes in view caused during the construction period. The views affected would be in the context of the existing A55 road corridor and therefore localised and experienced over a short period of time during transit through the works. Wider views would not be significantly affected.  Magnitude: <b>Moderate Negative</b> Effect: <b>Slight Adverse</b>	Year 1 and the Scheme would be complete and operational. Views from users of Conwy Road would not change significantly and would be experienced for a short period of time, the resultant magnitude of change would therefore be therefore negligible.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	Year 15 and the mitigation planting on the cuttings and embankments would be established and users of Conwy Road would have a very similar visual experience to the existing baseline conditions. It is therefore considered there would be no change in the view.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
LRN/2	Ysguborwen Road  Sensitivity: Low Distance from Scheme: Western section within Scheme extents	Ysguborwen Road runs east from Junction 16 into the village of Dwygyfylchi. Views from the road are contained close to the junction by roadside vegetation. Further east the road rises and roadside planting ends to afford open views across the A55 road corridor to the sea beyond with far reaching views to Anglesey, Puffin Island and the Great Orme. These views are lost from the road within the settlement boundary of the village and are largely contained by residential properties either side with glimpsed views of the mountains Penmaen-bach and Allt Wen further east and Penmaen Mawr headland to the west.	Views from users of Ysguborwen Road will remain largely the same as existing apart from during the construction period and between Junction 16 and the village of Dwygyfylchi. Open views to the north would be seriously disrupted during the construction period, similar in many ways to those experienced on Conwy Road (above).  Magnitude: <b>Moderate Negative</b> Effect: <b>Slight Adverse</b>	Year 1 and the Scheme would be complete and operational. Views from users of Ysguborwen Road would not change significantly and would be experienced for a short period of time, the resultant magnitude of change would therefore be therefore negligible. Open views to the north and north-east towards the open sea and the Great Orme would remain. Traffic on the A55 would be screened from view by the false bund but this positive visual effect would not be a significant factor given the low sensitivity of the visual receptor.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	Year 15 and the mitigation planting on the cuttings and embankments would be established and users of Ysguborwen Road would have a very similar visual experience to the existing baseline conditions. It is therefore considered there would be no change in the view.  Magnitude: <b>No Change</b> Effect: <b>Neutral</b>	
LRN/3	Glan yr Afon Road  Sensitivity: Low Distance from Scheme: Within Scheme extents	Glan yr Afon Road is the main road into Dwygyfylchi from Junction 16A. Sections of the road would remain the same as existing on the approaches into the village but would be significantly modified to the north forming connections to the new Junction 16A and link road that will connect to Ysguborwen Road close to Junction 16 further west. Existing views from the road are largely contained by roadside hedgerow with open fields beyond and the backdrop of Snowdonia mountain range beyond.	Users of Glan-yr-Afon Road are likely to experience significant changes in the view during the construction period in the vicinity of Junction 16A. Apart from this localised and short-term change views are would remain similar to the existing baseline scenario. Roadside hedgerows on the approaches to the caravan park would be lost.  Magnitude: <b>Moderate Negative</b> Effect: <b>Slight Adverse.</b>	Following completion of the works in Year 1 of opening, the views from the road would remain largely the same. Roadside hedgerows lost during the Construction Period would be replaced by roadside trees. Existing stone walls boundaries would be replaced.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	As per Year 1.  Magnitude: <b>Negligible</b> Effect: <b>Neutral</b>	

<b>ES Chapter 10 Appendices</b>	
10.1	Location of Designated Sites
10.2	Designated Sites within 5km
10.3	Archaeology and Heritage Desk based Assessment
10.4	Scheduled Monuments in the vicinity of Junction 16
10.5	Geophysical Survey Report
10.6	List of Assets: Value, Impact and Significance

**APPENDIX 10.1**  
**LOCATION OF DESIGNATED SITES**

Appendix 10.1 Junction 16



**APPENDIX 10.2**  
**DESIGNATED SITES WITHIN 5KM**

**Junction 16 Designated Sites within 5km Appendix 2**

<b>Cadw No</b>	<b>Name</b>	<b>Date</b>	<b>GR</b>	<b>SAM</b>	<b>LISTED</b>	<b>Value</b>	<b>Impact</b>	<b>Significance</b>
CN 283	Hut circles at Clip yr Orsedd	Prehistoric	SH 71091 75018	x		High	Negligible	Slight
CN024	Penmaenmawr Stone Circle	Prehistoric	SH 72114 74606	x		High	Negligible	Slight
CN 340	Maen Crwn Standing Stone	Prehistoric	SH 73101 74991	x		High	Negligible	Slight
CN 339	Bryn Derwydd Stone Circle	Prehistoric	SH 73226 75055	x		High	Negligible	Slight
CN353	Cefn Llechen Cairns	Prehistoric	SH 74301 75126	x		High	Negligible	Slight
CN124	Cefn Llechen Stone Circle	Prehistoric	SH 74744 75317	x		High	Negligible	Slight
CN116	Hafotty Standing Stone	Prehistoric	SH 74787 74960	x		High	Negligible	Slight
CN260	Ring Cairn North-West of Llyn y Wrach	Prehistoric	SH 74633 75802	x		High	Negligible	Slight
CN299	Gwern Engan Concentric Enclosed Hut Circle	Prehistoric	SH 75331 76794	x		High	Negligible	Slight
CN215	Hut Circle Settlement at Gwern Engan	Prehistoric	SH 75515 76452	x		High	Negligible	Slight
CN127	Hut Groups N of Cerrig y Dinas	Prehistoric	SH 75348 74143	x		High	Negligible	Slight
CN128	Round Hut 70m S of St Celynin's Church	Prehistoric	SH 75111 73656	x		High	Negligible	Slight
CN125	Caer Bach Hillfort	Prehistoric	SH 74422 72970	x		High	Negligible	Slight
CN317	Ffrith Llwynhwfa Burial Cairn	Prehistoric	SH 74327 72310	x		High	Negligible	Slight
CN157	Early Fields and Dwellings near Maen-y-Bardd	Prehistoric	SH 74134 71962	x		High	Negligible	Slight
CN122	Maen Penddu	Prehistoric	SH 73900 73574	x		High	Negligible	Slight
CN355	Cefn Maen Amor Stone Circle	Prehistoric	SH 73871 73590	x		High	Negligible	Slight



**APPENDIX 10.3**  
**ARCHAEOLOGY AND HERITAGE DESK BASED ASSESSMENT**

## A55 Junction 16

### Archaeology and Heritage Desk Based Assessment

#### 1. Introduction:

This Archaeology and Heritage Desk-Based Assessment has been prepared by Fiona Gale, Consultant Archaeologist, RML Ltd, as part of the assessment process leading to the Environmental Impact Assessment for proposed Junction alteration at Junction 16 on the A55 North Wales.

Fiona Gale is an Associate member of the Chartered Institute for Archaeologists (CIfA).

#### 2. Aims and Objectives:

This assessment has been carried out in accordance with the Chartered Institute for Archaeologists (CIfA) standard definition of a desk-based assessment (Standard and Guidance for Historic Environment Desk-Based Assessment, 2014):

*Desk-based assessment will determine, as far as is reasonably possible from existing records, the nature, extent and significance of the historic environment within a specified area. Deskbased assessment will be undertaken using appropriate methods and practices which satisfy the stated aims of the project, and which comply with the Code of Conduct and other relevant regulations of CIfA. In a development context, desk-based assessment will establish the impact of the proposed development on the significance of the historic environment (or will identify the need for further evaluation to do so), and will enable reasoned proposals and decisions to be made whether to mitigate, offset or accept without further intervention that impact.*

This study examines the cultural heritage potential of the proposed development site and the surrounding area. The aim of the study is to:

- Identify recorded cultural heritage sites within the site boundary and assess its heritage significance/value;
- Identify the potential for previously unrecorded sites to be present within the site;
- Identify potential impacts and mitigation strategies where appropriate; and
- Make recommendations for further work where required.

Cultural heritage within this context includes all buried and upstanding archaeological remains, built heritage sites, historic landscapes and any other features that contribute to the archaeological and historic interest of the area.

This baseline assessment considers the cultural heritage potential within the site itself, the surrounding area and wider local and regional context. This assessment does not attempt to plot and review every archaeological find and monument; rather it aims to examine the distribution of evidence and to use this to predict the archaeological potential of the study area and the likely impact of the development proposals upon those remains.

## Site Description

The A55 is the key route across North Wales, known as the North Wales Expressway it links into the ferry terminal at Holyhead and thus across to Ireland. The route was improved by Thomas Telford in the 1820s, the route has been upgraded to its current Expressway status in the intervening years with the most recent improvements to the east at Conwy/Colwyn Bay and Rhualt Hill in the 1980s and 90s and the west across Anglesey. Junction 16, located at SH 718766 is currently served by a roundabout.

The Site is Coastal the railway and sea to the north and land rising steeply to the south. There is extensive quarrying in the land to the south of the A55, where extremely hard granite has been quarried notably in the 19<sup>th</sup> and 20<sup>th</sup> centuries. In the location of Junction 16 the underlying bedrocks are Nant Ffrancon Sedimentary Siltstones dating to the Ordovician period with overlying glacial tills from the Quaternary. (<http://www.bgs.ac.uk/data/mapViewers/>: accessed March 2019).

## Development Proposals

Junction 16 on the A55 North Wales Expressway is currently served by a roundabout. There are proposals to remove the roundabout and alter the exit to one with slip roads which will extend as far east as Junction 16a. (Appendix 1)

## 3. Methodology

Impact assessment has been carried out through the consideration of baseline conditions in relation to the elements of the scheme that could cause cultural heritage impacts. Baseline conditions are defined as the existing environmental conditions and in applicable cases, the conditions that would develop in the future without the scheme. In accordance with best practice this report assumes that the scheme will be constructed, although the use of the word 'will' in the text should not be taken to mean that implementation of the scheme is certain.

No standardised method of evaluation and assessment is provided for the general assessment of impact significance upon cultural heritage although in May 2017 Cadw issued guidance on '*Heritage Impact Assessment*' particularly applying to listed building, conservation area and scheduled monument when seeking consent for change. Principles outlined in this will be applied here.

Amalgamating guidance from the 'Heritage Impact assessment' and the Secretary of State's criteria for Scheduling Monuments (Scheduled Monument Statement, Annex 1), Design Manual for Roads and Bridges, Volume 11, Part 3, Section 2, HA 208/07 and Transport Analysis Guidance (TAG Unit 3.3.9, Heritage of Historic Resources Sub-Objective) has been used to assess impact. Professional judgment is also used in conjunction with these criteria to undertake the impact assessment.

## Sources Consulted

A study area of a 1km radius from the centre of the proposed development has been examined to assess the nature of the surrounding heritage sites, and to place these sites within their archaeological and historic context. The sources consulted were:

- Gwynedd Regional Historic Environment Record (HER);
- Cadw and Local Planning Authority for designated sites;
- Caernarfonshire Archives;
- Historic mapping and aerial photographs including early Ordnance Survey maps; and LiDAR Data
- Appropriate documentary sources and archaeological journals.  
Including:
  - National Library Wales
  - Royal Commission on Ancient and Historic Monuments Wales

A site walkover survey was undertaken on June 9<sup>th</sup> 2019 to identify potential unrecorded heritage assets within the development site and to assess the suitability for mitigation measures. The site visit also assessed the potential impact of the development upon recorded heritage assets and their settings.

## 4. Legislation and Planning Policy Context

### **Ancient Monuments and Archaeological Areas Act 1979.**

Scheduled Monuments are designated by the Welsh Ministers on the advice of Cadw as selective examples of nationally important archaeological remains. Under the terms of Part 1 Section 2 of the Ancient Monuments and Archaeological Areas Act 1979 it is an offence to damage, disturb or alter a Scheduled Monument either above or below ground without first obtaining permission from the Welsh Ministers. This Act does not allow for the protection of the setting of Scheduled Monuments.

### **Planning (Listed Buildings and Conservation Areas) Act 1990**

The act outlines the provisions for designation, control of works and enforcement measures relating to Listed Buildings and Conservation Areas. Section 66 of the Act states that the planning authority must have special regard to the desirability of preserving or enhancing the character or appearance of Conservation Areas.

### **Historic Environment (Wales) Act 2016**

The Act amends the two pieces of UK legislation — the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990 — that currently provide the framework for the protection and management of the Welsh historic environment. It also contains new stand-alone provisions relating to historic place names; historic environment records and the Advisory Panel for the Historic Environment in Wales. It has three main aims:

- to give more effective protection to listed buildings and scheduled monuments;

- to improve the sustainable management of the historic environment; and
- to introduce greater transparency and accountability into decisions taken on the historic environment.

**Planning Policy Wales Edition 10 Chapter 6 (Distinctive and Natural Places - Historic Environment) December 2018**

Planning Policy Wales, Chapter 6, sets out the policies with regards to the historic environment and planning. The policies also contain guidance for local authorities to consider when developing local plans, including the effect of the re-use or new developments on historic areas and buildings. The policies outline the Welsh Government's objectives to protect, conserve, promote and enhance the historic environment as a resource for the general well-being of present and future generations and specifically to:

- Protect the Outstanding Universal Value of the World Heritage Sites in Wales:
- Conserve archaeological remains, both for their own sake and their role in education, leisure and the economy;
  - Safeguard the character of historic buildings and manage change so that their special architectural and historic interest is preserved;
- Preserve or enhance the character or appearance of conservation areas, whilst the same time helping them remain vibrant and prosperous;
- Preserve the special interest of sites on the register of historic parks and gardens in Wales; and
- Protect areas on the register of historic landscapes in Wales.

The duties of the Welsh Ministers to the historic environment of Wales are exercised through the Welsh Government's historic environment service (Cadw).

Section 6.1 contains advice on development management policies for making informed decisions on any proposed developments that may impact the historic environment. If development is likely to impact archaeological remains, throughout the guidance, the need for early consultation between developers and planning authorities, plus the need for an archaeological assessment to be carried out early in the process is heavily stressed.

The historic environment refers to all surviving physical remains of past human activity. The conservation of archaeological remains is a material consideration in determining a planning application. Where nationally important archaeological remains and listed buildings and their settings are likely to be affected by the proposed development, there should be a presumption in favour of their physical protection *in situ*. In cases involving less significant archaeological remains, local planning authorities will need to weigh the relative importance of the archaeological remains and their settings against other factors, including the need for the proposed development. The needs of archaeology and development may be reconciled if development discuss their proposal with the local planning authority at an early stage in pre-application discussions. Where it is not feasible to preserve remains *in situ*, an acceptable

alternative may be to arrange prior excavation and recording of archaeological remains and the publication of the results by means of granting planning permission subject to a negative condition.

There should be a general presumption in favour for the preservation of Listed Buildings and their settings that may be affected by the proposed development. The primary material consideration is to the statutory requirement to have special regard to the desirability of preserving the building, its setting or any features of special architectural or historic interest it possesses. The continuation or reinstatement of the original use should be the first option, **but** there should be flexibility in order to secure a building's survival or provide it with a sound economic future. Justification for alteration or demolition of Listed Buildings should be provided with applications. Conditions may be imposed for the recording of historic buildings.

There should be a presumption in favour for the preservation or enhancement of the character or appearance of Conservation Areas or their setting. Consideration of proposed developments in a conservation area should be made on the basis of a full application. There will be a strong presumption against the granting of planning permission for proposed developments, including advertisements, which damage the character or appearance of a conservation area or its setting. Preservation or enhancement of a conservation area can be achieved by a development which either makes a positive contribution to an area's character or appearance or leaves them unharmed.

World Heritage Sites and their **settings** (including their buffer zone, if applicable) are a material consideration in determining applications and the impacts of proposals. Cadw is a statutory consultee on planning applications likely to have an impact on the Outstanding Universal Value of a World Heritage Site.

When the local planning **authority** has identified historic assets of local interest, and included a policy in its development plan for their preservation and enhancement, any supporting supplementary planning guidance will be a material consideration when determining a planning application.

In relation to Parks, Gardens, on the first part of the Register of Landscapes, Parks and Gardens of Special Historic Interest, local **planning** authorities should protect and conserves parks and gardens and their settings included on this register. Cadw must be consulted on all planning applications where the proposed development is likely to affect the site of a historic park or garden or its setting, and the effect of the proposed development should be a material consideration in the determination of a planning application.

In relation to Historic Landscapes, on the second part of the register, should be considered by local planning authorities in considering the implications of developments which meet the criteria for Environmental Impact Assessment. Cadw must be consulted on development within a registered historic landscape area that requires an Environmental Impact Assessment.

PPW is underpinned by Technical Advice Note (TAN) 24, The Historic Environment(2017) (<https://gweddill.gov.wales/topics/planning/policy/tans/tan-24/?lang=en> ) and a series of best practice guidance documents which cover the following issues:

Heritage Impact Assessment in Wales

Managing Change in World Heritage Sites in Wales

Managing Change to Listed Buildings in Wales

Managing Change to Registered Historic Parks and Gardens in Wales

Managing Conservation Areas in Wales

Managing Historic Character in Wales

Managing Listed Buildings at Risk in Wales

Managing Lists of Historic Assets of Special Local Interest in Wales

Setting of Historic Assets in Wales

### **Wellbeing of Future Generations Act (Wales) 2015**

The Wellbeing of Future Generations Act (Wales) 2015, which came into force on April 1<sup>st</sup> 2016, requires public bodies to consider not only the present needs of local communities but also how decisions might affect people in the future. There are seven well-being goals identified: A prosperous Wales; A resilient Wales; A healthier Wales; A more equal Wales; A Wales of cohesive communities; A Wales of vibrant culture and thriving Welsh language and A globally responsible Wales. Particularly relevant to the historic environment is the goal concerning ‘A Wales of vibrant culture...’ *A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.*

### **Local Policy and Guidance**

#### **Conwy Local Development Plan 2007 -2022**

The Conwy Local Development Plan (LDP) was adopted in October 2013 and is currently beginning the process of review. The current LDP states:

*STRATEGIC POLICY CTH/1 – CULTURAL HERITAGE The council is committed to protecting and, where appropriate, enhancing its cultural and heritage assets. This will be achieved by:*

*a) Ensuring that the location of new development on both allocated and windfall sites within the Plan Area will not have a significant adverse impact upon heritage assets in line with Policies CTH/2 – ‘Development Affecting Heritage Assets’, DP/3 – ‘Promoting Design Quality and Reducing Crime’ and DP/6 – ‘National Planning Policy and Guidance’;*

*b) Recognising and respecting the value and character of heritage assets in the Plan Area and publishing Supplementary Planning Guidance to guide development proposals;*

*c) Seeking to preserve and, where appropriate, enhance conservation areas, Conwy World Heritage Site, historic landscapes, parks and gardens, listed buildings, scheduled ancient monuments and other areas of archaeological importance in line with Policy DP/6;*

*d) Protecting buildings and structures of local importance in line with Policy CTH/3 – ‘Buildings and Structures of Local Importance’;*

*e) Enhancing heritage assets through heritage and regeneration initiatives;*

*f) Preserving and securing the future of heritage assets by only permitting appropriate enabling development in line with Policy CTH/4 – ‘Enabling Development’; g) Ensuring that development is compatible with the long-term viability of the Welsh Language in line with Policy CTH/5 – ‘The Welsh Language’.*

Policy CTH/2 states

**DEVELOPMENT AFFECTING HERITAGE ASSETS** *Development proposals which affect a heritage asset listed below (a-f), and/or its setting, shall preserve or, where appropriate, enhance that asset. Development proposals will be considered in line with Policy DP/6, where applicable and Policy DP/3.*

- a) Conservation Areas*
- b) Conwy World Heritage Site*
- c) Historic Landscapes, Parks and Gardens*
- d) Listed Buildings*
- e) Scheduled Ancient Monuments*
- f) Sites of archaeological importance*

Policy CTH/3, relating to buildings states:

**BUILDINGS AND STRUCTURES OF LOCAL IMPORTANCE** *Development proposals affecting buildings or structures which make an important contribution to the character and interest of the local area will only be permitted where the building’s distinctive appearance, architectural integrity and its setting would not be significantly adversely affected.*

### **Supplementary Planning Guidance (SPG)**

Associated with the Conwy LDP are a number of supplementary planning guides which set out, in greater detail, the approach to be taken with particular areas of interest. LDP8 (adopted February 2014) relates to Buildings and Structures of Local Importance and the development of a Register of locally important buildings and structures. The SPG provides the criteria for selection of sites which appear on the Register.

[http://spp.conwy.gov.uk/upload/public/attachments/629/Conwy\\_Adopted\\_LDP\\_2007\\_2022\\_English\\_.pdf](http://spp.conwy.gov.uk/upload/public/attachments/629/Conwy_Adopted_LDP_2007_2022_English_.pdf)

SPG LDP14 relates to Conservation Areas and was adopted in July 2015. This document provides generic guidance relating to the approach to development in Conservation Areas and will be itself supplemented by detailed individual Conservation Area Management Plans. [https://spp.conwy.gov.uk/upload/public/attachments/645/LDP14\\_Conservation\\_Areas\\_SPG.pdf](https://spp.conwy.gov.uk/upload/public/attachments/645/LDP14_Conservation_Areas_SPG.pdf)

SPG LDP42 gives detailed guidance for the approach to be taken to development within the World Heritage Site of The Castles and Town Walls of King Edward in Gwynedd and effectively adopts the WHS Management Plan and Action Plan as SPG.

<https://spp.conwy.gov.uk/2017doc.asp?cat=12368&doc=38661>

### **Priorities for the Historic Environment of Wales**

In September 2018 the Welsh Government issued a statement outlining its priorities for the Historic Environment. The introduction notes *'The historic environment is the physical manifestation of Wales' cultural heritage; a precious inheritance that we must care for and pass on to our children to love, cherish and enjoy.....Caring for and appreciating our historic environment is not a marginal activity. It can play a key role in realising wider Welsh Government objectives. It contributes to all four themes of the National Strategy, Prosperity for All, by helping to deliver a more prosperous, active, learning and united nation. It can help underpin the ambitions set out in our Economic Action Plan by recognising the special places that form the backbone of our local economies. But most of all, it is at the heart of our well-being goals and our sense of pride as a nation.....There is now a real opportunity for our outstanding heritage to be positioned at the centre of our future well-being. Heritage contributes so much to so many of our goals: a healthy and active lifestyle, our economic vitality, opportunities for lifelong learning and skills, a sustainable environment and resilient communities. And of course, returning to where I started, the historic environment sits at the very centre of our cultural identity as a nation. It tells the story of Wales' place in the world, from its early beginnings to its role at the heart of the making of the modern world.'*

## **5. Baseline Data**

### **World Heritage Sites**

There are no World Heritage Sites within the immediate environment of Junction 16, however the WHS, The Castle and Town Walls of Edward 1 in Gwynedd, includes Conwy Castle which is five miles to the east and Caernarfon, 19 miles to the west. Despite the relevant proximity of Conwy Castle to the proposed junction alterations, the topography is such that highland separates the two locations and Conwy Castle is not impacted by the A55 as it is currently and this will not change with proposed alterations.

### **Scheduled Ancient Monuments**

There are no scheduled monuments within one kilometre of Junction 16 and the A55 corridor, however to the high land to the south contains a great deal of important prehistoric archaeology, much of which is scheduled. Within two kilometres of the road corridor at Junction 16 there are eight scheduled monuments, all of which are prehistoric and include Hut circles at Clip yr Orsedd (CN 283 Penmaenmawr SJ 71091 75018 ); Penmaenmawr Stone Circle (CN024 Penmaenmawr SJ 72114 74606) and Ring Cairn North-West of Llyn y Wrach (CN260 Henryd SJ 74633 75802). These sites are thought to date to the Bronze Age but there are also groups of hut circles which possibly date to the Iron Age and may have been linked to the now destroyed hillfort of Braich y Dinas. Braich y Dinas in turn was close to the location of the Neolithic Graig Llwyd axe factory.

### Listed Buildings

There are eight listed buildings within one kilometre of the junction and A55 corridor. All are listed at Grade 2 and are post medieval in date. They include Penmaenmawr Railway Station (16520); Horeb Chapel (3155) and the Church of St Seriol (22854). There are also ten buildings on a draft Local list maintained by Conwy Borough Council. (See Appendix 2)

### Conservation Areas

There are four Conservation Areas within the community of Penmaenmawr. The Town Centre area, Pen y Cae, St David's Road and Bell Cottages and Penmaen Conservation Area. Of which parts of two fall within one kilometre of Junction 16 and the road corridor, these are Penmaenmawr Town Centre and Pen y Cae. The Penmaenmawr Town Centre Conservation Area in part butts up to the A55 and railway corridor and the eastern-most boundary of the Conservation Area is within c 300 meters of the western-most extent of the road proposals. (Appendix 2)

### Parks and Gardens

There are no Registered Parks and Gardens within one kilometre of the Junction and A55 corridor and none within the wider area.

### Historic Landscapes

The North Arllechwedd Historic Landscape surrounds the settlement of Penmaenmawr, with part of the northern boundary within 400 metres of Junction 16. The Historic Landscape extends south to Garnedd uchaf in the Carneddau. Historic Landscape Characterisation has taken place across the Historic Landscape and the area close to Junction 16 falls into Area 10, Penmaenmawr/Dwygyfylchi. The characterisation notes that there was little development along the coastal strip until the nineteenth century *'The existing settlements at Penmaenmawr and Dwygyfylchi both expanded rapidly in the nineteenth century. At Penmaenmawr an initial quarry-workers' settlement of 1838 on the newly-built post road grew into a substantial town, housing both holidaymakers and quarry families.'* Samuel Dukinfield Darbishire was responsible for much of the development both quarry cottages for his workers and holiday development for the growing number of visitors brought by the railway, of which he was *'secretary of the Chester and Holyhead Railway Company'*.

### Historic Environment Record Data (see Appendix 2)

#### Prehistoric

Seven sites are noted within one kilometre, unsurprisingly there are two records noting finds of Graig Llwyd polished stone axes (PRN 67645, PRN 67784). Known locally as Pen Granite Graig Llwyd rock is defined as augite granophyre and has been extensively quarried in the nineteenth and twentieth centuries. The remains of quarrying dominate the coast road as you travel west. It was initially quarried in the Neolithic period and is the site of the largest axe factory in Wales. Polished Neolithic stone axes from Graig Llwyd are found across Wales and beyond as far as Peak District, Yorkshire and Midlands. Excavation were carried out here, during

1919-21 and in addition to the large quantity of flakes and roughouts noted across the hillside, five working floors were discovered. More recently Jane Kenney has drawn together and built on the work of Mr David Thomas who has been working in the area for many years.

Bronze Age finds are represented by a burnt mound NE of Allt Wen (727) and also the find of a socketed axe in the Conway Stone quarries, although the exact location is unknown.

Above the small settlement of Dwygyfylchi there is an Iron Age hillfort at Dinas Allt Wen (PRN 713), the entrance of which lies within one kilometre of the development proposals, Hut circles possibly associated with the hillfort are also noted within the study area. Now completely destroyed the hillfort of Braich y Dinas, immediately above Penmaenmawr, was extremely well preserved with large rubble ramparts and at least 90 stone huts surviving. Although described by H Hughes and being the subject of questions in Parliament by local MP Llewelyn Williams in 1909, the site has been completely destroyed by the granite quarrying which is so evident in the landscape today. As late as 1949 elements of its stonework were still surviving.

There is minimal evidence known about Roman activity in this coastal area. The known Roman route between Chester (Deva) and Caernarfon (Segontium) takes an upland route between Conwy and Bangor to avoid having to negotiate the Conwy estuary and coastal cliffs. A Roman coin (PRN 24156) of the house of Constantine was found in a front garden at Dwygyfylchi but it is possible that this was redeposited. The HER record suggests that the hillfort of Dinas Allt Wen is Roman but this is an incorrect attribution and there is no evidence for this.

There is evidence of early Medieval huts in the vicinity of the hillfort of Dinas Allt Wen (PRN 722), now deserted settlements in the area of Dinas Allt Wen and the hill Foel Lûs survive at Llys Helig (PRN 14610) and Dwygyfylchi (PRN 59903) but in both cases are in the higher land to the south of the proposed scheme. Dwygyfylchi Parish Church (PRN 6930) although built in 1760 and extensively altered in 1889 is located on the site of a medieval church first noted in the Norwich taxation of 1254.

The bulk of undesignated sites noted in the HER, within one kilometre of the junction proposals are Post Medieval in date and many relate to the quarrying, including PRN 7875, a WWI German Prisoner of War camp from where the POWs worked in the quarries. Other sites noted are features and buildings within the settlements including a partially demolished Commercial Unit and Garage (PRN 33341), enclosures at Penmaen bach (PRN 5476) and stretches of the old Telford Road (eg PRN 77132). For a full list see Appendix four.

### **Royal Commission Data**

The catalogues of the Royal Commission on Ancient and Historic Monuments Wales (RCAHMW) have been examined. Much of the information repeats sites already noted on the HER. There are more chapels and 19<sup>th</sup>/20<sup>th</sup> century buildings noted but these do not materially alter the information already noted.

The Royal Commission on Ancient and Historic Monuments Wales (RCAHMW) notes on its database, Coflein, a wall associated with a gas works (NPRN 401850) which was recorded as

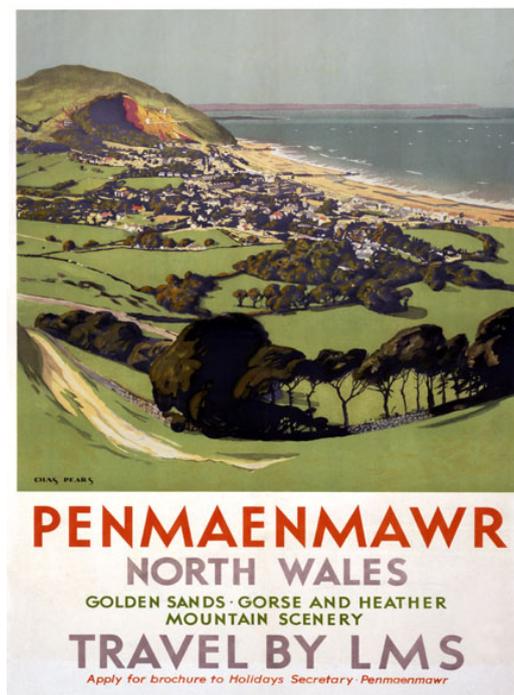
part of emergency works in 2003. The gas works lies almost directly beneath the carriageway of the A55 c 300metres east of the roundabout at Junction 16.

When visiting the RCAHMW Emergency Recording Collection, some information relating to recording work carried out in 2003 on parts of the boundary wall of the Gas works which were extremely close to the roundabout at Junction 16 were examined. These are saved under Catalogue number 42665 and relate to NPRN 401850. The plans and sections show the location of the surviving Gas Works wall and how rock armour and protective work relates to it at SH 273377. The wall in question is to the north of the railway line and from looking at OS maps and aerial photographs (See section 7) the gas works were confined to the south of the railway line. The early maps do however indicate a wall in the area recorded which may rather relate to the railway boundary or to sea defences. (Appendix 3)

### General Discussion

Penmaenmawr has developed in the post medieval period linked to both quarrying and to tourism. Visitors came predominantly once the Railway was in existence and holidaying at the coast became fashionable and accessible. *The Gossiping Guide to Wales* of 1885 says 'Penmaenmawr has so many attractions that the difficulty is where to begin in describing them and where to leave off!. It combines the advantages of sea and mountain in a way which no other watering place in Wales can rival. There are beautiful views from the steps of the bathing machines and from the boats out to sea' it also says 'Penmaenmawr rather resembles Torquay in character.....there are few persons who sojourn at Penmaenmawr who do not leave it with regret.' The Gossiping Guide for 1908 describes £20,000 that the local authority had 'expended' to construct 'a promenade and other improvements'. The main street east west through Penmaenmawr retains a well preserved arcade of shop fronts, which benefitted from the injection of funds from a Townscape Heritage Lottery grant in the 2000s.

LMS Railway poster promoting Penmaenmawr.



Architecture in Penmaenmawr uses both local stone from the Penmaenmawr quarries and brick, easily brought in once the railway existed. Alongside the 19<sup>th</sup> and early 20<sup>th</sup> century development there has been building in the later years of the 20<sup>th</sup> century and early 21<sup>st</sup>, and a sense that many of these residents commute. The historic development of the town is reflected in the number of Conservation Area designations, there are four Conservation Areas in Penmaenmawr.

## 6. Historic Mapping

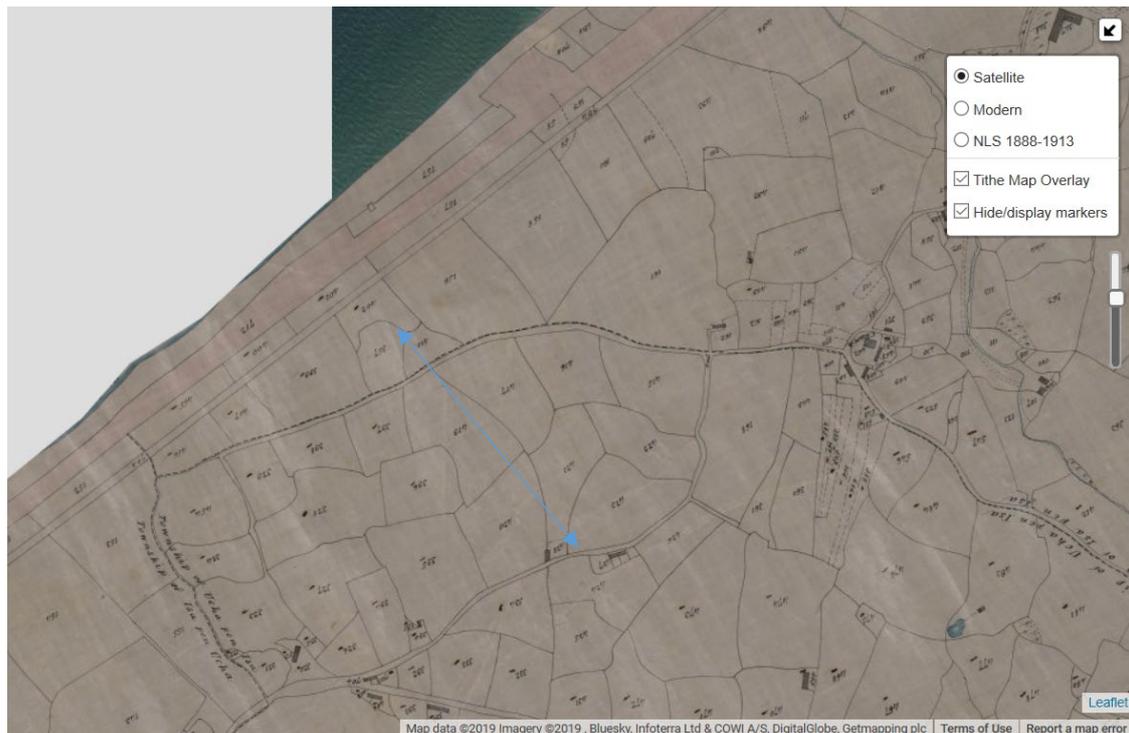
### Enclosure maps and estate maps

In checking the online database of Enclosure Awards compiled by Kain, Chapman and Oliver, there is no records of Enclosure maps and schedules existing for the Penmaenmawr area. Very often in areas where Tithe maps exist Enclosure awards are lacking and vice versa. <http://enclosuremaps.data-archive.ac.uk/search>

### Tithe maps

Payment of Tithes was a long established tradition whereby one tenth of a person's annual produce (crops, stock wool etc) were paid over to support the parish church. Payments in kind had sometimes been negotiated but this often led to disagreements between individual tithe payers and the local clergy. In August 1836 The Tithe Commutation Act was passed by Parliament. The Act established the Tithe Commission. Commissioners were responsible for producing reports on the agricultural potential of each area and for signing off the tithe award for each parish. The Commissioner with responsibility for north Wales was Aneurin Owen. There were no good maps at this time so Commissioners undertook surveys and mapped areas. Linked to the maps was an apportionment document which listed the name of the owner, occupant and size of all fields, often the name of the field was also given and what it was used for. The purpose of the documents was to set rates for the payment of tithe in money not in kind. Tithe maps were all produced between 1838 and 1850.

The Railway came to the north Wales coast in 1847 and this is shown as allocated land in the Tithe maps for the area now covered by Penmaenmawr. The road at this time runs close to the coast between Dwygyfylchi and the eastern side of what is now Penmaenmawr but goes inland to go through the embryonic settlement of Penmaenmawr. In the area of Dwygyfylchi it appears that the field pattern predates the railway and the coast road as, in places, boundaries cross (ie are cut by) the rail and road lines.



#### Location of Junction 16 on Tithe Map 1847

Penmaenmawr itself is small. Much of the land is either owned by Elias Jones or George Thomas Smith. There are the beginnings of activities other than agricultural, there is a building yard and plantation and house and yard occupied by William Jones, as well as a few houses, one marked as 'Shop newydd cottage' occupied by Elizabeth Williams, Goat Inn House (occupied by Robert Williams and demolished in 1988 when the A55 was undergoing alterations) and Cae Ty Popty (occupied by William Jones the same William Jones who owns the building yard). These and a scattering of other properties marked indicate that the settlement of Penmaenmawr itself is beginning to grow.

Eastwards towards the site of Junction 16 and beyond at Dwygyfylchi the Tithe maps shows the area to be predominantly rural. The boundary of the Townships of Ucha pen isa (east) and Isa pen Ucha (west) runs north south just to the immediate east of Junction 16. Land to the west is predominantly agricultural with some of the land owned by Lord Newborough. Much of this area is still open although several of the field boundaries have been lost, and football pitches etc developed. To the east in Ucha pen Isa land ownership is more varied and there are more buildings closer to Dwygyfylchi.

As part of the National Heritage Lottery Funded project Cynefin which put the Tithe maps and apportionments of Wales on line, the community at Dwygyfylchi carried out a lot of research and produced publically available information (The Tithe Maps of Wales Cynefin Mapiau Degwm Cymru: Dwygyfylchi) which acts as an addition to the information available on line. As part of the Cynefin project a local group, the Penmaenmawr Historical Society, researched some of the stories behind the buildings and field patterns visible on the Dwygyfylchi/Penmaenmawr tithe maps. The group looked thematically at the tithe

information and produced a booklet, *Dwygyfylchi*, with information about Farming, Mills and Education.

Dwygyfylchi is an older settlement than Penmaenmawr, the church is shown on the Tithe map as well as a number of buildings and strip fields (quilllets) in the village.

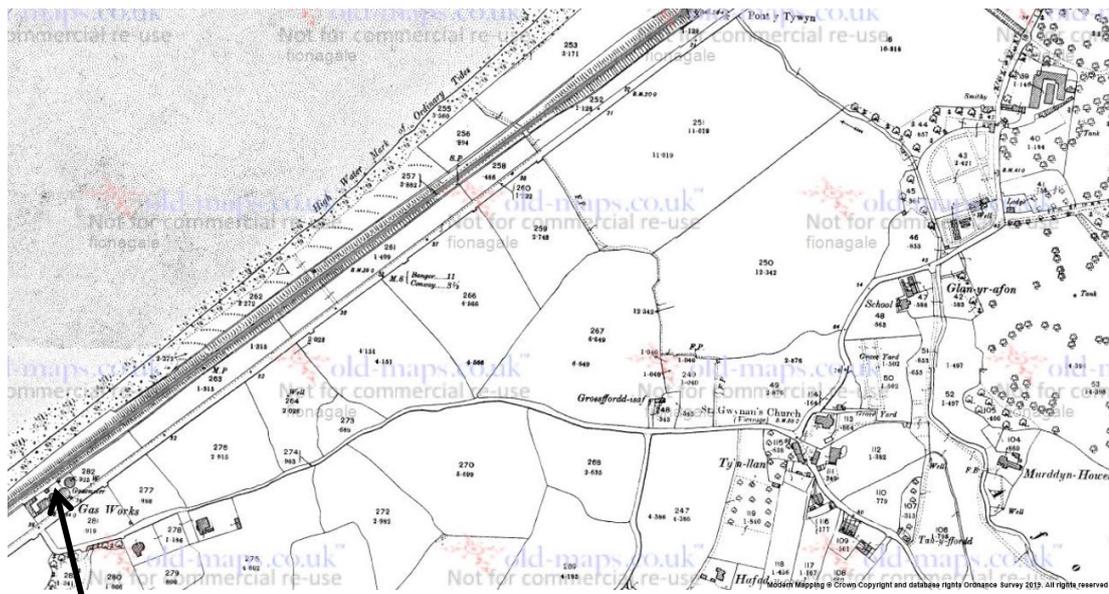
The area adjacent to what is now the A55 and Junction 16a is shown as largely arable although there is a building at the site of Junction 16a. These are noted in the apportionment as the Ship Inn (demolished to make way for the road in the 1980s) and Coal yard, occupied by Margaret Roberts and owned by George Thomas Smith.

<https://places.library.wales/browse/53.284/-3.891/14?page=1&alt=>

### **Ordnance Survey mapping**

The first edition Ordnance survey maps, at 1:2500 scale demonstrate that by the mid 1880s Penmaenmawr was beginning to develop as a 'seaside town'; the railway had been constructed and development along both Conwy Old Road and Bangor Road was growing. There was a large hotel, Penmaenmawr Hotel, just to the south west of the Station in the area which is now between Brynmor Terrace and Station Road West. In the wider area there is much evidence for quarrying and there are two tramway routes down from the quarries to the coast which linked directly into jetties for the transshipment of rock, the tramlines serve several of the quarry workings. The hillfort of Braich y Dinas is shown untouched as yet by the quarries. At Dwygyfylchi the settlement is small with the church, a school and Pendyffryn Hall (now a caravan park) the main development. Between the two settlements on the coast road between the road and the railway the gas works is shown with one gasometer. At what is now Junction 16a a building, possibly a pub or tavern, called the Ship is marked and in the area of what is now the sewage works just to the north west of Junction 16a is a building named Brickfield Cottage and what looks like a small brickworks. The Field pattern in those areas undeveloped now is largely the same as that present in the 1<sup>st</sup> Edition mapping.

Revisions in 1900 show several pools or pits at Brickfield Cottage and what looks to be three separate buildings where the Ship is marked on the 1<sup>st</sup> edition. Dwygyfylchi is little changed, just a few more buildings along Glan yr Afon Road, while the Gas works now has two gasometers. To the west of Junction 16 at this time Penmaenmawr is not greatly different from 2019, there is a little more infill development around the St Seiriol's Church but the open areas, and area around the house Bryn yr Wylfa are similar in 1899, although the garden of Bryn yr Wylfa has been cut into by the modern road.



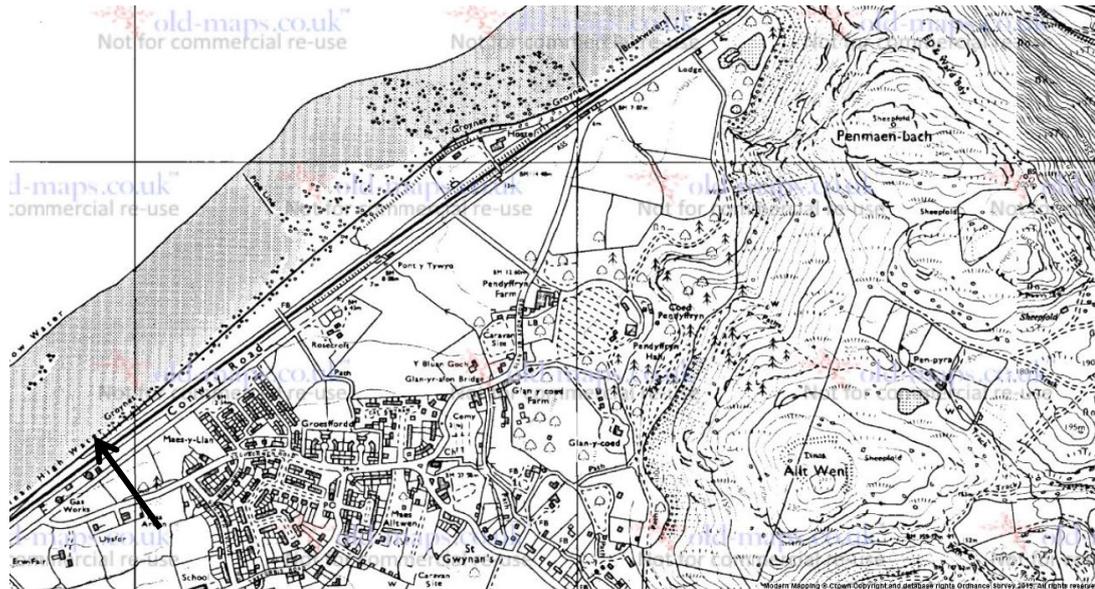
Location of Junction 16 on OS map 1900 (**need to source copy for publication**)

By 1913 Dwygyfylchi has grown a little, Ship Cottages are marked at Junction 16a and the Brickworks looks to be inactive with just Brickfield Cottage still in use. At this time Penmaenmawr Golf Links are marked at Dwygyfylchi where there is still currently a golf course. The eastern edge of Penmaenmawr settlement is very similar to the 1899/1900 layout.

By the 1953 map Dwygyfylchi is beginning to grow. The housing estates of Groesfordd and houses along Treforris Road and Gogarth have been built. Ship Cottages, Brickfield Cottage and the Gas Works appear to have changed little.

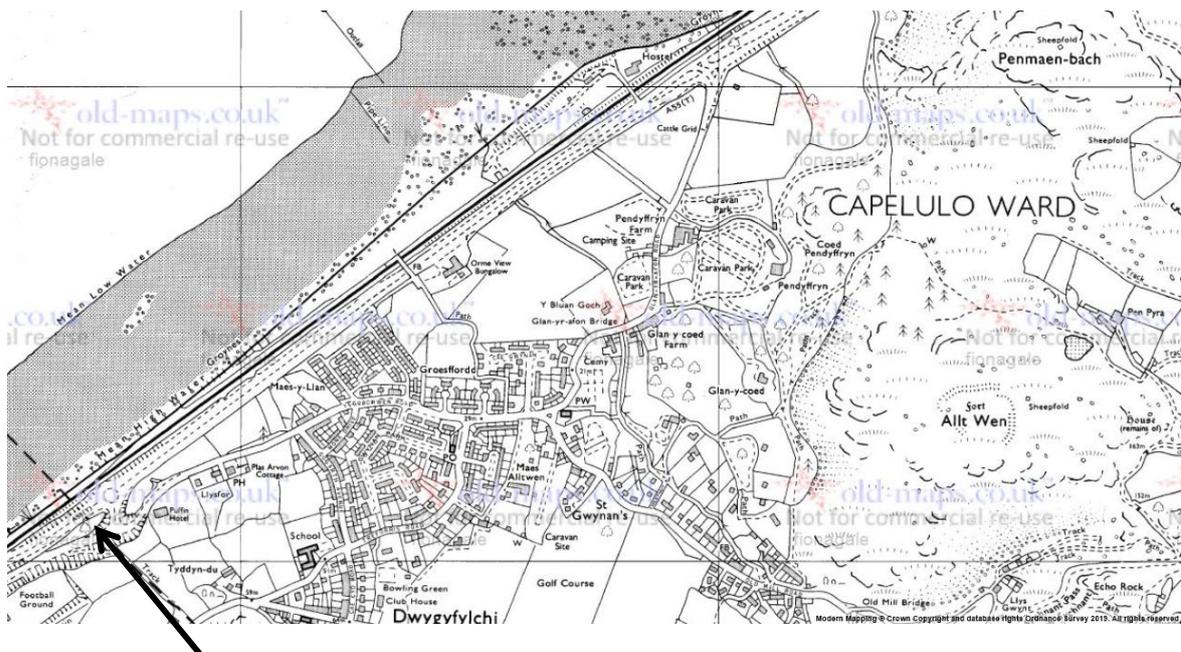
In 1963 the area of Maes y Llan had been built at Dwygyfylchi and it appears that 'pitches' are marked out in the grounds of Pendyfrynn Hall, perhaps the beginnings of the caravan park which is there now. The 1966 1:2500 map shows the infill east of St Seiriol's in the area known as Pen y Cae, to have taken place. At this stage the main coast road still goes through the centre of Penmaenmawr rather than the line parallel to the Railway which it has in 2019.

Maps of the mid 1970s, 1975, show an almost fully developed Dwygyfylchi and Rose Croft, now the Puffin Café, adjacent to the A55 between Junction 16 and 16a. Rosecroft began life as a seafront property, along the coast road, but a coast road which was not the busy A55 it now is. It was later known as Orme View Bungalow and one of the very early Little Chef restaurants opened on the site in the late 1960s, it remained operational until 2007. Ship Cottages and Brickfield Cottage are still upstanding and a Hostel is marked just to the east of Brickfield Cottage. The Gas works are still standing, with two gasometers, one of which is in a different location, and thus a replacement, of one shown on earlier maps.



Location of Junction 16 on 1975 OS map (need to source version that can be used)

The 1992 OS maps show the A55 as it is now, with the roundabout at Junction 16, and associated exit roads. The Gasworks and Ship Cottages have gone, but the Hostel, to the seaward side (north) of the railway just west of Junction 16a is still standing. Pendyffryn Hall is marked as a caravan park and what is now the Puffin Café is marked as Orme View Bungalow. The building Erw Fair, which is shown on the First Edition maps just to the south of the Gas Works, by 1992 is marked as the Puffin Hotel, Coflein notes that Erw Fair ( NPRN 407249) was in use as a Vicarage in 1862 and was converted to a hotel in 1946. The building which has a number of gables and an entrance tower is now in use as a Christian Centre, The Oasis Christian Centre.



Location of Junction 16 on 1992 OS map (need to source version that can be used)

## 7. Aerial Photography

Vertical aerial photographs dating back to the 1940s are held by the RCAHMMW. Those from the 1940s were undertaken by the Royal Air Force (RAF) while those dating to the later decades were commissioned from private companies. The Commission also holds some on shore oblique photographs taken by the RAF in the 1940s and 50s, these are 4" contact prints taken from glass negatives.

Aerial photographs from the following runs were examined:

RAF

Sheet 107, 58/2196 Frames 94-98 and 184-192

Sheet 107, 54/38 Frames 3018- 3025

Sheet 107,CPE/UK/1996 Frames 4102 -4107

OS

84 - 075 Fr 08,09,10,12,13,14,15,16

90 – 045 Fr 06-013

92 – 289 Fr 03 – 013

94 – 336 Fr 20 – 25

Also photographs from Meridian coverage were examined.

Through examination of the aerial photographs it is possible to see the development of Penmaenmawr and the A55. In the early 1940s and 1950s the coastal road is in the same location in the Dwygyfylchi area but rather than following the coast and railway line, the main road through Penmaenmawr is the route. Also at this time there are route ways down from the upland quarries to two jetties on the coast which were used to tranship stone directly onto waiting vessels, these are visible on photographs from the 1940s and 50s, and the Meridian photographs from 1981 although have disappeared by the early 1990s, they are likely to be tramways. In the early photographs (1940s) it is also possible to see active dumping in the area of the football pitch, SH725769, just to the west of the edge of Penmaenmawr and adjacent to the A55 (C.P.E/UK/1996 13 Apr 1947, 4108). The field pattern adjacent to the A55 is very similar to the modern day field pattern, however as time went on some areas of open field were taken into development. It is possible to see housing between the A55 and Ysguborwen Road being built in the immediate post WW2 period, also the development from camping in tents to more permanent static caravan sites for holiday accommodation. Aerial photos of 1990 and 1992 show the construction of the roundabout at Junction 16 and the road along the coastal area. In those from 1990 (045, Frame 013) it is possible to see the construction compound used for the roadworks in the eastern most field, Field 17 in the geophysical survey.

The gasworks, identified through the trawl of heritage data and noted on OS mapping from the first edition, is easy to pick out in the aerial photographs and the gas cylinders are in place at least until the early 1980s as they are visible on Meridian photographs of 17<sup>th</sup> April 1981 (08 81 019), by the time of the construction of the Junction 16 roundabout the sites has gone and the cylinders are no longer visible, although as noted above a section of what is thought to be the boundary wall of the gas works is recorded in 2003 by the RCAHMW.



Aerial Photo 1981 showing gasworks prior to construction of Junction 16 (**need to source permission and better image**)

### **LIDAR Data**

8.1 LiDAR data has been collected for parts of Wales and is available online via Natural Resources Wales. Data at 1m resolution is available for the coastal area of Llanfairfechan. LiDAR data has the potential to highlight previously unknown features which are not visible to the naked eye but may be visible through very small changes

in the local topography. Some of these features can be archaeological and relate to previously undiscovered sites or features.

The LiDAR data in the vicinity of Junction 16 and surrounding area does not indicate the presence of features or anomalies that have not been previously identified either within the Historic Environment Record or by the Geophysical Survey.

## 8. Field Survey

### Initial discussion

A field survey was undertaken on June 16<sup>th</sup> 2019, all open areas in the vicinity of the Junction and proposed alterations were examined. The weather was clear when this survey was undertaken. Much of the open area has been heavily managed in recent years and it was impossible to know whether there are archaeological features present. Areas immediately adjacent to the A55 between and just to the west of Junction 16, and as far east as Junction 16a and beyond were examined. The land use was largely pastoral, grassland for grazing with some areas used as sports pitches ( c SH725769) and some areas 'rough' land close to the A55 (c SH726771) where it was impossible to survey. Overall the boundaries of the fields appear to be relatively modern, possibly replacements. Areas adjoining the stream which flows from Dwygyfylchi and crosses under the A55 to the east of Puffin Café is a more wooded boundary.(Appendix 4)

### Field Survey Results

Very little of note was located during the field survey associated with Junction 16. With just one feature noted in otherwise heavily improved land.

Number	Site Name	Grid Ref SH	Description	Period	Survival	Condition	Significance
001	Dwygyfylchi Track	73257730	Stone edging to track (large rounded boulders Erratics?) leading from a field gate on the road side. Stone edging exist	Post Medieval	Moderate	Fair	Local

(All) Features noted were Post Medieval in date and relate to the modern field system.



Dwygyfylchi track located during field survey

## 9. Geophysical Survey

### Introduction

A geophysical survey across the main accessible open areas associated with Junction 16 was undertaken by Tigergeo during May 2019. Survey was undertaken using GNSS-tracked non-gradiometric arrays of caesium vapour magnetometers on non-magnetic platforms, including handcart and ATV based systems. The full report can be found in Appendix 4. Overall the data quality is high despite the high potential for ferrous contamination throughout. In some fields close to the existing trunk road there is the expected transient interference from passing traffic but this has not unduly limited the potential of the data.

### Results

The non-natural components within the results are limited to former cultivation, land drains, debris, utilities and areas of landfill. Two areas of landfill were previously known but a third has been identified through the geophysical survey (Field 2, 4 (previously unknown) and 13) . There are generally large areas of magnetic debris in the central area close to the village but notably less in the area of Pendyffryn Hall (parts of which are now a caravan park). There is evidence of Ridge and Furrow in several of the fields ( 5,6,9, 15 and 17) and notably Field 14 contains a range of anomalies potentially of interest. There is a reduced field linear (feature 16 in report) may be a field boundary or culvert, two bands or reduced magnetic intensity (features 18 and 19) which do not appear to be natural and may link to features of Pendyffryn Hall, possible land drains (features 27 and 28). There are hints at a possible organised

landscape linking in with Ridge and Furrow? Extensive debris and possible buried steel structure in Field 16 may relate to a circus which was held in this field in 2018, the crop marks of which are visible in a getmapping aerial photograph of 2018, it was also on site in early July 2019. The eastern most field, field 17 has signs of possible ridge and furrow but also a field boundary feature 22) which due to the inclusion of debris within it may not be of any great age. (Appendix 5)

Features identified during the Geophysical survey of Field 2 – 17.

ID	Data Class	Anomaly Class	Form Class	Feature Class	Feature Subclass	Comments	Field
3	TMI	Strong Variable	Area	<b>Debris</b>		<b>Known Landfill</b>	<b>2</b>
4	TMI	Observation	Linear Continuous	<b>Highlight</b>		Field observation - path of stream / water course	<b>2</b>
5	TMI	Strong Variable	Area	<b>Debris</b>		Probable landfill - possible debris from old Gas Works and road destruction/construction	<b>4</b>
6	TMI	Enhanced	Linear Continuous (Group)	<b>Agricultural</b>	<b>Cultivation</b>	Probable ridge and furrow	<b>5</b>
7	TMI	Enhanced	Linear Continuous (Group)	<b>Agricultural</b>		Probable ridge and furrow	<b>9</b>
8	TMI	Enhanced	Linear Continuous (Group)	<b>Agricultural</b>		Probable ridge and furrow	<b>10</b>
9	TMI	Strong Variable	Area	<b>Debris</b>		Possibly debris from surrounding structures or construction / agricultural activity	<b>10</b>
10	TMI	Strong Variable	Area	<b>Highlight</b>		Known road as seen on 1975 OS map	<b>4</b>
11	TMI	Strong Variable	Area	<b>Debris</b>		Possibly debris from surrounding structures or construction / agricultural activity (similar to 9)	<b>11</b>
12	TMI	Strong Variable	Linear Continuous	Utility		Probable Service	<b>13</b>
13	TMI	Strong Variable	Linear Continuous	Utility		Probable Service	<b>13</b>
14	TMI	Strong Variable	Linear Continuous	Utility		Known Service - Sewer	<b>13</b>
15	TMI	Strong Variable	Area	<b>Debris</b>		Known Landfill as seen on 1913 map. It is thought that the stream may once	<b>13</b>

ID	Data Class	Anomaly Class	Form Class	Feature Class	Feature Subclass	Comments	Field
						have flowed below this region	
16	TMI	Reduced	Linear Continuous	Agricultural?	Ditch?	Possible unknown field boundary.	14
17	TMI	Enhanced	Linear Continuous (Group)	Agricultural		See 6, 7 and 8	14
18	TMI	Reduced	Area	Highlight?	?	Uncertain, may be natural but could also be agricultural origin	14
19	TMI	Reduced	Area	Highlight		See 18, this example is slightly less well defined	14
20	TMI	Enhanced	Linear Continuous (Group)	Agricultural		See 6, 7, 8 and 17	15
21	TMI	Strong Variable	Area	Debris		Probable debris from temporary structures and boundaries only seen on 1992 OS maps and 1990 aerial photograph	16
22	TMI	Strong Variable		Fill		Known field boundary as seen on OS maps between 1913 and 1975, appears to be partially filled with modern debris	17
23	TMI	Enhanced	Linear Continuous (Group)	Agricultural	Drain		17
24	TMI	Enhanced	Linear Continuous (Group)	Agricultural		See 6, 7, 8, 17 and 20	17
25	TMI	Reduced	Linear Continuous (Group)	Agricultural	Drain	Similar to 23	17
26	TMI	Strong Variable	Area	Ferrous	Structure	A series of perhaps four underground probable ferrous elements to an unknown structure	16
27	TMI	Enhanced	Linear Continuous	Fill		Possible ditch or land drain	14
28	TMI	Enhanced	Linear Continuous	Fill		Possible ditch or land drain	14

## 10. Potential for previously unrecorded archaeological remains and Potential impacts

There is always the potential for previously unknown archaeological remains to be located. By studying the evidence for previously known information included on the Historic Environment Record, looking at early maps and documents and conducting a geophysical survey, the aim is to minimise this possibility. Dependant on the nature of possible previously unknown features the impact of proposals can range from minimal impact to serious/high impact.

In examining the information from the HER, the historical mapping, the field survey and the geophysical survey it is possible to see a gradual development of the coastal area both in terms of transport, with firstly the railway coming in in the 1840s and then the coast road diverting to hug the coast and the railway in the 1990s and in terms of the building or more structures such that Penmaenmawr grows from a very small and insignificant settlement at the time of the Tithe in the 1840s to both a seaside resort and an industrial settlement exploiting the 'granite' like rock in the hills immediately to the south. This gives a good indication of what to expect from possible below ground archaeological remains.

The geophysical survey in particular identifies below ground anomalies which may have relate to archaeological features below ground. A number of anomalies identified appear to relate to ridge and furrow agricultural activity. The Tithe maps of the 1840s in the Dwygyfylchi area, identify strip fields still in existence at this time, the ridge and furrow may indicate that the areas of strip fields were much more extensive.

A potential problematic area is the sections identified as landfill by the geophysical survey in Fields 2, 4 and 13. These areas have been confirmed by trial pitting and the debris buried ranges in date from late 19<sup>th</sup> century glass bottles through to pre WW2 pottery and in some cases some plastic artefacts. A green glass beer bottle with an embossed hand motif in the glass is marked Allsopp's Ltd who were a Burton on Trent brewer. The company went into receivership in 1913 although revived as Ind Coope and Allsopp in the 1930s. Another larger clear glass bottle is marked Property of T T Roberts Penmaenmawr.

The unknown element is whether there are archaeological features below the landfill sites or whether areas were cleared prior to being used as landfill. In Trial pitting the material below the landfill was predominantly fine, previously undisturbed and unexposed clay. However the Trial pits covered a very small percentage of the total area of these landfill sites. Thus these areas should be explored further as part of the archaeological mitigation which will need to take place. Due to the extent of the landfill and potential risks associated with landfill some of this will not be able to take place until the road scheme design has been finalised and be included during the mitigation phase. The final design of the scheme will be informed by the archaeological and cultural heritage work undertaken as part of the ES as well as the results from the trial pitting and geotechnical examination. Once this is known an approach can be designed in order to test what, if anything, lies below the landfill.

Previously unknown features identified as anomalies within the geophysical survey will be examined by the excavation of archaeological evaluation trenches, prior to the final design of the scheme, such that their nature, date and importance can be assessed and fed into the design process

Ensuring that as part of any development work there is an initial strip of the area and archaeological examination, with follow up recording or excavation as necessary the potential impact on currently unknown archaeology can be controlled and minimised such that preservation by record is ensured.

The impact of the alterations to Junction 16 on known cultural heritage is likely to be related to alterations in the sound of the road as much as direct physical impact. The sound of the road is noticeable at the hillfort of Dinas Alltwen, to the south and east of Dwygyfylchi and within the settlements of Dwygyfylchi and Penmaenmawr.

There are four Conservation Areas in Penmaenmawr; Penmaenmawr Conservation Area, Penmaenmawr (St David's Road) Conservation Area, Penmaenmawr (Penmaenan) Conservation Area and Penmaenmawr (Pen y Cae) Conservation Area. The extent of these Conservation Areas covers much of the central area of Penmaenmawr, demonstrating the quality of buildings within the town, Penmaenmawr benefitted from a Townscape Heritage Initiative, partly Lottery funded project in the 2000s, this project improved buildings particularly within the Town Centre Conservation Area. The Town Centre area abuts up to the A55 but at a distance of 1km west of Junction 16. This impact would be on the setting of the Conservation Areas and largely this would relate to the impact of noise.

There are no Registered Parks and Gardens within the Study area of Junction 16.

Listed buildings in the study area are predominantly of 19<sup>th</sup> century origin although also include the house Brynmor in Panmaenmawr which is noted on the Tithe map. None are likely to be directly physically impacted but a change in sound will impact their setting.

There are no scheduled monuments within the study area but there are a number within five kilometres (Appendix 6). These include a number of prehistoric monuments which are located in the uplands to the south of Penmaenmawr and Junction 16, monuments which are visited a great deal by walkers exploring the prehistoric landscape of the Registered Historic Landscape of North Arllechwedd. The setting of many of these monuments is protected by the topography as they are located south of the upland quarrying areas.

The quarries themselves, although neither listed nor scheduled, do form part of the North Arllechwedd Historic Landscape. The visible quarrying relate to the late Victorian period through to the 1960s however the area was also exploited for stone in the Neolithic period when it was quarried and made into polished axes which are found across Britain. The proposals for Junction 16 are will not directly physically impact on the quarrying remains and there is already an impact from the noise of the A55 and Junction as they are before any proposed alteration. There is a potential impact from a change in the noise from the road brought about by the proposed alteration in layout of the Junction.

## **11. Proposed Mitigation Measures and Recommendations**

An initial phase of archaeological evaluation of some of the key anomalies located as part of the geophysical survey is recommended should take place. In this way it would be possible to understand the nature, date and importance of these features and assess whether they should be preserved *in situ*, fully excavated or rapidly recorded as part of an archaeological scheme of work.

It is recommended that areas identified as landfill should be further examined as part of the mitigation strategy in order to identify whether there is evidence of human activity below or

whether earlier levels were destroyed as part of the establishment of the landfill sites. In this way it would be possible to understand the nature, date and importance of these features and assess whether they should be preserved *in situ*, fully excavated or rapidly recorded as part of an archaeological scheme of work

The results of the above two pieces of work will further inform the design process. Should nationally important remains be located which ideally should be preserved *in situ* the final design should incorporate this. If remains are regionally important it may be necessary to completely excavate them prior to the scheme progressing or rapidly record features as part of an archaeological watching brief alongside development.

As part of the proposed Junction alterations it is recommended that areas of ground which would be affected by new roadways, compounds and other features associated should be stripped of topsoil and an archaeological scheme of works should take place. Incorporated within this would be the recording by excavation of previously unknown features which may come to light. In this way any remains should be preserved by record.

Aside from direct physical impact on the archaeology and cultural heritage, sites located outside the area of this direct physical impact are already impacted by noise coming from the carriageway. This includes impacts on Listed Buildings, SAMs, Conservation Areas, Parks and Gardens and known sites noted on the HER. Proposed alterations to Junction 16 have the potential to change the noise impact on these sites. It is recommended that noise reduction surfacing and screening should be used to both lessen the impact of noise brought about by proposed changes to Junction 16, but also lessen the overall noise generated by the roadway to enhance and improve the setting of these sites. It is proposed that the suggested new long length of slip road would be sited in a false cutting with the aim of minimising both visual and noise intrusion. Such work has the potential to lessen the impact of noise, however noise reducing surfacing on both the slip road and the main carriageway of the A55 would improve the experience of seeing and visiting the sites and improve the experience of these historic settlements.

## **12. Conclusions**

This desk based assessment has been prepared in support of the Environmental Impact assessment relating to proposed changes to Junction 16 on the A55 north Wales.

Data was collected from the HER of the Gwynedd Archaeological Trust as well as other databases and documentary sources to inform the assessment. A geophysical survey and an archaeological walkover survey were completed. There are no scheduled monuments within the study area, 18 listed buildings, 4 conservation areas in Penmaenmawr, no Parks and Gardens noted within the study area and one registered historic landscape.

Non designated recorded heritage assets in the study area range in date from the Neolithic to the Post Medieval periods. Map regression has indicated that as the A55 has developed a number of buildings have been demolished to make way for various phases of road improvements. These include the Ship Inn, close to Junction 16a and a Gasworks immediately to the east of Junction 16.

Geophysical survey has identified anomalies along the line of proposed changes to Junction 16.

Field survey has identified a number of features within the study area.

There is the potential for there to be negative impact upon any below ground remains which may survive within the areas affected by proposed development. Recommendations noted above in Section 10 should be adhered to.

Those sites, both designated and non designated which are not directly impacted physically by proposed changes to Junction 16 have the potential to be impacted visually or more particularly by changes in the noise levels. As noted above in Section 10.5, screening and noise reduction surfacing should be employed to minimise this impact.

## References

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Appendices

Site proposals plan

HER Data

RCAHMW gas Works information

Field Survey Recording Form

Geophysical Survey Report

SAMs within 5 kms

**APPENDIX 10.4**  
**SCHEDULED MONUMENTS IN THE VICINITY OF JUNCTION 16**

## Appendix 10.4 Designated sites

### Scheduled Monuments in vicinity of Junction 15 and Junction 16

#### Hut circles at Clip yr Orsedd CN 283 Penmaenmawr SH 71091 75018

##### Prehistoric

The following provides a general description of the Scheduled Monument. The monument comprises a small, well-preserved unenclosed hut circle settlement of the Iron Age or Romano-British period (c. 800 BC - AD 400). The settlement consists of the foundation walls of three hut circles, which are the foundations of round houses, one displaying an annexe. Also present are several, probably associated, clearance cairns and field banks. It is possible that the hut settlement was contemporary with the period of occupation of a Romano-British period hillfort which stood at Braich-y-Dinas, above Penmaenmawr, which no longer survives. The archaeological significance of the site is enhanced by its survival in an area which was probably well settled during this period, but where remains have not always been preserved. The monument is of national importance for its potential to enhance our knowledge of prehistoric domestic life and social organisation. It retains significant archaeological potential, with a strong probability of the presence of structural evidence and associated archaeological features and deposits, including internal and external floor levels. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.

#### Penmaenmawr Stone Circle CN024 Penmaenmawr SH 72114 74606

##### Prehistoric

The following provides a general description of the Scheduled Monument. An area of the uplands above Penmaenmawr, which contains a dense coverage of prehistoric burial and ceremonial sites. Archaeological Item # CN024A - stone circle A low stony bank, about 1m wide, containing 10-12 stone uprights, encircles a level area 24m in diameter. The tallest uprights are 2m high; there are a number of smaller orthostats, and boulders, lying within the bank; the excavators counted 29 stones which they felt made up the stone circle, but there is evidence that a number of orthostats had been removed in earlier times. An early trackway curves round the N side of the circle, and is considered to be earlier than the circle, perhaps connected with the Graig Lwyd axe factory. Archaeological Item # CN024B - stone circle A bank of loose stone 2-2.5m wide and 0.3m high encircles an area 11.5m in diameter. This circle is situated 146m SW of CN024A, although hidden from it by a fold in the ground. The interior has been fully excavated, as has part of the ring. Archaeological Item # CN024C - stone circle Nine low stones form a rough arc of a circle about 15m in diameter. Three of the stones on the E side have a smaller stone by their side. The S side of the circle, if it is such, lies under the track. A single stone lying E of the arc and others to the N may be a part of the same site. Archaeological Item # CN024D - stone circle/stone setting A group of some 25 stones, now thought to represent an inner circle 3m across, with a linear feature consisting of a double line of uprights on the E side. Archaeological Item # CN024E - mound/cairn An oval mound, 14m long N-S and 10m wide E-W, and about 1m high. A telegraph pole has been erected on the NE side of the mound. Archaeological Item # CN024F - stones Five large boulders forming a rough circle 3m in diameter. The stones vary from 0.3 to 0.6m in height. This site has been excavated, with no major finds. Archaeological Item # CN024G - cairn? Archaeological Item # CN024H - cairn A large cairn 16m in diameter and 2.5m high. The centre of the cairn has been robbed, forming a large hole 5-6m across and 1-1.5m deep. There is a shallow ditch 1m wide, and an external bank 3m wide, around the base of the cairn. Archaeological Item # CN024I - cairn An oval setting of 8 stones 3m by 3.5m. There are gaps on the E and N sides, but the stones are set closely together on the W and S sides. Archaeological Item # CN024J - cairn A mound of grass covered stone 15m across. Five large kerb stones remain on the N side. Archaeological Item # CN024K - cairn A low grass-covered mound, 4.5m across, 0.3m high, very close to Cn024J. There is a suggestion of a slight ditch around it. Archaeological Item # CN024L - cairn? Two arcs of low grassy bank forming an oval, with a hollowed gully or path between them on top of the rounded hill called Moelfre. Previously interpreted as a hollowed cairn. It is about 3m x 2m internally and perhaps of 5.5m diameter overall. The banks are 0.3m high at most from the external ground level. Archaeological Item # CN024M - enclosure A circular feature noted from the air as a low shadow-mark. Although fugitive both from the air and upon the ground, it is nevertheless possible to see on the ground traces of an earthwork enclosure, some 40m in diameter. Its bank, which from the air appears to be about 2m broad, is scarcely perceptible from natural vegetation and hummock, but can be clearly observed up to about 0.25m high where the path deviates from a SW course from the Druid's Circle (CN024A). The monument is of national importance for its potential to enhance our knowledge of prehistoric ritual and funerary

activities. It retains significant archaeological potential, with a strong probability of the presence of associated archaeological features and deposits. The structures themselves may be expected to contain archaeological information concerning chronology and building techniques. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.

### **Maen Crwn Standing Stone CN 340 Penmaenmawr SH 73101 74991**

#### **Prehistoric**

The following provides a general description of the Scheduled Monument. The monument comprises a small, well-preserved unenclosed hut circle settlement of the Iron Age or Romano-British period (c. 800 BC - AD 400). The settlement consists of the foundation walls of three hut circles, which are the foundations of round houses, one displaying an annexe. Also present are several, probably associated, clearance cairns and field banks. It is possible that the hut settlement was contemporary with the period of occupation of a Romano-British period hillfort which stood at Braich-y-Dinas, above Penmaenmawr, which no longer survives. The archaeological significance of the site is enhanced by its survival in an area which was probably well settled during this period, but where remains have not always been preserved. The monument is of national importance for its potential to enhance our knowledge of prehistoric domestic life and social organisation. It retains significant archaeological potential, with a strong probability of the presence of structural evidence and associated archaeological features and deposits, including internal and external floor levels. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.

### **Bryn Derwydd Stone Circle CN 339 Penmaenmawr SH 73226 75055**

#### **Prehistoric**

The following provides a general description of the Scheduled Monument. The monument comprises the remains of a stone circle, probably dating to the Bronze Age (c.2300 BC - 800 BC). It is situated in enclosed pasture and consists of at least five small earthfast stones, set on a slight circular platform. The circle measures about 18m overall. The monument is of national importance for its potential to enhance our knowledge of prehistoric ritual practices. The monument retains significant archaeological potential with a strong probability of associated archaeological features and deposits and forms an important element in the wider prehistoric funerary and ritual landscape. The scheduled area comprises the remains described and an area around them within which related evidence may be expected to survive. It is circular and measures 30m in diameter.

### **Cefn Llechen Cairns CN353 Henryd SH 74301 75126**

#### **Prehistoric**

The following provides a general description of the Scheduled Monument. The monument comprises the remains of two small burial cairns, both probably dating to the Bronze Age (c.2300 BC - 800 BC) and situated within open moorland on the NW-facing slopes of Cefn Lechen. The grass and heather covered stone built cairns are both circular on plan and measure about 5m in diameter and up to 0.6m in height. The cairns have been inventoried as Cefn Lechen cairn A, situated to the SSE; and Cefn Lechen cairn B, situated to the NNW. The cairns have been disturbed in the past, with an exposed stone cist visible in the centre of each. The monument is of national importance for its potential to enhance our knowledge of prehistoric burial and ritual. The monument is an important relic of a prehistoric funerary and ritual landscape and retains significant archaeological potential, with a strong probability of the presence of both intact burial or ritual deposits and environmental and structural evidence, including a buried prehistoric land surface. The scheduled areas comprise the remains described and areas around them within which related evidence may be expected to survive. Area A, centred on Item A (Cefn Lechen cairn A, SH 742 749), is circular and measures 10m in diameter. Area B, centred on Item B (Cefn Lechen cairn B, SH 743 752), is circular and measures 15m in diameter.

### **Cefn Llechen Stone Circle CN124 Henryd CN124 SH 74744 75317**

#### **Prehistoric**

The following provides a general description of the Scheduled Monument. The monument comprises the remains of a stone circle, which probably date to the Bronze Age (c. 2300 - 800 BC). The remains consist of 3 standing stones, the largest being 1.5m x 0.7m, and 3 fallen stones. The circle is about 10m in diameter and is

crossed by a trackway. The monument is of national importance for its potential to enhance our knowledge of prehistoric burial and ritual practices. The features are an important relic of a prehistoric funerary and ritual landscape and retain significant archaeological potential. There is a strong probability of the presence of both intact ritual and burial deposits, together with environmental and structural evidence. Stone circles are often part of a larger cluster of monuments and their importance can be further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.

### **Hafotty Standing Stone CN116 Henryd SH 74787 74960**

#### **Prehistoric**

The scheduled monument comprises the remains of a standing stone, which probably dates to the Bronze Age (c. 2300 - 800 BC). It measures 2.25m high and nearly 0.8m square. The monument is of national importance for its potential to enhance our knowledge of prehistoric burial and ritual practices. It is an important relic of a prehistoric funerary and ritual landscape and retains significant archaeological potential. There is a strong probability of the presence of intact burial or ritual deposits, together with environmental and structural evidence. Standing stones are often part of a larger cluster of monuments and their importance can further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive.

### **Ring Cairn North-West of Llyn y Wrach CN260 Henryd SH 74633 75802**

#### **Prehistoric**

The following provides a general description of the Scheduled Monument. The monument comprises the remains of a large ring cairn of earth and stone, which probably dates to the Bronze Age (c. 2300 - 800 BC). The site is complete and well preserved with intact structural features. The orthostatic construction is undisturbed. The monument is of national importance for its potential to enhance our knowledge of prehistoric burial and ritual practices. The feature is an important relic of a prehistoric funerary and ritual landscape and retains significant archaeological potential. There is a strong probability of the presence of both intact ritual and burial deposits, together with environmental and further structural evidence, including surviving ground surfaces. Ring cairns may be part of a larger cluster of monuments and their importance can be further enhanced by their group value. The scheduled area comprises the remains described and areas around them within which related evidence may be expected to survive. It consists of a circle 24m in diameter centred on the cairn.

#### **Listed Buildings**

	<b>Number</b>	<b>Name</b>	<b>Grade</b>	<b>Easting</b>	<b>Northing</b>	<b>Community</b>	<b>Description</b>
1	16521	Incline Drumhouse at Middle Bank	II	270503	375945	Penmaenmawr	Late C19 counterbalance incline drumhouse; snecked rubble construction with mid-C20 concrete slab roof. The oak drum and steel cables remain in situ between two thick gable walls and the brake mechanism survives externally, though lacking its lever. Apparently one of the incline drumhouses shown on the 1888 OS map.
2	16523	Sett Makers Huts at New Bank	II	271683	375467	Penmaenmawr	Listed as an exceptionally scarce survival of an intact counterbalance incline drumhouse with associated sett makers' huts

3	3554	Glan-yr-Afon Farmhouse	II	269961	374452	Llanfairfechan	Two storeys, white-washed rubble with moderately-pitched slate roof. Two rectangular stone chimneys. Central doorway (boarded door) flanked by 12-pane hornless sashes. Two smaller windows on first floor, horned sashes. House extended to R at full height. Stone steps up to first floor doorway (boarded door), small window (hornless sash) to R; broad opening below to storage room/workshop with timber lintel.
4	16519	Primary Barn at Graiglwyd Farmhouse	II	271922	375787	Penmaenmawr	Late C16 or early C17 box-framed timber barn, encased in rubble probably later C17 or C18, and extended by 2 bays to the N in the C19.
5	16518	Graiglwyd Farmhouse	II	271892	375778	Penmaenmawr	A probable late C17 or early C18 house with earlier (late C16 or early C17) core. At some stage, presumably in the first half of the C19 century, the house was divided into two and the facade received twin entrances, thereby giving the impression of reflected units. Late C19 alterations and additions; presently one house.

**APPENDIX 10.5**  
**GEOPHYSICAL SURVEY REPORT**



## **A55 Junctions 15 and 16 Improvements**

### **Geophysical Survey Report**

(Caesium vapour magnetometry – Archaeology)

Version 1.0

**Project code:** APW191

#### **Produced for:**

Ramboll UK

#### **Lead Author:**

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**6th June 2019**



## A55 Junctions 15 and 16 Improvements

### Digital data

Item and version	Sent to	Sent date
CAD – Vector Elements 1.0	Fiona Gale and Andrew Sumner (RML); Mike Smith (Ramboll)	6 <sup>th</sup> June 2019

### Audit

Version	Author	Checked	Date
Interim			
1.0	ACK Roseveare	ACK Roseveare, MJ Roseveare	6 <sup>th</sup> June 2019

### Project metadata

<b>Project Code</b>	APW191
<b>Client</b>	Ramboll UK
<b>Fieldwork Dates</b>	16-17, 28-30 May 2019
<b>Field Personnel</b>	MJ Roseveare, ACK Roseveare
<b>Data Processing Personnel</b>	J Smith, ACK Roseveare
<b>Reporting Personnel</b>	ACK Roseveare, MJ Roseveare, J Smith
<b>Report Date</b>	6th June 2019
<b>Report Version</b>	1.0

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## **Non-Technical Summary**

A survey was commissioned by Ramboll UK to prospect land near Junctions 15 and 16 of the A55 for buried structures of archaeological interest. Survey was undertaken using GNSS-tracked non-gradiometric arrays of caesium vapour magnetometers on non-magnetic platforms, including handcart and ATV-based systems.

Good coverage of the route was achieved with only very small areas not able to be surveyed, usually through steepness of slopes or in one case, the presence of horses. Little of archaeological interest was seen in the survey data, although relict cultivation was detected in many areas, including on the steeper slopes. A small number of ditch fills seem likely to relate to unknown field boundaries or drainage. In three fields areas of landfill were mapped, two of them previously known but not accurately located and the third a new discovery. There is generally an enhanced quantity of magnetic debris in fields close to Junction 16, i.e. within the vicinity of the Victorian expansion of the village, but this is less evident at Junction 16A except where a previous construction compound is suspected. At Junction 15 the ground was found to be especially magnetic, from natural geological and hydrological causes.



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<b>Drawing</b>	<b>Title</b>
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DWG 02a-f	Magnetic Data - TMI
DWG 03a-f	Interpretation
DWG 04a-f	Interpretation - Vector

## 1 Introduction

TigerGeo was commissioned by Ramboll UK to undertake a geophysical survey of land near junctions 15, 16 and 16a of the A55, near Penmaenmawr and Dwygyfylchi in North Wales.

Survey was undertaken using an array of caesium vapour magnetometers to prospect for buried features possibly of archaeological interest, across multiple fields.

<b>Country</b>	Wales
<b>County</b>	Gwynedd
<b>Nearest Settlement</b>	Llanfairfechan (J15), Penmaenmawr and Dwygyfylchi (J16/16a)
<b>Central Co-ordinates</b>	268600,375370 (J15), 273380,377500 (J16/16a)

### 1.1 Geology

Fields	01	02	03	04-10	11	12-15	16	17
<b>Soilscapes Classification</b>	Freely draining slightly acid loamy soils (class 6)	unclassified (class 29), likely similar to class 13			Freely draining acid loamy soils over rock (class 13)			
<b>Superficial 1:50000 BGS</b>	Till, Devensian – Diamicton (TILLD)						Till, Devensian – Diamicton (TILLD), small area Peat (PEAT)	
<b>Bedrock 1:50000 BGS</b>	Nant Ffrancon Subgroup – Siltstone (NFR)	Conwy Rhyolite Formation – Mudstone (COR)	Conwy Rhyolite Formation – Rhyolite (COR)				Unnamed Igneous Intrusion, Ordovician – Rhyolite (UIIO)	

### 1.2 Other Environmental Factors

Fields	01	02	03	04-06	07-09	10	11	12	13	14	15	16	17
<b>Topography</b>	slopes down to NW	slopes down to NW					gentle slope down to SE (with made ground)		gentle slope down to SW	almost flat	slopes down to SW		
<b>Hydrology</b>	free draining	free draining, culverted stream in 02	free draining	damp, stream	free draining			free draining, stream between 13 and 14		free draining apart from small area (peat) at NW end stream			
<b>Current Land Use</b>	pasture	pasture					recreational	waste ground	pasture				
<b>Historic Land Use</b>	pasture	land fill	mixed agricultural						land fill	mixed agricultural			
<b>Vegetation Cover</b>	short grass	short grass			weedy grass	short grass	weedy grass	short grass					
<b>Sources of Interference</b>	none	fencing	traffic, fencing			none	traffic, electro-magnetic interference E end fields 12 and 13		traffic				

### 1.3 Heritage

The specification prepared by the client (Gale, 2019) contains a summary of the recorded archaeological knowledge (Historic Environment Record):

*In the general vicinity of both Junction 15 and 16 there are a number of archaeological features noted on the Historic Environment Record. On the hills to the south there are many important prehistoric remains (many scheduled). These hills also contain extensive 19th and 20th century quarrying.*

*Little is already known about the areas to be directly impacted by the proposals although first edition maps show a Gas works in the area of Junction 16, Coflein records that part of a wall related to this survives (NPRN 401850 noted in 2003). The HER notes a site, PRN 62369, Convalescent Home which is marked on the first edition Ordnance Survey mapping, as being under the carriageway of the A55 in the area of Junction 15.*

No archaeological information arising from the recent sewer construction in field 13 or housing immediately south of field 11/13 is known of.

#### 1.3.1 Review of Ordnance Survey mapping

Field 01 remains essentially unchanged throughout OS mapping from the 1880s to the current day.

Field 02-03 were truncated by the roundabout construction; field 02 is shown as a tip on the 1975 edition.

The boundaries of fields 04-10 are mostly unchanged. A small stub of old road crosses field 04 and there is a small building or structure (1901 map only) against a boundary crossing this field, which also disappears by 1913. The narrow strip of community garden appears from 1913. A well is marked fairly centrally to fields 07-09 (this is on the current stream course that divides them) in 1901 but not on any later mapping.

Field 12 shows buildings and additional boundaries to rear of Rosecroft / Orme View Bungalow from 1966 (now site of Puffin Cafe). The eastern end of field 13 is shown from 1913 to 1964 as rough ground enclosed by a boundary, approximately coincident with the visible landfill location. The 1913 mapping shows a possible depression within this.

Fields 14 to 17 are unchanged within the survey area, with the exception of additional field boundaries and a small building shown within field 16 on the 1992 edition only.

## 2 Discussion

The following paragraphs represent an interpretive summary of the survey. The numbers in square brackets refer to individual anomalies described in detail in the catalogue below and shown on DWG 03 onwards.

### 2.1 Data Quality and Coverage

Overall the data quality is high and despite the high potential for ferrous contamination throughout. In some fields close to the existing trunk road there is the expected transient interference from passing traffic but this has not unduly limited the potential of the data. In a couple of fields survey stopped slightly short of the road to avoid problems but usually steel sheep mesh fencing and roadside furniture was already becoming evident in the data.

There is some evidence for electromagnetic interference in fields 12 and 13, so close to the Puffin Cafe services, but this area is dominated by strongly magnetic landfill so there has been no effect upon the archaeological result.

Elsewhere there are the usual fencing and buried utilities that have the potential to mask more weakly magnetic sources in their vicinity. Away from these, data quality is high and with moderately high contrast throughout.

### 2.2 Geological Context

The till here is invariably magnetic and soils over it can also be strongly, and usefully, magnetic. At the eastern end, so Junctions 16 and 16a, there is less sign of the magnetic element within the till whereas it dominates the results at Junction 15 below Penmaen Mawr. However, it is still present and provides the dominant character of the natural texture.

At the eastern end, so directly below the slopes of Penmaenbach, the ground once again becomes more magnetic overall, as at Junction 15, suggesting a correlation between this and the harder rock of the northwards projecting spurs. The presence of accumulated hill wash in lower areas may be muting the magnetic character of the till deposits beneath.

Throughout the route the soils seem to be fairly magnetic and the presence of anomalies from ridge and furrow would suggest other negative or cut features would produce detectable anomalies in the absence of magnetising processes like heat.

### 2.3 Land Use and Archaeology by Field

Very few signs of former field layouts were seen and nothing that predates the series of historic OS mapping. In some fields there are weak signs of former ridge and furrow type cultivation and the occasional land drain; examination of satellite imagery suggests the presence of non-magnetic drains in some fields.

There is a large amount of magnetic debris buried within many of the fields, presumably from casual disposal, agricultural practices and material left over from modern house building. There are two known landfills, in fields 02 and 13, plus an unknown one in field 04.

#### 2.3.1 Field 01

The data is here dominated by strongly magnetic till deposits [2] with signs of cross-contour erosion structures, probably from water action over a prolonged period. Such strongly magnetic deposits have been observed elsewhere in Wales where reworking of the till has occurred. A stream, partly piped, may once had varying courses across this field. A pipeline [1] passes just south of the northern field boundary.

Nothing of archaeological interest was seen in this field but small discrete features may not be magnetically detectable against the natural background.

A small area at the northeast end of the field was not surveyed as it is dangerously steep.

### **2.3.2 Field 02**

Most of this field is affected one way or another by a former landfill [3], with waste being apparently buried in rectangular pits or cells. A small stream flows into this, within an area [4] of different magnetic character, before re-emerging near the foot of the slope.

It is unlikely that anything of archaeological interest could be present in this field.

### **2.3.3 Field 03**

Unlike its western neighbour, this field was not part of the former landfill and retains a natural character of moderately magnetic till deposits, much less magnetic than further west, e.g. within field 01. Nothing of interest was seen, although it is notable that this is one of the few fields within the survey to retain at least some of its original boundaries.

The southern part of this field, actually a separate field uphill of a lynchet, contained horses and was not surveyed.

### **2.3.4 Field 04**

The result from this field was a surprise, being dominated by strongly magnetic debris [5] throughout, with the exception of the small detached western area, the other side of the former road [10]. The topographic profile of the field is not what would be expected for this location and it seems likely that at least the raised southern part is a landfill, although of what date and purpose is not known.

### **2.3.5 Fields 05 and 06**

In contrast, field 05 has the expected gently sloping topography and is devoid of strongly magnetic debris, with signs [6] of former ridge and furrow type cultivation.

Field 06 is a narrow strip used as a community garden and could not be surveyed.

### **2.3.6 Fields 07, 08 and 09**

Again in contrast to its neighbour, field 07 is laced with magnetic debris which seems to cross a ditch and small stream into field 09. There is nothing visible in either field, so whether this is material introduced to infill the wet ground, for land improvement in general or just buried debris is not known. It is most prevalent at the highest part of the field, closest to the road and the community garden.

Field 08 was boggy and overgrown and was not surveyed.

In field 09 there are signs of ridge and furrow type cultivation [7], aligned with the present field boundaries that predate the 1800s OS mapping.

### **2.3.7 Field 10**

The upper half of this field is rich in buried magnetic debris [9] for no obvious reason. It extends right across the field so is not from the adjacent houses and maybe also not from their construction. Whether this is another informal rubbish dump, similar perhaps to the upper part of field 07, is uncertain.

In the lower part there is ridge and furrow type cultivation [8] parallel to that in adjacent field 09 and maybe once part of the same cultivated area. Encroachment by housing means it is not possible to be certain whether this is parallel to the original field boundaries. It seems likely that this extended the full length of the field but is hidden by debris.

### 2.3.8 Field 11

Like all the fields, this contains an area of strongly magnetic debris [11], here most likely left over from recent house construction immediately adjacent. Unlike many of the other fields, it contains a linear feature [30] that may be ditch fill and one unrelated to any known former field boundary. It could also be a drain, not least as the fill appears to contain discrete magnetic elements that could be debris.

The goal posts in the field have been moved and the western set appear to have previously been at [31] where the structure to support them remains buried and is probably a pair of steel tubes.

### 2.3.9 Fields 12 and 13

Field 12 has, over the years, been encroached upon, dumped upon and generally modified and when tested for magnetic character was found to be too debris laden to continue survey for archaeological purposes. The northeast end is made ground, extending the ground level of the services in that direction. However, magnetic debris was found everywhere, except a small part of the southwest corner which was instead populated with thorny bushes.

The northern part of field 13 is a known landfill, thought to have been a wartime refuse dump but actually visible plotted on a 1913 OS map so it is clearly older than this. As expected, it is all strongly magnetic [15] and appears to have a northern part and a southern extension bounded by the present earthworks. The stream has been diverted eastwards past this area in antiquity but presumably once flowed in the valley bottom now occupied by the landfill.

Inserted into the landfill is a modern sewer [14] and there may be connections into this at [12] and [13], unless, in the case of [13], this is a separate pipe turning parallel to [14].

There is nothing of obvious archaeological interest visible in the data from the rest of this field.

### 2.3.10 Field 14

This field contains a range of magnetic anomalies potentially of interest, with a reduced field linear [16] that might be an unknown former field boundary (wall footings?) or maybe a drainage structure like a culvert. Parallel to this are signs of former cultivation [17].

In the higher northwest end of the field there are two fairly narrow (4m wide) bands of reduced magnetic intensity [18] and [19], neither of which appear to be natural. Some disruption of the natural soil profile seems to have occurred and their angle precludes any obvious association with present boundaries or land use. They may be of archaeological interest but could also be the line of non-magnetic utilities, e.g. connections to the sewerage works immediately of the field. If not, then it is possible that these are former parkland features associated with Pendyffryn Hall.

A pair of very narrow linear anomalies [27] and [28] may be ditch fills but they could also be land drains, e.g. ceramic pipes. The fact that [27] appears to be parallel to [18] may be relevant given the previous observation that these features do not align with the present field boundaries.

It is not certain whether some of the mostly strongly magnetic discrete sources here may form part of an organised layout, e.g. a shallow curve passing northwards through the central part of the field.

### 2.3.11 Field 15

Nothing of archaeological interest was seen within this field with the exception of an area [20] of former cultivation.

The magnetic texture is here uniform across fields 14, 15 and 16 and all share a similar geomorphological situation of slightly undulating land away, except at the eastern end, from steep slopes. Of all the fields surveyed, these could be considered to have the highest potential for past activity and it is therefore of interest that little has been seen.

There is disruption of the till deposits in the northern part of the field although whether due to extraction or through natural processes is unclear.

### 2.3.12 Field 16

Debris [21] is present across much of this field and it is thought that there was once a construction compound somewhere within it, which might account for some of the material. There is also evidence for buried steel structures at [26] although whether these are also from previous construction is not known.

It seems likely that there is also former cultivation within the field but it is not clear against the background of significantly more magnetic debris. If there are other features of archaeological interest they are likewise not detectable.

### 2.3.13 Field 17

Little of archaeological interest was detected within this field, although there are signs [24] of former cultivation and land drains at [23] and [25].

There is a possible ditch fill at [22], maybe with debris within its fill so possibly not of any great age. There is nothing, e.g. former field boundaries, depicted here on old OS map editions.

## 2.4 Catalogue

ID	Data Class	Anomaly Class	Form Class	Feature Class	Feature Subclass	Comments	Field
1	TMI	Strong variable	Linear - continuous	Utility		Probable service	1
2	TMI	Strong variable	Area	Fill		Area of debris and highly magnetised soils	1
3	TMI	Strong variable	Area	Debris		Known landfill	2
4	TMI	Observation	Linear - continuous	Highlight		Field observation - path of stream / water course	2
5	TMI	Strong variable	Area	Debris		Probable landfill - possible debris from old Gas Works and road destruction/construction	4
6	TMI	Enhanced	Linear - continuous (group)	Agricultural	Cultivation	Probable ridge and furrow	5
7	TMI	Enhanced	Linear - continuous (group)	Agricultural		Probable ridge and furrow, see [6]	9
8	TMI	Enhanced	Linear - continuous (group)	Agricultural		Probable ridge and furrow, see [6] and [7]	10
9	TMI	Strong variable	Area	Debris		Possibly debris from surrounding structures or construction / agricultural activity	10
10	TMI	Strong variable	Area	Highlight		Known road as seen on 1975 OS map	4
11	TMI	Strong variable	Area	Debris		Possibly debris from surrounding structures or construction / agricultural activity, similar to [9]	11

ID	Data Class	Anomaly Class	Form Class	Feature Class	Feature Subclass	Comments	Field
12	TMI	Strong variable	Linear - continuous	Utility		Probable service	13
13	TMI	Strong variable	Linear - continuous	Utility		Probable service	13
14	TMI	Strong variable	Linear - continuous	Utility		Known service - sewer	13
15	TMI	Strong variable	Area	Debris		Known landfill as seen on 1913 OS map. It is thought that the stream may once have flowed below this region	13
16	TMI	Reduced	Linear - continuous	Agricultural?	Ditch?	Possible unknown field boundary	14
17	TMI	Enhanced	Linear - continuous (group)	Agricultural		See [6], [7] and [8]	14
18	TMI	Reduced	Area	Highlight?	?	Uncertain, maybe natural but could also be agricultural origin	14
19	TMI	Reduced	Area	Highlight		See [18], this example is slightly less well defined	14
20	TMI	Enhanced	Linear - continuous (group)	Agricultural		See [6], [7], [8] and [17]	15
21	TMI	Strong variable	Area	Debris		Probable debris from temporary structures and boundaries, only seen on 1992 OS map	16
22	TMI	Strong variable	Linear - continuous	Fill		Known field boundary as seen on OS maps between 1913 - 1975. Appears to be partially filled with modern debris	17
23	TMI	Enhanced	Linear - continuous (group)	Agricultural	Drain		17
24	TMI	Enhanced	Linear - continuous (group)	Agricultural		See [6], [7], [8], [17] and [20]	17
25	TMI	Reduced	Linear - continuous (group)	Agricultural	Drain	Similar to [23]	17
26	TMI	Strong variable	Area	Ferrous	Structure	A series of perhaps four underground probable ferrous elements to an unknown structure	16
27	TMI	Enhanced	Linear - continuous	Fill		Possible ditch or land drain	14
28	TMI	Enhanced	Linear - continuous	Fill		Possible ditch or land drain	14

ID	Data Class	Anomaly Class	Form Class	Feature Class	Feature Subclass	Comments	Field
29	TMI	Strong variable	Area	Debris		Landfill or construction debris	12
30	TMI	Enhanced	Linear - continuous	Fill		Possible ditch or drain	11
31	TMI	Strong enhanced	Discrete (group)	Ferrous	Structure	Base of former goal posts	11

## 2.5 Conclusions

Overall the quantity of anomalies that could represent features of archaeological interest is low and although small discrete features can be masked by the till deposits there are no signs of former field systems or settlement, so no evidence for an organised landscape. There are also no ring ditches or other indicators of funerary practice, although this, if it exists, might be expected more on the higher ground. The hillsides are generally more magnetic than the lower laying land, the latter maybe because of accumulated hill wash over the till, which, remains evident throughout to varying degrees.

The non-natural components within the result are limited to former cultivation, land drains, debris, utilities and areas of landfill. Two of the last were known but not mapped while the third, in field 04, was previously unknown.

There are generally large quantities of magnetic debris in the central area, so close to the village but there is notably less within the former parkland of Pendyffryn Hall. This may suggest that much of the debris is due to informal refuse disposal from the village, something that would not have been happening within the grounds of the Hall.

## 2.6 Caveats

Geophysical survey is reliant upon the detection of anomalous values and patterns in physical properties of the ground, e.g. magnetic, electromagnetic, electrical, elastic, density and others. It does not directly detect underground features and structures and therefore the presence or absence of these within a geophysical interpretation is not a direct indicator of presence or absence in the ground. Specific points to consider are:

- some physical properties are time variant or mutually interdependent with others;
- for a buried feature to be detectable it must produce anomalous values of the physical property being measured;
- any anomaly is only as good as its contrast against background textures and noise within the data.

TigerGeo will always attempt to verify the accuracy and integrity of data it uses within a project but at all times its liability is by necessity limited to its own work and does not extend to third party data and information. Where work is undertaken to another party's specification any perceived failure of that specification to attain its objective remains the responsibility of the originator, TigerGeo meanwhile ensuring any possible shortcomings are addressed within the normal constraints upon resources.

## 3 Methodology

### 3.1 Magnetic Principles

#### 3.1.1 Physical concepts

Magnetic survey for any purpose relies upon the generation of a clear magnetic anomaly at the surface, i.e. strong enough to be detected by instrumentation and exhibiting sufficient contrast against background variation to permit diagnostic interpretation. The anomaly itself is dependent upon the chemical properties of a particular volume of ground, its magnetic susceptibility and hence induced magnetic field, the strength of any remanent magnetisation, the shape and orientation of the volume of interest and its depth of burial. Finally the choice and configuration of measurement instrumentation will affect anomaly size and shape.

Sites present a complex mixture of these factors and for some the causative affects are not known. However, depth of burial and size are usually fairly constrained and background susceptibility can be estimated (or measured). The degree of remanent magnetisation is harder to predict and depends on both the natural magnetic properties of the soil and any chemical processes to which it has been subjected. Fortunately heat will raise the susceptibility of most soils and topsoil tends to be more magnetic than subsoil, by volume.

It is hard to draw reliable conclusions about what sort of geology is supportive of magnetic survey as there are many factors involved and in any case magnetic response can vary across geological units as well as being dependent upon post-deposition and erosional processes. In general a relatively non-magnetic parent material contrasting with a magnetisable erosion product, i.e. one which contains iron in the form of oxides and hydroxides, will allow archaeological structures to exhibit strong magnetic contrast against their surroundings and especially if the soil has been heated or subjected to certain processes of fermentation. In the absence of either, magnetic enhancement becomes entirely reliant upon the geochemistry of the soil and enhancement will often be weaker and more variable.

Analysis of the British Geological Survey (BGS) Geochemical Atlas (G-Base) for total soil iron reveals that for England and Wales 50% of the samples (the interquartile range) lie between 1.9% and 3.6% percentage iron with the median at 2.7%.

The principal magnetic iron mineral is the oxide magnetite which sometimes occurs naturally but is more often formed during the heating of soil. Subsequent cooling yields a mixture of this, non-magnetic oxide haematite and another magnetic oxide, maghaemite. Away from sources of heat, other magnetic iron minerals include the sulphides pyrite and greigite while in damp soils complex chemistry involving the hydroxides goethite and lepidocrocite can create strong magnetic anomalies. There are thus a number of different geochemical reaction pathways that can both augment and reduce the magnetic susceptibility of a soil. In addition, this susceptibility may exhibit depositional patterns unrelated to visible stratigraphy.

Most structures of archaeological interest detected by magnetic survey are fills within negative or cut features. Not all fills are magnetic and they can be more magnetic or less magnetic than the surrounding ground. In addition, it is common for fills to exhibit variable magnetic properties through their volume, basal primary silt often being more magnetic than the material above it due to the increased proportion of topsoil within it. However, a fill containing burnt soil may be much more magnetic than this primary silt and sometimes a feature that has contained standing water can produce highly magnetic silts through mechanical depositional processes (depositional remanent magnetisation, DRM).

A third structural factor in the detection of buried structures is the depth of topsoil over the feature. As fills sink, the hollow above accumulates topsoil and hence a structure can be detected not through its own magnetisation but through the locally deeper topsoil above it. The volume of soil required depends upon the magnetic susceptibility of the soil but just a few centimetres are often sufficient. Such a thin deposit can, however, easily be lost through subsequent erosion by natural factors or ploughing.

#### 3.1.2 Instrumentation

The use of the magnetic sensors in non-gradiometric (vertical) configuration avoids measurement sensitisation to the shallowest region of the soil, allowing deeper structures, whether natural or otherwise to

be imaged within the sensitivity of the instrumentation. This also allows the detection of shallow broad variations in magnetic susceptibility that might have archaeological significance. Suppression of ambient noise and temporal trends is reduced and therefore need reduction during processing.

The theoretical slightly reduced lateral resolution inherent to using non-gradiometric sensor arrays is practically not an issue and especially if processing includes a vertical pseudo-gradient conversion. The non-gradiometric system is thus overall a more capable configuration than the short gradiometers often used for archaeological studies.

Caesium instrumentation has a greater sensitivity than fluxgate instruments, however, at the 10 Hz sampling rate used here this increase in sensitivity is limited to about one order of magnitude. Greater benefit is obtained from a better signal-to-noise ratio meaning that sub-nanoTesla measurement is more practically achieved.

The array system is designed to be non-magnetic and to contribute virtually nothing to the magnetic measurement, whether through direct interference or through motion noise.

## 3.2 Magnetic Survey

### 3.2.1 Technical equipment

<b>Measured variable</b>	Magnetic flux density / nT (Total Magnetic Intensity / nT after removal of regional trend)
<b>Instrument</b>	Array of Geometrics G858 Magmapper caesium magnetometers
<b>Configuration</b>	Non-gradiometric transverse array, ATV towed (4 sensors) and handcart (2 sensors)
<b>Sensitivity</b>	0.03 nT @ 10 Hz (manufacturer's specification)
<b>QA Procedure</b>	Continuous observation
<b>Spatial resolution</b>	1.0m between lines, 0.25m mean along line interval

### 3.2.2 Monitoring & quality assessment

The system continuously displays all incoming data as well as line speed and spatial data resolution per acquisition channel during survey. Rest mode system noise is therefore easy to inspect simply by pausing during survey, and the continuous display makes monitoring for quality intrinsic to the process of undertaking a survey. Rest mode test results (static test) are available from the system.

## 3.3 Magnetic Data Processing

### 3.3.1 Procedure

All data processing is minimised and limited to what is essential for the class of data being collected, e.g. reduction of orientation effects, suppression of single point defects (drop-outs or spikes) etc. The processing stream for this data is as follows:

Process	Software	Parameters
Measurement & GNSS receiver data alignment	Proprietary	
Temporal reduction, regional field suppression	Proprietary	Bandpassed 0.3 – 10.0s
Gridding	Surfer	Kriging, 0.25m x 0.25m
Smoothing	Surfer	Gaussian lowpass 3x3 data (0.75m)

Potential field processing procedures are used where possible on gridded data from the above processing, allowing simulation of vertical gradient data, separation of deep and shallow magnetic sources, etc. The initial processing uses proprietary software developed in conjunction with the multisensor acquisition system. Gridded data is ported as data surfaces (not images) into Manifold GIS for final imaging, contouring and detailed analysis. Specialist analysis is undertaken using proprietary software.

## **3.4 Magnetic Interpretation**

### **3.4.1 Introduction**

Numerous sources are used in the interpretive process, which takes into account shallow geological conditions, past and present land use, drainage, weather before and during survey, topography and any previous knowledge about the site and the surrounding area. Old Ordnance Survey mapping is consulted and also older sources if available. Geological information (for the UK) is sourced only from British Geological Survey resources and aerial imagery from online sources. LiDAR data is usually sourced from the Environment Agency or other national equivalents, SAR from NASA and other topographic data from original survey.

Information from nearby surveys is consulted to inform upon local data character, variations across soils and near-surface geological contexts. Published data from other surveys may also be used if accompanied by adequate metadata.

Interpretation of magnetic data is undertaken using total intensity data, vertical pseudo-gradient and where relevant, shallow field, component models in parallel although for clarity only a subset of these may be presented in the report.

### **3.4.2 The contribution from geology and soils**

On some sites, e.g. some gravels and alluvial contexts, there will be anomalies that can obscure those potentially of archaeological interest. They may have a strength equal to or greater than that associated with more relevant sources, e.g. ditch fills, but can normally be differentiated on the basis of anomaly form coupled with geological understanding. Where there is ambiguity, or relevance to the study, these anomalies will be included in this category.

Not all changes in geological context can be detected at the surface, directly or indirectly, but sometimes there will be a difference evident in the geophysical data that can be attributed to a change, e.g. from alluvium to tidal flat deposits, or bedrock to alluvium. In some cases the geophysical difference will not exactly coincide with the geological contact and this is especially the case across transitions in soil type.

Geophysical data varies in character across areas, due to a range of factors including soil chemistry, near surface geology, hydrology and land use past and present. These all contribute to the texture of the data, i.e. a background character against which all other anomalies are measured.

### **3.4.3 Agricultural inputs**

Coherent linear dipolar enhancement of magnetic field strength marking ditch fills, narrow bands of more variable magnetic field or changes in apparent magnetic susceptibility, are all included within the category of former field boundaries if they correlate with those depicted on the Tithe Map or early Ordnance Survey maps. If there is no correlation then these anomaly types are not categorised as a field boundaries.

Banded variations in apparent magnetic susceptibility caused by a variable thickness of topsoil, depositional remanent magnetisation of sediments in furrows or susceptibility enhancement through heating (a by product of burning organic matter like seaweed) tend to indicate past cultivation, whether ridge-based techniques, medieval ridge and furrow or post medieval 'lazy beds'. Modern cultivation, e.g. recent ploughing, is not included.

In some cases it is possible to identify drainage networks either as ditch-fill type anomalies (typically 'Roman' drains), noisy or repeating dipolar anomalies from terracotta pipes or reduced magnetic field strength anomalies from culverts, plastic or non-reinforced concrete pipes. In all cases identification of a herring bone pattern to these is sufficient for inclusion within this category.

### **3.4.4 Features of archaeological interest**

Any linear or discrete enhancement of magnetic field strength, usually with a dipolar character of variable strength, that cannot be categorised as a field boundary, cultivation or as having a geological origin, is classified as a fill potentially being of archaeological interest. Fills are normally earthen and include an often

invisible proportion of heated soil or topsoil that augments local magnetic field strength. Inverted anomalies are possible over non-earthen fills, e.g. those that comprise peat, sand or gravel within soil. This category is subject to the 'habitation effect' where, in the absence of other sources of magnetic material, anomaly strength will decrease away from sources of heated soil and sometimes to the extent of non-detectability.

Former enclosure ditches that contained standing water can promote enhanced volumetric magnetic susceptibility through depositional remanence and remain detectable regardless of the absence of other sources of magnetic enhancement.

Anything that cannot be interpreted as a fill tends to be a structure, or in archaeological terms, a feature. This category is secondary to fills and includes anomalies that by virtue of their character are likely to be of archaeological interest but cannot be adequately described as fills. Examples include strongly magnetic bodies lacking ferrous character that might indicate hearths or kilns. In some cases anomalies of ferrous character may be included.

On some sites the combination of plan form and anomaly character, e.g. rectilinear reduced magnetic field strength anomalies, might indicate the likely presence of masonry, robber trenches or rubble foundations. Other types of structure are only included if the evidence is unequivocal, e.g. small ring ditches with doorways and hearths. In some circumstances a less definite category may be assigned to the individual anomalies instead.

It is sometimes possible to define different areas of activity on the basis of magnetic character, e.g. texture and anomaly strength. These might indicate the presence of middens or foci within larger complexes. This category does not indicate a presence or absence of discrete anomalies of archaeological interest.

### 3.5 Glossary

Acronym / term	Type	Definition
A	Physical quantity	SI unit Amp of electric current
BGS	Organisation	British Geological Survey
CIfA	Organisation	Chartered Institute for Archaeologists
dB	Physical quantity	Decibel, unit of amplification / attenuation
DRM	Process	Depositional Remanent Magnetisation
EAGE	Organisation	European Association of Geoscientists and Engineers
EGNOS	Technology	European Geostationary Navigation Overlay Service
ERT	Technology	Electrical resistivity tomography
ETRS89	Technology	European Terrestrial Reference System (defined 1989)
ETSI	Organisation	European Telecommunications Standards Institute
EuroGPR	Organisation	European Ground Penetrating Radar Association, the trade body for GPR professionals
G-BASE	Data	British Geological Survey Geochemical Atlas
GeoSoc	Organisation	Geological Society of London, the chartered body for the geological profession
GNSS	Technology	Global Navigation Satellite System
GPR	Technology	Ground penetrating radar
GPS	Technology	Global Positioning System (US)
inversion	process	A combination of forward and backward modelling intended to construct a 2D or 3D model of the physical distribution of a variable from data measured on a 1D or 2D surface. It is fundamental to ERT survey
IP	Physical quantity	Induced polarisation (or chargeability) units mV/V or ms
m	Physical quantity	SI unit metres of distance
mbgl	Physical quantity	Metres below ground level
MHz	Physical quantity	SI unit mega-Hertz of frequency
MS	Physical quantity	Magnetic susceptibility, unitless
mS	Physical quantity	SI unit milli-Siemens of electrical conductivity

Acronym / term	Type	Definition
nT	Physical quantity	SI unit nano-Tesla of magnetic flux density
OFCOM	Organisation	The Office of Communications, the UK radio spectrum regulator
Ohm	Physical quantity	SI unit Ohm of electrical resistance
OS	Organisation	Ordnance Survey of Great Britain
OSGB36	Data	The OS national grid (Great Britain)
OSTN15	Technology	Current coordinate transformation from ETRS89 to OSGB36 co-ordinates
RDP	Physical quantity	Relative Dielectric Permittivity, unitless
RTK	Technology	Real Time Kinematic (correction of GNSS position from a base station)
s	Physical quantity	SI unit seconds of time
TMI	Physical quantity	Total magnetic intensity (measured flux density minus regional flux density)
TRM	Process	Thermo-Remanent Magnetisation
V	Physical quantity	SI unit Volt of electric potential
WGS84	Data	World Geodetic System (defined 1984)

### 3.6 Selected reference

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- Gale, F, 2019, "Geophysical survey specification A55 J15 J16" unpublished specification
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- Scollar, I, 1990, "Archaeological Prospecting and Remote Sensing", Topics in Remote Sensing 2, Cambridge University Press
- Tarling, D H, *et al*, (ed.), 1999, "Palaeomagnetism and Diagenesis in Sediments", Geological Society, London, Special Publications, 151
- Telford, W M, *et al*, 1990, "Applied Geophysics", 2<sup>nd</sup> Edition, Cambridge University Press

### 3.7 Archiving and dissemination

An archive is maintained for all projects, access to which is permitted for research purposes. Copyright and intellectual property rights are retained by TigerGeo on all material it has produced, the client having full licence to use such material as benefits their project. Where required, digital data and a copy of the report can be archived in a suitable repository, e.g. the Archaeology Data Service, in addition to our own archive.

The archive contains all survey and project data, communications, field notes, reports and other related material including copies of third party data (e.g. CAD mapping, etc.) in digital form. Many are in proprietary formats while report components are available in PDF format.

The client will determine the distribution path for reporting, including to the end client, other contractors,

local authority etc., and will determine the timetable for upload of the project report to the OASIS Grey Literature library or supply of report or data to other archiving services, taking into account end client confidentiality.

TigerGeo reserves the right to display data rendered anonymous and un-locatable on its website and in other marketing or research publications.

## 4 Supporting information

### 4.1 Standards and quality (archaeology)

TigerGeo is developing an Integrated Management System (IMS) towards ISO certification for ISO9001, ISO14001 and OHSAS18001/ISO45001 and has appointed Alan Ward of Bigfoot Services Limited as our ISO/HSE Technical Advisor. For work within the archaeological sector TigerGeo has been awarded CIfA (Chartered Institute for Archaeologists) Registered Organisation status.

A high standard of client-centred professionalism is maintained in accordance with the requirements of relevant professional bodies including the Geological Society of London (GeoSoc) and the Chartered Institute for Archaeologists (CIfA). Senior members of TigerGeo are professional members of the GeoSoc (FGS), CIfA (MCIfA & ACIfA grades) and other appropriate bodies, including the European Association of Geoscientists and Engineers (EAGE) Near Surface Division (MEAGE) and the Institute of Professional Soil Scientists (MISoilSci).

In addition TigerGeo is a member of EuroGPR and all ground penetrating and other radar work is in accordance with ETSI EG 202 730.

The management team at TigerGeo have over 30 years of combined experience of near surface geophysical project design, survey, interpretation and reporting, based across a wide range of shallow geological contexts. Added to this is the considerable experience of our lead geophysicists in a variety of commercial and academic roles. All geophysical staff have graduate and in many cases also post-graduate relevant qualifications pertaining to environmental geophysics from recognised centres of academic excellence.

During fieldwork there is always a fully qualified (to graduate or post-graduate level) supervisory geophysicist leading a team of other geophysicists and geophysical technicians, all of whom are trained and competent with the equipment they are working with. Data processing and interpretation is carried out by a suitably qualified and experienced geophysicist under the direct supervision and guidance of the Senior Geophysicist. All work is monitored and reviewed throughout by the Senior Geophysicist who will appraise all stages of a project as it progresses.

Data processing and interpretation adheres to the scientific principles of objectiveness and logical consistency. A standard set of approved external sources of information, e.g. from the British Geological Survey, the Ordnance Survey and similar sources of data, in addition to previous TigerGeo projects, guide the interpretive process. Due attention is paid to the technical constraints of method, resolution, contrast and other geophysical factors.

There is a strong culture of internal peer-review within TigerGeo, for example, all reports pass through a process of authorship, technical review and finally proof-reading before release to the client. Technical queries resulting from TigerGeo's work are reviewed by the Senior Geophysicist to ensure uniformity of response prior to implementing any edits, etc.

Work is undertaken in accordance with the high professional standards and technical competence expected by the Geological Society of London and the European Association of Geoscientists and Engineers.

All work for archaeological projects is also conducted in accordance with the following standards and guidance:

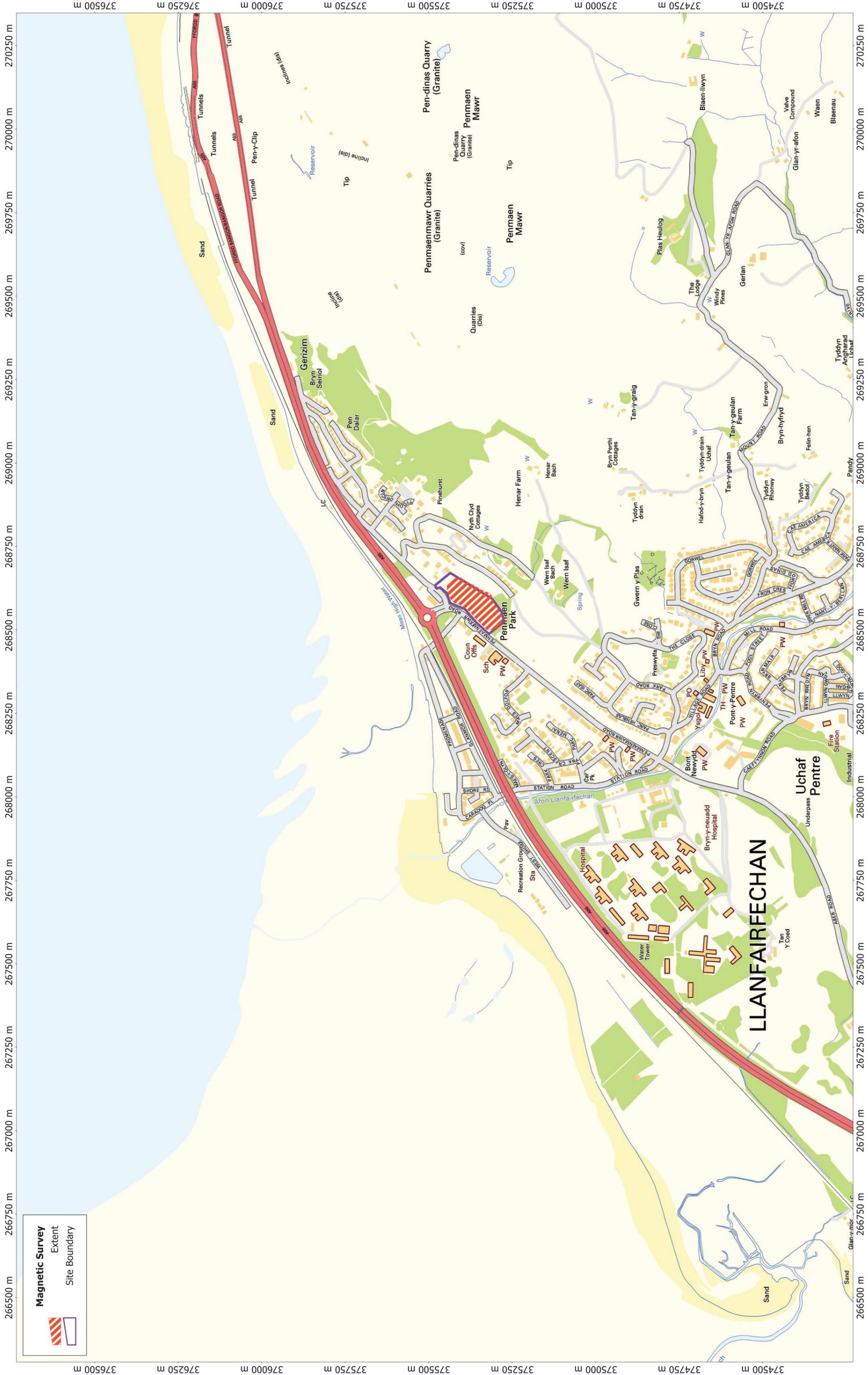
- David et al, "Geophysical Survey in Archaeological Field Evaluation", English Heritage, 2008;
- "Standard and guidance for Archaeological Geophysical survey", Chartered Institute for Archaeologists, 2014 (Updated 2016);

and TigerGeo meets with ease the requirements of English Heritage in their 2008 Guidance "Geophysical Survey in Archaeological Field Evaluation" section 2.8 entitled "Competence of survey personnel".

## 4.2 Key personnel

<b>Martin Roseveare, MSc BSc(Hons) MEAGE FGS MCIfA</b>	<b>Senior Geophysicist, Director</b>
<p>Martin specialised (MSc) in geophysical prospecting for shallow applications and since 1997 has worked in commercial geophysics. Elected a GeolSoc Fellow in 2009 he is now working towards achieving CSci. A member of the European Association of Geoscientists &amp; Engineers, he has served on the EuroGPR and CIfA GeoSIG committees and on the scientific committees of the 10th and 11th Archaeological Prospection conferences. He has reviewed papers for the EAGE Near Surface conference, was a technical reviewer of the Irish NRA geophysical guidance and is a founding member of the ISSGAP soils group. Professional interests include the application of geophysics to agriculture and the environment, e.g. groundwater and geohazards. He is also a software writer and equipment integrator with significant experience of embedded systems.</p>	
<b>Anne Roseveare, BEng(Hons) DIS MISoilSci</b>	<b>Operations Manager, Environmental Geophysicist - Data Analyst</b>
<p>On looking beyond engineering, Anne turned her attention to environmental monitoring and geophysics. She is a Member of the British Society of Soil Science (BSSS) and has specific areas of interest in soil physics &amp; hydrology, agricultural applications and industrial sites. Amongst other contributions to the archaeological geophysics sector over the last 18 years, Anne was the founding Editor of the International Society for Archaeological Prospection (ISAP) and is a founding member of the ISSGAP soils group. Specifications, logistics, safety, data handling &amp; analysis are integral parts of her work, though she is happily distracted by the possibilities of discovering lost cities, hillwalking and good food.</p>	
<b>Jennifer Smith, MSc</b>	<b>Fieldwork Manager, Environmental Geophysicist</b>
<p>Jen developed an interest in all aspects of topographical and geophysical survey whilst studying for a MSc in Archaeological Science at the University of Bristol. During her studies she obtained valuable experience in the use of and data analysis for various terrestrial geophysical techniques as well as develop her interest further by adding marine geophysical techniques to her working theoretical knowledge. She has worked as a near-surface geophysicist within archaeology for several years and has developed a good knowledge of UK geology. Outside of work, Jen is currently learning Java code but is easily distracted by keeping fit, exploring the world or some other hobby.</p>	
<b>Daniel Lewis, MA BA(Hons) ACIfA</b>	<b>Consultant Archaeologist</b>
<p>Daniel studied archaeology at the University of Nottingham and worked in field archaeology for many years, managing urban and rural fieldwork projects in and around Herefordshire. When the desk became more appealing he jumped into the world of consulting, working on small and large multi-discipline projects throughout England and Wales. At the same time, he returned to University, gaining an MA in Historic Environment Conservation. With over 15 years' experience in the heritage sector, Daniel has a diverse portfolio of skills. Here he ensures that geophysical work within the heritage sector is well grounded in the archaeology. His spare time includes much running up mountains</p>	
<b>Luigi Benente, MSc</b>	<b>Consultant Environmental Geophysicist</b>
<p>Luigi is an experienced geologist specialized in geophysics, who gained a blend of practical and technical experience within explorations carried out in Italy, Peru, Colombia, Ecuador, Mexico, Uzbekistan, Thailand and Nigeria. Resourceful and hardworking with a positive attitude in problem solving, he has the ability to lead a team through challenging tasks, organizing people and equipment in order to hit the goal in safety and with time conscious professionalism. He is attracted to discover hidden things within the earth and after celebrating with friends, good wine, good beer and lots of food he is able to repair most broken things...</p>	
<b>Alexandra Gereaa, MSc, BSc, PhD Candidate</b>	<b>Geophysical Processor &amp; Analyst</b>

Alexandra has a BSc in Geophysics and an MSc in Applied Geo-biology and started a PhD in the UK after living in Portugal for six months working on her master's degree. Since 2008 she has used most mainstream processing applications across electrical, magnetic and radar methods. She combines a love of nature and science and is currently studying plant roots in agricultural environments using geophysical methods. When not doing that she enjoys travelling, hiking, nature, yoga, books, foreign languages and cats. Two years ago she found a passion for electronics and started building different devices including intelligent gardening systems and coding in Python.



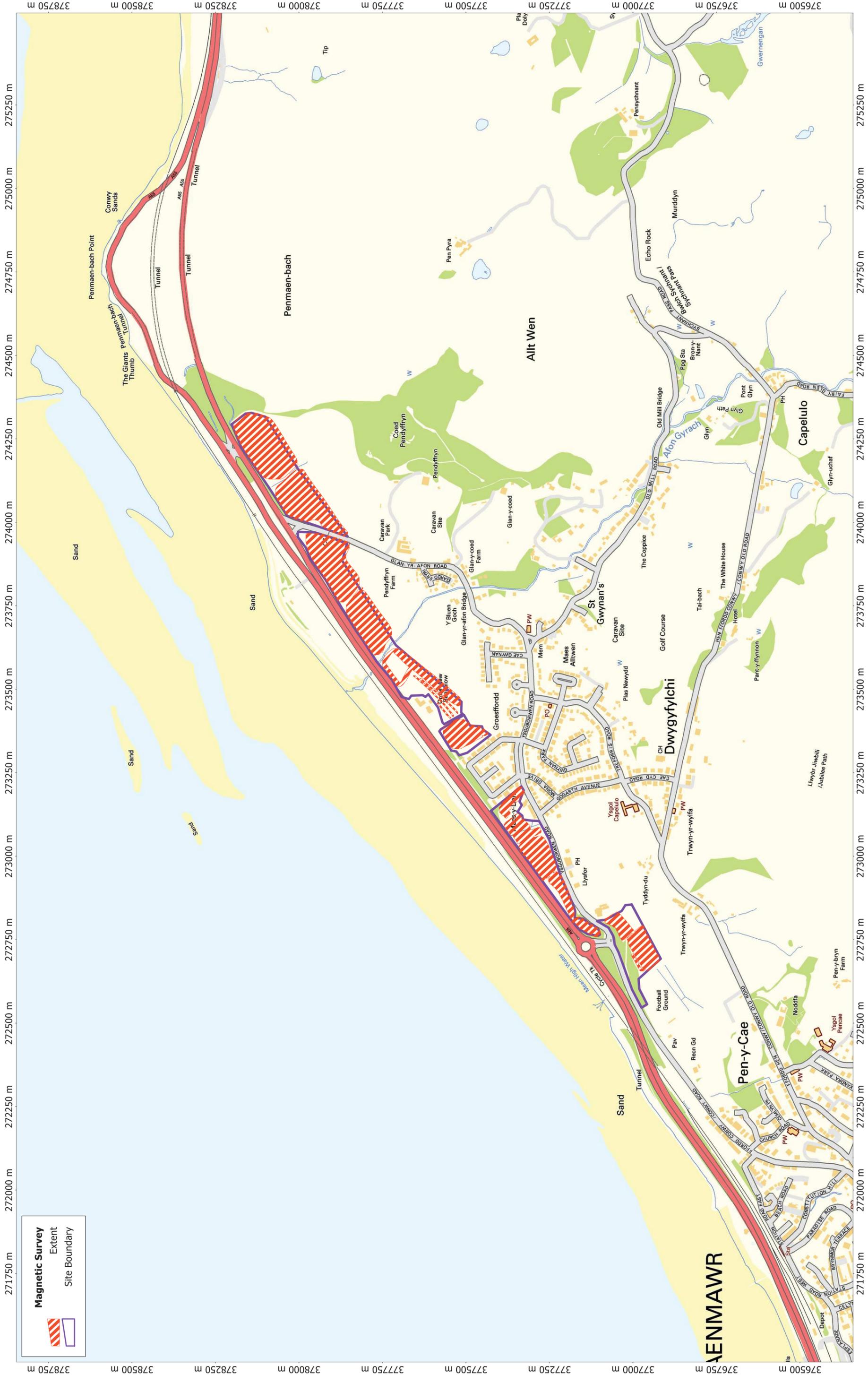
**Magnetic Survey**

- Extent
- Site Boundary

**APW191 A55 Junctions 15 and 16 Improvements  
DWG 01a Location J15**

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DWG 01b Location J16

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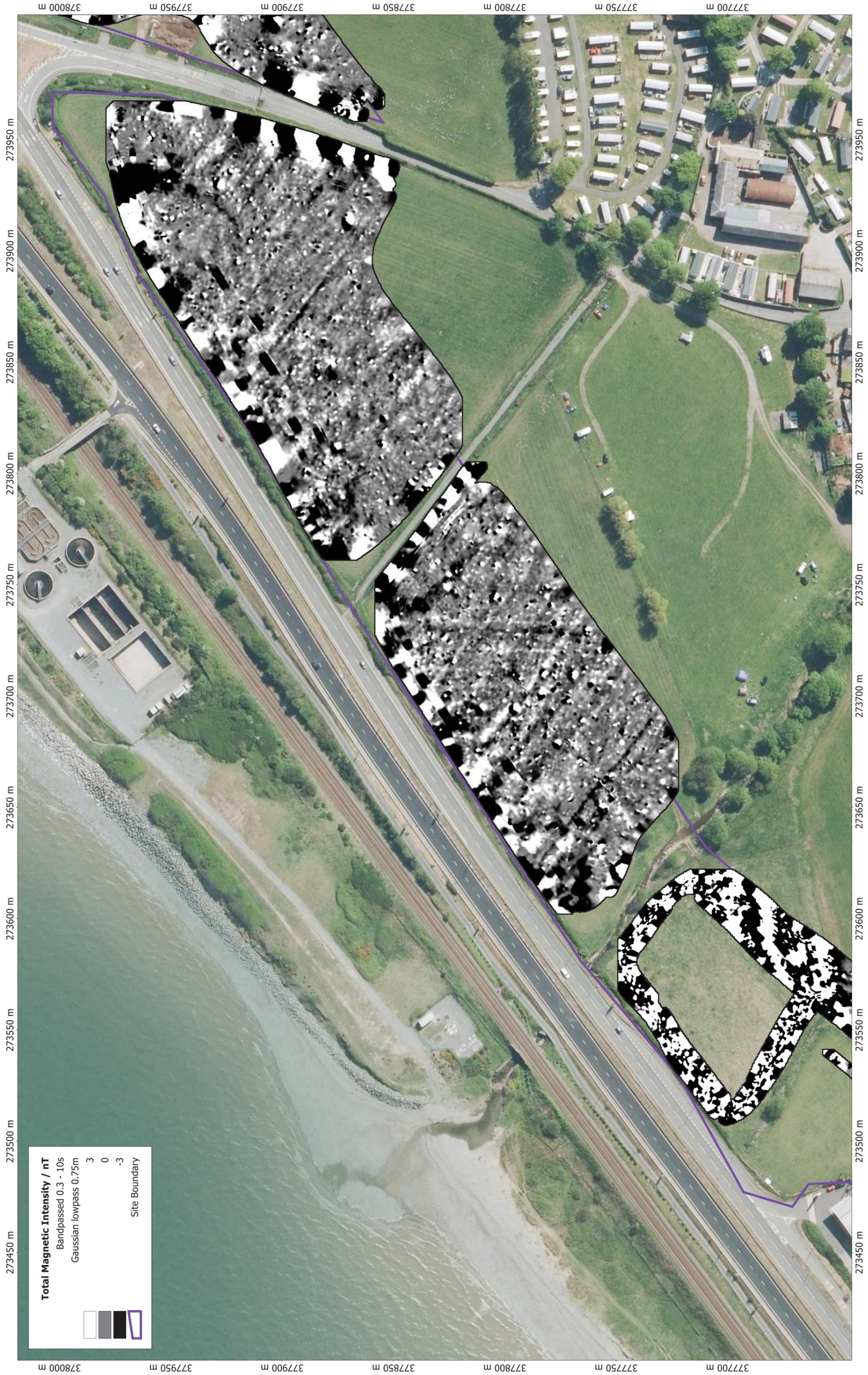
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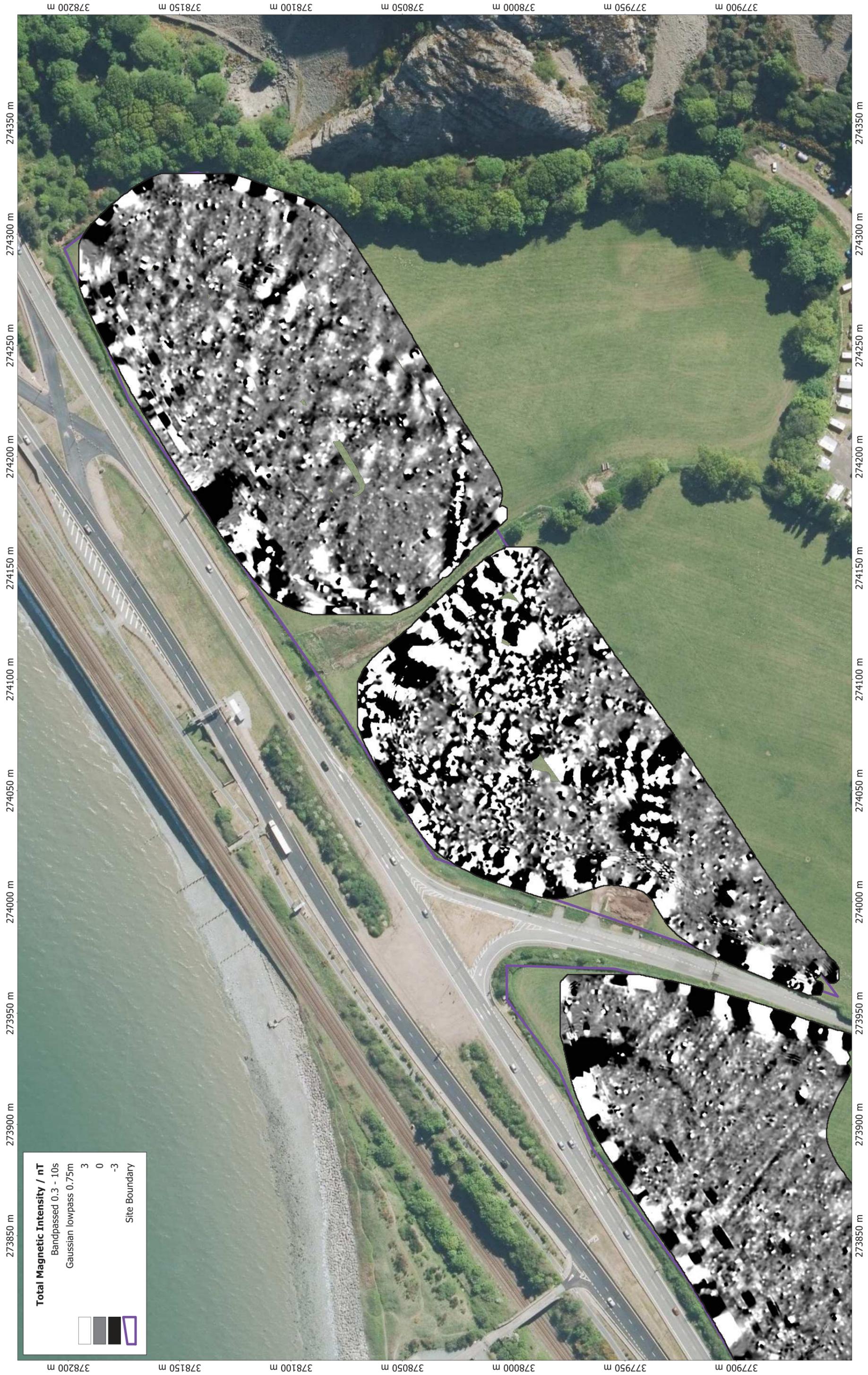
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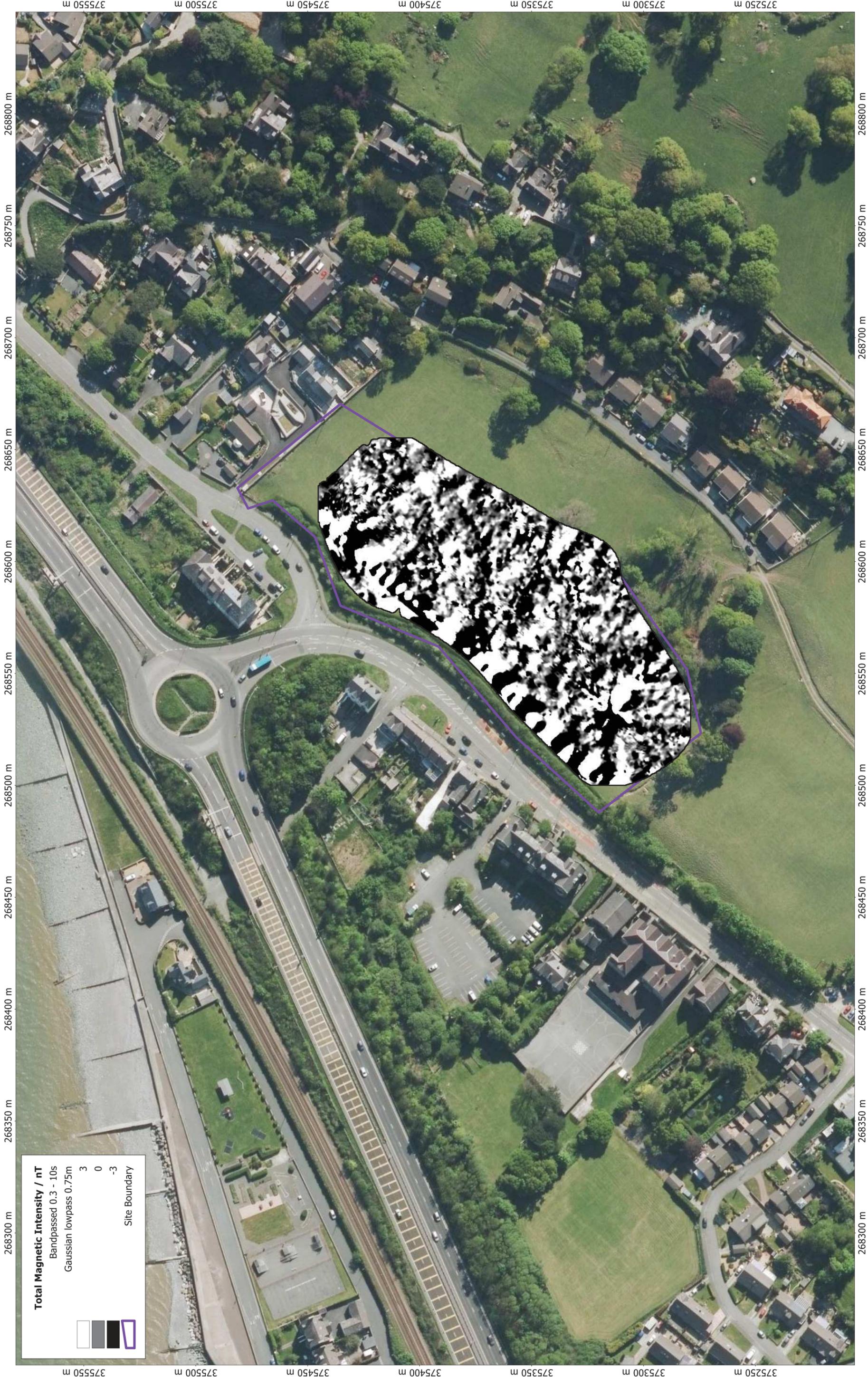
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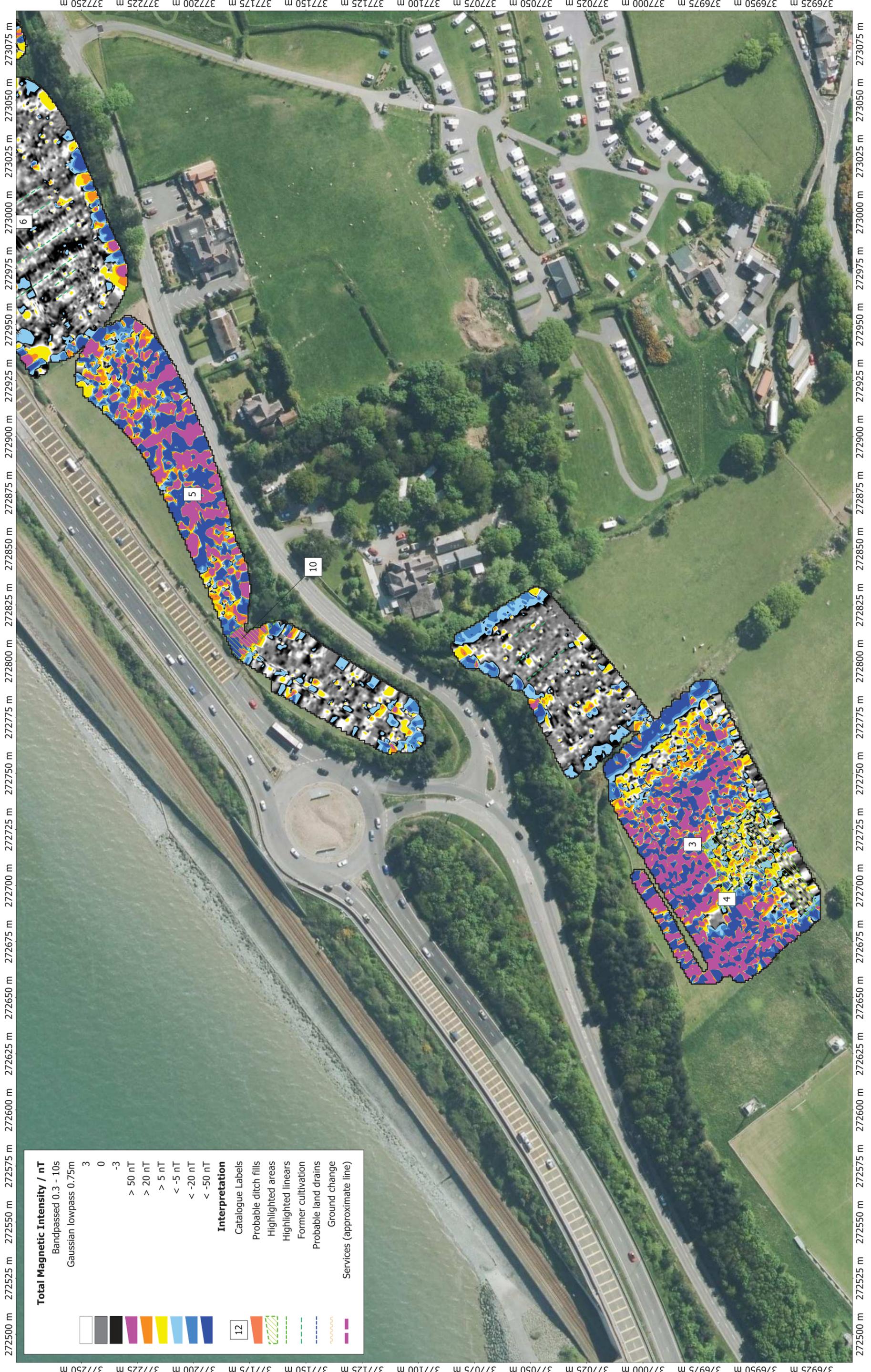
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DWG 02f Magnetic Data - TMI - Field 01

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**Total Magnetic Intensity / nT**  
 Bandpassed 0.3 - 10s  
 Gaussian lowpass 0.75m

3	3
0	12
-3	Probable ditch fills
> 50 nT	Highlighted areas
> 20 nT	Highlighted linears
> 5 nT	Former cultivation
< -5 nT	Probable land drains
< -20 nT	Ground change
< -50 nT	Services (approximate line)

**Interpretation**

- Catalogue Labels
- Probable ditch fills
- Highlighted areas
- Highlighted linears
- Former cultivation
- Probable land drains
- Ground change
- Services (approximate line)

376925 m 376950 m 376975 m 377000 m 377025 m 377050 m 377075 m 377100 m 377125 m 377150 m 377175 m 377200 m 377225 m 377250 m

272500 m 272525 m 272550 m 272575 m 272600 m 272625 m 272650 m 272675 m 272700 m 272725 m 272750 m 272775 m 272800 m 272825 m 272850 m 272875 m 272900 m 272925 m 272950 m 272975 m 273000 m 273025 m 273050 m 273075 m

APW191 A55 Junctions 15 and 16 Improvements  
 DWG 03a Interpretation - Fields 02 - 04

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 DWG 03b Interpretation - Fields 04 - 10

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**Total Magnetic Intensity / nT**  
 Bandpassed 0.3 - 10s  
 Gaussian lowpass 0.75m

3
0
-3
> 50 nT
> 20 nT
> 5 nT
< -5 nT
< -20 nT
< -50 nT

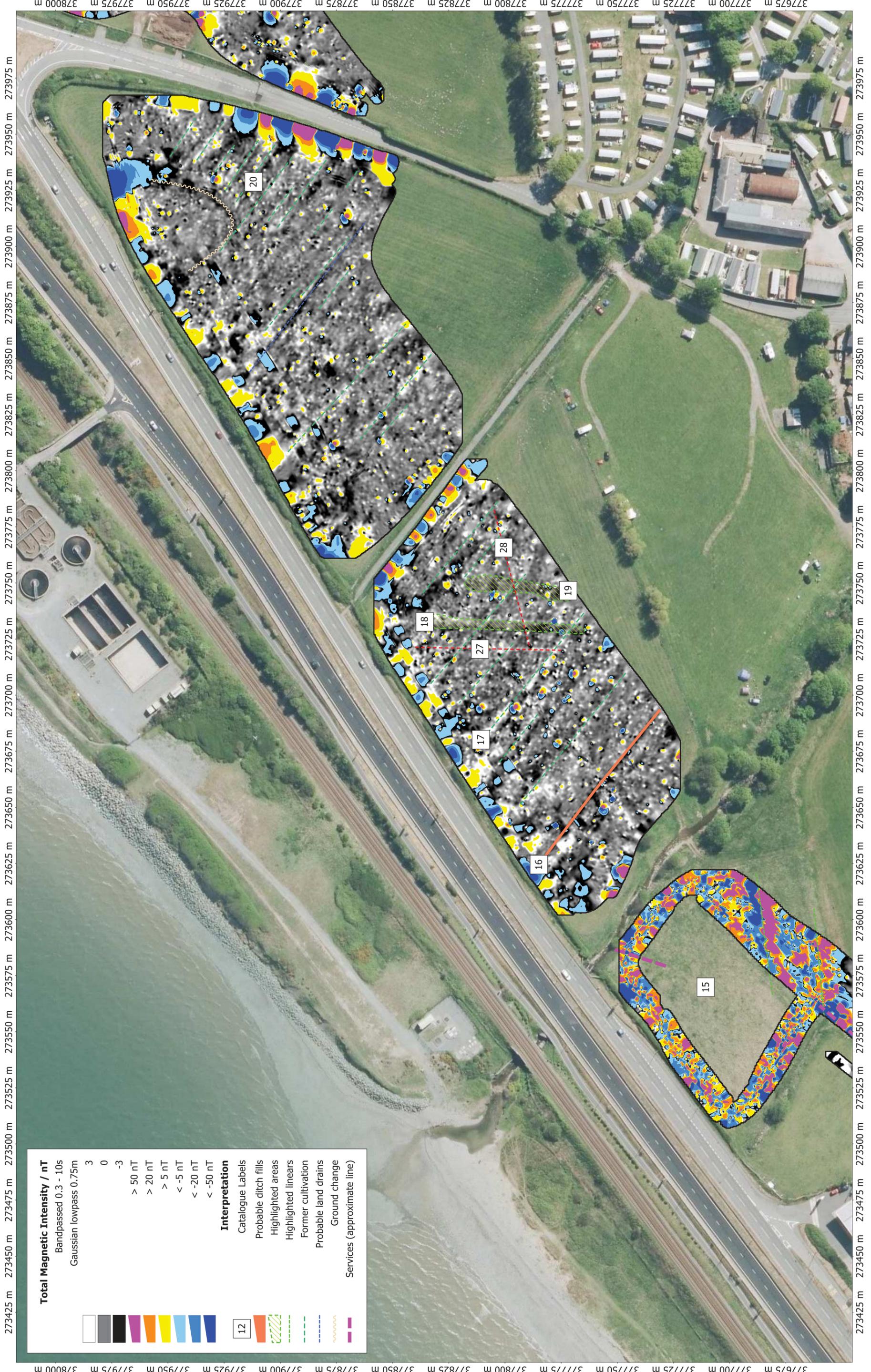
**Interpretation**

- Catalogue Labels
- Probable ditch fills
- Highlighted areas
- Highlighted linears
- Former cultivation
- Probable land drains
- Ground change
- Services (approximate line)

APW191 A55 Junctions 15 and 16 Improvements  
 DWG 03c Interpretation - Fields 11 - 13

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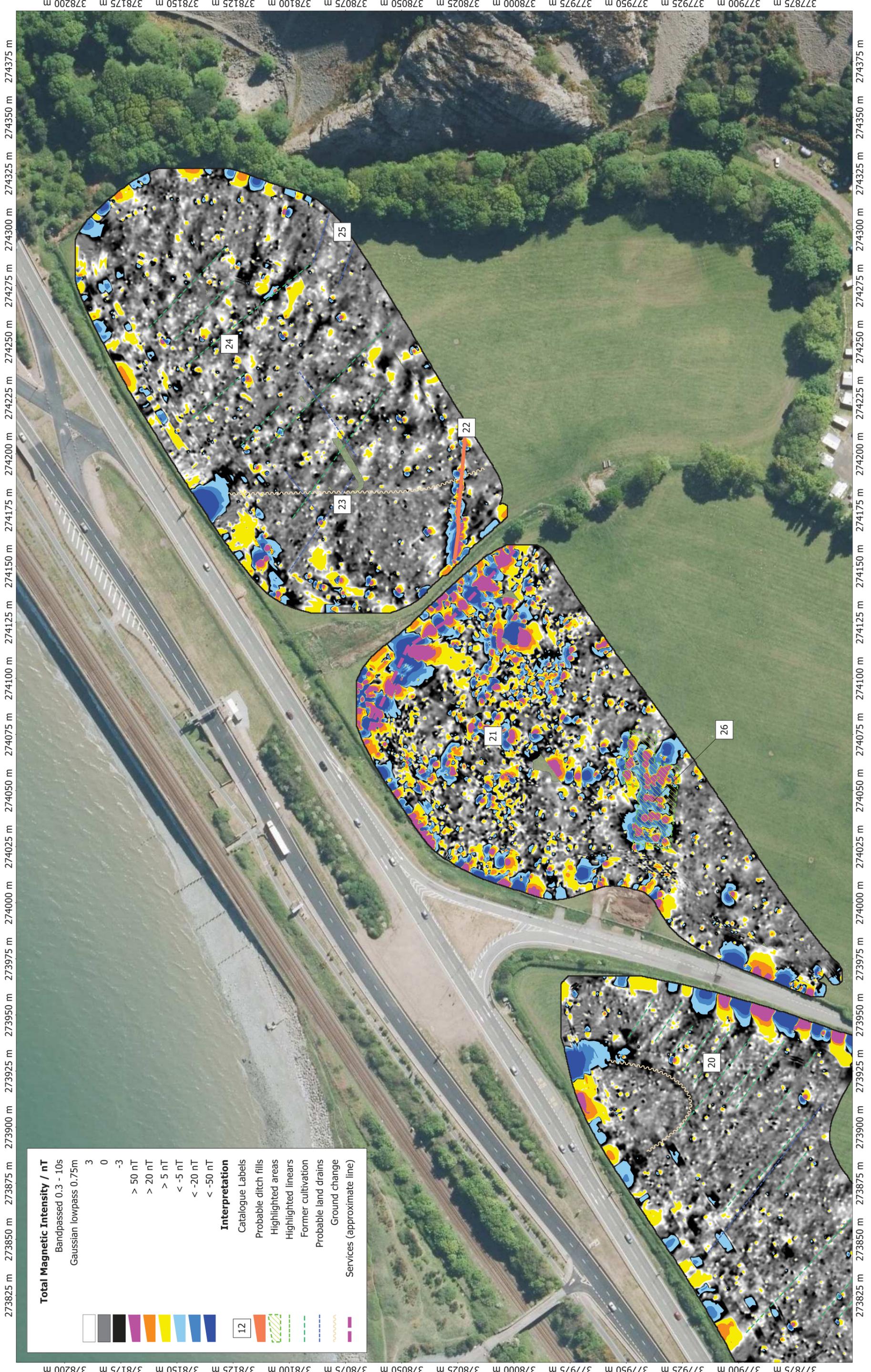




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 DWG 03d Interpretation - Fields 13 - 15

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**Total Magnetic Intensity / nT**  
 Bandpassed 0.3 - 10s  
 Gaussian lowpass 0.75m

3
0
-3
> 50 nT
> 20 nT
> 5 nT
< -5 nT
< -20 nT
< -50 nT

**Interpretation**

- Catalogue Labels
- Probable ditch fills
- Highlighted areas
- Highlighted linears
- Former cultivation
- Probable land drains
- Ground change
- Services (approximate line)

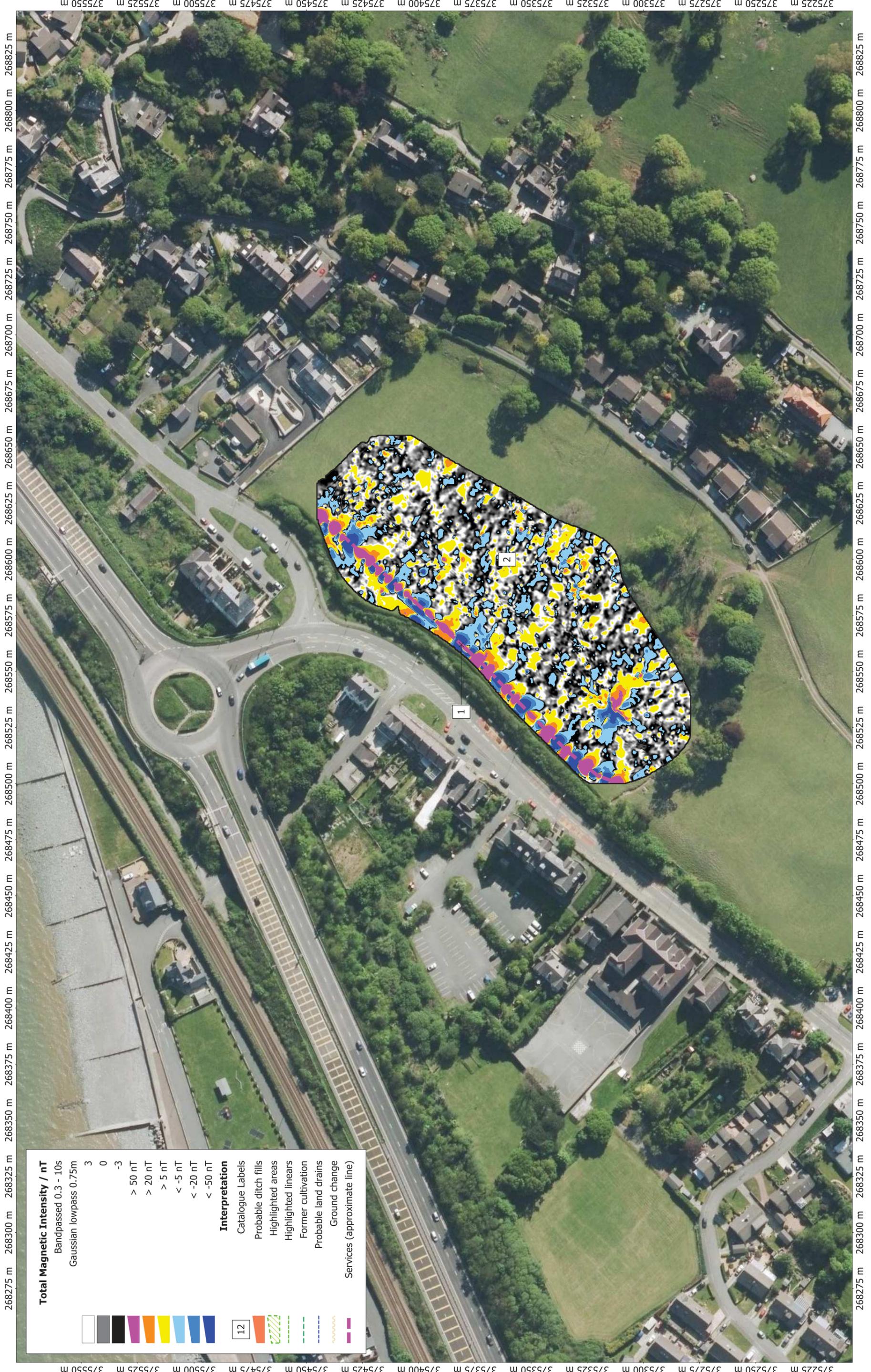
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377875 m 377900 m 377925 m 377950 m 377975 m 378000 m 378025 m 378050 m 378075 m 378100 m 378125 m 378150 m 378175 m 378200 m

APW191 A55 Junctions 15 and 16 Improvements  
 DWG 03e Interpretation - Fields 15 - 17

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**Total Magnetic Intensity / nT**  
 Bandpassed 0.3 - 10s  
 Gaussian lowpass 0.75m

3	0	-3
> 50 nT	> 20 nT	> 5 nT
< -5 nT	< -20 nT	< -50 nT

**Interpretation**

- Catalogue Labels
- Probable ditch fills
- Highlighted areas
- Highlighted linears
- Former cultivation
- Probable land drains
- Ground change
- Services (approximate line)

12

APW191 A55 Junctions 15 and 16 Improvements  
 DWG 03f Interpretation - Field 01

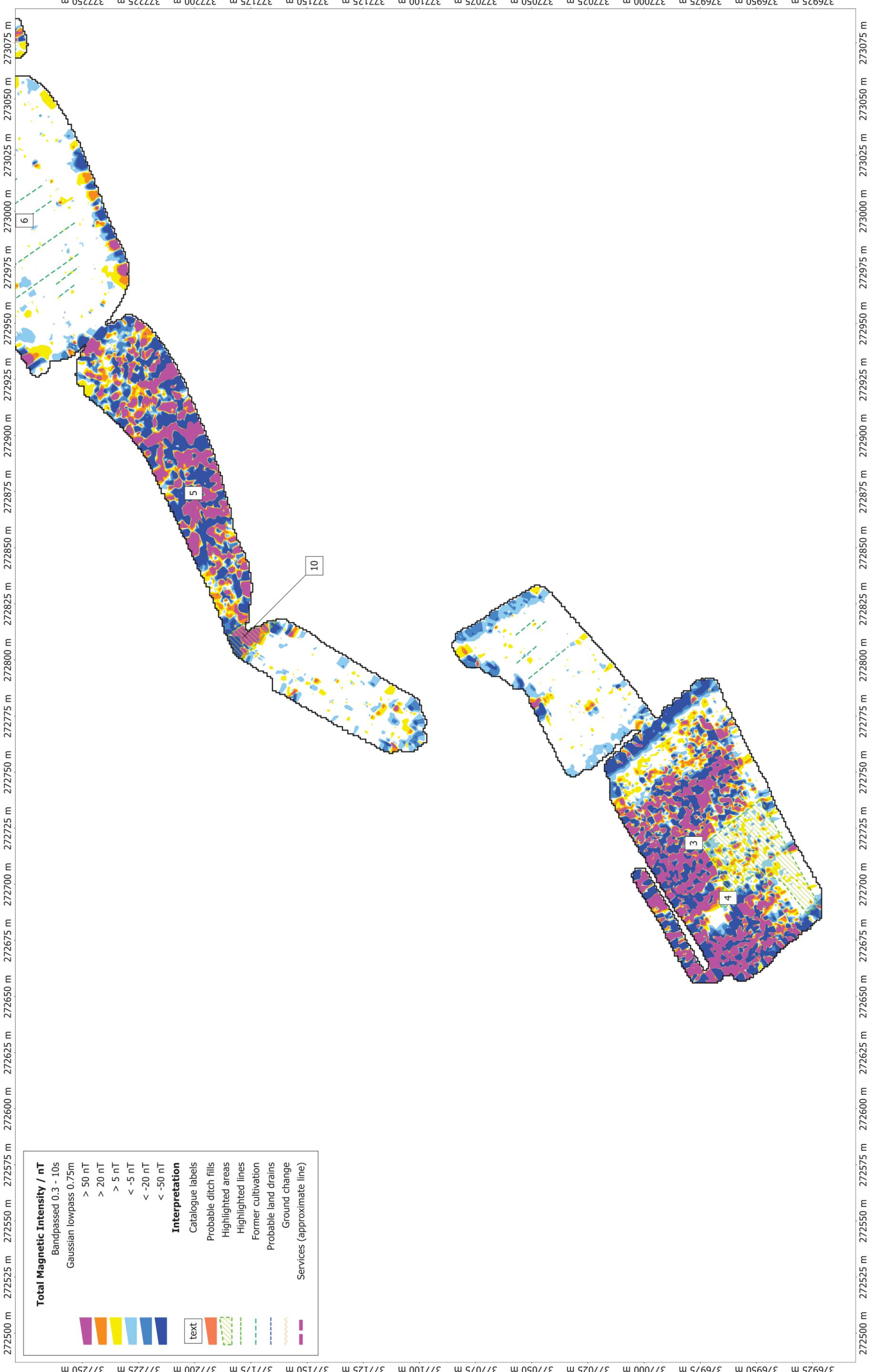
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268275 m 268300 m 268325 m 268350 m 268375 m 268400 m 268425 m 268450 m 268475 m 268500 m 268525 m 268550 m 268575 m 268600 m 268625 m 268650 m 268675 m 268700 m 268725 m 268750 m 268775 m 268800 m 268825 m

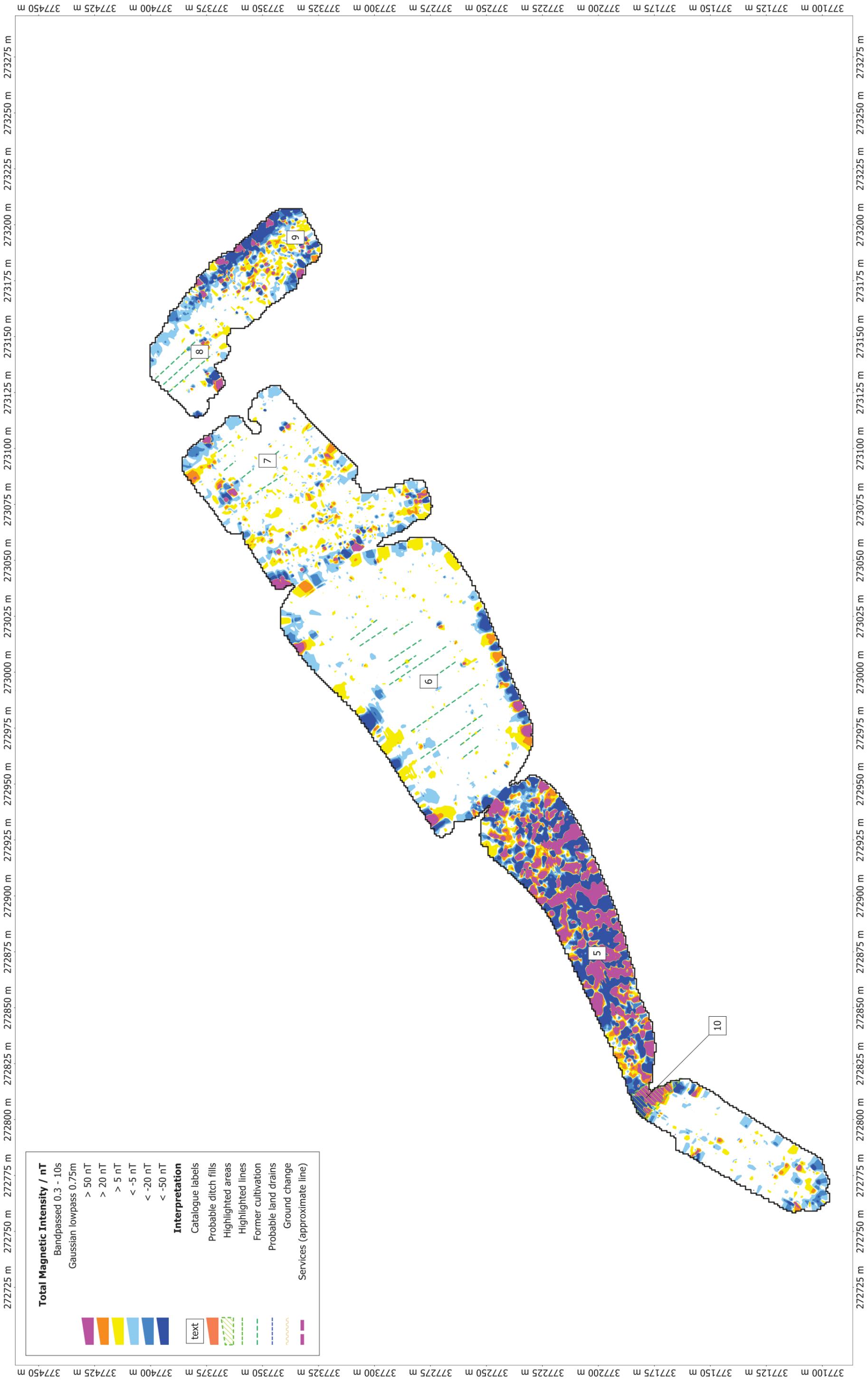
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 DWG 04a Interpretation Vector - Fields 02 - 04

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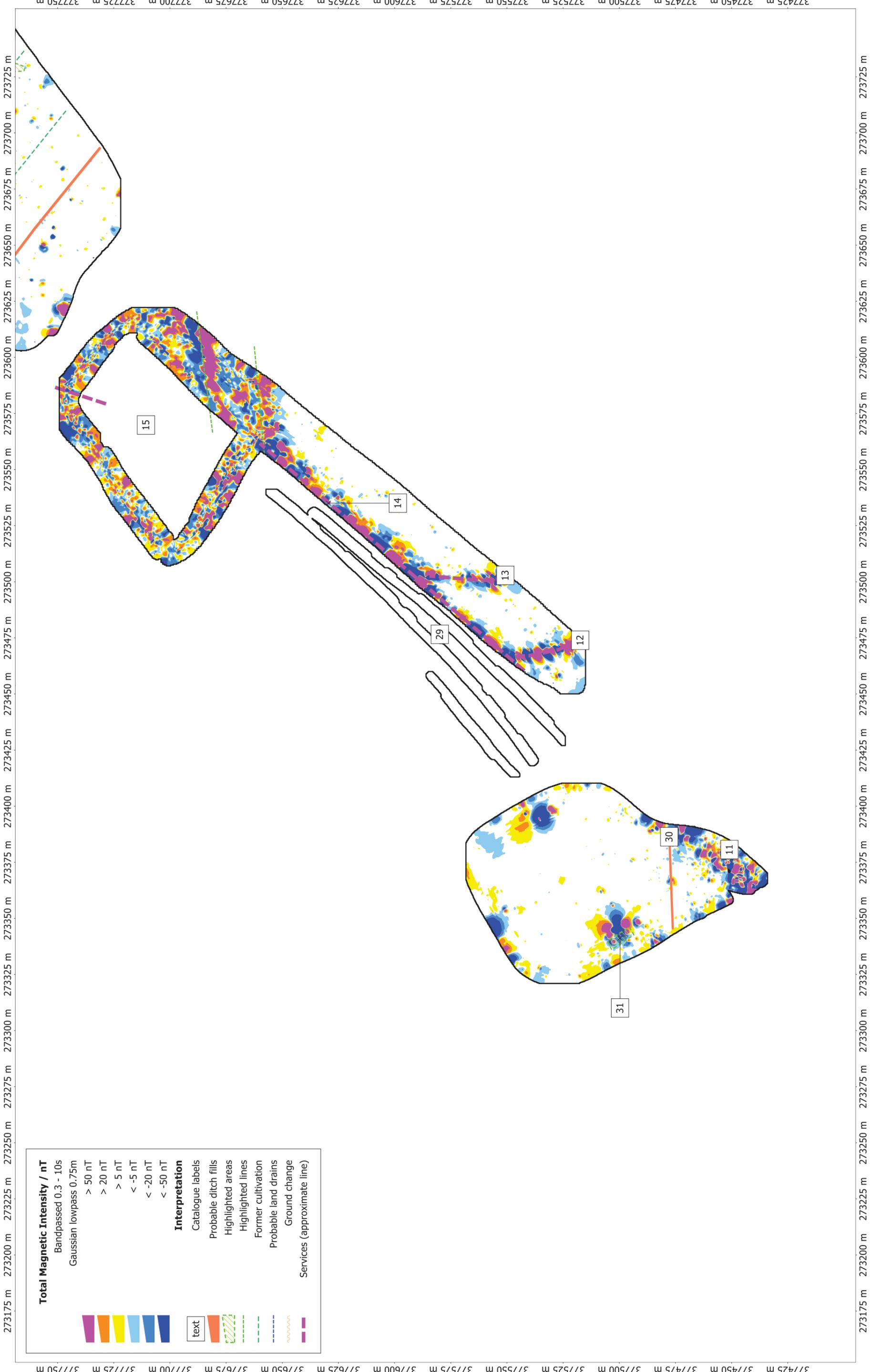
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377100 m 377125 m 377150 m 377175 m 377200 m 377225 m 377250 m 377275 m 377300 m 377325 m 377350 m 377375 m 377400 m 377425 m 377450 m

272725 m 272750 m 272775 m 272800 m 272825 m 272850 m 272875 m 272900 m 272925 m 272950 m 272975 m 273000 m 273025 m 273050 m 273075 m 273100 m 273125 m 273150 m 273175 m 273200 m 273225 m 273250 m 273275 m

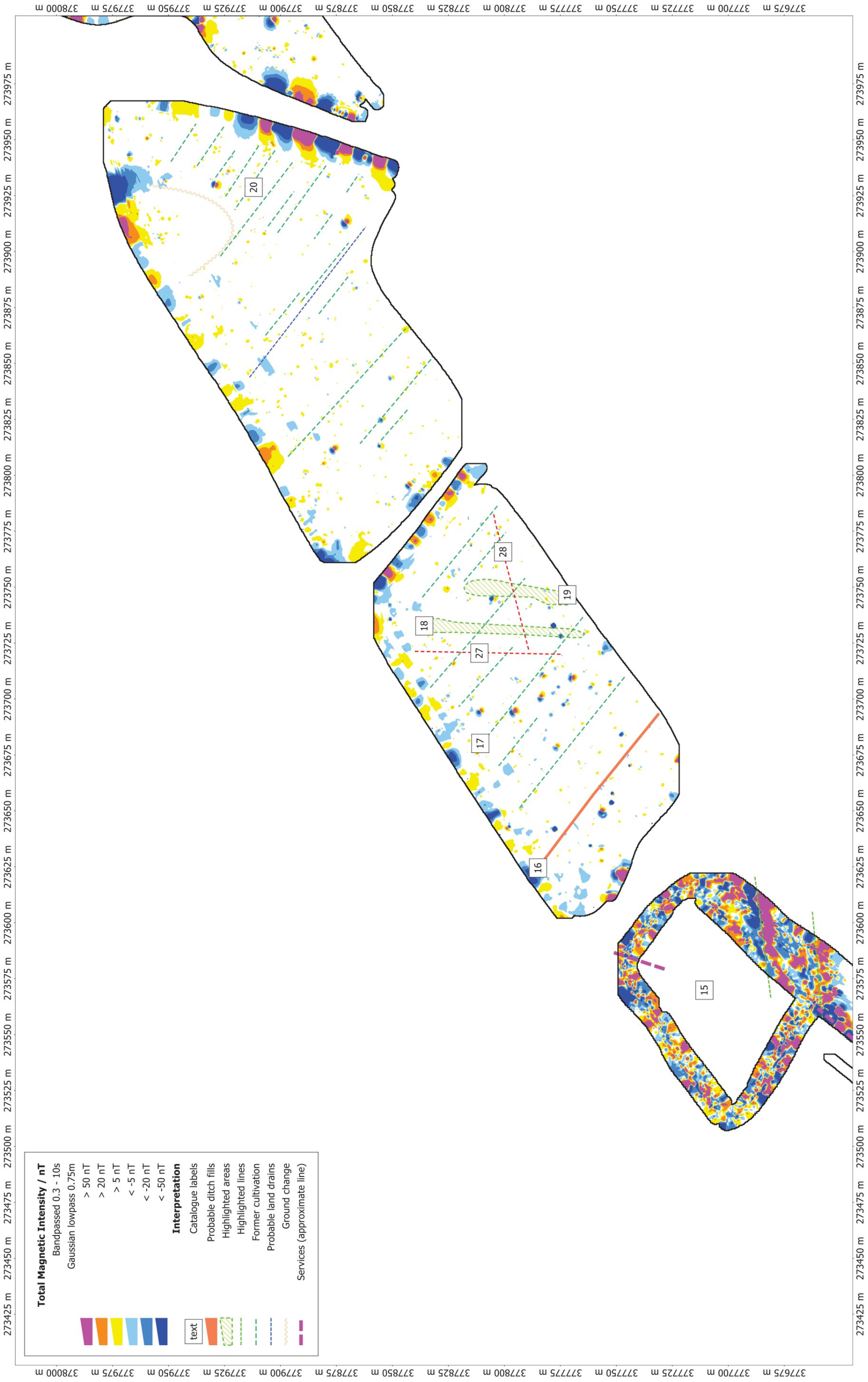
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APW191 A55 Junctions 15 and 16 Improvements  
 DWG 04c Interpretation Vector - Fields 11 - 13

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing  
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273425 m 273450 m 273475 m 273500 m 273525 m 273550 m 273575 m 273600 m 273625 m 273650 m 273675 m 273700 m 273725 m 273750 m 273775 m 273800 m 273825 m 273850 m 273875 m 273900 m 273925 m 273950 m 273975 m

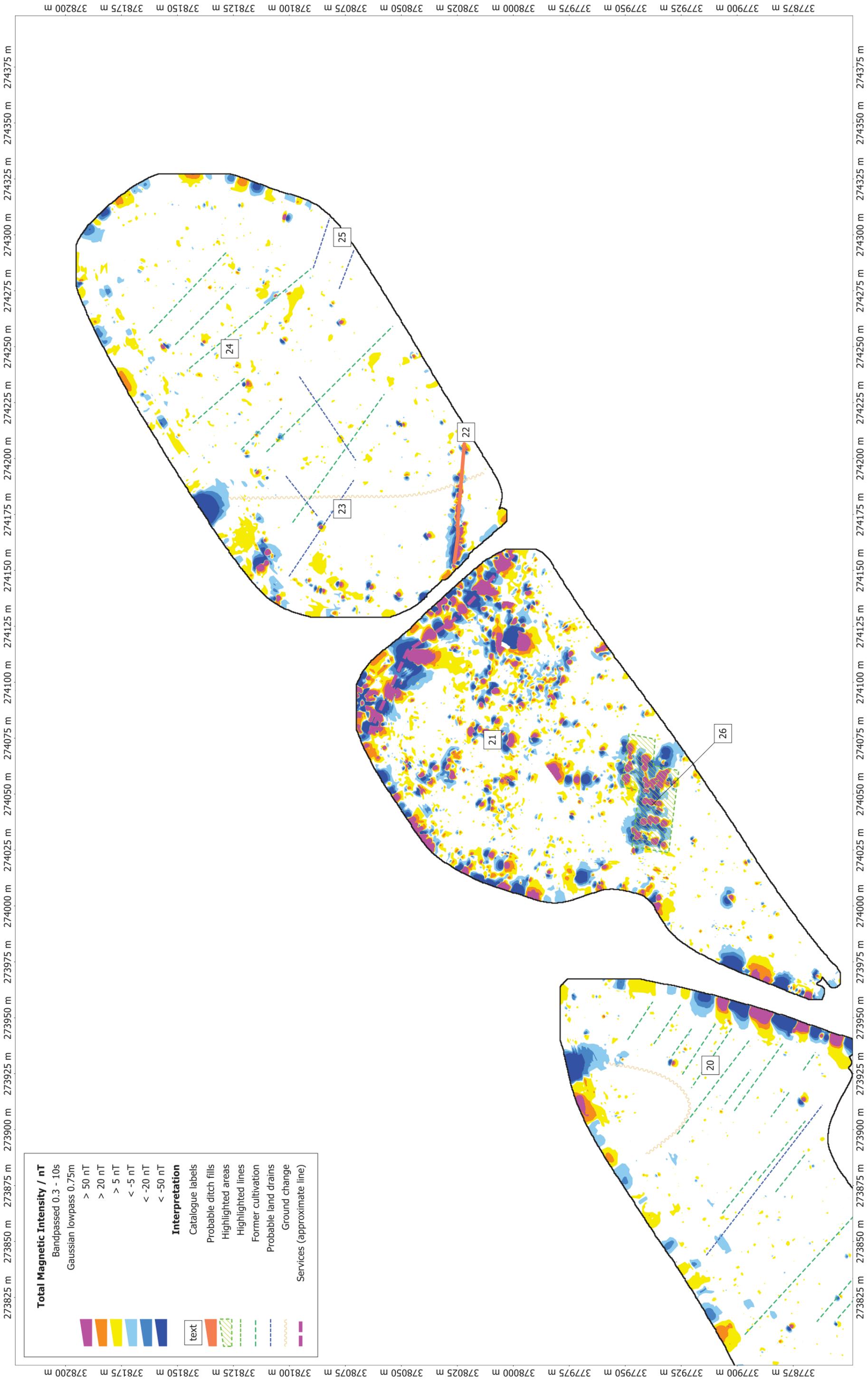
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APW191 A55 Junctions 15 and 16 Improvements  
DWG 04d Interpretation Vector - Fields 13 - 15

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APW191 A55 Junctions 15 and 16 Improvements  
 DWG 04e Interpretation Vector - Fields 15 - 17

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**Total Magnetic Intensity / nT**

Bandpassed 0.3 - 10s  
Gaussian lowpass 0.75m

- > 50 nT
- > 20 nT
- > 5 nT
- < -5 nT
- < -20 nT
- < -50 nT

**Interpretation**

- Catalogue labels
- Probable ditch fills
- Highlighted areas
- Highlighted lines
- Former cultivation
- Probable land drains
- Ground change
- Services (approximate line)

APW191 A55 Junctions 15 and 16 Improvements  
DWG 04f Interpretation Vector - Field 01

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**APPENDIX 10.6**  
**LIST OF ASSETS: VALUE, IMPACT AND SIGNIFICANCE**

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
1	66904	Railway Station, Penmaenmawr		II				SH7181976552	HER	Medium	Negligible	Neutral/Slight	
2	66906	Brynmor Cottage		II	Yes			SH7178176310	HER	Medium	Negligible	Neutral/Slight	
3	66907	Brynmor		II	Yes			SH7177576319	HER	Medium	Negligible	Neutral/Slight	
4	66909	Roman Catholic Church of the Lady of the Rosary		II	Yes			SH7235476522	HER	Medium	Negligible	Neutral/Slight	
5	66910	Horeb Capel, Dwygyfylchi		II				SH7313776883	HER	Medium	Negligible	Neutral/Slight	
6	66912	Gladstone Monument		II	Yes			SH7191376338	HER	Medium	Negligible	Neutral/Slight	
7	66913	Attached former Minister's House		II	Yes			SH7235976510	HER	Medium	Negligible	Neutral/Slight	
8	66916	Church of St Seiriol		II	Yes			SH7217576523	HER	Medium	Negligible	Neutral/Slight	
9	68628	St. Paul's Church,		BSLI/09 7 Draft				SH7168876306	HER	Low	Negligible	Neutral/Slight	
10	68629	Tabernacle Chapel,		BSLI/09 8 Draft				SH7170176335	HER	Low	Negligible	Neutral/Slight	
11	68634	Tan-y-foel (Noddfa), Penmaenmawr		BSLI/10 3 Draft				SH7250776560	HER	Low	Negligible	Neutral/Slight	
12	68635	Franciscan Friary		BSLI/10 5 Draft				SH7235876465	HER	Low	Negligible	Neutral/Slight	
13	68636	Bryn Hedd, Penmaenmawr		BSLI/10 6 Draft				SH7212576469	HER	Low	Negligible	Neutral/Slight	

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
14	68637	Former Mountain View Hotel		BSLI/10 7 Draft				SH7204576332	HER	Low	Negligible	Neutral/ Slight	
15	68638	Penholm,		BSLI/10 8 Draft				SH7225076480	HER	Low	Negligible	Neutral/ Slight	
16	68639	White House, Formerly Tai-bach,		BSLI/11 0 Draft				SH7377676736	HER	Low	Negligible	Neutral/ Slight	
17	74697	Glan y Mor,		BSLI/11 3 Draft				SH7210076401	HER	Low	Negligible	Neutral/ Slight	
18	74699	Capel y Glyn, Capelulo		BSLI/11 8 Draft				SH7425576616	HER	Low	Negligible	Neutral/ Slight	
19	15811	North Arllechwedd Penmaenmawr/Dwyg yfylchi, Landscape					Yes	SH72907710	HER	High	Negligible	Slight	Noise reduction
20	62443	Penmaenmawr (Pen-y-Cae), Conservation Area			Yes			SH7220376347	HER/Conwy	Medium	Minor	Slight	Noise reduction
21	62445	Penmaenmawr Town Centre			Yes			SH7199176367	HER/Conwy	Medium	Negligible	Neutral/ Slight	
22	67645	Stone axe, Sychnant Pass						SH747770	HER	Low	No Change	Neutral	
23	67784	Stone axe, Foel Lûs						SH732762	HER	Low	No Change	Neutral	
24	2828	Socketed Axe						SH75507800	HER	Low	No Change	Neutral	
25	727	Burnt Mound, NE of Allt Wen						SH74757744	HER	Medium	Minor	Slight	Noise reduction
26	62737	Entrance to Dinas Allt Wen Hillfort						SH7461177358	HER	Medium	Minor	Slight	Noise reduction

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
27	62738	Possible hut circle, Allt Wen						SH7451477365	HER	Medium	Minor	Slight	Noise reduction
28	7092	Flint Core, Findspot						SH74407690	HER	Low	No Change	Neutral	
29	713	Dinas Allt Wen Hillfort						SH74557733	HER	Medium	Minor	Slight	Noise reduction
30	24156	Roman Coin, Findspot, Dwygyfylchi						SH73427726	HER	Low	No Change	Neutral	
31	722	Long Huts, Remains of, E of Allt Wen						SH74957729	HER	Medium	Negligible	Neutral/Slight	
32	14610	Llys Helig Weirs,						SH73407885	HER	Low	Negligible	Neutral/Slight	
33	2825	Stone Ring,						SH75057741	HER	Low	No Change	Neutral	
34	3467	Stone Head						SH72107663	HER	Low	No Change	Neutral	
35	59903	Field System, Dwygyfylchi						SH73727686	HER	Medium	Negligible	Neutral/Slight	
36	6809	Dwygyfylchi Medieval Township						SH73007700	HER	Medium	Minor	Slight	Noise reduction
37	6930	Dwygyfylchi Parish Church						SH73677730	HER	Medium	Negligible	Neutral/Slight	
38	7504	Deserted Rural Settlement, Allt Wen						SH74657735	HER	Medium	Minor	Slight	Noise reduction
39	14672	Shelter,						SH72697594	HER	Low	Negligible	Neutral/Slight	
40	18397	United Reform Church Hall and Manse						SH71807625	HER	Low	No Change	Neutral	
41	21051	Quarry, Llys Gwynt						SH74507710	HER	Low	No Change	Neutral	
42	21052	Granite Quarry, Chwarel						SH75007800	HER	Medium	No Change	Neutral	

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
43	18295	Carved Stones, Plas Coch						SH72277614	HER	Low	No Change	Neutral	
44	2847	St. Gwynan's Church						SH73677730	HER	Medium	Negligible	Neutral/Slight	
45	38087	Shell Midden						SH73287767	HER	Low	Moderate	Slight	Potential Watching Brief
46	56331	Shalom Convent						SH7237576542	HER	Low	No Change	Neutral	
47	56332	Buildings and Glasshouses, S of Noddfa Convent						SH7247776509	HER	Low	No Change	Neutral	
48	56333	Building, E of Noddfa Convent						SH7255976542	HER	Low	No Change	Neutral	
49	56334	Kennels, E of Noddfa Convent						SH7257276545	HER	Low	No Change	Neutral	
50	56335	Building, S of Glyn						SH7430776692	HER	Low	No Change	Neutral	
51	56336	Footbridge, W of Yr Hen Fewlin, Glyn Woods						SH7433876796	HER	Low	No Change	Neutral	
52	56337	Pond, S of Yr Hen Felin, Glyn Woods						SH7439276801	HER	Low	No Change	Neutral	
53	56338	Old Mill Bridge, NW of Hen Felin, Glyn Woods						SH7429576901	HER	Low	No Change	Neutral	
54	56341	Muryddyn Hywel House						SH7382677276	HER	Low	No Change	Neutral	
55	56342	Footbridge, W of Muryddyn Hywel House						SH7385677280	HER	Low	No Change	Neutral	
56	56343	Footbridge W of Pentrefelyn						SH7407577055	HER	Low	No Change	Neutral	
57	56344	House, Pentrefelyn						SH7403077050	HER	Low	No Change	Neutral	
58	58805	Original road from Conwy to Penmaenmawr						SH7293576889	HER	Low	No Change	Neutral	
59	62311	Lonfa						SH7245476174	HER	Low	No Change	Neutral	

## Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
60	62313	Noddfa,						SH7206876557	HER	Low	No Change	Neutral	
61	62314	Bronwylfa						SH7236076814	HER	Low	No Change	Neutral	
62	62739	Stone graffiti, Allt Wen						SH7452377352	HER	Low	Negligible	Neutral/Slight	
63	62740	Boundary across Allt Wen						SH7448377262	HER	Low	Negligible	Neutral/Slight	
64	62741	Mound on Allt Wen						SH7457777296	HER	Low	Negligible	Neutral/Slight	
65	62743	Small shelter, Allt Wen						SH7447177283	HER	Low	Negligible	Neutral/Slight	
66	62744	Sheepfold and walling, east of Allt Wen						SH7463477388	HER	Low	Negligible	Neutral/Slight	
67	62745	Hollows and mounds on the lower slopes of Allt Wen						SH74777727	HER	Low	Negligible	Neutral/Slight	
68	62746	Trackway, lower slopes of Allt Wen						SH7484877238	HER	Low	Negligible	Neutral/Slight	
69	62747	Borrow pit, lower slopes of Allt Wen						SH7488477230	HER	Low	Negligible	Neutral/Slight	
70	62748	Hollow, east of Allt Wen						SH7471477338	HER	Low	Negligible	Neutral/Slight	
71	62749	Hollow above Llys Gwynt						SH7451277019	HER	Low	No Change	Neutral	
72	68631	Austrian Restaurant, Capelulo						SH7434776579	HER	Low	No Change	Neutral	
73	68632	Glyn Terrace, Dwygyfylchi						SH7415276975	HER	Low	No Change	Neutral	
74	74694	Garden Feature, Y Bluen Goch						SH7373177557	HER	Low	No Change	Neutral	
75	74701	Pendyffryn, Dwygyfylchi						SH7412377618	HER	Low	No Change	Neutral	

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
76	74702	Pendyffryn Estate Buildings, Dwygyfylchi						SH7392577683	HER	Low	No Change	Neutral	
77	74703	Trwyn-yr-wylfa,						SH7283076754	HER	Low	No Change	Neutral	
78	74704	Glan-y-Coed, Dwygyfylchi						SH7398877172	HER	Low	No Change	Neutral	
79	74705	Glyn, Capelulo						SH7431276774	HER	Low	No Change	Neutral	
80	77132	Telford Road, possible, Penmaenbach Point						SH74527848	HER	Low	Negligible	Neutral/Slight	
81	24161	Ring, Findspot						SH71807670	HER	Low	No Change	Neutral	
82	33341	Commercial Unit and Garage						SH7172076300	HER	Low	No Change	Neutral	
83	7875	POW Camp, Site of, Penmaenmawr						SH72007600	HER	Low	No Change	Neutral	
84	2855	Cairn Ring						SH74997754	HER	Medium	No Change	Neutral	
85	34610	Felin-newydd,						SH7411177015	HER	Low	No Change	Neutral	
86	5476	Enclosures, Penmaenbach						SH74807780	HER	Low	Negligible	Neutral/Slight	
87	62742	Platform on Allt Wen						SH7459477309	HER	Low	Negligible	Neutral/Slight	
88	62801	Cave above Llys Gwynt						SH7453076983	HER	Low	No Change	Neutral	
89	6603	Ridge and Furrow, Nr. Pen Sychnant						SH75007750	HER	Low	No Change	Neutral	
90	6891	Area of Ridge and Furrow, Penmaenbach						SH75207740	HER	Low	No Change	Neutral	
91	723	Long Hut, NE of Allt Wen						SH74707756	HER	Low	Negligible	Neutral/Slight	
92	725	Cairn, Possible Remains of, Foel Lus						SH73247618	HER	Low	No Change	Neutral	

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
93	1743	Poss Hut Circle						SH72487675	HER	Low	Minor	Neutral/Slight	
	<b>Geo No</b>												
94	ID 3	Known landfill						SH72707698	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
95	ID 4	Field observation - path of stream / water course						SH72687698	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
96	ID 5	Probable landfill - possible debris from old Gas Works and road destruction/construction						SH72907728	Geophysics	Unknown	Major	Unknown	Evaluation Excavation
97	ID 6	Probable ridge and furrow						SH73007731	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
98	ID 7	Probable ridge and furrow, see [6]						SH73107735	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
99	ID 8	Probable ridge and furrow, see [6] and [7]						SH73157743	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
100	ID 9	Possibly debris from surrounding structures or construction / agricultural activity						SH73207740	Geophysics	Unknown	Moderate	Unknown	Evaluation Excavation
101	ID 10	Known road as seen on 1975 OS map						SH72817720	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
102	ID 11	Possibly debris from surrounding structures or construction / agricultural activity, similar to [9]						SH73317750	Geophysics	Unknown	Moderate	Unknown	Evaluation Excavation
103	ID 12	Probable service						SH73457751	Geophysics	Low	Moderate	Slight	Watching Brief
104	ID 13	Probable service						SH73487755	Geophysics	Low	Moderate	Slight	Watching Brief
105	ID 14	Known service - sewer						SH73597760	Geophysics	Low	Moderate	Slight	Watching Brief
106	ID 15	Known landfill as seen on 1913 OS map. It is thought that the stream may once have flowed below this region						SH73597770	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
107	ID 16	Possible unknown field boundary						SH73647775	Geophysics	Unknown	Major	Unknown	Evaluation Excavation
108	ID 17	See [6], [7] and [8]						SH73667775	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
109	ID 18	Uncertain, maybe natural but could also be agricultural origin						SH73697780	Geophysics	Unknown	Major	Unknown	Evaluation Excavation
110	ID 19	See [18], this example is slightly less well defined						SH73737780	Geophysics	Unknown	Major	Unknown	Evaluation

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
													Excavation
111	ID 20	See [6], [7], [8] and [17]						SH73657777	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
112	ID 21	Probable debris from temporary structures and boundaries, only seen on 1992 OS map						SH74087800	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
113	ID 22	Known field boundary as seen on OS maps between 1913 - 1975. Appears to be partially filled with modern debris						SH74207806	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
114	ID 23	Drain						SH74327811	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
115	ID 24	See [6], [7], [8], [17] and [20]						SH74307821	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
116	ID 25	Similar to [23]						SH74337806	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
117	ID 26	A series of perhaps four underground probable ferrous elements to an unknown structure						SH74007780	Geophysics	Unknown	Major	Unknown	Evaluation Excavation
118	ID 27	Possible ditch or land drain						SH73687776	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation

**Appendix 10.6: Junction 16 Lists of Assets with Value, Impact and Significance of Effect**

No	PRN	Name	SAM	Listed	CA	PG	HL	GR	Source	Value	Impact	Significance	Further Assessment
119	ID 28	Possible ditch or land drain						SH73827773	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
120	ID 29	Landfill or construction debris						SH73507760	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
121	ID 30	Possible ditch or drain						SH73307748	Geophysics	Unknown	Major	Slight/Moderate	Evaluation Excavation
122	ID 31	Base of former goal posts						SH73357757	Geophysics	Low	Major	Slight/Moderate	Evaluation Excavation
	<b>Field No</b>												
123	001	Dwygyfylchi Track						SH73257730	Field Survey	Low	Negligible	Neutral	
	<b>NPRN</b>												
124	401850	Penmaenmawr Gas Works wall						SH72777725	RCAHMW	Low	Major	Slight/Moderate	Watching Brief
125		Ship Inn						SH74007805	OS 1 <sup>st</sup> ed	Low	Major	Slight/Moderate	Watching Brief
126		Brickfield Cottage						SH73657805	OS 1 <sup>st</sup> ed	Low	Major	Slight/Moderate	Watching Brief

<b>ES Chapter 12 Appendices</b>	
12.1	Dust Risk Assessment Methodology
12.2	2018 Meteorological data
12.3	Scheme Traffic Data
12.4	No <sub>x</sub> Concentration Verification Method
12.5	Details of Bias Adjustment and Annualisation

**APPENDIX 12.1**  
**DUST RISK ASSESSMENT METHODOLOGY**

## Determining Dust Emission Magnitude

Large	Medium	Small
<b>Demolition</b>		
<ul style="list-style-type: none"> <li>total building volume &gt;50,000 m<sup>3</sup></li> <li>potentially dusty construction material (e.g. concrete)</li> <li>on-site crushing and screening</li> <li>demolition activities &gt;20 m above ground level</li> </ul>	<ul style="list-style-type: none"> <li>total building volume 20,000m<sup>3</sup> – 50,000m<sup>3</sup></li> <li>potentially dusty construction</li> <li>demolition activities 10-20m above ground level</li> </ul>	<ul style="list-style-type: none"> <li>total building volume &lt;20,000m<sup>3</sup></li> <li>construction material with low potential for dust release (e.g. metal cladding or timber)</li> <li>demolition activities &lt;10m above ground</li> <li>during wetter months</li> </ul>
<b>Earthworks</b>		
<ul style="list-style-type: none"> <li>total site area &gt;10,000m<sup>2</sup></li> <li>potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size)</li> <li>&gt;10 heavy earth moving vehicles active at any one time</li> <li>formation of bunds &gt;8m in height</li> <li>total material moved &gt;100,000 tonnes</li> </ul>	<ul style="list-style-type: none"> <li>total site area 2,500m<sup>2</sup> - 10,000m<sup>2</sup></li> <li>moderately dusty soil type (e.g. silt)</li> <li>5-10 heavy earth moving vehicles active at any one time</li> <li>formation of bunds 4m - 8m in height</li> <li>total material moved 20,000 - 100,000 tonnes</li> </ul>	<ul style="list-style-type: none"> <li>total site area &lt;2,500m<sup>2</sup></li> <li>soil type with large grain size (e.g. sand)</li> <li>&lt;5 heavy earth moving vehicles active at any one time</li> <li>formation of bunds &lt;4m in height</li> <li>total material moved &lt;20,000 tonnes</li> <li>earthworks during wetter months</li> </ul>
<b>Construction</b>		
<ul style="list-style-type: none"> <li>total building volume &gt;100,000m<sup>3</sup></li> <li>piling</li> <li>on-site concrete batching</li> <li>sandblasting</li> </ul>	<ul style="list-style-type: none"> <li>total building volume 25,000m<sup>3</sup> - 100,000m<sup>3</sup></li> <li>potentially dusty construction material (e.g. concrete)</li> <li>piling</li> <li>on-site concrete batching</li> </ul>	<ul style="list-style-type: none"> <li>total building volume &lt;25,000 m<sup>3</sup></li> <li>construction material with low potential for dust release (e.g. metal cladding or timber)</li> </ul>
<b>Trackout</b>		
<ul style="list-style-type: none"> <li>&gt;50 HDV (&gt;3.5t) movements in any one day</li> <li>potentially dusty surface material (e.g. high clay content)</li> <li>unpaved road length &gt;100m</li> </ul>	<ul style="list-style-type: none"> <li>10-50 HDV (&gt;3.5t) movements in any one day</li> <li>moderately dusty surface material (e.g. high clay content)</li> <li>unpaved road length 50m – 100m</li> </ul>	<ul style="list-style-type: none"> <li>&lt;10 HDV (&gt;3.5t) movements in any one day</li> <li>surface material with low potential for dust release</li> <li>unpaved road length &lt;50m</li> </ul>

## Determining Receptor Sensitivity

High	Medium	Low
<b>Sensitivities of People to Dust Soiling Effects</b>		
<ul style="list-style-type: none"> <li>users can reasonably expect a enjoyment of a high level of amenity; or</li> <li>The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.</li> <li>indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.</li> </ul>	<ul style="list-style-type: none"> <li>users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or</li> <li>the appearance, aesthetics or value of their property could be diminished by soiling; or</li> <li>The 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.</li> <li>Indicative examples include parks and places of work.</li> </ul>	<ul style="list-style-type: none"> <li>the enjoyment of amenity would not reasonably be expected; or</li> <li>property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or</li> <li>there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.</li> <li>indicative examples include playing fields, farmland</li> </ul> <p>(Unless commercially-sensitive horticultural), footpaths, short term car parks and roads.</p>
<b>Sensitivities of People to the Health Effects of PM<sub>10</sub></b>		
<ul style="list-style-type: none"> <li>locations where members of the public are exposed over a time period relevant to the air quality objective for PM<sub>10</sub> (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).</li> <li>Indicative examples include residential properties, Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.</li> </ul>	<ul style="list-style-type: none"> <li>locations where the people exposed are workers, and</li> <li>exposure is over a time period relevant to the air quality objective for PM<sub>10</sub> (in the case of the 24-hour objectives,</li> <li>a relevant location would be one where individuals may be exposed for eight hours or more in a day).</li> <li>Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM<sub>10</sub>, as protection is covered by Health and Safety at Work legislation.</li> </ul>	<ul style="list-style-type: none"> <li>Locations where human exposure is transient.</li> <li>Indicative examples include public footpaths, playing fields, parks and shopping streets.</li> </ul>
<b>Sensitivities of Receptors to Ecological Effects</b>		
<ul style="list-style-type: none"> <li>locations with an international or national designation and the designated features may be affected by dust soiling; or</li> <li>locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain.</li> <li>Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.</li> </ul>	<ul style="list-style-type: none"> <li>locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or</li> <li>Locations with a national designation where the features may be affected by dust deposition.</li> <li>Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.</li> </ul>	<ul style="list-style-type: none"> <li>Locations with a local designation where the features may be affected by dust deposition.</li> <li>Indicative example is a local Nature Reserve with dust sensitive features.</li> </ul>

## Determining Sensitivity of the Area

### Dust Soiling Effects on People and Property

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

### Human Health Impacts

	Annual Mean PM <sub>10</sub> concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m <sup>3</sup>	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	>28-32 µg/m <sup>3</sup>	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	>24-28 µg/m <sup>3</sup>	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m <sup>3</sup>	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium		>1	High	Medium	Low	Low	Low
Low		>1	Medium	Low	Low	Low	Low

### Ecological Impacts

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

## Determining Risk of Dust Impacts

### Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

## Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

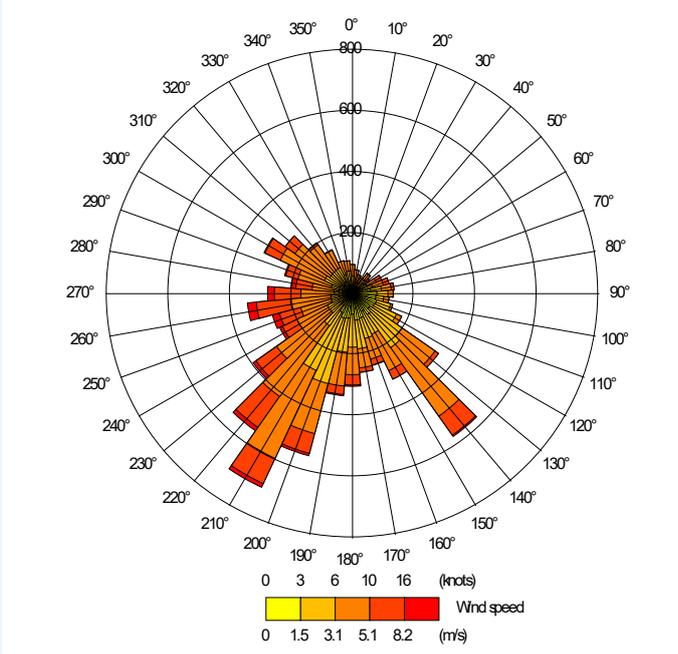
## Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

## Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

**APPENDIX 12.2**  
**2018 METEOROLOGICAL DATA**

<p>Meteorological Data</p>	<p>2018 Hourly meteorological data from Rhyl NO2 Station has been used in the model. The wind rose is shown below.</p> 
<p>ADMS</p>	<p>Version 4.1.1</p>
<p>Time Varying Emission Factors</p>	<p>Based on Department for Transport statistics. Table TRA0307. Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2018.</p>
<p>Latitude</p>	<p>53.2°</p>
<p>Surface Roughness</p>	<p>A value of 0.5 for Parkland Open Suburbia was used to represent the modelled area. A value of 0.3 for agricultural areas was used to represent the meteorological station site.</p>
<p>Minimum Monin-Obukhov length</p>	<p>A value of 10 for Small towns was used to represent the modelled area and the meteorological station site.</p>
<p>Emission Factor Toolkit (EFT)</p>	<p>V9.0 , May 2019.</p>
<p>NO<sub>x</sub> to NO<sub>2</sub> Conversion</p>	<p>NO<sub>x</sub> to NO<sub>2</sub> calculator version 7.1, May 2019</p>
<p>Background Maps</p>	<p>2017 reference year background maps</p>

**APPENDIX 12.3**  
**SCHEME TRAFFIC DATA**

J16 Scheme Traffic Data

Road name	Direction	2018		DM 2022		DS 2022		DM-DS
		AADT	%HGV	AADT	% HGV	AADT	%HGV	% AADT Change
A55 between J16-J16A	W (After High Street)	17945	8.6	19045	7.7	19045	7.6	0.0%
	E (Before Off Slip to Bangor Road)	18011	10.5	19040	10.1	19040	10.1	0.0%
A55 between J16A-J16	W	16633	7.4	17694	7.2	17699	7.3	0.0%
	E	16921	9.4	17882	9.1	17760	10.0	-0.7%
A55 between J16-J17	W	19047	7.3	20300	7.1	20304	7.1	0.0%
	E	19244	8.8	20402	8.5	20596	9.3	1.0%
Glan-Yr_Afon Road	W	731	7.4	920	6.0	631	5.6	-31.4%
	E	0	0.0	0	0.0	324	1.4	#DIV/0!
Old Mill Road	S	51	13.2	57	12.2	57	12.2	0.0%
	N	21	20.2	24	17.6	44	9.7	81.6%
Ysgubor wen Road	W	805	4.9	1017	4.5	716	4.0	-29.6%
	E	292	8.0	352	6.8	459	6.6	30.5%
New Link Road	W	0	0.0	0	0.0	207	4.7	N/A
	E	0	0.0	0	0.0	2544	6.9	N/A
Treforris Road	W	311	5.4	383	4.5	192	2.1	-50.0%
	E	167	0.0	206	0.0	200	0.0	-2.9%
Old Mill Road	S	95	10.8	103	10.6	103	9.2	0.0%
	N	50	8.4	54	7.8	74	5.7	36.1%
Conway Old Road	W	99	37.4	82	18.9	77	13.9	-5.8%
	E	255	33.6	266	33.0	92	0.5	-65.5%
Penmaen mawr Road (towards Pendular )	W	204	24.5	280	19.2	280	19.2	0.0%
	E	403	9.0	473	7.9	473	10.0	0.0%

W: Westbound; E: eastbound; N: Northbound; S: Southbound.



J16 Scheme Baseline and 'Do Minimum' Modelled Road Network Sources



J16 Scheme 'Do Something' Modelled Road Network Sources

**APPENDIX 12.4**  
**NO<sub>x</sub> CONCENTRATION VERIFICATION METHOD**

## Nitrogen Dioxide

The model has been run to predict the 2018 annual mean road-NO<sub>x</sub> contribution at three monitoring locations (identified in Table 12. 7). Concentrations have been modelled at a height described in Appendix E Annualisation.

The model output of road-NO<sub>x</sub> has been compared with the 'measured' road-NO<sub>x</sub>, which was calculated from the measured NO<sub>2</sub> concentrations and the adjusted background NO<sub>2</sub> concentrations within the NO<sub>x</sub> from NO<sub>2</sub> calculator.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution. This factor was then applied to the modelled road-NO<sub>x</sub> concentration for each monitoring site to provide adjusted modelled road-NO<sub>x</sub> concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO<sub>x</sub> concentrations with the predicted background NO<sub>2</sub> concentration within the NO<sub>x</sub> from NO<sub>2</sub> calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (Figure D.1).

Monitor	Monitored NO <sub>2</sub> µg/m <sup>3</sup>	Measured Road NO <sub>x</sub> µg/m <sup>3</sup>	Modelled Roadside NO <sub>x</sub> µg/m <sup>3</sup>	Ratio Measured NO <sub>x</sub> / Modelled road NO <sub>x</sub>	Total NO <sub>2</sub> after adjustment µg/m <sup>3</sup>	% Difference in NO <sub>2</sub> after adjustment
Ramboll 1	14.6	14.4	5.3	2.69	13.3	-8.4
Ramboll 2	13.7	12.7	8.2	1.55	15.4	12.6
Ramboll 3	15.9	17.0	8.0	2.11	15.2	-4.3

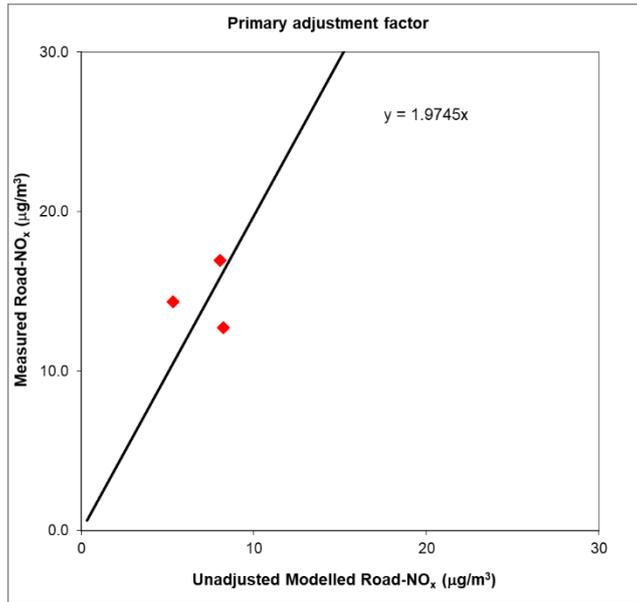
The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

<b>Primary Adjustment Factor</b>	<b>1.9745</b>
Secondary adjustment factor	1.0636

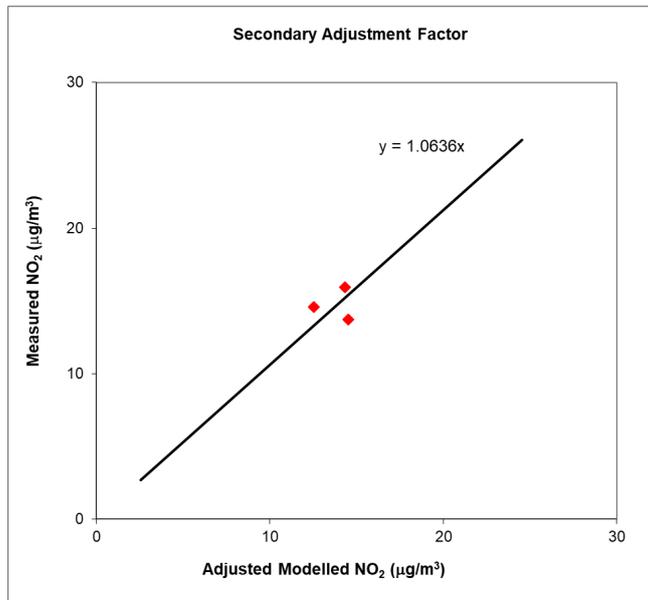
The results imply that overall, the model was under-predicting the road-NO<sub>x</sub> contribution. This is a common experience with this and most other models. The final NO<sub>2</sub> adjustment is minor.

Model uncertainty has been estimated by calculating the root mean square error (RMSE). The calculated RMSE was 1.3 µg/m<sup>3</sup> (3%) after adjustment which is within the suggested value (10% of the objective being assessed) in LAQM.TG(16). The model has therefore performed sufficiently well for use within this assessment.

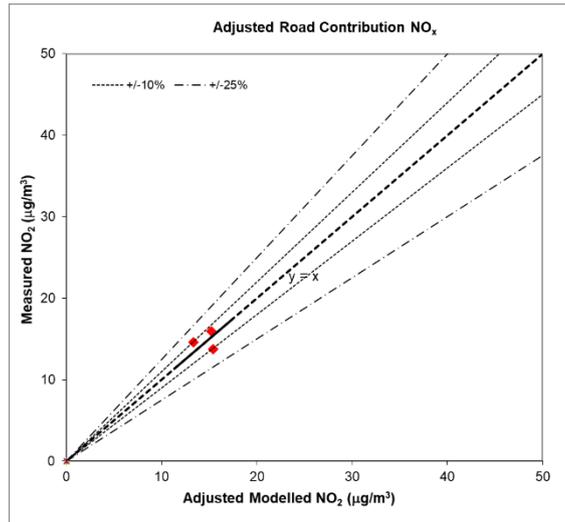
Figure D.3 compares final adjusted modelled total NO<sub>2</sub> at each of the monitoring sites, to measured total NO<sub>2</sub>, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line.



**Figure D.1: Comparison of Measured Road-NO<sub>x</sub> with Unadjusted Modelled Road-NO<sub>x</sub> Concentrations**



**Figure D.2: Comparison of Measured NO<sub>2</sub> with Primary Adjusted Modelled NO<sub>2</sub> Concentrations**



**Figure E.3: Comparison of Measured NO<sub>2</sub> with Fully Adjusted Modelled NO<sub>2</sub> Concentrations**

**Particulates (PM<sub>10</sub> and PM<sub>2.5</sub>)**

There is no PM<sub>10</sub> monitoring in close proximity to the proposed development site. Therefore, the primary adjustment factor calculated for NO<sub>2</sub> concentrations has been applied to the modelled road-particulates concentrations.

**APPENDIX 12.5**  
**DETAILS OF BIAS ADJUSTMENT AND ANNUALISATION**

## Bias Adjustment

Diffusion tubes exhibit bias when compared to results from automatic analysers, and diffusion tube results are routinely adjusted to account for this. The 2018 national bias adjustment for Gradko 50% TEA in acetone tubes (spreadsheet v09/19) has been applied to the 2018 diffusion tube data. The bias factor of 0.89 has been based in 18 studies.

## Annualisation

Monitoring commenced on the 4<sup>th</sup> July 2018 until the 2<sup>nd</sup> February 2019. Consequently, only 7 months of data were available, and the monitoring data do not meet the data capture requirements to represent a full calendar year. Therefore, in accordance with the guidance set out in Box 7.9 of LAQM.TG(16), the data have been adjusted to an annual mean, based on the ratio of concentrations during the short-term monitoring period to those over the February 2018 to February 2019 calendar year. This has utilised data from four background sites operated as part of the Automatic Urban and Rural Network (AURN) where long-term data are available (with data capture >85%).

The annual mean nitrogen dioxide concentrations and the period means for each of the monitoring sites from which adjustment factors have been calculated are presented in the table below.

**Table E1: Annualisation factors**

Automatic Station	Approximate Distance to Site (km)	Type	Annual Mean (06/02/2018-06/02/2019)	Period Mean		
				DT6 (04/07/18 - 09/01/19)	DT4 (4/7/18-01/08/18; 5/9/18-6/2/19)	DT5 (04/7/18-01/8/18; 5/9/18-5/12/18; 9/1/19 - 6/2/19)
Wirral Tranmere	65 km	Urban Background	17.9	16.8	19.0	18.0
Aston Hill	105 km	Rural Background	3.1	2.8	3.0	3.1
Blackpool	85 km	Urban Background	12.8	11.2	13.9	13.6
Stoke-on-Trent Centre	123 km	Urban Background	24.1	24.7	27.2	26.1
Average Ratio Am/Pm				<b>1.07</b>	<b>0.94</b>	<b>0.97</b>

**Table E2: Diffusion tubes location and height**

Duplicate Tubes - NO <sub>2</sub>		x	y	Heigh (m)	Distance to kerb (m)
1	Ysguborwen Road (Lamp post at the bottom of Gogarth Avenue, LL34 6PT)	273129	377283	2.3	1.4
2	Ysguborwen Road (Opposite the house next to The Gladstone pub, LL34 6PS)	272938	377214	2.12	1.2
3	Ysguborwen Road (4th lamppost from junction, Just short of the junction to Conway Road)	272794	377103	2.3	2.5

**Table E3: Monitoring data annual mean**

DT	Period	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	Period Mean	Annual Mean	Bias Adj (0.89)
	On	04/07 /2018	01/08 /2018	05/09 /2018	04/10 /2018	31/10 /2018	05/12 /2018	09/01 /2019			
	Off	01/08 /2018	05/09 /2018	04/10 /2018	31/10 /2018	05/12 /2018	09/01 /2019	06/02 /2019			
1	Measure d	16.6	16.5	14.9	15.4	13.8	16.1	M	15.3	16.4	14.6
		15.8	17.6	15.1	14.8	11.9	14.8	M			
	Average	16.2	17.0	15.0	15.1	12.8	15.5	-			
2	Measure d	20.0	M	24.1	15.7	12.3	13.7	15.2	16.3	15.4	13.7
		18.5	M	20.8	14.9	11.2	13.3	16.2			
	Average	19.2	-	22.5	15.3	11.8	13.5	15.7			
3	Measure d	15.5	20.5	16.1	18.2	11.9	14.0	M	16.7	17.9	15.9
		21.6	21.0	17.8	16.3	13.6	14.0	M			
	Average	18.5	20.7	16.9	17.3	12.7	14.0	-			

M: missing

<b>ES Chapter 13 Appendices</b>	
13.1	Construction Noise Assumptions

## **APPENDIX 13.1 CONSTRUCTION NOISE ASSUMPTIONS**

Plant items

Plant	BS5228 Ref.	Source Type	%on-time/frequency*	Sound power (dBA)
<b>Phase 1 Traffic management</b>				
HGV	BS 5228 Table D.7 averaged numbers 121-122	Moving point source	2/hr	106
Cutters, drills and small tools	BS 5228 Table D.6 ref 54	Moving point source	2/hr	109
Tipper Lorry	BS 5228 Table C.8 ref 20	Moving point source	1/hr	107
<b>Phase 2 Site clearance</b>				
HGV	BS 5228 Table D.7 avg no.'s 121-122	Moving point source	2/hr	106
Dozer	BS 5228 Table C.2 ref 10	Moving point source	2/hr	108
Dumper	BS 5228 Table C.2 ref 31	Moving point source	2/hr	115
Pulveriser mounted on excavator	BS 5228 Table C.1 ref 4	Moving point source	2/hr	108
Mobile crane	BS 5228 Table C.4 ref 39	Point sources	50%	105
<b>Phase 2 Excavation</b>				
Excavator	BS 5228 Table D.3ref 35	Moving point source	2/hr	106
Loader (tracked)	BS 5228 Table D.3 ref 13	Moving point source	2/hr	113
Dozer	BS 5228 Table C.2 ref 10	Moving point source	2/hr	108
HGV	BS 5228 Table D.7 avg no.'s 121-122	Moving point source	2/hr	106
Crusher	BS 5228 Table C.1 ref 14	Moving point source	2/hr	110
<b>Phase 2 Substructure</b>				
Cutters, drills and small tools	BS 5228 Table D.6 ref 54	Point source	33%	109
HGV	BS 5228 Table D.7 avg no.'s 121-122	Moving point source	2/hr	106
Ready-mix concrete lorry	BS 5228 Table C.4 ref 18	Moving point source	2/hr	103
Concrete pump	BS 5228 Table C.3 ref 26	Moving point source	2/hr	103
Sheet steel piling rig	BS 5228 Table C.3 ref 9	Moving point source	2/hr	91
Mobile crane	BS 5228 Table C.4 ref 39	Point sources	50%	105
<b>Phase 2 Superstructure</b>				
Cutters, drills and small tools	BS 5228 Table D.6 ref 54	Point source	33%	109
Ready-mix concrete lorry	BS 5228 Table C.4 ref 18	Moving point source	2/hr	103
Concrete pump	BS 5228 Table C.3 ref 26	Point source	50%	103
Scaffolding and mobile hydraulic access	Table 5228 Table C.4 ref 57	Point source	50%	95

Mobile crane	BS 5228 Table C.4 ref 39	Point sources	50%	105
<b>Phase 2 Finishing works</b>				
Road Planer	BS 5228 Table C.5 ref 7	Moving point source	2/hr	110
Vibratory compactor	BS 5228 Table C.5 ref 29	Moving point source	2/hr	110
Road Roller	BS 5228 Table C.5 ref 19	Moving point source	2/hr	108
<b>Phase 3 Road works</b>				
HGV	BS 5228 Table D.7 ave no.'s 121-122	Moving point source	2/hr	106
Cutters, drills and small tools	BS 5228 Table D.6 ref 54	Moving point source	1/2hr	109
Road Planer	BS 5228 Table C.5 ref 7	Moving point source	2/hr	110
Petrol hand-held circular saw	BS 5228 Table C.4 ref 70	Moving point source	1/2hr	119
<b>Phase 4 Finishing works</b>				
Road Planer	BS 5228 Table C.5 ref 7	Moving point source	2/hr	110
Vibratory compactor	BS 5228 Table C.5 ref 29	Moving point source	2/hr	110
Road Roller	BS 5228 Table C.5 ref 19	Moving point source	2/hr	108
*%on-time applied to point sources and frequency applied to moving line sources				

### *Construction noise modelling*

Construction plant noise has been modelled in Cadna-A® with reference to construction works locations as shown in the following drawings:

Ramboll Drawing: Junction 15 Temporary Traffic Layout Construction Phase 1 (*drawing number A55J15J16-RAM-XX-15-DR-T-1171, dated March 2019*)

Ramboll Drawing: Junction 15 Temporary Traffic Layout Construction Phase 2 (*drawing number A55J15J16-RAM-XX-15-DR-T-1172, dated March 2019*)

Ramboll Drawing: Junction 15 Temporary Traffic Layout Construction Phase 3 (*drawing number A55J15J16-RAM-XX-15-DR-T-1173, dated March 2019*)

Ramboll Drawing: Junction 15 Temporary Traffic Layout Construction Phase 4 (*drawing number A55J15J16-RAM-XX-15-DR-T-1174, dated March 2019*)

<b>ES Chapter 14 Appendices</b>	
14.1	Walking, Riding, Cycling and Horse-Riding Assessment

**APPENDIX 14.1  
WALKING, RIDING, CYCLING AND HORSE-RIDING ASSESSMENT**

Intended for  
**Welsh Government**

Document type  
**Assessment**

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**October 2018**

# **A55 JUNCTIONS 15 AND 16 IMPROVEMENTS**

## **WALKING, CYCLING & HORSE- RIDING ASSESSMENT**

## **A55 JUNCTIONS 15 AND 16 IMPROVEMENTS WALKING, CYCLING & HORSE-RIDING ASSESSMENT**

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A55 JUNCTIONS 15 AND 16 IMPROVEMENT OPTIONS

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DESCRIPTION OF ACTIVE TRAVEL OPPORTUNITIES

# 1. SCHEME DESCRIPTION AND BACKGROUND

## 1.1 Background

The A55 Junction 15 and Junction 16 Improvement Scheme includes the replacement of 2 existing roundabouts with 2 grade separated junctions. There are currently 9 options under consultation, with a preferred option to be identified in Autumn 2018. In accordance with HD 42/17, the scale of the scheme has been assessed (by the Lead Assessor) and is considered to qualify as a 'large' scheme for the purposes of this assessment. Therefore, the scheme will be subject to a Walking, Cycling & Horse Riding Assessment (WCAHR) during the options stage of the proposed highway scheme; this will then be followed by Walking, Cycling & Horse Riding Reviews at the preliminary and detailed design stages.

The purpose of the WCAHR Assessment is to facilitate the inclusion of all walking, cycling & horse-riding modes in the A55 Junctions 15 and 16 improvement scheme design process from the earliest stage, enabling the design team to identify opportunities for improved facilities and integration with the local and national network throughout the design process.

Aims of the WCAHR Assessment are to:

- Gain an appropriate understanding of all the existing facilities for pedestrians, cyclists and equestrians in the study area;
- Provide background information that can be referred to throughout the design process; and
- Identify opportunities for improvement for users.

The WCAHR Assessment contains the following elements:

- Definition of the study area;
- A review of walking, cycling & horse-riding policies and strategies;
- Collision data;
- Public transport service and interchange information;
- Key trip generators and local amenities;
- Existing walking, cycling & horse-riding network facilities within the local area;
- Existing walking, cycling & horse-riding network facilities at a strategic level; and
- Walking, cycling & horse-riding survey data.

## 1.2 Proposed Highway Scheme

The A55 junctions 15 and 16 are the only 2 roundabouts on the Euroroute E22 Trans-European Transport Network (TEN-T). This causes problems to the traffic using the A55 travelling along the route.

The purpose of the project is to remove the 2 roundabouts at A55 junctions 15 and 16 and replace them with upgraded junctions. The new junctions will mean that traffic will not need to slow down at the roundabouts thus reducing delays. The removal of the roundabouts will also make the junctions safer, both to traffic travelling along the A55 and for people wishing to enter and leave the A55 in these locations. The project will also address a number of substandard features of the trunk road in the vicinity of the junctions.

Table 1.1 presents the nine junction improvement options for junctions 15 and 16 providing the scheme reference for each option, which junction the option is designed for and a brief description

of the improvement scheme. The 9 junction options, including Public Rights of Way and Cycleway routes are presented in Appendix 1.

**Table 1.1: A55 Junctions 15 & 16 Improvement Scheme**

<b>A55 Improvement Options</b>			
<b>No.</b>	<b>Ref.</b>	<b>Junction</b>	<b>Improvement Scheme Description</b>
1	J15 OPTA	15	2-way movement. WB off/on only. No EB on/off.
2	J15 OPTB	15	4-way movement with bridge across A55.
3	J15 OPTC	15	2-way movement. WB off but no WB on. New under bridge under A55 for EB on but no EB off.
4	J15 OPTD	15	4-way movement. New r/bt to allow EB on/off. Overbridge over A55 and T junction to allow WB on/off.
5	J15 OPT E	15	4-way movement. Same as Option 4 only with the r/bt to west of overbridge at the site of the Heath building.
6	J16 OPTA	16	4-way movement with bridge across A55. New Link road linking to Glan-Yr-Afon Rd and Ysguborwen Rd.
7	J16 OPTB	16	4-way movement. EB off/on via slip at existing r/bt. W/B off/on facilitated by an overbridge located to north-east of existing r/bt.
8	J16 OPTC	16	3-way movement, no EB off. EB on via a new underpass under A55. WB off/on at existing junction.
9	J16 OPTD	16	3-way movement, no EB off. EB on via an overbridge across A55. WB off/on at existing junction.

The key objective for the scheme is to improve access to regional, national and international markets and employment opportunities, in addition to improving resilience and safety and reducing delays both to local traffic as well as for people travelling along the A55.

### 1.2.1 Scheme Objectives

**OBJ1** Improve access to regional, national and international markets and improve access to employment opportunities

**OBJ2** Improve road safety on the A55 from Junction 14 to Junction 16A

**OBJ3** Improve resilience on the A55 for strategic and local traffic

**OBJ5** Improve journey times, journey time reliability and safety for access onto the A55

**OBJ6** Reduce severance with coastal areas for the Non-Motorised Users and enhance provision made for walkers and cyclists

**OBJ7** To take reasonable steps to build healthier communities and better environments

**OBJ8** Opportunities to provide integrated transport are increased

The scheme objectives include improving conditions for walking, cycling and horse-riding as the current route has limited facilities and connections for users. The project team are consulting with local groups, eg Cycling UK and Sustrans and CCBC and the WG, to identify opportunities to improve Active Travel in connection with the project. Where there is a direct impact on existing

walking and cycling routes as a result of the scheme, we will ensure all existing movements will be accommodated. We will also seek to make improvements to walking and cycling routes where feasible, with a particular focus on improving NMU access to the coastline for local residents.

### **1.3 Study Area**

The approximate study area for this Assessment Report can be found in Appendix 2. The assessment area includes the section of A55 and the local highway network between Penmaenmawr, Llanfairfechan and Dwygyfylchi.

## 2. WALKING, CYCLING & HORSE-RIDING ASSESSMENT

This chapter summarises the findings of the assessment. The findings under each topic area are summarised below and any potential opportunities for improvements are noted and summarised in Chapter 3.

### 2.1 Review of Walking, Cycling and Horse-Riding Policies and Strategies

This section provides an overview of relevant walking, cycling and horse-riding local and national policies and the information contained in the documents below will help to inform the identification of opportunities and incorporate them into the scheme through the WCAHR process. The documents reviewed are:

- Planning Policy Wales, 2018;
- Planning Policy Wales, Technical Note, 18 Transport;
- Active Travel (Wales) Act 2013;
- Design Guidance Active Travel (Wales) Act 2013;
- Well-Being of Future Generations (Wales) Act 2015;
- Strategy for the Horse Industry in England and Wales; and,
- The Conwy Local Development Plan 2007-2022.

#### 2.1.1 Planning Policy Wales, 2018

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government, while it is supplemented by a series of Technical Advice Notes. The primary objective of the PPW is *"to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic and environmental and cultural well-being of Wales..."*.

Transport Assessments are identified in the policy as *"an important mechanism for setting out the scale of anticipated impacts a proposed development, or redevelopment, is likely to have. They assist in helping anticipate the impacts of development so that they can be understood and catered for appropriately"*.

It is also stated that *"Transport Assessments can be required for any proposed development if the planning authority considers that there is a justification or specific need. Transport Assessments provide the basis for negotiation on scheme details, including the level of parking, and measures to improve walking, cycling and public transport access..."*

#### 2.1.2 Planning Policy Wales, Technical Advice Note, 18 Transport

This Technical Advice Note (TAN) supplements the Planning Policy Wales and should be taken into account by local planning authorities when they are preparing transport related development plans. This TAN outlines how to integrate land use and transport planning, while it explains how transport impacts should be assessed and mitigated.

Integration of land use planning and development of transport infrastructure is of crucial importance in addressing the environmental aspects of sustainable development and can help the Welsh Government to achieve their objectives for transport through:

- Improving accessibility by walking, cycling and public transport;

- Ensuring that transport is accessible to all, taking into account the needs of disabled and other less mobile people;
- Promoting walking and cycling;
- Supporting traffic management measures;
- Promoting sustainable transport options for freight and commerce;
- Supporting sustainable transport options in rural areas;
- Supporting necessary infrastructure improvements; and
- Ensuring that, as far as possible, transport infrastructure does not contribute to land take, urban sprawl or neighbourhood severance.

According to the same document, when preparing development plans and in determining planning applications, authorities should:

- Ensure that pedestrian routes provide a safe and fully inclusive pedestrian environment, particularly for routes to primary schools;
- Ensure the adoption of suitable measures, such as wide pavements, adequate lighting, pedestrian friendly desire lines and road crossings, and traffic calming;
- Promote the reallocation of road space to pedestrians;
- Support the use of public rights of way for local journeys;
- Identify and protect existing and proposed routes suitable for the use of cyclists and walkers; and
- Ensure that new development encourages cycling by giving careful consideration to location, design, access arrangements, travel 'desire lines' through a development, and integration with existing and potential off-site links.

### 2.1.3 Active Travel (Wales) Act 2013

Key objectives of the Welsh Government are to enable more people to walk, cycle and generally travel by more sustainable modes of transport.

One of the major steps in achieving these goals was the Active Travel (Wales) Act 2013 which gained Royal Assent on 4 November 2013. The Active Travel Act requires local authorities to consult on their existing route maps and integrated network maps and makes the consultation one of the factors that the Welsh Ministers consider in deciding whether to approve the maps.

Further, it gave the Welsh Ministers the power to issue guidance on the location, nature and condition of active travel routes and facilities to ensure they are suitable for use.

### 2.1.4 Design Guidance Active Travel (Wales) Act 2013

According to the Active Travel Act, safety concerns related to the existing infrastructure, such as road junctions, are the biggest barriers to walking and cycling.

*It is also stated that "Where infrastructure already exists, breaks in the network and varying standards can affect people's ability to make use of it and that the purpose of this document is to provide a consistent standard to work to when planning, designing, constructing and maintaining networks and routes for walking and cycling."*

This document provides advice on the planning, design, construction and maintenance of active travel networks and infrastructure, and is to be used at all stages of the process. There are also

details on the design of active travel routes – links, junctions and crossings which meet the needs of pedestrians and cyclists in urban and rural areas.

The Design Guidance Active Travel (Wales) Act 2013 also provides advice on how active travel should be integrated with other modes of transport (cycle, walking, park and cycle). Well-connected interchanges to the cycle network and walking routes should be considered a very high priority in the planning of the pedestrian or walking network.

#### 2.1.5 Well-Being of Future Generations (Wales) Act 2015

The Well-Being of Future (Wales) Act is about to improve the social, economic, environmental and cultural well-being of Wales.

It sets out the long-term goals, while it looks how to prevent problems and take a more joined-up approach. The 7 well-being goals as stated in the document are:

- A prosperous Wales;
- A resilient Wales;
- A healthier Wales;
- A more equal Wales;
- A Wales of cohesive communities;
- A Wales of vibrant culture and thriving Welsh language; and,
- A globally responsible Wales.

#### 2.1.6 Strategy for the Horse Industry in England And Wales

The Strategy has been developed by the British Horse Industry Confederation (BHIC) in partnership with the Government and sets out a vision of where the industry aspires to be within 10 years.

Its purpose is to foster a robust and sustainable horse industry, increase its economic value, enhance the welfare of the horse and develop the industry's contribution to the cultural, social, educational, health and sporting life of the nation.

Key aims of the Strategy are:

- To bring the Horse Industry together and develop its national, regional and local impact;
- To increase participation in equestrianism and the social contribution of the Horse Industry;
- To boost the economic performance of equine businesses;
- To raise equestrian skills, training and standards;
- To increase access to off-road riding and carriage driving; and,
- To consider the environmental impact of the horse.

#### 2.1.7 The Conwy Local Development Plan 2007-2022

The Conwy Local Development Plan (LDP) replaces existing Structure Plans and Local Plans which previously provided the policy framework for the Conwy Plan Area. It sets out the key challenges facing Conwy, identifies the vision, objectives and the Spatial Strategy for development in the area over the period 2007-2022, while providing the basis by which planning applications will be determined.

According to the LDP, convenient access via footways, cycle infrastructure and public transport should exist or be provided where appropriate, thereby encouraging the use of these modes of travel for local journeys and reducing the need to travel by private car and improving the accessibility of services to those with poor availability of transport.

Furthermore, leisure and recreation routes are also an important resource, particularly to improve access to the surrounding countryside as part of a healthy lifestyle.

## 2.2 Collision Data

Records of accidents and casualties for the study area (Llanfairfechan, Penmaenmawr and Dwygyfylchi) for a 5-year period from 2012-2016 has been obtained from the STATS19 database ([www.data.gov.uk](http://www.data.gov.uk)) and the data has been analysed to identify any trends and areas of particular concern. Locations and detailed descriptions of the accidents in the study area can be found in Appendix 3, while a summary of them is presented in Table 2.1.

**Table 2.1: Accident Data by Year and Severity**

Year	Severity			Vulnerable Road Users			Total Casualties	Total Accidents
	Slight	Serious	Fatal	Pedestrians	Cyclists	Motorcycle		
2012	3	6	0	1	1	2	13	9
2013	11	1	0	2	1	1	16	12
2014	6	2	0	0	0	4	10	8
2015	6	1	0	2	0	1	11	7
2016	2	2	1	1	0	0	7	5
<b>Total</b>	<b>28</b>	<b>12</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>8</b>	<b>57</b>	<b>41</b>

Analysis of the data has revealed during this time there have been 41 accidents involving either cyclists, equestrians or pedestrians. Of these accidents one was recorded as fatal, 12 serious and 28 slight.

In Llanfairfechan, Penmaenmawr and Dwygyfylchi, during the 5 year period, 6 pedestrians and 2 cyclists were involved in those accidents recorded.

## 2.3 Public Transport Services and Interchange Information

### 2.3.1 Bus

Four bus services 5, 75, A55 and X5 serve Llanfairfechan, Penmaenmawr and Dwygyfylchi and are summarised in Table 2.2.

**Table 2.2: Bus Services in the Study Area**

Service	Bus Route	Frequency		
		MON-FRI	SAT	SUN
5	Llandudno- Conwy-Bangor- Caernarfon	30mins (from 6.30am to 19:50), 60mins (from 19:50 to 23:50)		60mins (from 09:08 to 22.20)
X5	Llandudno- Conwy-Bangor- Caernarfon	30mins (from 07:15 to 18:25)		60mins (from 10:38 to 19:38), last service at 23:30
A55	Llandudno- Conwy-Bangor- Caernarfon	Only one service leaving at 08:38 from the Bont Newydd bus stop		n/a
75	Llanfairfechan- Llandudno	Two services (09:58, 13:46)		n/a

Source: <http://www.conwy.gov.uk/en/Resident/Parking-Roads-and-Travel/Public-Transport/Assets-Bus-pass/documents/Bus-Information/Conwy-Public-Transport-Guide-2018.PDF>

Service 75 is a smaller vehicle providing limited services for Pendalar.

The route maps of the 4 services can be found in Appendix 4.

Bus services 5 and X5 access Dwygyfylchi at junction 16A, passing through Penmaenmawr. The services continue onto the A55 via junction 15A and access Llanfairfechan from junction 15 before re-entering the A55 via junction 14.

The eastbound route of bus services 5 and X5 exits Llanfairfechan at junction 14, continues onto the A5, and accesses Penmaenmawr via junction 15A. The services then exit Dwygyfylchi via junction 14A and then travel west along A55 using the junction 16 roundabout to turn around to head east.

The westbound and eastbound routes of the A55 bus service are the same for both directions. Buses access/exit Llanfairfechan at junction 14, continuing onto the A55. The service accesses/exits Penmaenmawr at junction 15A and finally accesses/exits the A55 via junction 16.

With regards to the bus service 75, it accesses/exits Llanfairfechan at junction 14, continues onto the A55, accesses/exits Penmaenmawr via junction 15 and finally enters/exits Dwygyfylchi from junction 16A.

### 2.3.2 Rail

Railway stations are located in Llanfairfechan and Penmaenmawr and are served by Arriva Trains Wales with services to Chester via Colwyn Bay, Rhyl, Prestatyn and Flint from 05:55am to 23:59pm. Passenger services run between Holyhead and Crewe approximately every two hours during the week and on Saturdays. There are around 4 services on a Sunday. There are no bus services connecting to either train station. Rail services in the study area can be found in Appendix 5.

## 2.4 Trip Generators

### 2.4.1 Key Trip Generators and Local Amenities

There are a wide variety of trip generators in the vicinity of the proposed improvements that could be attractive to pedestrians, cyclists and equestrians including:

- Hotels and Restaurants in Llanfairfechan, Penmaenmawr and Dwygyfylchi;
- Penmaenmawr Golf Club;
- Conwy (Caernarvonshire) Golf Club;
- Snowdonia National Park;
- Retail Units in Penmaenmawr and Llanfairfechan;
- Glyn Uchaf Stables; and
- Schools in Llanfairfechan, Penmaenmawr and Dwygyfylchi.

There are 4 schools (Table 2.3) located in the study area, while all the trip generators can be found in Appendix 6.

**Table 2.3: Schools in Study Area**

<b>Llanfairfechan</b>	
<b>Primary Schools</b>	<b>Address</b>
Ysgol Pant y Rhedyn	Penmaenmawr Road, LL33 0PA
Ysgol Babanod Llanfairfechan	Pentref Road, LL33 0PA
<b>Penmaenmawr</b>	
<b>Primary Schools</b>	<b>Address</b>
Ysgol Pencae	Graiglwyd Road, LL34 6YG
<b>Dwygyfylchi - Capelulo</b>	
<b>Primary Schools</b>	<b>Address</b>
Ysgol Capelulo	Treforis Road, LL34 6RA

Source: <http://www.conwy.gov.uk/en/Resident/Education-and-Families/Schools/Schools-Units-Colleges/Schools-Units-Colleges-and-Centres.aspx>

Ysgol Pant y Rhedyn school is accessible off Penmaenmawr Road, where footways are provided on the north-west part of the road, with a bus stop (services 5, 75, A55, X5) located approximately 60m north-east of the school.

The main access road to Ysgol Babanod Llanfairfechan school is Village Road, footways are provided on both sides, with a bus stop located 50m north of the school's main entrance.

Ysgol Pencae school is located to the east of Penmaenmawr and is accessible off Graiglwyd Road. There are no footways present in the vicinity of the school, while a bus stop (service 75) is located close to the main entrance.

Ysgol Capelulo school is located to the west of Dwygyfylchi and is accessible off Treforis Road, where footway provision is only present to the east of the school on the north side of the road. The nearest bus stop is located at approximately 200m from the school.

#### 2.4.2 Future Trip Generators

A review of committed development within Conway and its 3 neighbouring councils; Denbighshire, Gwynedd and Anglesey, has been undertaken. The 4 following residential developments have been identified as potential future trip generators, with all developments likely to be completed by 2022.

- 1) Residential development for 17 units (8 apartments and 9 dwellings with associated access) located on Penmaenmawr Road to the north of Llanfairfechan. The main access for pedestrians and cyclists to the development would be expected to be from Penmaenmawr Road, providing good connectivity to the existing NCN 5 route.
- 2) A residential development located on Conway Road in Penmaenmawr. The development has planning permission for 23 units across two blocks (1 block of 16 apartments and 1 block of 7 apartments) and the main access for pedestrians and cyclists to the development would be expected to be from Conway Road, while the railway station is accessible off Station Road East; cyclists and pedestrians have access to the NCN 5 via the subway located on Station Road East.
- 3) A residential development located on Penmaenmawr Road in Llanfairfechan and has planning permission for 28 units. The main access to the development would be expected to be from Penmaenmawr Road which forms part of the NCN 5, while footways are presented on both sides of the road.
- 4) A residential development located on Ysguborwen Road in Dwygyfylchi. The development has planning permission for 46 units and is accessible for pedestrians off Ysguborwen Road where footways are provided on both sides of the road. Cyclists have access to the NCN Route 5 at approximately 250m from the development site through the bridge to the north east of the development.

#### 2.5 Site Visit

The site visit was undertaken by Nicola Evans (Lead Assessor) and Ioannis Spyropoulos (Assessor) on Thursday, 6 September 2018, between 11:00 and 16:00 during daylight hours. An additional site visit may be undertaken later in the year during the early evening to review darkness hours. The site visit took the form of walking along a variety of pedestrian and cycling facilities, both within the extents of the scheme and beyond the scheme footprint. The level of use and condition/suitability of each route during the site visit were recorded and potential improvements, repairs were noted (see Appendix 7). The weather during the morning period of the site visit was overcast with rain and during the afternoon it was dry and sunny.

The primary findings of the site visit were:

- No queues or delays were observed at any surveyed location during the site visit;
- Very few cyclists were observed using the section of NCN 5 located along the beach on Penmaenmawr;
- Relatively high volume of cyclists was observed on Penmaenmawr Road;
- No cycle access (ramps) is provided at the surveyed overbridge (Location 10), which links Dwygyfylchi with NCN5;
- No separate cycleway provision is provided on Penmaenmawr Road which forms part of the NCN5;

- No cycle storage is provided at any of the two railway stations; and
- No pedestrian crossing facilities are provided on any of the roads located in front of the surveyed schools.

A summary of observations from site visits to the local schools in the study area are presented in Table 2.4.

**Table 2.4: Summary of School Site Visits**

School	Comment/Observations
Ysgol Pant y Rhedyn	<p>A number of parents and younger pupils were observed walking from Ysgol Babanod Llanfairfechan to Ysgol Rhedyn. Parents typically park in The Heath car park on the south eastern side of the school and pupils cut through via a footpath after school. Some parking bays are also available and used by parents at the school entrance.</p> <p>It was noted that a few pupils from Aber School were dropped off by Alpine Travel Bus at the bus stop located approximately 60m opposite the school. A school crossing patrol officer assisted pupils crossing Penmaenmawr Road.</p>
Ysgol Babanod Llanfairfechan	<p>A parking area is provided to the south-west of the school. PRow are located to the south of the school, connecting to Aber Road, Cae Ffynnon Road and Village Road. There is a pedestrian crossing facility located on Penmaenmawr Road to the west of the school, with footways located on both sides of Village Road to the east of the school.</p>
Ysgol Pencae	<p>There are a lack of pedestrian or cycling facilities within the vicinity of the school. There is a school crossing patrol on Conway Old Road.</p>
Ysgol Capelulo	<p>There is a footway on Trefforis Road to the east of the school. There are no designated cycleways however, cycle bays were noted within the school grounds.</p>

A number of observations were also noted on an additional site visit which took place on 30 July 2018. The weather during the site visit was dry but overcast. The primary findings of this site visit were:

- Little evidence of horse riders – although we have received anecdotal evidence that horse riders use the beach;
- A number of cyclists were observed travelling along various sections of the NCN 5. These were noted to be keen cyclists, as opposed to family or leisure cyclists;
- Two pedestrians walking dogs were observed along the Network Rail access adjacent to junction 15;
- Approximately 15 pedestrians, including families, were observed picnicking and walking along the promenade;
- One passenger was observed waiting for bus services at Penmaenmawr Road. The Arriva bus was observed using the bus gate exiting the A55 onto Penmaenmawr Road; and
- Approximately 5 people were observed walking along the seafront towards the Beach Café.

## 2.6 Consultation with Key Stakeholders

A Public Information Exhibition (PIE) was held at Penmaenmawr Museum, Penmaenmawr on Wednesday, 13 December 2017, The Church Institute, Llanfairfechan on Thursday, 14 December 2017 and St Gwynin’s Parish Hall, Dwygyfylchi on Friday, 15 December 2017. Consultation leaflets were sent via email to key stakeholders and parties who were involved in the previous consultation undertaken by Atkins on 2008, including those identified in Table 2.5.

**Table 2.5: Engagement with Statutory Stakeholder Organisations during PIE, December 2017**

Statutory Consultees	Non-Statutory Consultees
Natural Resources Wales (NRW)	Local residents and commuters
CADW Office, Welsh Government	Local businesses
Councils (Councillors & Officers)	Local Action Groups
Conwy County Borough Council	Town Clerks
Gwynedd Council	Bus and train companies
Denbighshire County Council	Cycling groups
Ynys Mon/Anglesey Council	Ramblers Association
North and Mid-Wales Trunk Road Agent (NMTRA – previously known as NWTRA)	Gwynedd Archaeological Trust
Emergency service providers, including the North Wales Police, North Wales Fire and Rescue Service and Welsh Ambulance Services NHS Trust (North Region)	Local Wildlife Trust
Public Utilities	Holyhead Port Authority
Network Rail	Freight Transport Association
	Road Haulage Association
	Federation of small businesses

Further public consultation exhibitions were held at St. Gwynin’s Parish Hall, Dwygyfylchi on Tuesday, 12 June 2018, Penmaenmawr Community Centre, Penmaenmawr on Wednesday, 13 June 2018 and Llanfairfechan Community Centre, Llanfairfechan on Thursday, 14 June 2018. A preview session was held on Monday evening, 11 June 2018 for Conwy County Borough Council councillors at Conwy Business Centre, Llandudno Junction.

Key stakeholder organisations contacted included, but not limited to, are presented in Table 2.6. Additional meetings were held with the parties highlighted in bold, either during the formal consultation period or in the run up to or after the end of the period.

**Table 2.6: Engagement with Statutory Stakeholder Organisations during PIE, June 2018**

Statutory Stakeholder Organisations	
Cable & Wireless UK	<b>North Wales Fire &amp; Rescue Service</b>
CADW	<b>North Wales Police</b>
<b>Conwy County Borough Council (CBC)</b>	NTL: Telewest
Conwy Town Council	Openreach
Denbighshire County Council	Penmaenmawr Town Council
Dwr Cymru Welsh Water	Powergen
Fibrespeed, JSM Group Ltd	SP Energy / Manweb

<b>Statutory Stakeholder Organisations</b>	
Gwynedd Council	Virgin Media
<b>Llanfairfechan Town Council</b>	Wales & West Utilities
Magnox Electric PLC	Welsh Ambulance Service NHS Trust
National Grid	<b>Welsh Government (WG)</b>
National Power Plc	Western Power Distribution
<b>Natural Resources Wales</b>	Ynys Mon / Isle of Anglesey Council
<b>NMWTRA</b>	Zayo Fibrespeed

During the consultation event on Tuesday, 12 June 2018, a meeting was held between the Project Team and Paul Smith, Active Travel, CCBC, Carole Willgoose, Active Travel, WG and James Healey Project Manager, WG.

Details of each of the options were presented and existing pedestrian, cyclist and equestrian facilities within the vicinity of the proposed scheme were discussed and recorded. In addition, the meeting was used to explore planned and aspirational routes, connections and other facilities for the benefit of pedestrians, cyclists and equestrians.

Primary comments from the meeting included:

- Overall, CCBC would like to see improved NMU access for local residents to the NCN5 and to the beach;
- Some evidence of equestrian use on the beach – accessed via Pen slip-road beach club;
- Access to the seafront for NMU restricted due to steps. Walls need to be retained as they are part of the sea defence. Issues with access to the Promenade for cyclists around bird sanctuary and through the existing kissing gate near Pant Pavilion;
- Need to ensure there are sufficient crossing points and that pedestrian/cycle links are provided where scheme impacts on pedestrian/cycle routes. Consider locations of crossing points – need to be realistic/compliant. Need to consider desire lines. Check LDP for details of further developments – consider connectivity;
- Footbridge across the A55 is not just used to access bus stop, it is currently used to provide access to the beach – would be met with resistance if this is removed. Ideally be good to provide cycle access on the bridge;
- Shore Road East is currently in poor condition – would be good to improve pedestrian/cycle facilities – make car feel like a guest in a pedestrian environment. Keep design in keeping with the local area – not a city scheme; and
- Need to consider interaction between pedestrian/cyclists and A55, to reduce interruption of NMU flow.

## **2.7 Existing Pedestrian, Cyclist and Equestrian Facilities Within the Local Area**

The following pedestrian, cyclist and equestrian facilities within the local area have been identified:

### **2.7.1 Pedestrian Facilities**

Public Rights of Way can be found in Appendix 8 and have been extracted from Conwy’s Council website.

The Wales Coast Path and NCN 5 shares the same route which currently runs along the North Wales coastline connecting Dwygyfylchi, Penmaenmawr and Llanfairfechan locally. Long distance the route connects Reading and Holyhead via Oxford, Stratford-upon-Avon, Birmingham, Chester, Colwyn Bay and Bangor. Locally there are issues with accessing the NCN 5 in main due to the A55.

### **Llanfairfechan**

Footways are present along the entire length of Penmaenmawr Road, Promenade and Station Road.

Pedestrian crossing facilities are provided on the Penmaenmawr Road/Station Road junction.

Pedestrian access to the beach can be obtained via an underpass close to Penmaenmawr Station, connecting to the Beach Café and NCN5.

### **Penmaenmawr**

Footways are present along Bangor Road, Conway Road and Paradise Road, which leads to Penmaenmawr railway station.

Pedestrian crossing facilities are provided on the Bangor Road/Paradise Road junction, while a zebra crossing is provided on Bangor Road between Station Road West and Celyn Street.

### **Dwygyfylchi**

Footways are present along Ysguborwen Road, while no pedestrian crossing facilities are provided.

There is a public right of way providing access to the beach from Ysguborwen Road, via a footbridge over the A55.

## 2.7.2 Cyclist Facilities

### **Llanfairfechan**

National Cycle Route 5 runs through Llanfairfechan along Aber Road, onto Penmaenmawr Road, up through Pendalar and onto the overbridge of the A55 towards Penmaenmawr.

There are no cycle storage facilities at Llanfairfechan Rail Station.

### **Penmaenmawr**

A shared use foot/cycle path (NCN 5) is provided along the coast line.

No cycle storage is provided at Penmaenmawr Rail Station.

### **Dwygyfylchi**

No dedicated cycling facilities are provided in Dwygyfylchi.

### 2.7.3 Equestrian Facilities

No specific equestrian facilities have been identified within the scheme area.

## 2.8 Existing Pedestrian, Cyclist and Equestrian Facilities Beyond Scheme Extents and Links to County/Strategic Networks

The following pedestrian, cyclist and equestrian facilities outside the immediate scheme extents, but within the study area, have been identified.

### 2.8.1 Pedestrian and Cyclist Facilities

NCN Route 5.

Various footways are identified in Appendix 9.

### 2.8.2 Equestrian Facilities

No equestrian facilities have been identified.

CCBC Integrated Network Maps (INM), as approved by the WG in February 2018, are provided in Appendix 9. The INM proposals are a requirement of the Active Travel (Wales) Act 2013 and identify the future development of strategic walking, cycling and/or equestrian routes in CCBC.

## 2.9 Pedestrian, Cyclist and Equestrian Survey Data

Surveys of the numbers of pedestrians, cyclists and equestrians within the study area were undertaken on bank holiday Monday, 28 May 2018. The survey was undertaken by TRL 360 between 08:00 and 20:00. Data from the surveys are presented in Table 2.7, while survey data and locations are identified in Appendix 10. The count surveys have been undertaken at the following locations:

- **Survey 1** – The A55 overbridge - the survey included the pedestrian/cycle overbridge and pedestrian/cycle route to A55 bus stop, cycle route/footway along Penmaenmawr Road, and NCN 5 cycleway;
- **Survey 2** – Shore Road East/Penmaenmawr Road;
- **Survey 3** – Penmaenmawr Road;
- **Survey 4** – Station Road/Aber Road/Village Road – signalised crossing;
- **Survey 5** – Aber Road;
- **Survey 6** – High Street;
- **Survey 7** – Beach café – monitor NCN 5 cycle route usage and subway under A55 into Penmaenmawr (and return);
- **Survey 8** – Fernbrook Road/Bangor Road/Brymor Terrace/Pant-y-Afon;
- **Survey 9** – Conway Road/Ysguborwen Road; and,
- **Survey 10** – A55 Overbridge (near Shell garage) – monitor who is using overbridge and cycle route.

Table 2.7: Pedestrian and Cyclist Flows on Survey Locations

Survey Ref	Location	Bicycle	Pedestrian	Equestrian	Total
1	Footway	6	17	0	23
1	Overbridge	2	36	0	38
1	A55 Bus Stop (North)	0	0	0	0
1	A55 Bus Stop (South)	0	0	0	0
1	Penmaenmawr Road	169	110	0	279
2	Shore Road East/Penmaenmawr Road	190	342	0	532
3	Penmaenmawr Road	135	193	0	328
4	Village Road/Aber Road	171	1268	0	1,439
5	Aber Road	74	67	0	141
6	High Street/NCN 5	190	56	0	246
7	NCN 5	328	1,736	0	2,064
7	Subway Under A55	154	1,881	0	2,035
8	Brynmor Terrace/Bangor Road	105	1,724	0	1,829
9	Conway Road/Ysgurborwen	35	101	0	136
10	Overbridge	40	514	0	554
10	NCN5	257	34	0	291

The following is a summary of the main points from the data:

- No equestrian use was recorded at any of the survey sites;
- Survey data suggests all routes surveyed are actively used by both pedestrians and cyclists; and
- There are no cycle facilities at overbridges no. 1 and no. 10; however, a number of cyclists were surveyed using these links suggesting a demand for these facilities.

## 2.10 Consultation with Local User Groups and Wider Public

Further to the above PIE and Public Consultation events, an Active Travel liaison meeting was held at The Heath, Penmaenmawr on Friday, 27 July 2018, between the Project Team and Carole Willgoose, WG, Paul Smith, CCBC, Victor Turner (CCBC), Richard Evans-Snarr (CCBC), John Mather (Cycling UK) and Glyn Evans (Sustrans).

The objective of the meeting was to identify potential opportunities to improve walking, cycling and equestrian facilities both within the footprint of the scheme, but also to identify opportunities through Active Travel beyond the scheme footprint. Minutes from the meeting are provided in Appendix 11.

A meeting was also held on Monday, 30 July 2018, at Conwy Business Centre, Llandudno Junction with local Bus Operators. The meeting was attended by James Healey (WG), David Hall (WG),

Bob Saxby (Bus Users UK), Chris Owens (Alpine Travel), Dafydd Williams (Arriva) and the Project Team.

Each of the options were presented and the potential impact on bus services identified, in summary for Junction 15 the preferred option was B, and the least preferred was option A. For junction 16, the most preferred was option A, with the remaining options viewed as no worse than the existing scenario. Minutes from the meeting are provided in Appendix 11.

Further consultation in respect to walking, cycling and equestrian facilities will be ongoing throughout the project.

### 3. USER OPPORTUNITIES

The opportunities highlighted below are considered to be relevant to the scheme and should be considered by the wider design team throughout the progression of the scheme design in addition to any further opportunities that may arise through the ongoing development of the design phase, and the ongoing Active Travel consultation. Although the scheme options vary, it should be noted that where the scheme directly impacts on any NMU routes, as a minimum all existing movements will be retained within the proposed scheme design. Table 3.1 identifies a number of scheme specific opportunities to improve walking and cycling routes.

#### 3.1 Scheme Specific Opportunities

Table 3.1 Scheme Specific Opportunities

Description
Improvements to overbridges to accommodate cyclists, specifically A55 overbridge at Shell garage and existing overbridge at Pendalar
Cyclists on Penmaenmawr Road, which forms a section of the NCN Route 5, are exposed to traffic and thus dedicated/shared cycleway are recommended to be provided
Ensure continuity of NCN 5 through Penmaenmawr Road/Junction 15
Provision of pedestrian crossing on Penmaenmawr Road (to the north of Junction 15)
Provision of pedestrian crossing on Penmaenmawr Road (to the south of Junction 15)
Repositioning of bus stops on Glan Yr Afon Road
Improvements to footway surfacing/dropped kerb provision along NCN 5 (in proximity to scheme design)
Seek to incorporate footway/cycleway provision on any new highway/infrastructure (where permitted) to improve access to coastline

#### 3.2 Opportunities Identified Through Site Visit

A number of opportunities for walking and cycling routes were identified during the site visit, as presented in Appendix 7. These are presented in Table 3.2.

Table 3.2 Opportunities Identified Through Site Visit

Location	Proposed Improvement
The A55 pedestrian overbridge. Eastbound pedestrian footway to A55 bus stop. Westbound footway to stairs leading down towards beach. NCN 5 along Penmaenmawr Road.	<ul style="list-style-type: none"> <li>Upgrade bridge to provide cycle access. NCN 5 runs along Penmaenmawr Road and this would provide access for cyclists onto the beach, and Shore Road East. Survey data suggests cyclists already use the overbridge.</li> <li>Improve current unlit stepped access to 'track' which provides access to the beach and Shore Road East.</li> <li>Improvements to 'track' – surfacing/lighting etc.</li> <li>Provision of dropped kerbs and resurfacing of footways along Penmaenmawr Road.</li> </ul>
Shore Road East/Penmaenmawr Road	<ul style="list-style-type: none"> <li>Provision of dropped kerbs and resurfacing of footways along Penmaenmawr Road.</li> <li>Provision of pedestrian crossing facility on Penmaenmawr Road.</li> <li>Provision of cycle lanes along Penmaenmawr Road.</li> </ul>
Station Road/Aber Road/Village Road – signalised crossing.	<ul style="list-style-type: none"> <li>Provision of advanced stop line to help cyclists pull away in front of traffic</li> </ul>
Aber Road	<ul style="list-style-type: none"> <li>Provision of cycle lanes along Aber Road.</li> </ul>
High Street/NCN 5	<ul style="list-style-type: none"> <li>Improvements to drainage to reduce flooding on steps.</li> <li>Improvements to lighting underneath the A55 bridge.</li> </ul>
Beach Café	<ul style="list-style-type: none"> <li>Improvements to lighting along the NCN 5.</li> </ul>
Fernbrook Road/Bangor Road/Brymor Terrace/Pant-y-Afon.	<ul style="list-style-type: none"> <li>Dropped kerbs on Bangor Road.</li> <li>Provision of advanced stop line on Conway Road to help cyclists pull away in front of traffic.</li> </ul>
Conway Road/Ysguborwen Road. (next to J16)	<ul style="list-style-type: none"> <li>Relocation of bus stop.</li> <li>Realignment of cycleway/footway through junction.</li> <li>Designed waiting area for cyclists at junction.</li> </ul>
A55 Overbridge (near Shell garage).	<ul style="list-style-type: none"> <li>Upgrade bridge to provide cycle access.</li> <li>Improve current unlit stepped access to 'track' which provides access to the beach and Dwygyfylchi.</li> <li>Improvements to 'track' – surfacing/lighting etc.</li> </ul>

### 3.3 Active Travel Opportunities

Active Travel journeys are those made to or from a workplace or educational establishment, or in order to access health, leisure or other services or facilities. As such, many of the improvements identified to walking, cycling and horse-riding routes could potentially be classed as Active Travel improvements and are described in Table 3.3.

Detailed description of each Active Travel opportunity can be found in Appendix 12.

**Table 3.3 Active Travel Opportunities**

<b>Llanfairfechan</b>
Improvement to the unpaved sections of the Coastal Path to the West of the Llanfairfechan promenade.
Improved links to Llanfairfechan station from the Coastal Path, including the provision of signage and cycle storage.
Improvement to access from Shore Road East and the Promenade to the Beach Front Path, which is currently unsuitable for cyclists and disabled users due to the kerb and steps through the sea wall.
Improvements through the footprint of the scheme, to improve links onto the sea front from the Sustrans Route 5, including signing, markings and landscaping.
An improved Cycling and walking link from the Promenade to the railway underpass (adjacent to the Pendalar footbridge), consisting of coastal protection works and a short 150m footway link.
A replacement footbridge, to link Pendalar to the coast.
<b>Penmaenmawr and Dwygyfylchi</b>
Penmaenmawr Station improvements, including the provision of cycle storage.
Improved signage, road and footpath markings to create a Beach Front to Station to Town Link.
Provision of a cycleway ramp down to Sustrans Route 5 from the existing Puffin Footbridge.
A circular walking link via Darbyshire's Bridge, via the beach and dunes and Puffin Footbridge, by providing a new footbridge crossing the A55.
Advanced Stop Lines on Penmaenmawr Road/Station Road junction to allow cyclists to be positioned ahead of the traffic.

## 4. WALKING, CYCLING AND HORSE-RIDING ASSESSMENT TEAM STATEMENT

As Lead Assessor, I confirm that this Walking, Cycling and Horse-Riding Assessment Report has been compiled in accordance with DMRB HD42/17 and contains the appropriate information for the wider design team. The Walking, Cycling and Horse-Riding Assessment was undertaken by the following Assessment and Review Team:

### Walking, Cycling and Horse-Riding Lead Assessor

Nicola Evans

Signed:



Principal Transport Planner  
Ramboll

Date:

12.10.18

### Walking, Cycling and Horse-Riding Assessor

Ioannis Spyropoulos

Signed:



Transport Planner  
Ramboll

Date:

12.10.18

As design team leader, I confirm that the assessment has been undertaken at the appropriate stage of the scheme development and that the wider team has been involved in the process.

I confirm that, in my professional opinion, the appointed Lead Assessor has the appropriate experience for the role making reference to the expected competencies contained in HD 42/17.

### Design Team Leader

Rob Griffiths

Signed:

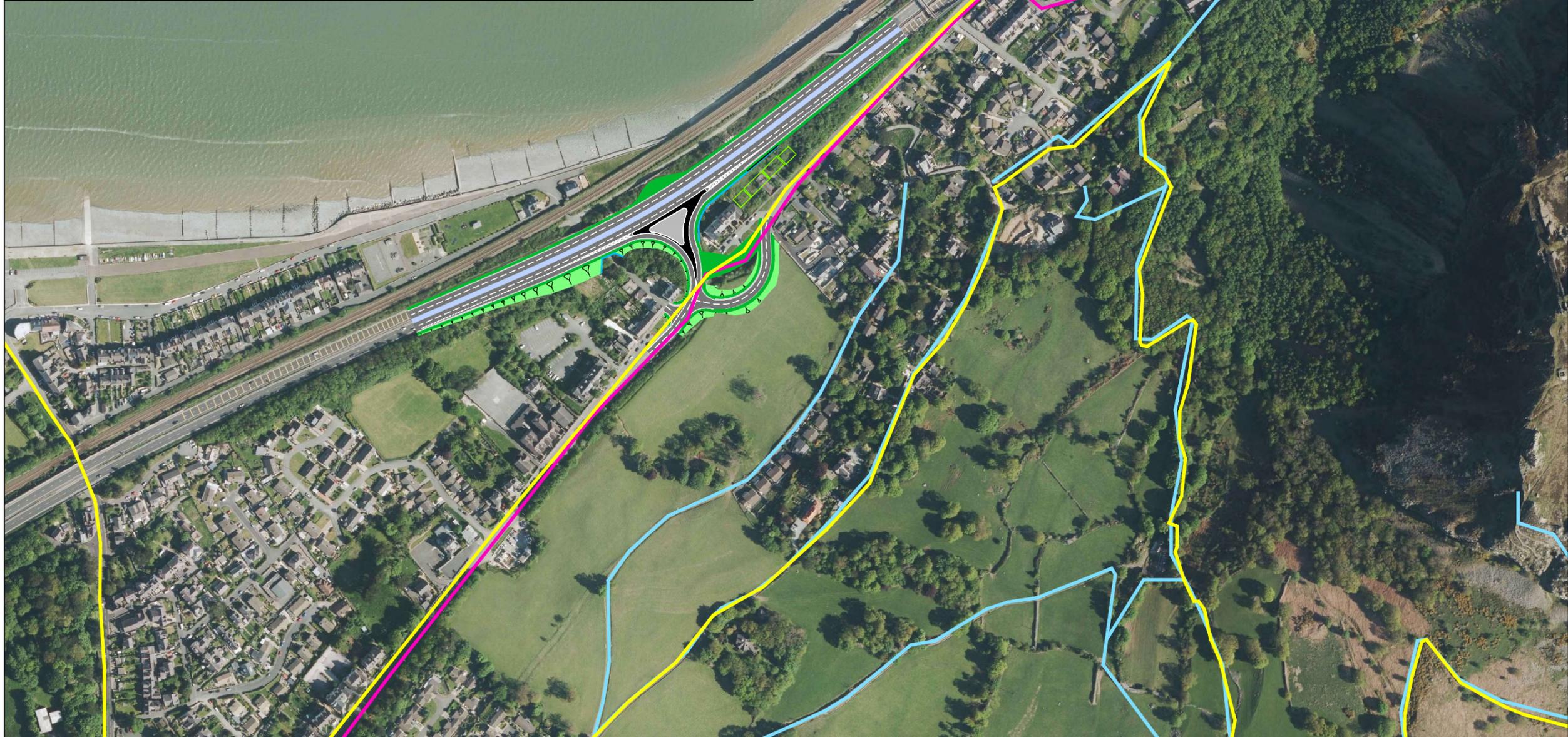
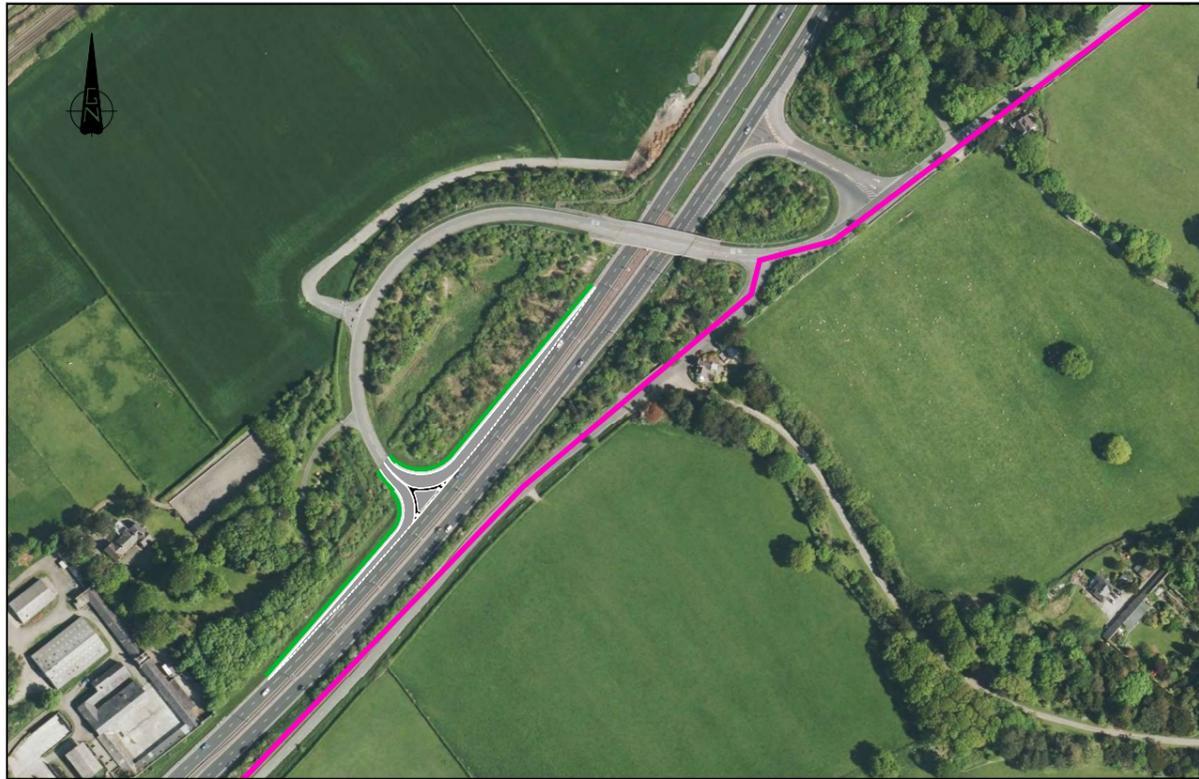


BSc (Hons) CENG MICE  
Ramboll UK Ltd

Date:

12.10.18

**APPENDIX 1**  
**A55 JUNCTIONS 15 AND 16 IMPROVEMENT OPTIONS**



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KEY

- PUBLIC RIGHT OF WAY —
- NATIONAL CYCLE NETWORK —
- WALES COAST PATH —

Rev	Description	DDMM YYYY	DRN CHK By Chk	APP

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A55 JUNCTION 15 IMPROVEMENT OPTION A PROW & CYCLEWAYS

Project No: 1620000620	Scale (@A1): 1:2000	Drawn: JW	Date: MAY 18
Drawing No: RAM-03-XX-SK-J-1000	Rev: P01		



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PUBLIC RIGHT OF WAY	
NATIONAL CYCLE NETWORK	
WALES COAST PATH	

Rev	Description	DDMM YYYY	DRN CHK By Chk	APP
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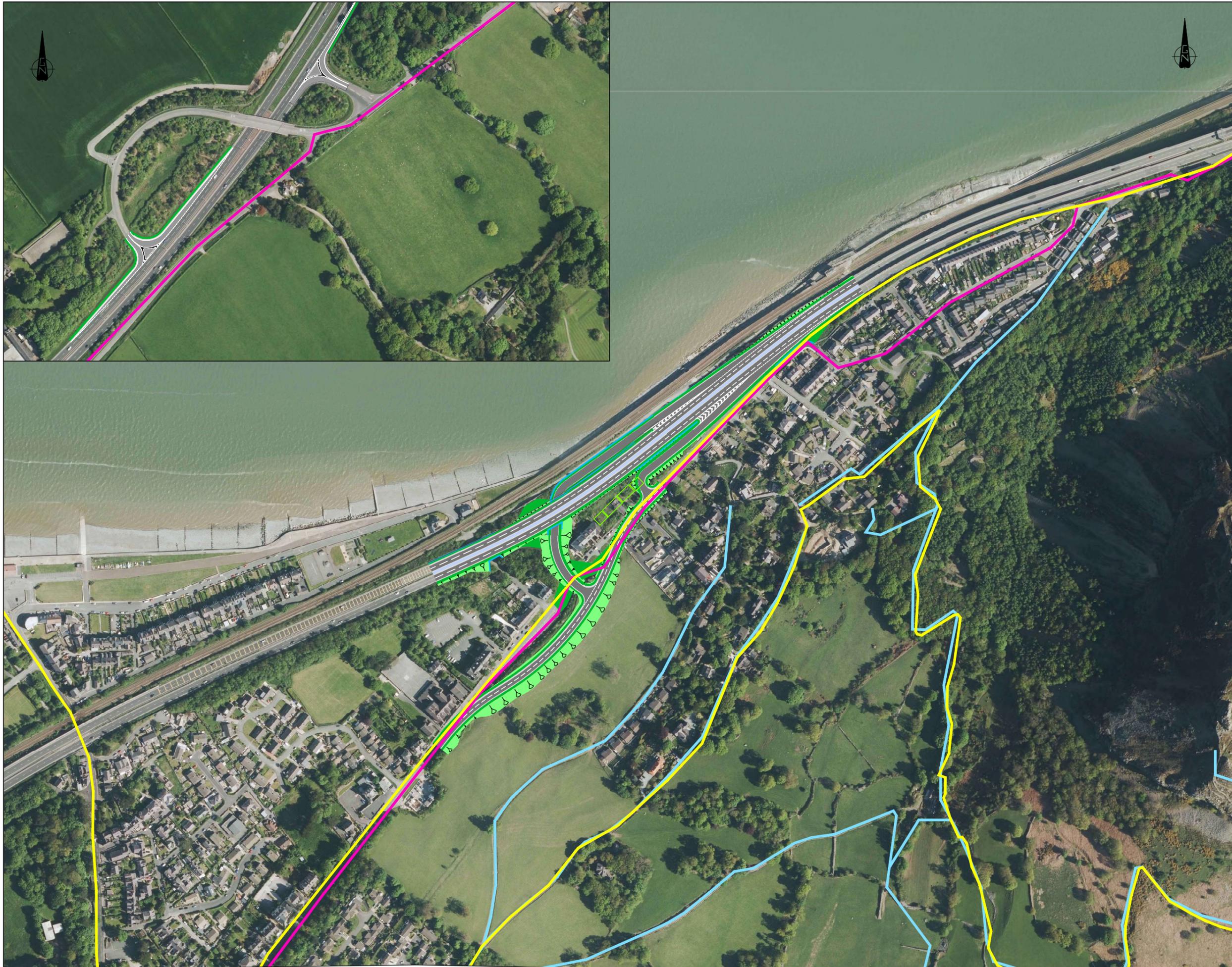
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### A55 JUNCTION 15 IMPROVEMENT OPTION B PROW & CYCLEWAYS

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KEY

PUBLIC RIGHT OF WAY	
NATIONAL CYCLE NETWORK	
WALES COAST PATH	



Rev	Description	DDMM YYYY	DRN CHK By Chk	APP

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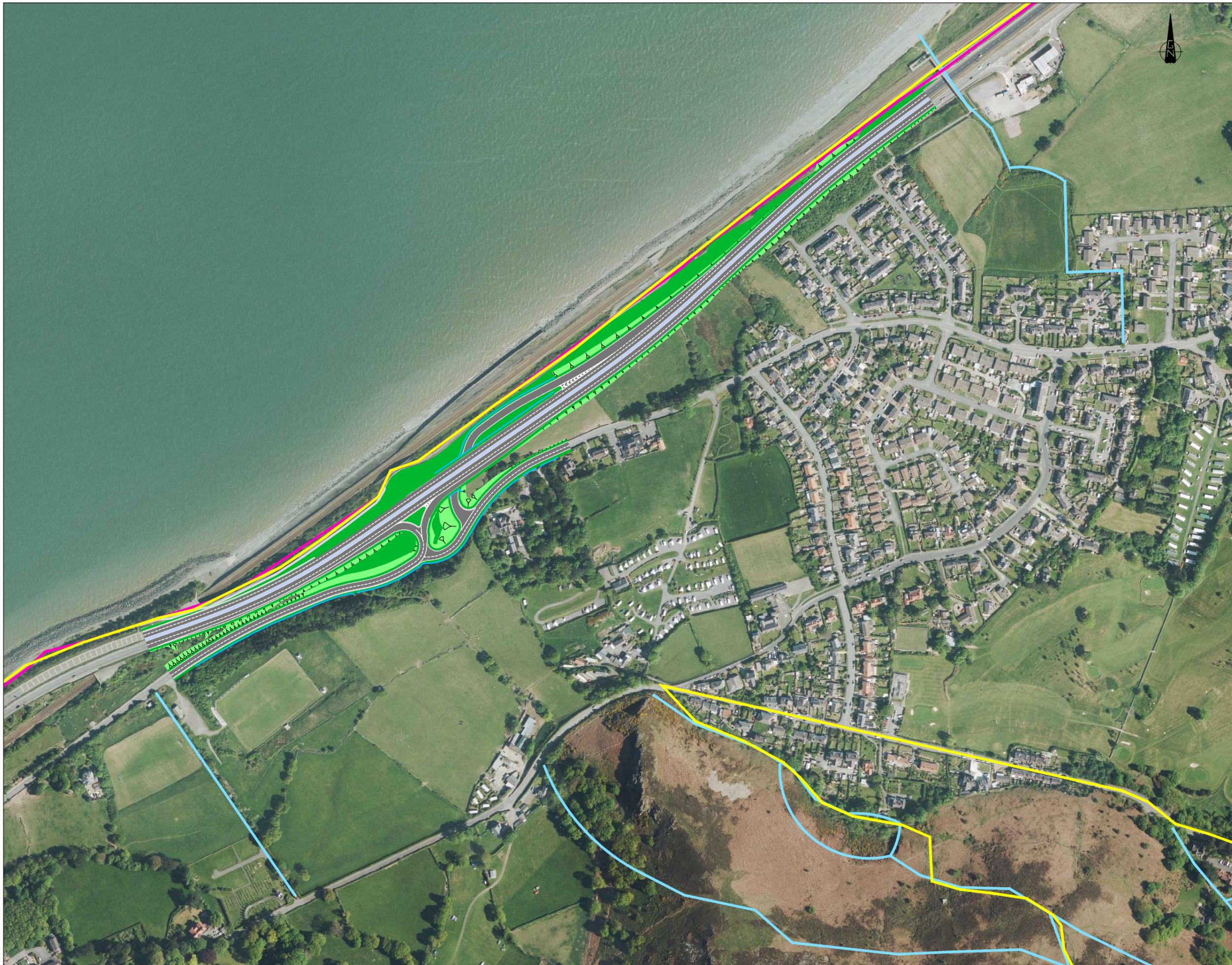
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NATIONAL CYCLE NETWORK	
WALES COAST PATH	

PO1	DESCRIPTION	DDMM YYYY	DRN CHK	APP
Rev	Description	Date	By Chk	App

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 Welsh Government

RICHARDS  
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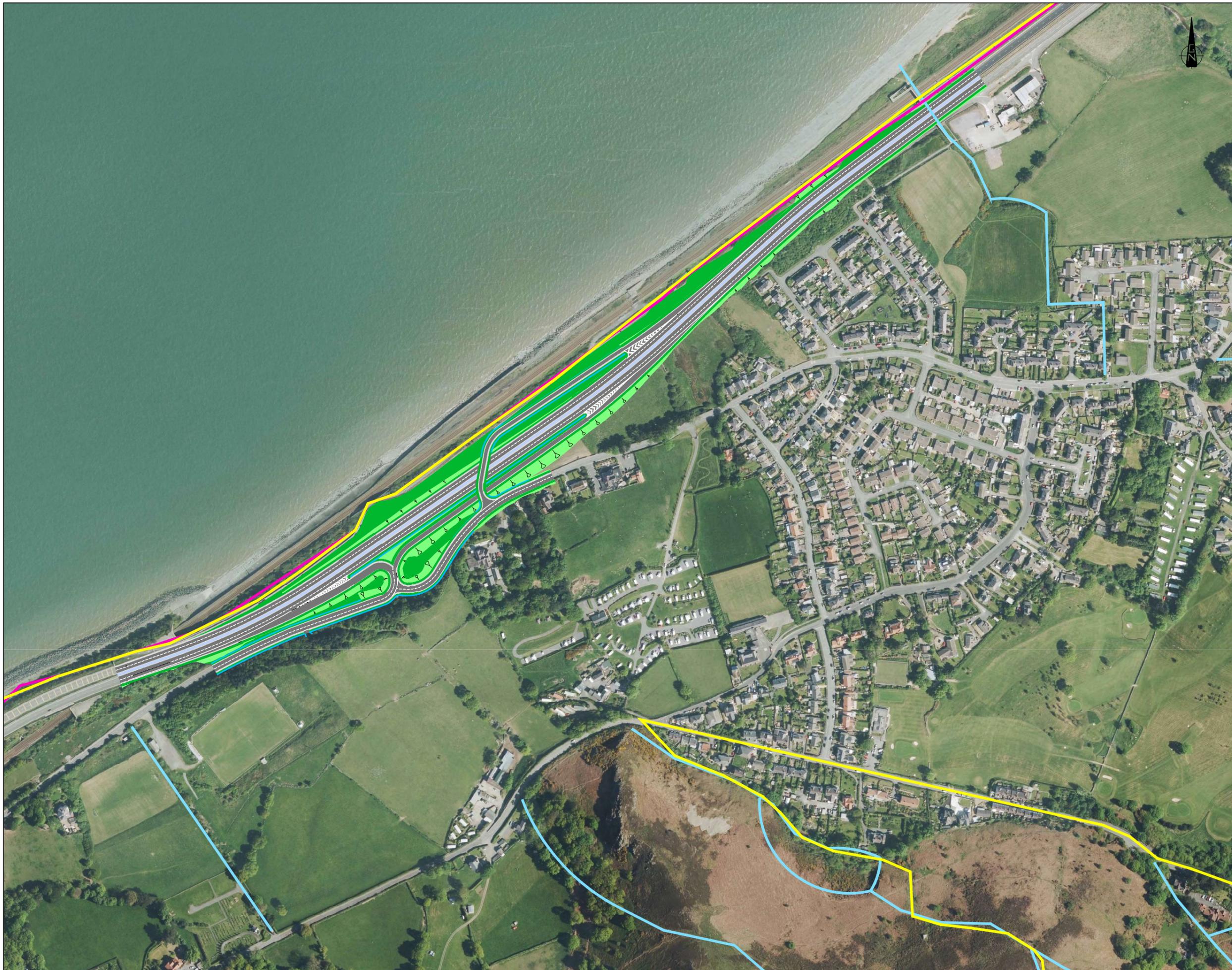
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Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:2000	JW	MAY 18
Drawing No:	Rev:		
RAM-03-XX-SK-J-1007			P01



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KEY

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NATIONAL CYCLE NETWORK	
WALES COAST PATH	

Rev	Description	DDMM YYYY	DRN CHK By Chk	APP

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A55 JUNCTION 15 & 16 IMPROVEMENTS



A55 JUNCTION 16 IMPROVEMENT OPTION D PROW & CYCLEWAYS

Project No: 1620000620	Scale (@A1): 1:2000	Drawn: JW	Date: MAY 18
Drawing No: RAM-03-XX-SK-J-1008	Rev: P01		

## **APPENDIX 2 STUDY AREA**



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KEY

NCN ROUTE 5

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

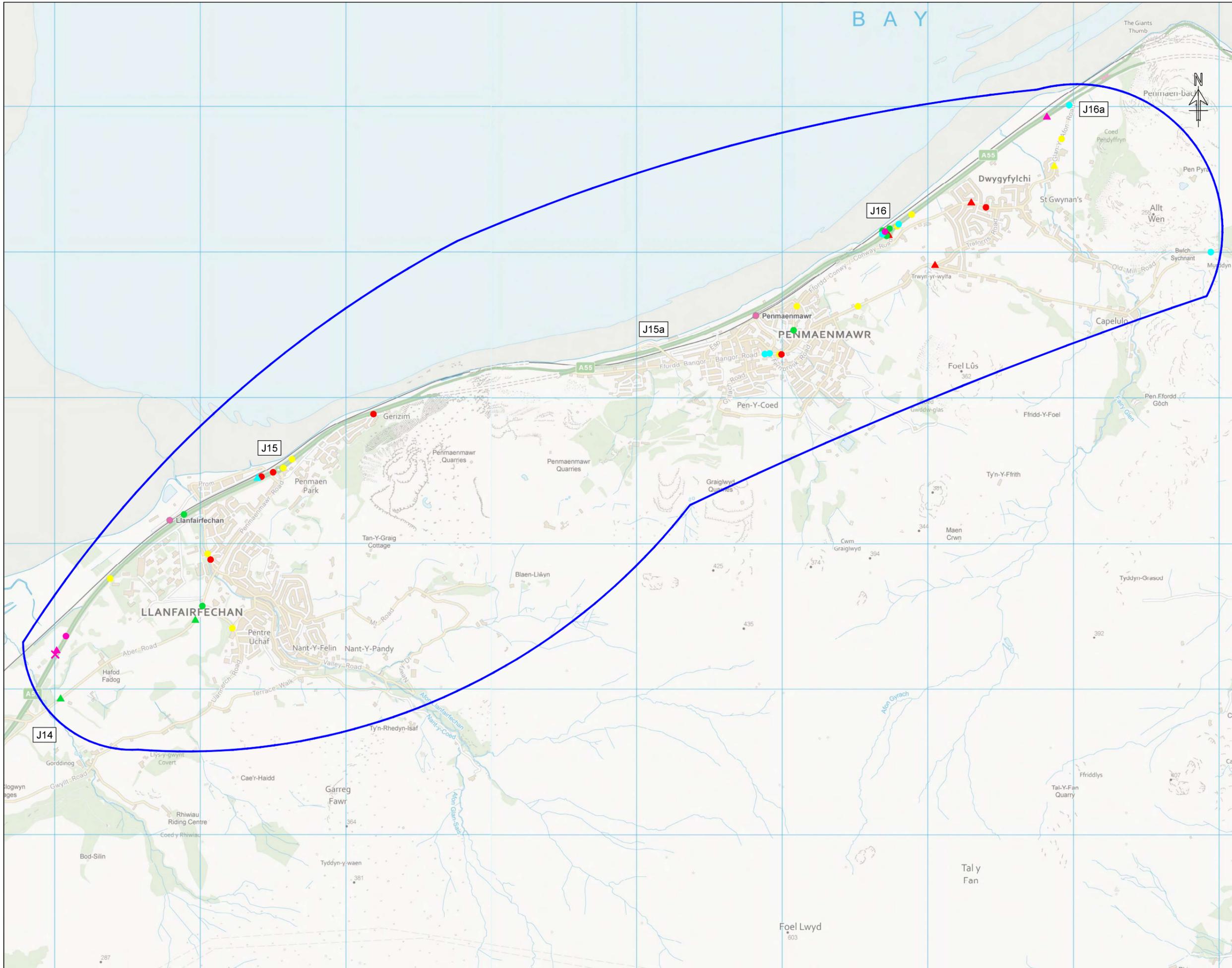
**A55 JUNCTION 15 & 16 IMPROVEMENTS**



**STUDY AREA**

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:12000	JW	DEC 18
Drawing No:	RAM-ZZ-ZZ-SK-J-3000		Rev:
			P01

## **APPENDIX 3 COLLISION DATA**



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**KEY**

- STUDY AREA
- 'SLIGHT' ACCIDENT
- △ 'SERIOUS' ACCIDENT
- × 'FATAL' ACCIDENT
- ACCIDENT DATA 2012
- ACCIDENT DATA 2013
- ACCIDENT DATA 2014
- ACCIDENT DATA 2015
- ACCIDENT DATA 2016

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

**FOR INFORMATION**

**A55 JUNCTION 15 & 16 IMPROVEMENTS**



**TRAFFIC ACCIDENT LOCATIONS (2012-2016)**

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:12000	JW	DEC 18
Drawing No:	RAM-ZZ-ZZ-SK-J-3005		Rev:
			P01

Collision data 2012

Year	DateOfAccident	neOfAcciddecalAuthori	Easting	Northing	Zone	RoadType	loadNumbe	Pedestrians	Cars	Motorcyclists	Pedal cyclists	Ridden horse	otalVehicle	Fatal	Serious	Slight	TotalCasualties
2012	25/06/2012 00:00	1506	W06000003	268500	375490	12	Dual carriageway	A55	0	3	0	0	3	0	0	2	2
2012	18/09/2012 00:00	1109	W06000003	268420	375460	12	Dual carriageway	A55	0	3	0	0	3	0	0	1	1
2012	20/12/2012 00:00	812	W06000003	269190	375890	13	Dual carriageway	A55	0	3	0	0	3	0	0	1	1
2012	24/09/2012 00:00	409	W06000003	272720	377110	24	Dual carriageway	A55	0	1	0	0	1	0	2	0	2
2012	15/03/2012 00:00	1803	W06000003	273050	376910	26	Single carriageway	U	1	0	0	1	0	1	2	0	2
2012	15/08/2012 00:00	1308	W06000003	268070	374890	10	Single carriageway	U	0	1	1	0	0	2	0	0	1
2012	17/06/2012 00:00	1706	W06000003	273300	377340	25	Single carriageway	U	0	1	1	0	0	2	0	1	2
2012	17/06/2012 00:00	1906	W06000003	273400	377310	26	Single carriageway	U	0	4	0	0	0	4	0	0	1

Collision data 2013

Year	DateOfAccident	neOfAcciddecalAuthori	Easting	Northing	Zone	RoadType	loadNumbe	Pedestrians	Cars	Motorcyclists	Pedal cyclists	Ridden horse	otalVehicle	Fatal	Serious	Slight	TotalCasualties
2013	20/06/2013 00:00	906	W06000003	267380	374760	10	Dual carriageway	A55	0	1	0	0	1	0	0	1	1
2013	15/03/2013 00:00	703	W06000003	268630	375580	13	Dual carriageway	A55	0	2	0	0	2	0	0	1	1
2013	04/08/2013 00:00	708	W06000003	268570	375520	13	Dual carriageway	A55	0	2	0	0	2	0	0	3	3
2013	19/03/2013 00:00	1703	W06000003	272890	377260	24	Dual carriageway	A55	0	1	0	0	2	0	0	1	1
2013	25/05/2013 00:00	1605	W06000003	272790	377180	24	Dual carriageway	A55	0	2	0	0	2	0	0	1	1
2013	16/07/2013 00:00	2007	W06000003	272520	376630	23	Single carriageway	U	0	2	0	0	2	0	0	1	1
2013	20/11/2013 00:00	1511	W06000003	272100	376630	23	Single carriageway	U	1	1	0	0	1	0	0	1	1
2013	26/05/2013 00:00	5	W06000003	273870	377590	27	Single carriageway	U	0	0	1	0	1	0	1	0	1
2013	08/08/2013 00:00	2108	W06000003	273920	377780	27	Single carriageway	U	0	1	0	1	0	2	0	0	1
2013	15/08/2013 00:00	1008	W06000003	268220	374420	1	Single carriageway	U	0	2	0	0	2	0	0	3	3
2013	08/11/2013 00:00	1211	W06000003	271980	376300	21	Single carriageway	U	0	3	0	0	3	0	0	1	1
2013	23/12/2013 00:00	1012	W06000003	268050	374930	10	Single carriageway	U	1	1	0	0	1	0	0	1	1

Collision data 2014

Year	DateOfAccident	neOfAcciddecalAuthori	Easting	Northing	Zone	RoadType	loadNumbe	Pedestrians	Cars	Motorcyclists	Pedal cyclists	Ridden horse	otalVehicle	Fatal	Serious	Slight	TotalCasualties
2014	27/12/2014 00:00	1030	W06000003	267887	375201	13	Dual carriageway	A55	0	1	0	0	1	0	0	2	2
2014	17/10/2014 00:00	747	W06000003	272701	377142	24	Dual carriageway	A55	0	3	0	0	3	0	0	2	2
2014	19/04/2014 00:00	1130	W06000003	272737	377164	24	Roundabout	A55	0	1	1	0	2	0	0	1	1
2014	10/03/2014 00:00	1335	W06000003	272717	377114	24	Roundabout	A55	0	0	1	0	1	0	0	1	1
2014	27/05/2014 00:00	1700	W06000003	268014	374572	1	Single carriageway	U	0	2	0	0	2	0	0	1	1
2014	19/06/2014 00:00	1700	W06000003	267966	374472	1	Single carriageway	U	0	3	0	0	3	0	1	0	1
2014	04/02/2014 00:00	1223	W06000003	267039	373933	10	Single carriageway	U	0	1	1	0	2	0	1	0	1
2014	25/01/2014 00:00	1100	W06000003	272078	376466	23	Single carriageway	U	0	1	1	0	2	0	0	1	1

Collision data 2015

Year	DateOfAccident	neOfAcciddecalAuthori	Easting	Northing	Zone	RoadType	loadNumbe	Pedestrians	Cars	Motorcyclists	Pedal cyclists	Ridden horse	otalVehicle	Fatal	Serious	Slight	TotalCasualties
2015	24/07/2015 00:00	1517	W06000003	268392	375448	12	Dual carriageway	A55	0	0	1	0	1	0	1	0	1
2015	07/01/2015 00:00	1415	W06000003	272695	377131	24	Dual carriageway	A55	0	2	0	0	2	0	0	1	1
2015	20/10/2015 00:00	1600	W06000003	272800	377194	24	Dual carriageway	A55	0	3	0	0	4	0	0	3	3
2015	05/05/2015 00:00	2236	W06000003	273972	378012	27	Dual carriageway	A55	0	1	0	0	1	0	0	3	3
2015	06/03/2015 00:00	1610	W06000003	271880	376302	20	Single carriageway	U	1	1	0	0	1	0	0	1	1
2015	02/08/2015 00:00	715	W06000003	271913	376307	20	Single carriageway	U	0	2	0	0	2	0	0	1	1
2015	22/08/2015 00:00	215	W06000003	274946	377002	29	Single carriageway	U	1	1	0	0	1	0	0	1	1

Collision data 2016

Year	DateOfAccident	neOfAcciddecalAuthori	Easting	Northing	Zone	RoadType	loadNumbe	Pedestrians	Cars	Motorcyclists	Pedal cyclists	Ridden horse	otalVehicle	Fatal	Serious	Slight	TotalCasualties
2016	25/01/2016 00:00	2000	W06000003	267007	374251	10	Dual carriageway	A55	0	2	0	0	4	0	1	0	1
2016	08/02/2016 00:00	1030	W06000003	267076	374365	10	Dual carriageway	A55	0	2	0	0	2	0	0	2	2
2016	17/08/2016 00:00	1915	W06000003	267002	374239	10	Dual carriageway	A55	0	1	0	0	2	1	0	0	1
2016	27/10/2016 00:00	747	W06000003	272706	377143	24	Dual carriageway	A55	1	1	0	0	2	0	0	1	1
2016	10/02/2016 00:00	1640	W06000003	273819	377930	27	Dual carriageway	A55	0	1	0	0	2	0	1	1	2

## **APPENDIX 4 ROUTE MAPS OF BUS SERVICES**



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KEY

BUS ROUTE —

BUS STOPS ●

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS



BUS ROUTE X5 WESTBOUND

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:12000	JW	DEC 18
Drawing No:	Rev:		
RAM-ZZ-ZZ-SK-J-3010	P01		



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KEY

BUS ROUTE 

BUS STOPS 

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS



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BUS ROUTE X5 EASTBOUND

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1620000620	1:12000	JW	DEC 18
Drawing No:	RAM-ZZ-ZZ-SK-J-3011		Rev:
			P01



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KEY

BUS ROUTE

BUS STOPS

Rev	Description	DDMM YYYY	DRN CHK	APP
		Date	By Chk	App

FOR INFORMATION

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BUS ROUTE  
A55 EASTBOUND

Project No: 1620000620	Scale (@A1): 1:12000	Drawn: JW	Date: DEC 18
Drawing No: RAM-ZZ-ZZ-SK-J-3013			Rev: P01



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KEY

BUS ROUTE

BUS STOPS

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

### A55 JUNCTION 15 & 16 IMPROVEMENTS

### BUS ROUTE A55 WESTBOUND

Project No:	Scale (@A1):	Drawn:	Date:
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KEY

BUS ROUTE

BUS STOPS

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS



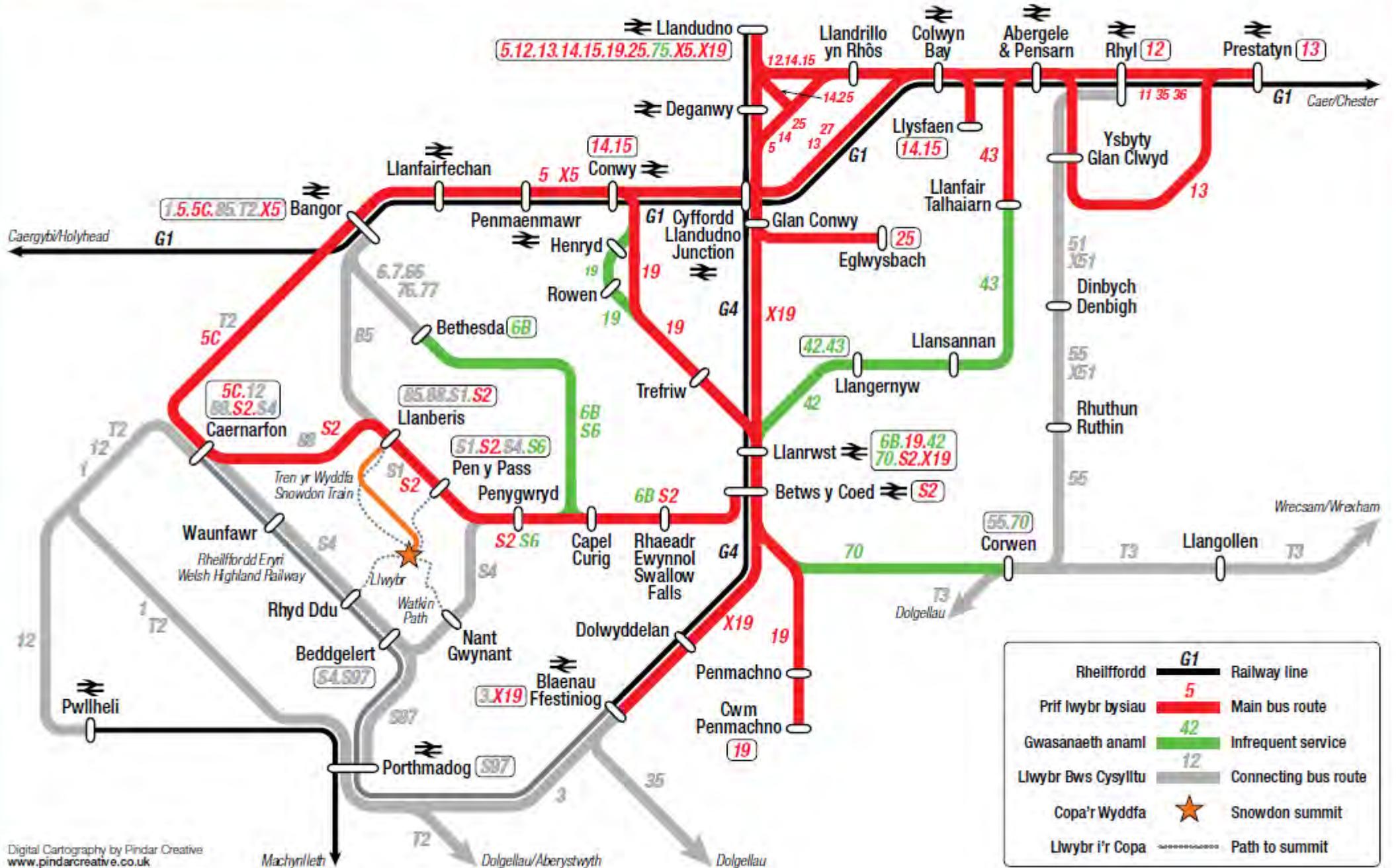
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BUS ROUTE 75

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:12000	JW	DEC 18
Drawing No:	Rev:		
RAM-ZZ-ZZ-SK-J-3014	P01		

**APPENDIX 5**  
**RAIL MAP**

# Map Bysiau a Threnau / Bus and Train Map



## **APPENDIX 6 TRIP GENERATORS**

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KEY

- GLYN UCHAF STABLES ●
- PUBLIC RIGHTS OF WAY —
- RESTAURANTS, PUBS AND HOTELS ●
- RETAIL UNITS ●
- SCHOOLS ●
- SNOWDONIA NATIONAL PARK ▨
- NCN ROUTE 5 —
- TRAIN STATIONS ⇄
- HEALTH FACILITIES ●
- BUS STOPS 🚌

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS

Llywodraeth Cymru  
Welsh Government

RICHARDS  
MUNRO & PARTNERS  
ARCHITECTS

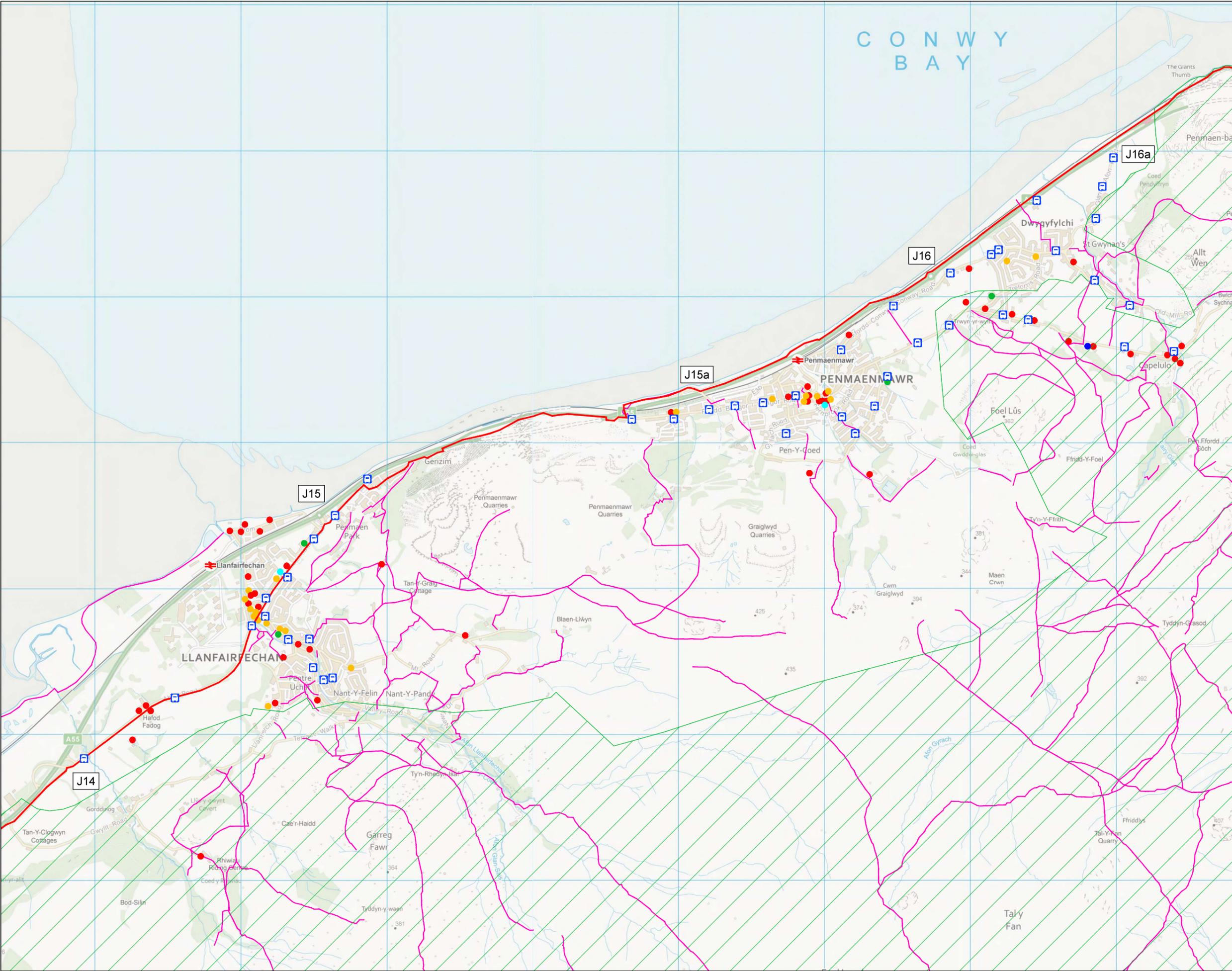
YGC

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TRIP GENERATORS

Project No:	1620000620	Scale (@A1):	1:12000	Drawn:	JW	Date:	DEC 18
Drawing No:	RAM-ZZ-ZK-SK-J-3001	Rev:	P01				



**APPENDIX 7**  
**SITE VISIT ASSESSMENT TABLE**

Site/Survey Location	Daily Usage (based on May bank holiday survey data) (Cyclists/Pedestrians)	Route Condition	Potential Improvements
<p>Location 1: The A55 pedestrian overbridge. Eastbound pedestrian footway to A55 bus stop. Westbound footway to stairs leading down towards beach. NCN 5 along Penmaenmawr Road.</p>	<p>177/163</p>	<p>The pedestrian overbridge is unlit, and in good condition providing access from Penmaenmawr to the disused eastbound bus stop on the A55 and footway connecting to 'track' (via steps) providing access to the beach and Shore Road East. Lit footway along eastbound side of A55 is in good condition – existing bus stop is no longer used. Overall, the footways either side of Penmaenmawr Road are considered to be in good condition. There is some lighting provision, which is considered to be adequate. Inconsistent provision of dropped kerbs along the footway. NCN5 runs along Penmaenmawr Road – no separate cycleway provision.</p>	<ul style="list-style-type: none"> <li>• Upgrade bridge to provide cycle access. NCN 5 runs along Penmaenmawr Road and this would provide access for cyclists onto the beach, and Shore Road East. Survey data suggests cyclists already use the overbridge.</li> <li>• Improve current unlit stepped access to 'track' which provides access to the beach and Shore Road East.</li> <li>• Improvements to 'track' – surfacing/lighting etc.</li> <li>• Provision of dropped kerbs and resurfacing of footways along Penmaenmawr Road.</li> </ul>
<p>Location 2: Shore Road East/Penmaenmawr Road</p>	<p>190/342</p>	<p>Footways and lighting are provided on both sides of Penmaenmawr Road. No provision of pedestrian crossing facilities on Penmaenmawr Road or along the footway at its intersection with Shore Road. NCN5 runs along Penmaenmawr Road – no separate cycleway provision.</p>	<ul style="list-style-type: none"> <li>• Provision of dropped kerbs and resurfacing of footways along Penmaenmawr Road.</li> <li>• Provision of pedestrian crossing facility on Penmaenmawr Road.</li> <li>• Provision of cycle lanes along Penmaenmawr Road.</li> </ul>

Location 3: Penmaenmawr Road.	135/193	Overall, the footways either side of Penmaenmawr Road are considered to be in good condition. Lighting provision is considered adequate. NCN5 runs along Penmaenmawr Road – no separate cycleway provision.	<ul style="list-style-type: none"> <li>• No potential improvements</li> </ul>
Location 4: Station Road/Aber Road/Village Road – signalised crossing.	171/1,268	The junction is in good condition with adequate lighting and road marking. NCN5 runs along Penmaenmawr Road – no separate cycleway provision.	<ul style="list-style-type: none"> <li>• Provision of advanced stop line to help cyclists pull away in front of traffic</li> </ul>
Location 5: Aber Road.	74/67	The footways either side of Aber Road are considered to be in good condition, while lighting provision is considered to be adequate NCN5 runs along Aber Road – no separate cycleway provision.	<ul style="list-style-type: none"> <li>• Provision of cycle lanes along Aber Road.</li> </ul>
Location 6: High Street/NCN 5.	190/56	The footways either sides of High Street are in good condition, while adequate traffic signs are provided for cyclists and pedestrians. Links to the NCN 5 to the south and north of High Street are unlit, while pedestrians can access the NCN 5 along the beach via steep steps.	<ul style="list-style-type: none"> <li>• Improvements to drainage to reduce flooding on steps.</li> <li>• Improvements to lighting underneath the A55 bridge.</li> </ul>
Location 7: Beach Café.	484/3,617	Very good condition of the railway underpass connecting Penmaenmawr beach to Station Road East with adequate lighting. Access to beach/NCN 5 clearly signed. No adequate lighting along NCN 5. Cycle racks are provided out of the path near the Beach Café.	<ul style="list-style-type: none"> <li>• Improvements to lighting along the NCN 5.</li> </ul>

Location 8: Fernbrook Road/Bangor Road/Brymor Terrace/Pant-y-Afon.	105/1,724	Adequate lighting and in overall good condition. Provision of guard-railing. Survey data suggest cyclists pass through the junction.	<ul style="list-style-type: none"> <li>• Dropped kerbs on Bangor Road.</li> <li>• Provision of advanced stop line on Conway Road to help cyclists pull away in front of traffic.</li> </ul>
Location 9: Conway Road/Ysguborwen Road.	35/101	No good visibility for traffic on Conway Road approaching the roundabout. Good lighting provision. The roundabout provides access to A55.	<ul style="list-style-type: none"> <li>• Relocation of bus stop.</li> <li>• Realignment of cycleway/footway through junction.</li> <li>• Designed waiting area for cyclists at junction.</li> </ul>
Location 10: A55 Overbridge (near Shell garage).	297/548	The pedestrian overbridge is accessible via Maes Y Llan. It is unlit and in good condition providing access to the beach, NCN 5 and Dwygyfylchi. A bus stop is located at the south side of overbridge at approximately 80m and is accessible via a footpath. NCN 5 runs at the north side of overbridge in the form of separated cycle lane.	<ul style="list-style-type: none"> <li>• Upgrade bridge to provide cycle access.</li> <li>• Improve current unlit stepped access to 'track' which provides access to the beach and Dwygyfylchi.</li> <li>• Improvements to 'track' – surfacing/lighting etc.</li> </ul>

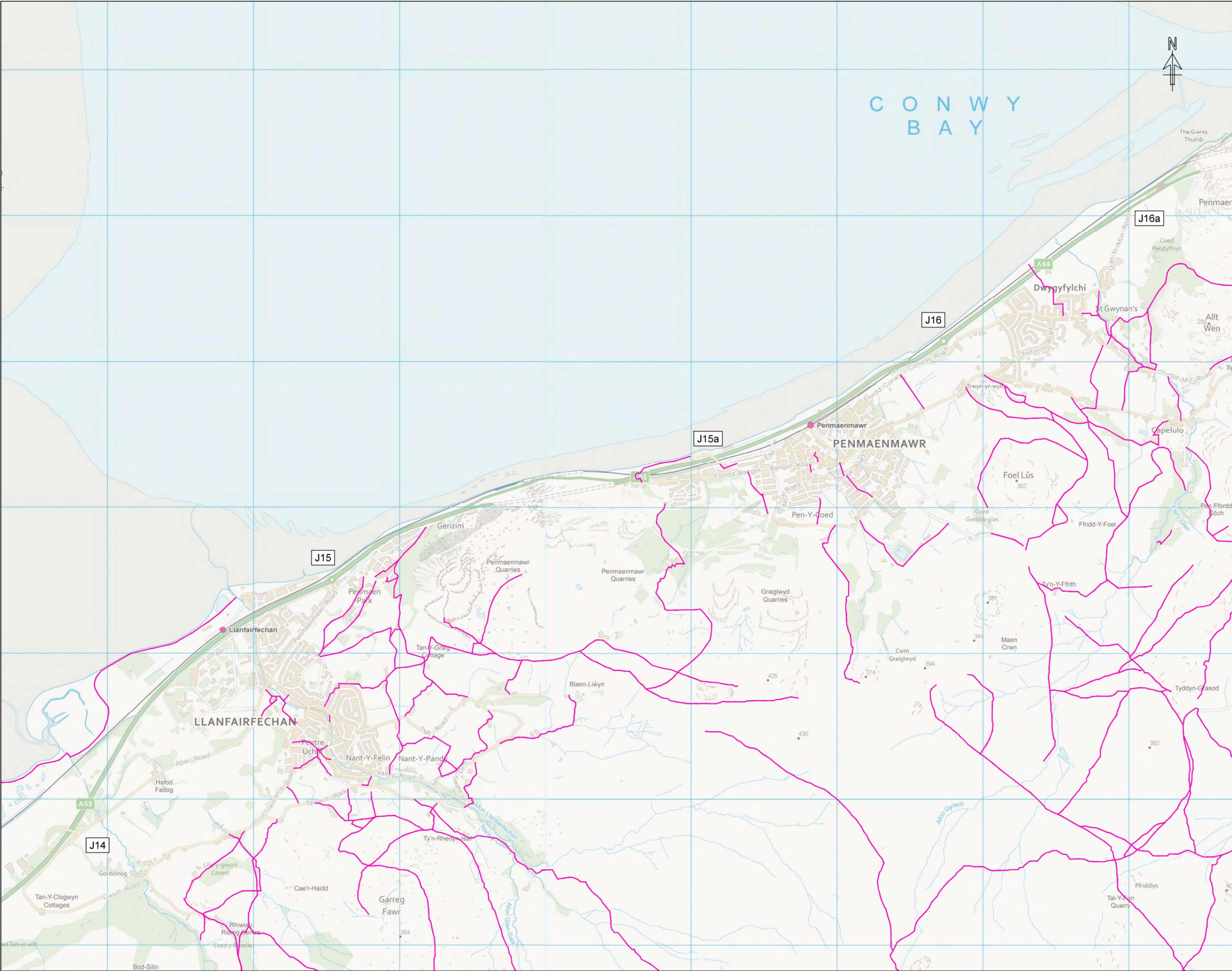
**APPENDIX 8  
PUBLIC RIGHTS OF WAY**

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KEY

PUBLIC FOOTPATHS 



Rev	Description	DDMM YYYY	DRN CHK	APP
		Date	By Chk	App

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS



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LOCATION OF PUBLIC FOOTPATHS

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1620000620	1:12000	JW	DEC 18
Drawing No:	Rev		
RAM-ZZ-ZK-SK-J-3002	P01		

**APPENDIX 9**  
**CCBC INTEGRATED NETWORK MAPS**



**Legend / Eglurhad**

- Active Travel Route / Lwybr Teithio Llesol
- Undefined path design / Ddiunkad lwybr heb ei ddiffinio
- Footpath (away from road) / Lwybr troed (i ffwrdd o'r ffordd)
- Footway (alongside road) / Troedfordd (ochr yn ochr â ffordd)
- Cycle track (away from road) / Trac beilo (i ffwrdd o'r ffordd)
- Cycle track (alongside road) / Trac beilo (ochr yn ochr â ffordd)
- Shared use foot/cycle path (away from road) / Lwybr o'rdded/beilo a renlli (i ffwrdd o'r ffordd)
- Shared use foot/cycle path (alongside road) / Lwybr o'rdded/beilo a renlli (ochr yn ochr â ffordd)
- Segregated foot/cycle path (away from road) / Lwybr o'rdded/beilo wedi'i wahanu (i ffwrdd o'r ffordd)
- Segregated foot/cycle path (alongside road) / Lwybr o'rdded/beilo wedi'i wahanu (ochr yn ochr â ffordd)
- Cycle route (on road, not segregated) / Lôn feleio (ar y ffordd, heb ei gwahanu)
- Cycle lane (on road, segregated) / Lôn feleio (ar y ffordd, wedi'i gwahanu)
- Pedestrian zone / Ardal o'rdded
- Pedestrian and cycle zone / Ardal o'rdded a beilo
- Road without footway / Ffordd heb droedfordd
- Line end points / Penyllau ddiwedd llinell
- Integrated Network / Rhwydwaith Integredig

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**Legend / Eglurhad**

- Active Travel Route / Llywybr Teithio Llesol
- Undefined path design / Dyluniad llywybr heb ei ddiffinio
- Footpath (away from road) / Llywybr i'wedd (o'r ffordd)
- Footway (alongside road) / Troedffordd (cochr yn ochr & ffordd)
- Cycle track (away from road) / Trac beiolol (o' ffordd)
- Cycle track (alongside road) / Trac beiolol (cochr yn ochr & ffordd)
- Shared use foot/cycle path (away from road) / Llywybr o'rdded/beiolol a sennol (cochr yn ochr & ffordd)
- Shared use foot/cycle path (alongside road) / Llywybr o'rdded/beiolol a sennol (cochr yn ochr & ffordd)
- Segregated foot/cycle path (away from road) / Llywybr o'rdded/beiolol wedi'i wahangu (o' ffordd)
- Segregated foot/cycle path (alongside road) / Llywybr o'rdded/beiolol wedi'i wahangu (cochr yn ochr & ffordd)
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- Cycle lane (on road, segregated) / Lôn feiclo (ar y ffordd, wedi'i gwahanu)
- Pedestrian zone / Areal cerdded
- Pedestrian and cycle zone / Areal cerdded a beiolol
- Road without footway / Ffordd heb droedffordd
- Line end points / Pwntiau ddiwedd llinell
- Integrated Network / Rhwydwaith Integredig

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**APPENDIX 10**  
**LOCATIONS AND RESULTS OF THE SURVEY DATA**

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KEY

PEDESTRIANS/CYCLISTS



Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS



PEDESTRIANS & CYCLISTS SURVEY LOCATIONS 1-5

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:3000	JW	DEC 18
Drawing No:	Rev:		
RAM-ZZ-ZZ-SK-J-3003	P01		



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KEY  
 PEDESTRIANS/CYCLISTS

Rev	Description	DD/MM/YYYY	DRN/CHK	APP

FOR INFORMATION

A55 JUNCTION 15 & 16 IMPROVEMENTS



PEDESTRIANS & CYCLISTS SURVEY LOCATIONS 6-10

Project No:	Scale (@A1):	Drawn:	Date:
1620000620	1:5000	JW	DEC 18
Drawing No:	Rev:		
RAM-ZZ-ZK-SK-J-3004	P01		

**APPENDIX 11**  
**MINUTES FROM THE MEETING**

# MINUTES OF MEETING

Project name **A55 J15 and J16 Improvements**  
Project no. **1620000620**  
Subject **Active Travel/Cycling Consultation**  
Meeting date **27/07/18**  
Location **The Heath, Llanfairfechan**  
Meeting no. **01**  
Taken by **Nicola Evans**  
Participants **Rob Griffiths (Ramboll), Paul Smith (CCBC), Victor Turner (CCBC), Richard Evans-Snarr (CCBC) John Mather (Cycling UK), Glyn Evans (Sustrans), Gareth Barker (Corderoy), Carol Willgoose (WG)**  
Copy to **As above, James Healey, Jenny Bringleoe**  
Next meeting **Tbc**

Agenda

- [1 \*\*Introductions\*\*](#)
- [2 \*\*Objective of the meeting\*\*](#)
- [3 \*\*Brief review of scheme and options\*\*](#)
- [4 \*\*Identify opportunities to improve NMU facilities\*\*](#)
- [5 \*\*AOB\*\*](#)

Date 27/07/2018

## 1 **Introductions**

Introductions were made.

## 2 **Objective of the meeting**

RG outlined the purpose of the meeting; to seek feedback on potential opportunities to improve NMU and Active Travel Provision between A55 Junctions 14 and 16A.

At this early stage in scheme development it is an opportunity to identify potential options to improve walking/cycling/horse riding to be explored further.

Any existing NMU facilities, within the footprint of the scheme, will be retained or improved as part of the scope of the scheme. The details will depend on which option is selected, however the general philosophy will be to provide safe, well-marked, signed and landscaped routes in accordance with Active Travel guidelines.

In addition to this there is the opportunity to explore the feasibility of NMU improvements beyond the scheme footprint. In particular, there is scope to provide Active Travel improvements in the wider area. It should be noted however that there is no commitment at this stage to provide Active Travel improvements outside of the

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scheme footprint. Alternative funding streams will however be investigated and if approved these improvements will be incorporated within the scope of the scheme.

GE questioned who had been consulted ie Living Streets etc. It was explained that an extensive list of consultees/stakeholders had been identified based upon those previously involved with the Stage One Consultation and updated accordingly. Emails/letters were issued advising of the consultation period and requesting comments/feedback. It was agreed where we have received direct feedback ie Sustrans and Cycling UK we will hold face to face meetings. Relevant stakeholders ie Living Streets will remain updated as details of design options progress. This approach was considered to be reasonable by those present in the meeting. [POST MEETING NOTE – Living Streets were not included in the initial consultation list, they will now be contacted].

JM appreciated the opportunity to identify opportunities and build relationships with the project team. It is recognised there is a gap between aspirations and what can be provided. It is important to avoid damaging existing facilities.

### **3 Brief Review of the scheme and options**

There are still nine options being considered, as above, we will seek to incorporate NMU movements within the design of the preferred option. Where the scheme directly impacts the NMU routes we will maintain or improve all existing facilities, in addition we will seek to include improved signage/linage etc.

Consultation on the detailed design will be undertaken as appropriate.

### **4 Identify opportunities to improve NMU/Active Travel facilities**

Local Councillors are keen to see connections to the NCN 5 from the local area ie Penmaenmawr, Llanfairfechan and Dwygyfylchi.

Funding for Active Travel is dependent upon the information presented in the INM - integrated network map. However, it is recognised that the current INM will not reflect the opportunities that this scheme may present.

JM stated there is a real issue in Pendalar. The recommended maximum incline for active travel routes is 5%, Pendalar significantly exceeds this at 21%. It is important for people to be able to move from Pendalar onto Shore Road East, and to tie in to the cycle route linked to the Abergwyngregyn and Tai'r Meibion scheme. Providing access to the promenade and to the beach is important.

GE advised that Sustrans provided comments to Stage One – don't feel that these comments have been considered.

RES recommended a proper masterplan is required between J14 and J16a – to ensure scheme won't hinder future opportunities. Any proposed active travel scheme will need to be audited in accordance with Active Travel Design Guidance, and the active travel audit tool kit. Schemes should score above 70. (it is noted that a revised edition of the design guidance is currently being progressed). Sustrans could assist with this audit (for a fee).

RG presented a number of options considered to date [Drawing Nos A55J15J16-RAM-XX-XX-DR-T-0001 and 0002]. General comments to these concepts:

Any NMU provision on road with speed limit over 40mph has to be off road. Important to recognise the difference between NCN and Active Travel Routes. Active Travel routes are different and need to provide a continuous link eg from a residential area to local facility etc. Active travel links should not end at the scheme footprint boundary.

Potential issues with rail crossings – Network Rail are not typically supportive of increasing usage at crossing points.

Must consider who would benefit from these improvements. In line with active travel should focus on providing benefits to local residents, not visitors.

Improvements proposed to signage, cycle parking at station etc. provide better signage and connectivity.

Removal of footbridge to be considered further – initial view was this provided access to the bus stop only. View that this can provide access on to the beach etc. Option to improve access from the bridge? Utilise underpass under railway line.

Issue with bus access – eastbound movements are restricted due to a lack of opportunity to turn buses. Bus gate will also need to be removed, currently speeds are naturally reduced due to vehicles slowing down for the roundabout, if this is removed speeds will be increased.

Pendalar route. Local residents unhappy with cyclists passing so close to front of properties. Dave Peel was considering design for cycle route on Mona Terrace (private road) – CW to contact for update.

Potential to provide a link along coastline extension of NCN route, in connection with coastal protection scheme. Engineered structure along Network Rail wall. Would provide active travel connectivity.

Need to be aware of other schemes/developments in the area. Ie car park space has been identified as potential for cycle parking however there is a possibility that the car park may be sold and therefore usage may not be an option.

[PS/RES] The above are good ideas however need to consider whether these are Active Travel. Should also focus on connecting local people to local facilities, does not include leisure trips. Would want to see improvements to help NMU access to local facilities as well as improved linkages to the NCN. ie Dropped kerbs, crossing points, link train station to promenade – important that the pedestrian does not feel second class to the car. Need to focus on what is existing and what is presented in INM. Suggested Ramboll drawings are updated to include routes identified on INM.

Some options may need consultation with Sian Williams and Owen Conroy (CCBC), who is progressing with coastal protection works.

CW questioned whether any of the active travel options had been progressed since the last consultation meeting. Advised that each option should be assessed against the project

objectives, which includes active travel. Therefore may need to consider progressing the design of some of the active travel elements.

Ramboll drawings and Technical Note to be circulated with these meeting minutes. It was suggested that these can form a starting point to capture additional ideas that CCBC/Sustrans/Cycling UK might have for NMU and Active Travel improvements. Ramboll will update the documents to include feedback received from the various organisations.

## 5 AOB

Access to schools – RES can provide a tool used to identify issues on specific individual routes to school. Conwy currently looking into an existing route along a narrow hill in Penmaenmawr under active travel as there is no footway provision and this road is used as a route to school.

Any comments required prior to the end of the consultation stage ends 28<sup>th</sup> August.

Minutes to be circulated – any additional comments will be incorporated to ensure consistency.

### Actions:

Action	Responsibility
Circulate Drawing Nos A55J15J16-RAM-XX-XX-DR-T-0001 and 0002 presented at meeting and accompanying technical note [A55-RAM-XX-XX-TN-T-0001] for comment.	RG
Identify any additional potential improvements	CCBC/Sustrans/Cycling UK
Request update from David Peel on status of cycle route design on Mona Terrace.	CW
Update Drawing Nos A55J15J16-RAM-XX-XX-DR-T-0001 and 0002 with routes identified on INM.	RAMBOLL

# MINUTES OF MEETING

Project name **A55 J15 and J16 Improvements**  
 Project no. **1620000620**  
 Subject **Bus Operator Review of Options**  
 Meeting date **30.07.18**  
 Location **Conwy Business Centre, Conwy**  
 Meeting no. **01**  
 Taken by **Nicola Evans**  
 Participants **David Hall (WG), James Healey (WG), Gareth Barker (Corderoy), Rob Griffiths (Ramboll), Bob Saxby (Bus Users UK), Chris Owens (Alpine Travel), Dafydd Williams (Arriva)**  
 Absent **Steve Jones (Jones Coaches),**  
 Copy to **As above plus Jenny Bringloe**  
 Next meeting **tbc**

- Agenda
- 1 **Introductions**
  - 2 **Scheme Overview**
  - 3 **Bus Services (Public and School) and Bus Stop Usage**
  - 4 **Long term Plans for Bus Lay-bys and Gates**
  - 5 **Mitigation Measures**
  - 6 **Impact of J15 Options on Bus Operations**
  - 7 **Impact of J16 Options on Bus Operations**
  - 8 **Aspirations to Enhance Bus Provision**
  - 9 **AOB**

Date 31/07/2018

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## 1 **Introductions**

Introductions were given.

## 2 **Scheme Overview**

Outline of the scheme and the options for Junctions 15 and Junctions 16 presented.

JH stated we were keen to receive views from bus operators on the options presented.

RG explained background to project, the PIE presented options and received opinions from the public etc, Public consultation recently presented 9 options. Under some of the options, some existing movements will no longer be permitted and will impact on bus services.

## 3 **Bus Services (Public and School) and Bus Stop Usage**

It is understood that the bus stops on the A55 are currently closed. Alpine and Arriva do not operate any services from the bus stops located on the A55. It's a possibility that a college bus collects students from this bus stop.

There is no demand to retain these bus stops on the A55.

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Service 75 (mini bus) currently operates in Pendalar – am and pm service only.

#### **4 Long term Plans for Bus Lay-bys and Gates**

Speeds along the A55 are due to increase due to removal of roundabouts which currently reduce speeds on the approach to the bus gate.

Bus gate could be replaced with ANPR. However, this doesn't address safety issues and issue regarding reducing speeds. It was agreed that the bus gate off the A55 isn't ideal, and that alternative solutions should be identified.

#### **5 Mitigation Measures**

RG presented an option for a turning head – in location of existing bus stop where caravans are parked. Will need significant turning head and area of land. Arriva may be able to provide details of bus size, and details of similar facility.

May still result in 3 minute increase in running time.

BS advised we need to consider majority of people (100+) who are using the service - who will experience additional 3 minute journey against the potential few people who may use the service from Pendalar.

BS queried whether it would be an option to include addition bus lane from existing bus gate? However, there is an issue with space due to local constraints etc.

Issues with changing service routes ie if services are every 15minutes but only one an hour accesses Pendalar. Likely that they won't know which services is actually arriving due to delays etc.

Rather than a turning head would focus on making sure that access to the next stop down, layout between the existing two stops is level etc.

Arriva would rather avoid turning head, as additional time taken serving Pendalar would make service unviable.

Agreed not to proceed with turning head proposal.

It is noted bus operators concerns that the westbound exit from Dwygyfylchi, re-entering the A55 remains a concern.

Eastbound services operate every 15 minutes, access via J16A requires left turn, and uses roundabout to turn around adding approx. 3 minutes to journey times.

#### **6 Impact of J15 Options on Bus Operations**

##### **Option A**

Movements limited to westbound off and westbound on at Llanfairfechan. Eastbound on/off movements will be located at J14. It is proposed to improve J14 to full design standard.

Potentially may lose the bus stop currently accessed via the bus gate. The stop further south would be retained, however this would not be ideal for the public in Pendalar. Bus operators not overly concerned with the removal of this stop.

This option would likely add additional 10 minutes to the services, increasing costs. May need additional bus service to maintain frequency, which would have expensive implications @£100k for the bus operator.

BS considered this as an awful option and a complete disaster in terms of buses.

Proposals currently recommend removal of footbridge – however this is being reconsidered to provide access to the beach.

BS questioned whether bus stops on the slip road is an option? Advised this is unlikely due to design standards and lack of available width (RG).

Alpine consider the removal of the roundabouts as a huge benefit for bus operators. Local vehicle speed usually very high makes it very difficult for buses to pull out.

#### **Option B**

Full movement junction including link onto promenade. Would require removal of existing new houses and bus gate.

CO considered the overpass would be better in terms of bus operators. Would consider access to promenade would be of benefit to local residents and could enable access for tourist buses to the promenade.

It was noted that feedback during the consultation on improved access to the Promenade was mixed.

This option would be good for School bus movements – no impact on existing services no additional resources required.

#### **Option C**

Limited movements with Option A. Bus gate closed.

Potential impact for coaches with the Underpass. Issues regarding 10% gradient and bend, advised to make the turn as shallow as possible so coaches can travel at 30mph. Slip on needs to be long enough to enable buses to enter A55 – may struggle with gradient.

#### **Option D**

Full movement eastbound on/off elevated slip roads traffic lights at top link road in Llanfairfechan. Westbound movements permitted on/off here. No link to promenade.

May require demolition of new residential buildings.

This would be better to enable buses to get enough speed onto A55.

Disadvantage that you are moving bus movements away from Pendalar, but moving closer to the school.

#### **Option E**

Similar to Option D with eastbound on/off slip located to the east of the westbound slips.

Full movement eastbound on/off elevated slip roads traffic lights at top link road in Llanfairfechan. Westbound on/off movements permitted here. No link to promenade.

Would require removal of The Heath.

This would be better to enable buses to get enough speed onto A55.

Disadvantage that you are moving bus movements away from Pendalar, but moving closer to the school.

#### **Junction 15 Summary**

Option B – preferred

Option A - least preferred

## **7 Impact of J16 Options on Bus Operations**

#### **Option A**

Utilises current J16A and sewage works access.

Westbound movements same as present, and same issues. Ie access off J15A west of Penmaenmawr westbound slip provides dangerous access onto A55.

Mitigation measures on A55 should be considered. Alpine have had instances where buses have collided with cars. Consider putting a turning circle here to avoid this movement? However, this leads to an increase in journey times and operating costs, and could lead to reduction in services etc.

Alpine suggested at Atkins consultation a westbound bridge/viaduct (££).

Would it be an option to remove new link road and spend budget on improving junction 15A.

Option A considered best option as provides improved access to Dwygyfylchi.

#### **Option B**

Option utilises current rbt for westbound on/off movements. Moving A55 across into hillside, providing a new link over near Gladstone Hotel to elevated eastbound slip roads.

Option enables all movements. Benefit slightly less as eastbound buses will need to use 16A and then travel west to J16 as at present before turning again to go east.

Bus operators previously used a turning circle at St Gwinin's church - locals used to park which prevented this movement. Didn't save much time and didn't work.

**Option C - underbridge**

No eastbound off movement permitted. This is no change to the existing bus movement although it is recognised that restricted movements are not ideal.

Previous comments on gradients etc should be noted.

**Option D - overbridge**

No eastbound off movement permitted. This is no change to the existing bus movement although it is recognised that restricted movements are not ideal.

Previous comments on gradients etc should be noted

**Summary Junction 16**

Option A – preference.

Consider inclusion of bus bridge at J16A on Option B, C and D.

**8 Aspirations to Enhance Bus Provision**

No bus links to Penmaenmawr or Llanfairfechan rail stations – this is due to a lack of demand.

Consider inclusion of a bus bridge at J16A to provide safer access for buses onto the A55.

**9 AOB**

BS recommended that the scheme should include for the cost of paying for a shuttle service during the construction phase. This has been done previously when the roundabouts or junctions at one end were closed. It seems likely that closures are inevitable at various stages during the works therefore the cost of a bus shuttle needs to be included from the outset rather than being an unexpected extra later on.

Comments were made on the Abergwyngregyn and Tai'r Meibion scheme [BS]. Would like to see the existing single track road for buses only so they can use in both directions – so they wouldn't have to do dog leg and enter A55 to enter/exit Abergwyngregyn. It was noted that this is a separate scheme being progressed and this section is being upgraded for cycles only. RG commented this was outside the bounds of our scope.

**APPENDIX 12**  
**DESCRIPTION OF ACTIVE TRAVEL OPPORTUNITIES**

## Detailed Description of Active Travel Opportunities

### **Improvement to Coastal Path**

The existing coastal path is paved from Shore Road East, along the sea front all the way to a point half way along the woodland, in line with the western extremity of the hospital site to the south of the A55. It provides a safe, quiet, attractive alternative to the current NCN 5 route through Llanfairfechan.

However, west of the above point, the route is unpaved all the way to the level crossing. Paving of this length (approximately 900m), together with the improvements outlined above (1, 2) would provide a high-quality alternative to the current NCN 5 route through the town, for walkers and cyclists.

Conwy/NRW are currently examining ways of accommodating sea level rise due to climate change, and such an improvement would need to work with these plans.

### **Improved Links to Llanfairfechan Station from Coastal Path**

Improved signage from the sea front path, together with covered lockable cycle storage at the station, would increase the attractiveness of using this integrated transport (cycle/rail) option for many journeys.

### **Improvement to Access from Shore Road East and the Promenade to the Beach Front Path**

The access from the eastern end of the Promenade at Shore Road East onto the Beach Front Path is currently unsuitable for cyclists and disabled users, due to the kerb and then the steps through the sea wall.

Provision of a wider opening, together with ramp rather than steps/kerb, and improved signage and markings would provide improved access to the sea front for cyclists and disabled users.

### **Improvements Through the Footprint of the Scheme**

The scheme provides the opportunity to improve links onto the sea front from the NCN 5 Cycleway (currently along Penmaenmawr Road) to the east.

A new improved corridor would be formed by means of improved signing, markings and landscaping. The provision would differ with each Scheme Option, though most would link via Shore Road East.

### **Improved Cycling and Walking Link from Promenade to Railway Underpass**

Apart from at low tide (where people use the beach), there is currently no beach front walking link between the community east of the current J15 roundabout and the promenade. People currently use the footbridge over the A55 to access bus stops but there is no link to the sea front.

Sea front access for this community would be improved substantially if the footbridge link over the A55 were to be retained and extended to link in to the track currently used as access by Network Rail. There is then an underpass which takes the track under the railway to a path extending east along the sea front.

There is however no link west to the promenade and facilities. People currently making the journey to the sea front would walk on roads and access via Shore Road East. Providing a short (150m) footway link at promenade level would provide direct access for the community to the sea front.

This would require coastal protection works (rock armouring) over this length also, but it would provide a significant community benefit.

### **Replacement Footbridge**

The existing footbridge, which presently serves a bus stop for schoolchildren on the A55 Eastbound carriageway, is due to be scrapped and not replaced in the new scheme. An alternative would need to be found for the schoolchildren.

Most scheme options contain new slip roads which would require modification or demolition of the existing footbridge.

A replacement footbridge in the current position but linking instead down to the underpass below the railway (see 8) would provide a sea front link for the community east of J15 as well as linking to an improved bus stop on Penmaenmawr Road (see 10).

### **Improved Bus Stop Provision at Eastern End of Penmaenmawr Road**

The current bus stop at the eastern end of Penmaenmawr Road serves only buses exiting the A55 Westbound carriageway at the bus gate. Eastbound travellers have to walk an extra 500m close to The Heath to pick up an eastbound bus. For older and disabled people in the community east of J15, this represents a significant challenge given the topography of the area.

The feasibility of providing a bus turning area has been examined briefly and a site identified for a potential roundabout to allow buses to turn, just west of the junction of Penmaenmawr Road and Tyddyn Drycin.

This is adjacent to the existing footbridge ramp and would be located in private land currently used as an area for the parking of caravans and other vehicles.

The roundabout/turning area would potentially affect accesses to three properties.

### **Improvement to Sustrans Route 5 adjacent to Mona Terrace**

The existing designated cycle route follows an existing narrow road (Pendalar) with many parked cars on a tortuous vertical alignment. Representations have previously been made to the Welsh Government, according to the PROW Officer at Conwy, to improve this by taking the cycleway past Mona Terrace running parallel to the A55 Westbound carriageway.

It is understood that the previous scheme looked at the feasibility of re-routing the cycleway along the designated parking area and (potentially private) road in front of the properties and that this was dropped due to land issues.

A potential alternative would be to locate the cycleway in Welsh Government land on the A55 side of the boundary fence. This would require vegetation clearance, a small retaining wall and a guardrail to the A55 side. The affected length is of the order of 100m. The cycleway could then be re-directed back onto the public section of Penmaenmawr Road at either end.

### **Link around Pen-y-Clip Headland**

Provision of a dedicated foot-cycle link between Llanfairfechan and Penmaenmawr just above high tide level around the headland to link the existing coastal path east of Llanfairfechan to the existing coastal path west of Penmaenmawr.

Currently the NCN 5 route utilises the old coach road which is narrow and very hilly, making it a challenge for many leisure users, and discouraging its use as an active travel route.

At low tide people can walk on the beach between the two towns, however at high tide there is no alternative low level link.

A 1.5km long new path could be built at low level. This would abut the existing Network retaining wall along most of its length and abut the headland for the remaining length. It would need to be integrated into a rock armouring/coastal protection solution.

Such an improved relatively flat path would increase the usage of the coastal path and attract more active travel usage.

### **Penmaenmawr Station Improvement**

There is no dedicated covered cycle parking at Penmaenmawr Station. However, there is

ample clear (hardened) unused space in the Station Car Park in which a shelter could be located. This would help to improve integrated transport usage (cycle/rail).

#### **Beach Front to Station to Town Link**

The current link from the beach front to the town centre is poorly signed. Provision of additional flag signs and better road and footpath markings, from the beach front, along Station Road and Paradise Road to the town centre, would increase usage for the benefit of both the town and for cyclists (NCN 5) and station users.

#### **Improvements Through the Footprint of the Scheme**

The scheme provides the opportunity to improve pedestrian and cycle routes through the scheme, linking onto the Sustrans Cycleway. The link would differ depending on option chosen.

#### **Cycleway ramp down to NCN 5 Route from existing Puffin Footbridge**

The current access down from the footbridge to the cyclist route is via steps, requiring cyclists to dismount and being unsuitable for disabled use. The footbridge could be improved by replacement or addition of a dedicated ramp and better lighting. By linking the NCN 5 Route to the housing in Dwygyfylchi, active travel provision would be enhanced.

#### **Improved Walking Link to Beach**

If a new footbridge were provided at Junction 16 (see 17), then an improved walking route via Darbyshire's Bridge could be provided to give improved access to the beach, providing a potential circular walking route via the beach and dunes and Puffin Footbridge.

#### **Advanced Stop Lines on Penmaenmawr Road/Station Road junction**

Considering that Penmaenmawr Road forms part of the NCN Route 5, advanced stop lines could be provided on Penmaenmawr Road/Station Road junction that could give cyclists a safe place to stop and allow them to be positioned ahead of other traffic so they have more time to pull off as the lights change.

<b>ES Chapter 16 Appendices</b>	
16.1	Greenhouse Gas Assessment Summary

**APPENDIX 16.1**  
**GREENHOUSE GAS ASSESSMENT SUMMARY**

## A55 Junction 16 Construction Greenhouse Gas Assessment

Item	Quantity	Unit	Carbon Factor (tCO <sub>2</sub> e per unit)	Carbon (tCO <sub>2</sub> e)	Carbon Factor Source	Assumptions and Limitations
<b>Materials (Embodied Carbon)</b>						
Pre-cast concrete	1,720	tonne	0.122	210	ICE v3.0: Precast concrete, UK general mix (ref1)	Includes kerbs, man holes, gullies, headwalls, culverts structures (J16a overbridge).
Ready-mix concrete	16,683	tonne	0.103	1,718	ICE v3.0: In-situ, general concrete (ref1)	Includes kerb backing, man holes, ducting, small sign foundations, ADS foundations, CSB foundation, structures (Glan y Afon bridge, Maes y llan wall, J16 over bridge, Dwygfichi foot bridge).
Steel (rebar)	656	tonne	1.99	1,305	ICE v3.0: Steel, rebar (ref1)	Includes structures structures (Glan y Afon bridge, Maes y llan wall, J16 over bridge, Dwygfichi foot bridge).
Steel (galvanised)	104.63	tonne	2.76	289	ICE v3.0: Steel, hot dipped galvanised steel (ref1)	Includes lighting columns and weight for 1/3 double sided and 2/3 single sided safety barriers and steel from noise barriers.
Aggregates	53511	tonne	0.00747	400	ICE v3.0: General aggregates (ref1)	Includes filter drains and pavenment foundation (assumes 600mm).
Asphalt	30,785	tonne	0.053	1,638	ICE v3.0: Asphalt 4.5% binder content (ref1)	Includes Inlay/ overlay (100mm average) full dpeth trunk (300mm) and full depth country 200mm).
Plastic	58.42	tonne	2.52	147	ICE v3.0: HDPE plastic (ref1)	Includes HDPE pipework (300mm) and plastic ducting (150mm).
Brick	94.89	tonne	0.21	20	ICE v3.0: General brick (ref1)	Density material factor for brick is 2.13kg per brick (ref1) Includes walls and man hole cover risers
Timber	71.93	tonne	0.263	19	ICE v3.0: Timber softwood - no carbon storage (ref1)	Includes post and 4 rail fence, fencing to properties (1.8m height) and wooden component of noise barrier (2m height).
				<b>Subtotal</b>	<b>5,745.96</b>	
<b>On site emissions</b>						
Heavy Plant (Diesel)	871,080.00	Litre	0.003211	2,797.21	UK Government GHG Conversion Factors 2019: Average diesel blend including well to tank emissions (ref2)	Assumes 8 items of heavy plant (e.g 4 x large excavators, 4 X 35 tonne dump trucks) utilised for 50% of the 24 month construction period. Fuel consumption of 30 litres / hour estimated based on average of values for heavy construction plant (ref3)
Medium Plant (Diesel)	734,973.75	Litre	0.003211	2,360.15	UK Government GHG Conversion Factors 2019: Average diesel blend including well to tank emissions (ref2)	Assumes 9 items of medium plant (e.g. 2 x crane, 2 x diesel generators, 1 x bulldozer, 1 x telehandler, 2 x JCB, 1 x concrete batching plant ) utilised for 75% of the 24 month construction period. Fuel consumption of 15 litres / hour estimated based on average of values for medium construction plant (ref3)
Light Plant (Diesel)	97,996.50	Litre	0.003211	314.69	UK Government GHG Conversion Factors 2019: Average diesel blend including well to tank emissions (ref2)	Assumes 6 items of light plant (e.g. 4 x air compressor, 1 x compactor, 1 x water bowsers, ) utilised for 75% of the 24 month construction period. Fuel consumption of 3 litres / hour estimated based on average of values for light construction plant (ref3)
				<b>Subtotal</b>	<b>5,472.05</b>	
<b>Transport</b>						
Road transport (Heavy Duty Vehicles)				481.50	UK Government DEFRA Emissions Factors Toolkit version 9.0 (ref4)	Total km of HGV construction vehicles travelled for 24 month construction assuming a maximum travel distance of 30km, 80Kph speed limit and 9.5% of HGVs, 90.5% LGVs. Refer to Chapter 12, Air Quality for assumptions.
				<b>Subtotal</b>	<b>481.50</b>	
<b>Waste Disposal</b>						
Construction waste	150.00	tonnes	0.001	0.19	UK Government GHG Conversion Factors 2019. Mix of construction wastes, landfill (ref2)	Refer to Chapter 15, Material Assets and Waste, for assumptions. 70% of off cuts, surplus materials and site operations during construction can be recycled.
				<b>Subtotal</b>	<b>0.19</b>	
				<b>Total</b>	<b>11,699.70</b>	<b>over the 24 month construction period</b>

Project Phase	Total Emissions (MtCO <sub>2</sub> e)	Relevant National Carbon Budget (2018-2022) (MtCO <sub>2</sub> e)	Welsh Annual Carbon Budget (2016-2020) (MtCO <sub>2</sub> e)	% of National Budget	% of Welsh Budget
Construction	0.0117	2,544	225.6	0.000460%	0.005186%

MtCO<sub>2</sub>e = 1,000,000 (One million metric tonnes of carbon dioxide equivalent)

#### References

- 1 University of Bath Inventory of Carbon and Energy (ICE) Version 3.0. Available at: <http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html#XPaGoFWWyUk> [Access 10/10/2019]
- 2 UK Government emissions conversion factors for greenhouse gas company reporting 2019. Available at: <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting> [Accessed 10/10/2019]
- 3 Spon's Civil Engineering and Highway Works Price Book, 2019.
- 4 UK Government DEFRA Emissions Factors Toolkit version 9.0. Available at <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html> [Accessed on 25/10/2019]

<b>ES Chapter 18 Appendices</b>	
18.1	Health Impact Assessment

**APPENDIX 18.1**  
**HEALTH IMPACT ASSESSMENT**

Intended for  
**Welsh Government**

Document type  
**Report**

Date  
**24 January 2020**

# **A55 JUNCTIONS 16 IMPROVEMENTS HEALTH IMPACT ASSESSMENT (HIA)**

## A55 JUNCTIONS 16 IMPROVEMENTS

Project name **A55 Junctions 16 Improvements**  
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## 1. INTRODUCTION

1. The A55, also known as the North Wales Expressway, is a strategic route along the North Wales Coast connecting many towns, villages and local communities. Part of the Euroroute E22 Trans-European Transport Network, the A55 contains two roundabouts at Junctions 15 and 16 that are the only roundabouts in the Euroroute E22. This causes problems to the traffic using the A55 travelling along the route, limiting the smooth flow of traffic and resulting in increased journey times and poor journey time reliability. They also contribute to the incidence of stationary traffic backing up into the A55 Pen-y-Clip and Penmaenbach Tunnels, which in turn can be an increased safety hazard.
2. The purpose of the project is to remove the two roundabouts at Junctions 15 and 16, and construct new grade separated junctions to improve safety and access to Llanfairfechan, Penmaenmawr and Dwygyfylchi.
3. This Appendix discusses potential impacts on human health which may potentially result from the construction and operation of the Proposed Scheme for Junction 16 as compared to the “do-minimum” current scheme. It uses this information and the context of the Proposed Scheme to define the scope of assessment that will be taken forward in the development of the Environmental Impact Assessment (EIA).
4. While human health examines potential health effects in individuals within the population, population health is a broad term that includes the health outcomes of a group of individuals, including the distribution of such outcomes within the group. In this assessment, these groups are the geographic populations near Junction 16, near the town of Penmaenmawr and the village of Dwygyfylchi. The health outcomes of such groups are of relevance to policy makers in both the public and private sectors.
5. Note that human health is not just the overall health of a population but also includes the distribution of health within sub-populations of the population. Overall health could be quite high if most of the population is relatively healthy—even though a minority of the population is much less healthy. The impact of the Proposed Scheme on such susceptible subpopulations is also important.
6. The Proposed Scheme has the potential to impact the health of the community as a whole as well as the health of individual community members. In addition to influencing more traditional pollution metrics which factor into traditional human health risk assessments, the Proposed Scheme has the potential to alter journey times, road safety, reliability and resilience, noise disturbance, and affect local the communities where people reside, thus influencing the health and well-being of community members through environmental, social and economic pathways.
7. The World Health Organisation defines health as a state of complete physical, mental and social well-being, factors which span environmental, social and economic aspects. In Wales, there is also a statutory duty to consider well-being as part of the Well-Being

of Future Generations Act. Therefore, the assessment will need to be sufficiently broad to cover the potential determinants to health and not just focus on environmental hazards.

8. This Report therefore considers how the Proposed Scheme may affect health and well-being, including for example the risks to human health due to water contamination, air pollution, and accidents or disasters. This type of assessment is referred to as a Health Impact Assessment (HIA).

## 2. REGULATORY/POLICY FRAMEWORK

9. The following legislative and policy guidance has been considered in assessing impacts on population and health:

### **2014 EIA Directive**

10. A Population and Human Health chapter is required by EU Directive 2014/52/EU (itself amending Directive 2011/92/EU) to evaluate impacts on human health.

### **The Environmental Impact Assessment (Miscellaneous) Amendments Relating to Harbours, Highways and Transport) Regulations 2017**

11. Schedule 2 of The Environmental Impact Assessment (Miscellaneous) Amendments Relating to Harbours, Highways and Transport) Regulations 2017 amended 'Part VA Environmental Impacts' of the Highways Act 1980. The scoping amendments include a wider list of potential issues to be considered, though not necessarily a list of topics to include in an EIA, including the addition of "Population and Human Health." Each of these parameters needs to be considered in the light of the nature of the proposed development, the nature of the site and any interactions with other systems, processes, or sites. Scoping should be used to remove issues that are not likely to result in significant environmental effects and focus the assessment on the issues that may result in significant effects.

### **Public Health (Wales) Act 2017**

12. The Public Health (Wales) Act 2017 includes a prospective provision within Part 6 for Regulations to be made, requiring HIAs to be carried out by public bodies. Although the Act was enacted in July 2017, Part 6 had yet to be implemented at the time of writing. Part 6 of the regulations notes that an authority must specify:
- a. The circumstances in which a public body must carry out an HIA;
  - b. The way in which a HIA is to be carried out.

### **The Well-Being of Future Generations (Wales) Act 2015**

13. The Well-Being of Future Generations (Wales) Act 2015 puts in place the legislation needed to make public bodies listed in the Act think more about the long-term, work better with people and communities and each other, and look to prevent problems by taking a more proactive, sustainable and joined-up approach. It puts in place seven well-being goals, as presented below.



Figure A1: Well-being goals from the Well-Being of Future Generations (Wales) Act 2015

### Equality Act 2010

14. The public-sector equality duty created by the Equality Act 2010 came into force in April 2011. It requires public sectors to have due regard to the need to eliminate discrimination, advance equality of opportunity, and foster good relations, when making decisions and setting policies. To do this, it is necessary for them to understand the potential effects of its activities on different people. Where these are not immediately apparent, it may be necessary to carry out some form of assessment or analysis, in order to understand them.

### The Equality Act 2010 (Statutory Duties) (Wales) Regulations 2011

15. The Welsh government have brought in specific equality duties in order for public bodies to better perform their public-sector equality duties, in the form of the Equality Act 2010 (Statutory Duties) (Wales) Regulations 2011. These Regulations place duties on the devolved public sector, including Welsh Government, including those that cover equality impact assessments.

### The Children's Act 1989

16. The Children Act 1989 allocates duties to ensure children are safeguarded and their welfare is promoted.

### Other Guidance

17. HIA is not currently a statutory requirement in Wales (or anywhere in the UK) but the Welsh Government increasingly regards it as best practice to consider health and well-being specifically in non-health domains. As such, HIAs are referred to in guidance from the Welsh government, including:

- a. Draft Ministerial Interim Planning Policy Statement (DMIPPS) 02/063 which supports a consideration of health and well-being at a local level and is supplementary guidance to Planning Policy Wales for large planning applications and Local Development Plans (LDPs).
  - b. The Welsh Transport Appraisal Guidance (WelTAG) that has been developed by the Welsh Government to ensure that public funds are invested in a way that ensures they maximise contribution to the well-being of Wales.
18. However, the amended EIA Directive requires that population and health factors should be considered as part of the EIA process, although the Directive itself (as well as the transposed UK legislation) does not define how it should be addressed.
19. National strategies, such as the Clean Air Strategy 2019, that are relevant to Population and Human Health are referenced in the appropriate Chapters.
20. At a local level, the Proposed Scheme has links to a number of policies contained in Conwy Local Development Plan 2007-2022, which was adopted in 2013. These include (not exclusively):
  - a. Spatial Objective S013: To protect and improve accessibility to essential services and facilities, including open space, allotments, health, education and leisure.
  - b. Policy CFS/11: Development and open space, which recognises “the benefits to health and well-being that parks and open spaces bring to communities,” as described in the Conwy Health Strategy.
  - c. Strategic Policy STR/1: Sustainable transport, development and accessibility to support healthy lifestyles.
  - d. Strategic Policy STR/4: Non-motorised Travel, which highlights that “Leisure and recreation routes are also an important resource, particularly to improve access to the surrounding countryside as part of a healthy lifestyle.”
21. The recently published DMRB Standard LA112 discusses how population and health should be addressed in an EIA for a highways project. However, it does not include any specific guidance on how any associated health impact assessment should be undertaken. Notwithstanding this, the Chapter must include information which, considering current knowledge and methods of assessment, is reasonably required by the project authority to reach a reasoned conclusion about the significant effects. As the Population and Human Health Chapter overlaps with many of the EIA topics (for example air quality and noise) described in the Design Manual for Roads and Bridges (DMRB) Volume 11, to avoid duplication, reference will be made to the relevant DMRB standards and guidance as appropriate.
22. The following guidance has been taken into account when completing the assessment of potential impacts to population and human health:

- a. Material provided by the Wales Health Impact Assessment Support Unit (WHIASU). WHIASU is an all-Wales service responsible to Public Health Wales and funded by Welsh Government as a part of a wider strategy to improve health, reduce inequalities, and assist organisations in planning a health future.
- b. IEMA Health in Environmental Impact Assessment, A Primer for a Proportionate Approach, 2017.
- c. Guidance provided by the World Health Organization (WHO).
- d. Guidance provided by the World Bank International Finance Corporation (IFC) Introduction to Health Impact Assessment.
- e. Guidance provided by the Society of Practitioners of Health Impact Assessment (SOPHIA).

### 3. STUDY AREA

23. A description of the Proposed Scheme can be found in Chapter 2 (Scheme Description) of the Environmental Impact Assessment (EIA) report. The broader study area includes the A55 corridor between Junction 14 and Junction 16A, which runs parallel to the railway in close proximity to the centres of Llanfairfechan, Penmaenmawr and Dwygyfylchi (see figure A2, below). The overall study area therefore includes the residential areas between Junction 14 and Junction 16A, including the towns of Llanfairfechan, Penmaenmawr and the village of Dwygyfylchi. Although the geographical scope of the assessment will vary between different health factors being assessed, the data will generally be assessed at a ward level. Depending on the health factors being considered, the buffer(s) will be defined in accordance with the relevant topic’s study area and will be applied proportionately.

Figure A2 Location and setting of Junction 16 (not to scale)



24. Junction 16 on the A55 is an existing at-grade roundabout located on the A55 North Wales Coast road to the south of the Chester to Holyhead railway. Junction 16 provides access to the town centre of Penmaenmawr and residential areas such as Pen-y-Coed and Pen-y-Cae lying on elevated land to the south and south east. To the north of the A55 and the railway lies Penmaenmawr Promenade and the foreshore.
25. The existing Junction 16 lies between the town of Penmaenmawr and the village of Dwygyfylchi. Junction 16 provides access to the town centre of Penmaenmawr and residential areas such as Pen-y-Coed and Pen-y-Cae lying on elevated land to the south and south east. Residential properties in Penmaenmawr extend across most of the coastal plain with the railway and A55 occupying a wide corridor along the coast. On the seaward side of the railway is the paved promenade, with a café, paddling pool, a skatepark and pebble beach all of which was constructed into the sea when the A55 was built. In Dwygyfylchi residential areas and caravan parks are mostly located further inland with a small number of properties close to the A55 in the Maes y Llan area.
26. There are a wide range of community facilities in the town of Penmaenmawr including schools, care homes, health centre, public halls, public parks and recreation areas,

- shops, public houses, places of worship and a seaside promenade. The Wales Coastal Path and National Cycle Route run along the promenade and follow the A55 and the coast to the east and west. There are three places of worship, a primary school, a public beach, a parish hall, a hotel and public house in Dwygyfylchi and several caravan parks.
27. Further east of Penmaenmawr lie Dwygyfylchi and Capellulo. These villages are accessible from the A55 at Junction 16A, which lies further east of Junction 16. Junction 16A provides west bound access only. The only other means of access to the two towns is via the Sychnant Pass Road, an unclassified local road with steep gradients and tight bends that connects the two villages to the town of Conwy.
  28. Dwygyfylchi, lies to the north east of Penmaenmawr, at the northern limit of the and foothills of Snowdonia between the peaks of Foel Lûs and Alltwen. The parish church of St Gwynin stands in the centre of the village, primarily a residential area occupying the generally much flatter coastal plain. On the outskirts of the village lie Penmaenmawr Golf Course and several static caravan sites. North of the village lies the A55 (Junction 16A) and Chester Holyhead Railway Line. A sewage treatment works lies on a small coastal strip north of the railway and A55. The village is well connected to the A55 and local road network that provide access to amenities in Penmaenmawr and the village of Capellulo.
  29. Capellulo is a small village south east of Dwygyfylchi occupying slightly higher land at the foot of Sychnant Pass and the wooded valley of the Afon Gyrach known as Fairy Glen. The village lies just within Snowdonia National Park and is popular venue for walkers and ramblers with a network of footpaths and long-distance paths leading to the surrounding hills and countryside.
  30. The Proposed Scheme for Junction 16 will encourage free-flowing traffic in both directions on the A55, improve road safety and improve access to the communities of Penmaenmawr and Dwygyfylchi by replacing the roundabout at Junction 16 with westbound on and off slip roads only and upgrading Junction 16A to a grade-separated junction. Slip roads will allow safer access and egress from the A55 with local roads modified to meet current highway design standards. A new link road connecting Junctions 16 and 16A will run roughly parallel to the A55, behind the Puffin Café linking back into Ysguborwen Road near to Junction 16. The link road incorporates a new active travel route which connects to the existing Sustrans National Cycle Network Route 5, which runs parallel to the north of the A55. The Junction 16A arrangement consists of an overbridge, located to the north-west of Glan-y-Afon Road. The slip roads would be constructed on raised embankments. The Preferred Scheme extends towards the Penmaenbach tunnels to the east of Junction 16A and encompasses the maintenance cross over area. Further details are contained in Chapter 2 (Scheme).
  31. The nearest sensitive receptors to direct impacts from Junction 16 are residential dwellings along Ysguborwen Road and Maes-y-LLan. The locations of a selection of local amenities used by the local community are shown in the Figures A3 and A4, below.

**Figure A3: Locations of the local amenities in Penmaenmawr**



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**Figure A4: Locations of the local amenities in Dwygyfylchi**



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**Populations: Construction workers and Local communities**

32. Some of the most significant effects would occur during construction of the Proposed Scheme. Construction experts have advised on suitable construction methods and a

construction programme has been developed so that these significant effects can be predicted. Measures have been developed to protect the environment and thus the nearby communities.

33. Working hours would be subject to agreement with the Local Authority Environmental Health Officer and may vary by location and activity. Typically, contractors work Monday to Friday 7 AM (summer) or 7.30 AM (winter) to 7 PM (summer) or 4:30 PM (winter), with earlier end times (4.30 PM) on Saturday and no Saturday work in the winter. There would normally be no working on Sundays or Bank Holidays.
34. Site specific risk assessments and method statements would be produced by the contractor, prior to any work activities commencing to ensure that health and safety responsibilities are met in relation to site personnel and the public. A 'Permit to Work' procedure is required for any construction activities where the contractor has identified that there is a high residual risk of harm.
35. In addition to the construction workers, this assessment will also consider the health and well-being status of all people within the local community, and in particular any specific vulnerable and/or disadvantaged groups that may be particularly affected (such as young children, young people, older people and people with disabilities). As part of this effort, we have analysed the population make-up of Penmaenmawr and Dwygyfylchi taking into account the impact of the preferred option on equality (for example in relation to protected characteristics, such as disability, religion or belief under the Equality Act 2010), diversity and human rights.

### **3.1 Community Population density**

36. The Proposed Scheme is located in a rural area with low population density. The nearest homes are along Ysguborwen Road and Maes-y-LLan. The nearest population centres are the Town of Penmaenmawr and the village of Dwygyfylchi, both in Conwy County Borough. Both are located along the seaside.
37. Penmaenmawr has a resident population (30 June 2017) estimated to be 2,422 people and a population density of approximately 2,833 persons per square kilometre. Dwygyfylchi has a resident population (30 June 2017) of 1,211 people and a population density of approximately 2,329 persons per square kilometre.<sup>1</sup>

### **3.2 Population structure**

38. The age profile of Penmaenmawr and Dwygyfylchi are contrasted to the age profile for the Wales in Table A1 (for mid-2017). Approximately 23% (Penmaenmawr) and 30% (Dwygyfylchi) of the population is age 65 years or older, slightly higher than Wales where this percentage is 21%. The older age profile in the study area is an important consideration for the health and equalities assessments, as the elderly population can be

<sup>1</sup> <https://citypopulation.de/en/uk/wales/>

considered a susceptible population. Furthermore, the elderly are likely to have an increased requirement for healthcare services and changes to well-being and mobility.

**Table A1: Age profile of Penmaenmauwr and Dwygyfylchi**

	<b>Penmaenmauwr</b>	<b>Dwygyfylchi</b>	<b>Wales</b>
Total	2,700 (100%)	1,350 (100%)	3,125,165 (100%)
Age 0-15 years	450 (17%)	200 (15%)	559,260 (18%)
Age 16-29 years	400 (14%)	150 (15%)	557,536 (18%)
Age 30-44 years	500 (19%)	200 (15%)	538,085 (17%)
Age 45-64 years	800 (30%)	400 (30%)	827,015 (26%)
Age 65 years and older	850 (22%)	600 (30%)	643,269 (21%)

39. The gender split in Wales is fairly even with 51% of the population female and 49% male. The gender distribution in Penmaenmawr and Dwygyfylchi is similar: 51% female and 49% male in Penmaenmawr and 52% female and 48% male in Dwygyfylchi.

### 3.3 Ethnicity

40. Data from the 2011 census shows that Penmaenmawr and Dwygyfylchi are comprised of fairly homogeneous ethnic populations with over 96% (Penmaenmawr) and over 98% (Dwygyfylchi) of the population being classified as White British as compared to 93% in this category across Wales. Although the 'other white' category is comparable in Penmaenmawr (2.09% versus 2.38%), other white is lower in Dwygyfylchi (0.94%) and both the mixed ethnic groups and other ethnic groups are much lower in both locations as compared to Wales as a whole.

**Table A2: Ethnicity by broad ethnic group (Source: Census 2011)**

	<b>Penmaenmawr</b>	<b>Dwygyfylchi</b>	<b>Wales</b>
Total	2,868 (100%)	1,485 (100%)	3,063,456 (100%)
White British	2,766 (96.44%)	1,457 (98.11%)	2,855,450 (93.21%)
Other white	60 (2.09%)	14 (0.94%)	72,803 (2.38%)
Mixed ethnic group	23 (0.80%)	9 (0.61%)	31,521 (1.03%)
Other ethnic group	19 (0.66%)	5 (0.34%)	103,682 (3.38%)

### 3.4 Religion

41. The 2011 census shows that Penmaenmawr and Dwygyfylchi also have fairly homogeneous populations with respect to religion. While the religion of majority in (61% in Penmaenmawr; 69% in Dwygyfylchi) is Christianity, less than 1.6% (1.8% in Penmaenmawr; 1% in Dwygyfylchi) belong to other religions, with more than 30% (37.25% in Penmaenmawr; 30.11% in Dwygyfylchi) having no religious affiliation. In

contrast, over 10% of the general population of Wales identify with other religions, including Muslim (1.5%), Hindu (0.3%), Sikh (0.1%), and Jewish (0.1%). A large proportion of the Welsh population (7.6%) identified as 'other religions' without specification.

**Table A3: Religion distribution in Penmaenmawr and Dwygyfylchi compared to Wales**

	<b>Penmaenmawr</b>	<b>Dwygyfylchi</b>	<b>Wales</b>
Christian	1,626 (61.17%)	961 (68.89%)	57.6%
Other religion	42 (1.58%)	14 (1.00%)	10.3%
No religion	990 (37.25%)	420 (30.11%)	32.1%

### **3.5 Socioeconomic**

#### **3.5.1 Per capita income**

42. The median per capita household income in Dwygyfylchi was £30,300 with those in the lowest quartile earning £17,900 or less (CACI PayCheck, 2018)<sup>2</sup>. Per capita household income is not reported for Penmaenmawr. In contrast, the median gross weekly earnings for full-time adults working in Wales were £509.0 in April 2018 (£26,468 annualized<sup>3</sup>). Although not directly comparable (the latter is only among working adults, as opposed to taking into account pensioners), it appears that the average household in Dwygyfylchi is higher than the average across Wales.

<sup>2</sup> <https://www.caci.co.uk/products/product/paycheck>

<sup>3</sup> <https://gweddiill.gov.wales/statistics-and-research/annual-survey-hours-earnings/?lang=en>

## 4. BASELINE CONDITIONS: THE DO-MINIMUM CURRENT SCHEME

43. Baseline conditions were established through a preliminary scoping review based on expert judgement, considering publicly available baseline data (such as the statistical population profiles for wards published by Conwy CBC and the Welsh Index of Multiple Deprivation [WIMD] 2014 data)<sup>4</sup> and findings from the Welsh Transport Appraisal Guidance (WelTAG) and the associated distributional impact assessment.
44. In the subsections below, we review baseline data as discussed in the relevant Environmental Impact report Chapters:
- a. Chapter 6. Geology and Soils
  - b. Chapter 9. Landscape
  - c. Chapter 11. Community Assets
  - d. Chapter 12. Air Quality
  - e. Chapter 13. Noise and Vibration
  - f. Chapter 14. All Travellers
  - g. Chapter 17. Risks of Accidents or Disasters

### 4.1 Geology and Soils

45. As described in Chapter 6, several historical ground investigations were performed in the Study Area. These investigations help define the baseline conditions.
46. Several areas showed evidence of 'organic' odours, all of which were associated with natural strata:
- 'Slight hydrocarbon odour' noted 3.0 - 3.5 meters below ground level, potentially associated with localized contamination by ash, clinker and tarmacadam.
  - 'Strong organic odours' noted 2.4 - 3.8 meters below ground level, associated with natural strata and soft silt (alluvium).
47. Soil samples in historical investigations indicate localised contamination of soil with polycyclic aromatic hydrocarbons (naphthalene, 2-methylnaphthalene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(ah)anthracene), as well as metals (lead, copper, zinc). No evidence of coal tar or asbestos were identified. Radon potential for properties in the Study Area range from <1% up to a maximum radon potential of 5-10%.

### 4.2 Landscape

48. As described in Chapter 9, Penmaenmawr is a former quarry town that developed in 1830 as a result of quarrying the igneous rock diorite out of the nearby Penmaenmawr

<sup>4</sup> <https://www.conwy.gov.uk/en/Resident/Resident.aspx>; <https://statswales.gov.wales/Catalogue/Community-Safety-and-Social-Inclusion/Welsh-Index-of-Multiple-Deprivation>

mountain. Graiglwyd Quarries have over time greatly reduced the height of the mountain that was once much higher with a rounded top and crowned with an old hillfort.

49. Further east of Penmaenmawr lie the villages of Dwygyfylchi and Capellulo. These villages are accessible from the A55 at Junction 16A, which lies further east of Penmaenmawr and Junction 16. Junction 16A provides west bound access only. The only other means of access to the two villages is via the Sychnant Pass Road, an unclassified local road with steep gradients and tight bends that connects the two villages to the town of Conwy.
50. There are a wide range of community facilities in the town of Penmaenmawr including schools, care homes, health centre, public halls, public parks and recreation areas, shops, public houses, places of worship and a seaside promenade. The Wales Coastal Path and National Cycle Route run along the promenade and follow the A55 and the coast to the east and west. Further east of Penmaenmawr lie the villages of Dwygyfylchi and Capellulo.
51. The Study Area contains several landscape character areas that differ in scale and appearance in a relatively small area. The coastal setting of Penmaenmawr is open and attractive and contrasts in spectacular fashion with the mountainous backdrop of Snowdonia to the south. Manmade features punctuate the landscape in similarly spectacular fashion, with the A55 road and rail corridor forging an urban barrier between the town and coast and with quarrying activity visible on the hillside above the town.
52. East of Penmaenmawr town the landscape character is more rural but fragmented by a number of different land uses and influenced by the presence of the A55 road corridor. Further south and inland the influences of the A55 road corridor diminish and the landscape becomes more intimate and enclosed primarily due to topography with steep sided mountain slopes and river valley of Fairy Glen and Sychnant Pass. Mature woodland and tree cover also is more prevalent along the riverbank of the Afon Gyrach and valley bottom of Capelulo and Dwygyfylchi.
53. There are currently several long-distance routes and public rights-of-way located in the Study Area.
54. The A55 and railway have a significant effect on the audible tranquillity in the area impacting on the coastal tranquillity for users of Penmaenmawr promenade and nearby residents in Dwygyfylchi. Visual effects on tranquillity are experienced at greater distances on elevated ground as a result of constant movement of traffic and high sided vehicles. These effects are apparent both day and night with vehicle headlights and lighting at Junctions. Overhead gantries lighting columns and illuminated road signage all add to the discord and intrusiveness of the road corridor. Road traffic, particularly high sided vehicles are also highly visible and audible elements and vary in intensity

depending on number of road traffic movements and annual average daily traffic (AADT).

55. National Cycle Route 5 (NCN5) is a long-distance cycle route that runs between Reading and Holyhead, a distance of 381 miles and along the North Wales Coast between Penmaenmawr and Llanfairfechan. The route runs between the main Chester Holyhead railway line and the A55 road corridor as a segregated route. There is currently no direct route to the village of Dwygyfylchi or the town of Penmaenmawr.
56. The Wales Coast Path is a recreational route that covers a total of 870 miles with the Chester to Bangor section covering 80 miles. The route approaches NCN Route 5 is also used as alternative coastal route for the Wales Coast Path. The path runs along the NCN 5 route and also inland across the upland areas above the town of Penmaenmawr and lowland areas close to Dwygyfylchi.
57. North Wales Path runs from Bangor in the west to Prestatyn in the east and overlaps the more recent Wales Coast Path in some sections. The route runs along some scenic upland paths above Penmaenmawr and Dwygyfylchi and forms circular routes with other public rights of way using the local road network in places.
58. There are also a few localized public rights of way within the Study Area. These are discussed in Chapter 14.

### **4.3 Community Assets**

59. As outlined in Chapter 11, the Study Area includes zero doctor surgeries or pharmacies, zero hospitals, zero aged people homes, zero schools, and zero libraries. A small portion of land to the front of the Oasis Retreat Center resides in the Study Area. There are 4 separate open spaces areas, including two open spaces at the Maes y Llan residential estate, an open space at the same location that is used for various sports, and the footbridge and route to and from the beach (crossing the A55).

### **4.4 Air Quality**

60. As outlined in Chapter 12, baseline concentrations of selected pollutants were determined from a combination of Defra-modelled background concentrations and measurements at area monitors.
61. Background concentrations of oxides of nitrogen (NO<sub>x</sub>), as modelled by Defra, were estimated at concentrations of 8.8 µg/m<sup>3</sup> in 2018, and projected to be 7.2 µg/m<sup>3</sup> in 2022.
62. There is no NO<sub>2</sub> monitoring undertaken by the CCC monitoring network in close proximity to the J16 Scheme. The annualization mean concentration of NO<sub>2</sub> from a separate monitoring program conducted on behalf of the Welch Government between April 7, 2019 and June 2, 2019, was 14.6 µg/m<sup>3</sup>, 13.7 µg/m<sup>3</sup>, and 15.9 µg/m<sup>3</sup> along Ysguborwen Road.

63. Background particulate matter with an aerodynamic diameter of 10µm or less (PM<sub>10</sub>), as modelled by Defra, were estimated at concentrations of 7.8 µg/m<sup>3</sup> in 2018, and projected to be 7.5 µg/m<sup>3</sup> in 2022. There is no PM<sub>10</sub> monitoring available from the CCC monitoring network in close proximity to J16, and no modelling performed for future scenarios.

#### **4.5 Noise and Vibration**

64. As described in Chapter 13, the baseline noise levels were assessed by survey undertaken during the daytime on 12 July, 2019. The measurements were carried out at eight locations representative of the nearest Noise Sensitive Receptors (NSRs). All measurements were 15 minutes in duration, and multiple measurements were averaged to obtain a typical daytime noise level.
65. Noise was reported as ambient noise level (LAeq) with its value equivalent in time to a steady sound level. Values at the seven monitoring locations ranged from 54 dB to 72 dB. Road traffic noise was estimated using the LA10 indicator used in the Calculation of Road Traffic Noise (CRTN) prediction method. Values at the seven monitoring locations ranged from 55 dB to 74 dB. The highest noise levels for both LAeq and LA10 were located at a set of two monitoring stations, at 71 dB (LAeq) and 74 dB (LA10).

#### **4.6 All Travellers**

66. Chapter 14 lays out the impacts on all travellers: pedestrians, cyclists, equestrians and vehicular travellers. The area contains several public rights of way and cycling areas, including:
- a. The National Cycle Network (NCN) Route 5 which extends along the North Wales coast from Chester to Holyhead along the coastline passing Penmaenmawr.
  - b. The Wales Coast Path from Chester extends along the coast through Penmaenmawr and Llanfairfechan with an optional inland route at Penmaenmawr.
  - c. A public footpath which crosses the A55 using footbridge close to Puffin Café Services.
  - d. A public footpath provides access between Conway Road and Conway Old Road.
67. In addition, there are a number of informal pathways within the area including the footpath between A55 and Glan-y-Afon Road (historically known as Bangor Fields Road).
68. As described in Chapter 16, the Proposed Scheme would provide some overall benefits to the users of the National Cycle Network and the Wales Coastal Path through improvements to the network by providing a new shared use route across the A55 alongside the new link road. There would also be improved access through the provision of ramped access at the existing footbridge west of Shell Garage and Puffin Café that would improve accessibility and connectivity.

69. Count surveys and a site visit were used to assess how frequently each right-of-way and cycling area was used, and the general conditions. The count surveys were undertaken Thursday, 6 September, 2018. Up to 328 cyclists and 1881 pedestrians were counted on the survey day at any given location.
70. Traffic flow data along A55 in the vicinity of J16A through J17, and local roads were modelled for the do minimum situation for 2022. Annual average daily traffic (AADT) of 39,782 was projected for the stretch of A55 between J16A-J16; 40,702 was projected for the stretch of A55 between J16-J17. Travel along the local roads was much lower, with AADT of 4,321 along Conway road; 4,085 along Bangor Road; 1,629 along High Street; 1,369 along Ysguborwen Road; 1,101 along Pant-Yr-Afon; and less than 1,000 along Glan-Yr\_Afon Road, Treforris Road, Conway Old Road (in either direction), and Old Mill Road.

#### **4.7 Risks of Accidents or Disasters**

71. As described in Chapter 17, North Wales has low vulnerability to natural disasters such as major earthquakes, volcanic activity and tsunamis which pose risk to projects in other parts of the globe. In recent decades there has been an increase in the number of severe weather events, however, particularly those that lead to flooding.
72. The A55 dual carriageway route follows the north Wales coast and there is some extreme topography along the route, including rocky coastline and cliffs, low-lying river flood plains, and coastal foreshore. The steep rocky headlands of Penmaenmawr and Penmaenbach extend into the sea, while between them is a gently sloping landscape occupied by settlements. To pass through this landform the road uses tunnels, follows cliff-side terraces, and embankments on the shoreline. The main Chester to Holyhead Railway shares the narrow transport corridor. For much of the route from Chester to Holyhead, the A55 and the railway are located on former intertidal land and the foreshore. These are now behind the 19th century sea defences provided mainly for the railway, and this is the case at Dwygyfylchi. However, at Penmaenmawr the A55 occupies the coastal land with the railway to the south.
73. Some of these communities along the coast, such as Penmaenmawr and Dwygyfylchi, are dependent on the A55 trunk road for connectivity to the rest of Wales and so the resilience of this route is fundamental to their viability and quality of life.
74. Possible major accidents and disasters include:
  - a) Extreme tides and resulting flooding, particularly during extreme weather conditions. Along the coast at Penmaenmawr and Dwygyfylchi there are no areas of settlement that are at risk of flooding from the sea. There are areas at risk of flooding alongside the Afon Gyrach to the north and south of Glan yr Afon Bridge that are classified as Flood Zone 2 (1% to 0.1% probability) and Flood Zone 3 (0.5% to 0.1% probability). There are no sea defences along this length of the

coast, although the railway would limit the extent to which flooding from the sea could extend.

- b) Flooding from rivers and surface water. The local catchments are small but mountainous with short, steep routes down to the coastal plain and sea. The Afon Gyrach is the largest watercourse and periods of precipitation can result in a rapid increase in the volume and velocity of water descending the steeper upland channel, followed by restrictions as the river channel gradient eases on the coastal plain through the settlement of Dwygyfylchi. The resulting slower-moving water may back up in the river channel and can flood adjacent low-lying areas of the coastal plain and settlement. The potential for localised flooding can be exacerbated by the condition of the tide to cause flooding near the coast, where the Gyrach passes under the A55 and railway.
- c) Closure of road tunnels. Traffic accidents or other events could close tunnel roads through the headlands with the consequence that travellers and goods would be unable to travel east or west on this international route.
- d) Traffic and rail accidents could occur within or adjacent to the Proposed Scheme with fatalities, serious injuries and potential for spillage of loads. These risks already exist for the existing A55 Junction, but the changes brought about could change driving conditions and the consequent risks of major accidents occurring. As described in the Economic Assessment Report, a review of the five-year (2014-2018) accident data for the A55TM Study Area revealed 29 motor vehicle accidents. One accident was fatal, 7 were recorded as serious, and 21 were recorded as slight.

## 5. ASSESSMENT METHODOLOGY: HEALTH IMPACT ASSESSMENT

75. HIA is a tool designed to help communities, decision makers, and practitioners make choices that improve public health through making recommendations to optimize health gains from the project or Scheme and reduce potential negative health impacts or inequalities. It attempts to broadly assess the potential health outcomes (both adverse and beneficial) of a proposed project, plan or programme, or policy and to deliver evidence-based recommendations that optimise health gains and reduce or remove potential negative impacts or inequalities. It considers not only the more traditional determinants of health (anticipated changes in air pollution, water pollution) but also more social and economic impacts.
76. HIA is a process that helps evaluate the potential health effects of a plan, project or programme, or policy before it is built or implemented using quantitative, qualitative, and participatory techniques. HIAs bring potential positive and negative public health impacts and considerations to the decision-making process for plans, projects or programmes, and policies that fall outside traditional public health arenas, such as transportation and land use. An HIA may help decision-makers make choices among alternatives and improvements to prevent disease or injury, and actively promote well-being. It also provides practical recommendations to increase positive health effects and minimize negative health effects.
77. The major steps in conducting an HIA include:
- a. Screening (identifying plan, project, or policy decisions for which an HIA would be useful).
  - b. Scoping (planning the HIA and identifying what health risks and benefits to consider).
  - c. Assessment (identifying affected populations and quantifying health impacts of the decision).
  - d. Recommendations (suggesting practical actions to promote positive health effects and minimize negative health effects).
  - e. Reporting (presenting results to decision makers, affected communities, and other stakeholders).
  - f. Monitoring and evaluation (determining the HIA's impact on the decision and health status).

### 5.1 Screening

78. Consultation was carried out during the Public Information Exhibition held in December 2017 and the 12-week WeITAG Stage Two Public Consultation held during the summer of

2018, including Environmental Liaison Group meetings with statutory consultees such as representatives from Conwy CBC Environmental Health team. The primary purpose of this consultation was to collate information regarding stakeholders' views on the possible options and general environmental information. This consultation did not specifically include health concerns.

79. A number of stakeholder groups were contacted asking for input into the HIA. Written consultation was carried with key bodies whilst preparing the population and human health assessment. It was anticipated that this would be focussed on Public Health Wales, including the Conwy CBC 'Social Care and Wellbeing' team, the Local Public Health Director, together with the Conwy CBC Environmental Health team. A detailed consultation exercise beyond these organisations was not proposed although other parties that might wish to comment were identified, as follows, and were consulted by email on 6 September, 2019:
- a. University Health Board (Betsi Cadwaladr).
  - b. Conwy and Denbighshire Public Services Board.
  - c. Dewis Cymru (general email address for Care Inspectorate Wales).
  - d. Conwy People's Partnership.
  - e. Community and Voluntary Support Conwy (North Wales Citizens' Panel).
80. No responses were received from this outreach.

## **5.2 Scoping**

### **Determinants of health and well-being**

81. As defined by the World Health Organisation:
- Determinants of health are factors which influence health status and determine health differentials or health inequalities. They are many and varied and include, for example, natural, biological factors, such as age, gender and ethnicity; behaviour and lifestyles, such as smoking, alcohol consumption, diet and physical exercise; the physical and social environment, including housing quality, the workplace and the wider urban and rural environment; and access to health care (Lalonde, 1974; Labonté 1993). All of these are closely interlinked and differentials in their distribution lead to health inequalities.*
82. The health determinants identified during the preliminary Scoping Review (with reference to the WIAHU Health and Well-Being Determinants Checklist) as being relevant to the Proposed Scheme are shown in the table below.

**Table A4: Health and well-being determinants identified during the preliminary scoping review**

<b>Health and Well-Being Determinants</b>	<b>Preliminary assessment of relevant factors (not exclusively)</b>	<b>Relevant to Construction</b>	<b>Relevant to Operation</b>
Lifestyles	Physical activity	✓	✓
Social and community influences on health	Family organisation and neighbourliness, social support networks (such as midwives, health visitors, social services), community identity, other social exclusion, including severance (where barriers to pedestrian movement are introduced or removed). These impacts are linked to those associated with access to services (eg. safe routes to schools or child care centres).	✓	✓
Living / environmental conditions affecting health	Built environment, noise, air and water quality, attractiveness of area, green space and play areas, community safety (including road hazards).	✓	✓
Economic conditions affecting health	Access to employment and affordability of transport (including public transport or fuel costs). How the preferred option impacts an individual may depend on where people live relative to services.	✓	✓
Access and quality of services	Access to amenities, including health care (eg GP surgery or hospitals), training / education and shops. This is linked to any increase in journey length / cost of travel compared to the do minimum scenario.	✓	✓
Macro-economic, environmental and sustainability factors	Climate	✓	✓

83. Based on the Scoping Report submitted in January 2019, the following effects were **scoped out** of the HIA:

- a. Individual and lifestyle effects such as smoking, diet, use of alcohol, cigarettes, non-prescription drugs, and sexual activity should not differ between do-minimum and the preferred option.
- b. Social factors such as neighbourliness, sense of belonging, local pride, community identity, cultural and spiritual ethos, and racism should not differ between do-minimum and preferred option.
- c. Workplace conditions should not differ between do-minimum and preferred options.

- d. Macro-economic, environmental and sustainability factors including Government policies, biological diversity, gross domestic product, and climate should not differ between do-minimum and preferred options.
  - e. Living conditions such as smell, odour and waste management are unlikely to differ between do-minimum and preferred options from the perspective of health. Localised odours from soil disruption are considered in other Chapters (such as Chapter 6: Soils and Geology), and were judged to have minimal impact as organic odours are not considered to be offensive or unpleasant<sup>5</sup>.
84. Based on the Scoping Report submitted in January 2019, the following effects were **scoped in**. Some of these topics will be included in the Populations and Health Chapter (Chapter 19). To avoid duplication, reference will be made to the relevant chapters as appropriate.
- a. Impacts on individuals, including lifestyle factors such as physical activity, risk-taking activities, and impact on access to health care services (Chapter 14: All Travellers).
  - b. Impacts on social effects and health. For example, the preferred option may impact on the availability of housing, access to cost-effective public transportation or the potential to encourage families to use cycle tracks (Chapter 14: All Travellers).
  - c. Impacts on accessibility and active travel, including the encouragement of walking/cycling, and traffic management and calming measures (Based on Chapter 14: All Travellers).
  - d. Impacts on access to skills and knowledge, including access to training and education (Chapter 19: Population and Health).
  - e. Impacts on the community, including social support mechanisms, social networks and neighbourliness (Chapter 19: Population and Health).
  - f. Impacts on Community divisions and degree of isolation. This criterion can apply to either groups or individuals. The Project has the most potential to impact community severance and degree of isolation for those options where properties are located within slip road 'islands' or along-side roads that form part of the Proposed Scheme (Chapter 19: Population and Health).

<sup>5</sup> <http://www.iaqm.co.uk/text/guidance/odour-guidance-2014.pdf>

- g. Impacts on the historical identity of a community, as well as cultural and spiritual ethos. This could include the impact on designated Conservation Areas, townscape and landscape and isolation from areas important to the community such as the coast or the mountains. Where severance is reduced, this would potentially provide a positive effect (Chapter 19: Population and Health).
  - h. Impacts on the local community, related to issues associated with the built environment, housing, noise and air quality, physical view and outlook (e.g. those associated with changes to the landscape/townscape). The Proposed Scheme has the potential to impact during both its construction and operational phases (Chapter 5: Geology and soils; Chapter 9: Landscape; Chapter 12: Air Quality; Chapter 13: Noise and Vibration).
  - i. Impacts on employment, occupation, and income (Chapter 19: Population and Health).
  - j. Impacts on socio-economic, cultural and environmental and sustainability factors, including biological diversity, efficient use of resources, pollution, diversity / local distinctiveness and climate. It should be noted that it was not envisaged it would be considered proportionate to carry out a socio-economic study as part of this work (Chapter 19: Population and Health).
85. Based on the overall project considerations identified during the scoping stage and the findings of the assessment carried out under the Welsh Transport Appraisal Guidance (WelTAG), it was determined that a prospective desktop/rapid HIA, compared no-change option with the preferred option, was the most appropriate approach.
86. Typically, a prospective desktop/rapid HIA would involve a suitable investigation of health impacts, including a short desk-top review of evidence and the gathering of further information from key stakeholders. Although an attempt at consultation was carried out with statutory consultees, no additional consultation took place with members of the public.

### **5.3 Assessment**

87. This assessment incorporates a review of available data, including initial feedback from the WelTAG Stage Two Public Consultation process, and a critical review of possible health impacts by the project team with a focus on establishing where significant effects could arise. It considers other relevant activities described elsewhere in this Environmental Impact Assessment document, including the air quality and noise review and consideration of effects on all travellers.

88. There are two relevant time periods to consider impacts on human health: during the Construction Phase and after completion during the Operational Phase (including use and any maintenance activities).
89. During the Construction Phase, impacts can potentially affect both construction workers and the nearby community. During this Phase the focus will be on the immediate construction zone, as well as nearby receptors.
90. After the Construction Phase and during the Operation Phase, the impacts can potentially affect nearby communities, either through direct or indirect impact of the new highway configuration. The impact of the Operational Phase was assessed up to 15 years after opening.
91. When considering the impacts on health, both during the Construction Phase and the Operational Phase, the buffer applied will depend on the impact being considered. For example, as described Chapter 12, the health impacts associated with construction dust were considered within 350 m of the associated works, whereas the air quality during the Operational Phase was considered in the immediate vicinity of the Proposed Scheme and adjoining road (up to a distance of 200 m). Reference is made to the relevant chapters for the appropriate buffers that were applied.
92. In the subsections below, we assess impacts as discussed in the relevant Environmental Impact report Sections:
  - a. Chapter 6. Geology and Soils
  - b. Chapter 9. Landscape
  - c. Chapter 11. Community Assets
  - d. Chapter 12. Air Quality
  - e. Chapter 13. Noise and Vibration
  - f. Chapter 14. All Travellers
  - g. Chapter 17. Risks of Accidents or Disasters

### **5.3.1 Geology and Soils**

93. As described in Chapter 6, the only potentially significant effect identified for the Proposed Scheme with regards to Geology and Soils relates to workers in confined spaces (if introduced). This would require mitigation in order to reduce the potential effects. Following implementation of the mitigation by the Contractor these would no longer be considered potentially significant effects.
94. There would be no long-term significant effect on the groundwater beneath the site from the Proposed Scheme and risks associated with the ground conditions can be adequately managed during Construction and Operation Phases.

95. A number of standard best practice measures will therefore be adopted during construction and operation of the site in order to ensure that the contamination identified at the site does not result in any significant environmental effects. These best practice measures are described in Chapter 6.

### **5.3.2 Landscape**

96. As described in Chapter 9, six Landscape Character Areas (LCA's) were identified as being potentially significant landscape receptors in the study area for Junction 16. These LCA's are:
- a. LCA 2 – Penmaenmawr Beach
  - b. LCA 9 – A55 Pen-y-clip to Penmaenbach
  - c. LCA 10 – Pendyffryn Pasture and Parkland
  - d. LCA 16 – Penmaenmawr Pant-yr-Afon
  - e. LCA 17 – Dwygyfylchi
  - f. LCA 26 – Pant yr Afon Pasture
  - g. LCA 33 – Foel Wen Moorland
  - h. LCA 34 – Allt Wen Moorland
97. Potential adverse impacts on LCA 2, Penmaenmawr Beach, were judged to be neutral with no direct impacts. The Proposed Scheme will have no potentially significant effects as the area lies on the seaward side of the A55 road and rail corridor.
98. Potential adverse impacts on LCA 9, A55 Pen-y-clip to Penmaenbach, were judged to be moderate, with a slight adverse change in landscape character associated with a road widening for the Proposed Scheme. There will be extensive earthworks and false cutting to integrate the Proposed Scheme into the localised landscape. Roadside vegetation that would be removed would be replaced with similar mitigation planting, but the overall effects would be the extension of the existing corridor. Overall, this was judged as having a moderately adverse impact.
99. Potential adverse impacts on LCA 10, Pendyffryn Pasture and Parkland, were judged to be moderate, with a direct effect on land take in this area, extending further south-east from the A55 with the proposed link road and new Junctions 16 and 16A. Areas of remaining pasture would be lost due to the encroachment of the Scheme between Junctions 16 and 16A south from the existing road corridor towards the settlement boundary of Dwygyfylchi. Overall, this was judged as having a moderately adverse impact.
100. Potential adverse impacts on LCA 16, Penmaenmawr Pant-yr-Afon, were judged to be without change. Overall, this was judged as having a neutral impact.

101. Potential adverse impacts on LCA 17, Dwygyfylchi, were judged to be minor, with encroachment of the existing A55 road corridor southwards towards the settlement boundary of Dwygyfylchi. Overall, this was judged as having a slight adverse impact.
102. Potential adverse impacts on LCA 26, Pant yr Afon Pasture, were judged to be moderate, with some localised encroachment of the Proposed Scheme south from the existing Junction 16. This would be seen as a widening of the road corridor that is already a prominent man-made landscape element within the area. Overall, this was judged as having a slightly adverse impact.
103. Potential adverse impacts on LCA 33, Foel Wen Moorland, were judged to be without change from baseline conditions. Overall, this was judged as having a neutral impact.
104. Potential adverse impacts on LCA 34, Allt Wen Moorland, were judged to be without change from baseline conditions. Overall, this was judged as having a neutral impact.
105. The most significant potential effects on landscape would be local to the existing road corridor. The widening of the road corridor to form new junctions at 16 and 16A would have little effects on the surrounding landscape character that is already heavily influenced by the existing A55 road corridor. There would be localised changes to the character of the existing road corridor and immediate surroundings during the construction phase, which may be disruptive with significant construction activities over an 18-24-month period that would be difficult to mitigate against. However, following the construction phase, the potential landscape effects would be associated with the widening of the existing road corridor that would represent a low magnitude of change compared to the construction of a new section of road through open countryside.

### **5.3.3 Community Assets**

106. As described in Chapter 11, the Proposed Scheme will result in the temporary loss of use of four areas located within the Study Area, including a football pitch at the Maes Y Llan residential estate. The temporary removal of the existing open space area at Maes Y Llan would be a 'moderate adverse' impact, potentially achieving 'beneficial' on completion of the Proposed Scheme. Overall, this impact is considered as neutral-to-beneficial.
107. The Proposed Scheme is considered beneficial by reducing the severance of members the community from the coast and by enhancing active travel provisions for walkers and cyclists.

### **5.3.4 Air Quality**

108. As described in Chapter 12, the Proposed Scheme has the potential to impact air quality in both the Construction Phase and the Operational Phase.
109. During the construction phase, dust impacts may be caused by earthworks and site preparation, demolition of existing structures, construction of structures such as foundations, material handling, construction of on- and off-site highway improvements,

and various landscaping activities. Dust impacts would be anticipated to be greatest in dry weather, especially following periods without rain.

110. The closest sensitive receptors to construction activity will be residential properties along A55, Conway Road, Ysuborwen Road and Glan-Yr-Afon Road.
111. Much of the dust generated during the construction phase is likely to be coarse particle sizes, with only a fraction likely to be in the PM<sub>10</sub> size range. As described in Chapter 12, the risk of dust soiling impacts is likely to be highest for earthworks and construction activities. However, this is anticipated to be low without mitigation and negligible with mitigation, and the risk of human health effects from this activity is likewise anticipated to be negligible.
112. To assess the impacts during the operational phase, Chapter 12 presents the changes in NO<sub>2</sub> and PM<sub>10</sub> concentrations by comparing the 'do minimum' scenario with the 'do something' scenario.
113. NO<sub>2</sub> impacts from the Proposed Scheme are projected to be negligible, with concentrations at all receptors modelled decreasing slightly, remaining the same, or increasing by no more than 1%.
114. PM<sub>10</sub> impacts are also projected to be negligible, with concentrations at all receptors modelled decreasing slightly, remaining the same, or increasing no more than 0.7%.
115. Based on these two pollutants, the health implications of air quality changes from the Proposed Scheme are judged to be minimal, and no health effects are anticipated from these minimal air quality changes resulting from the Proposed Scheme.

### **5.3.5 Noise and vibration**

116. As described in Chapter 13, noise was assessed during both the Construction Phase and the Operations Phase.

#### Construction Phase

117. All demolition and construction effects are expected to be direct and temporary, with a construction environmental management plan (CEMP) defining all mitigation measures and a defined best practices measure (BPM) to minimise the noise and vibration effects at receptors in the vicinity of the construction.
118. Construction-related activities were predicted for noise-sensitive receptors. No significant noise effects are predicted during the Construction Phase.
119. Significant vibration levels may occur during the finishing works activity of Phase 2 at some assessment locations (C1, P2, and P4). Assessment receptor P4 is representative of properties located along Maes Y Llan; therefore, vibratory compaction is assessed to result in significant impacts at these assessment locations.

#### Operations Phase

120. The Proposed Scheme is predicted to result in a noise level decrease at majority of the receptors. This is attributed to a diversion of traffic from Glan-Yr-Afon Rd in Dwygyfylch into a new bypass road. Where a noise level increase is predicted, this is attributed to an increase in traffic speed around the existing junction and realignment of the roads with introduction of additional carriageways closer to the receptors. No receptors are predicted to experience a significant decrease in effect.
121. No receptors are predicted to experience an increase in noise level of at least 3dB; therefore, the Scheme is assessed to result in no significant operational noise effects in the short-term.
122. Predicted noise effects during the Operation Phase suggest no significant noise effects will occur overall. For those properties along Maes y Llan, which were identified as Priority Areas under strategic noise mapping, the incorporation of low noise thin surface system and the introduction of roadside noise barriers should mitigate the excess noise. Therefore, Proposed Scheme is assessed to result in no significant noise effects during the Operations Phase.

#### **5.3.6 All Travellers**

123. As described in Chapter 14, there may be impacts to travellers during the Construction Phase and Operation Phase.

#### Construction Phase

124. During construction, which is anticipated to last 18 months, there will be two lanes of traffic in each direction with reduced speed.
125. National Cycle Network (NCN) 5 will be severed during construction along the north side of A55. This impact on community severance is assessed as a major- to moderately adverse impact.
126. Conway Road potentially may be impacted due to construction of a cycleway. This impact on community severance is assessed as a major- to moderately adverse impact.
127. Glan y Afon Road potentially may be impacted due to construction of a cycle/footway. This impact on community severance is assessed as a minor adverse impact.
128. The overbridge may be temporarily impacted due to refurbishing the Pendalar footbridge with Disability Discrimination Act (DDA)-compliant ramps. This impact on community severance is assessed as a major- to moderately adverse impact.
129. The stepped footpath between Maes Y Llan, Dwygyfylchi and the A55 will be permanently closed. This impact is considered beneficial on safety grounds, as it removes direct pedestrian access to A55.

130. A new footway access to the New Link Road will be formed in the Proposed Scheme, and the existing access to Puffin footbridge will be retained. The Bangor Fields Road access will also be permanently closed during construction works, with an alternative route provided via Glan Y Afon and the New Link Road in the Operational Phase. The impact on community severance is considered moderate-to-major adverse.
131. There will be a temporary closure of the Network Rail access track during part of the construction works.
132. The narrow lanes and reduced speed along the A55 during construction is likely to result in an increase in drivers stress and frustration. Furthermore, fear of potential accidents could increase due to the presence of roadworks and narrow lanes. Uncertainty may result from temporary road closures and changes to access or egress arrangements to and from the A55 to local road. These effects are considered adverse.
133. Non-motorised user journeys adjacent to construction works are likely to be subject to a temporary increase in noise levels due to construction machinery and works. The assessment of visual and noise impacts of the Proposed Scheme is detailed in Chapters 9 and 14 respectively in this ES.
134. Without mitigation, the Construction Phase will therefore cause considerable disruption to drivers and non-motorised users.

#### Operational Phase

135. Overall the Proposed Scheme seeks to improve the quality of non-motorised user routes through a series of mini-Schemes as identified in Chapter 2. These mini-Schemes will be designed to current standards and will seek to improve connectivity to the local area for pedestrians and cyclists through the provision of dedicated facilities.
136. As described in Section 4, only minimal changes are anticipated to the average automobile daily trips, with no change greater than 12.5% from the do minimum situation in 2022.
137. Reductions in traffic of up to 51.4% on Conway Old Road (Dwygyfylchi to Capelulo), 46.4% Conway Old Road (Dwygyfylchi to Penmaenmawr) and 33.5% Treforris Road, Dwygyfylchi are predicted. These changes may result in noticeable benefits.
138. There will be improved accessibility between Dwygyfylchi, NCN5, and Penmaenmawr due to improved cycleway and footway along Glen y Afon. This impact on community severance is assessed as a major beneficial impact.
139. The closure of an informal footpath between Glen y Afon and A55, as well as the closure of a footpath between Dwygyfylchi, NCN5 and Penmaenmawr is assessed as a moderately adverse impact.
140. The Proposed Scheme will include some mitigation measures, including a signalled controlled junction at 16A, which incorporates at-grade signalised crossing connecting to

the shared cycle/footway on Glan Y Afon and the new link road. This will improve safety for non-motorised users and improve connectivity to NCN5 and the coast.

141. Removal of the J16 roundabout seeks to address existing issues with resilience, delays, and safety, therefore reducing driver stress and frustration. Furthermore, fear of potential accidents could decrease, and uncertainty should be minimised. These effects are all considered beneficial.

Overall (both phases)

142. Proposed mitigation during the Construction Phase should reduce the impact of the Proposed Scheme during this phase.
143. While there are several major-to-minor adverse impacts anticipated during construction, the benefits during the operational phase are anticipated to outweigh these anticipated impacts, with a net result of a beneficial impact.
144. In addition, a new link road will provide connectivity between Penmaenmawr and Dwygyfylchi. The improved at grade junction at Junction16a will enable 4-way movements by utilising an overbridge with a junction to the north of the A55 and a junction to the south. The slip roads are raised locally to allow the bridge to pass over the A55

**5.3.7 Risks of Accidents and Disasters**

145. As described in Chapter 17, several accidents and disasters were considered in the Environmental Impact Analysis. With the exception of traffic accidents, most of those considered fall under the general heading of 'natural disasters.'
146. The A55 lies on the coast, elevated a few metres above the high tide line but protected by coastal flood defences and the railway. Risk of flooding were therefore analysed.
147. The Proposed Scheme lies on the coast with much of the existing A55 elevated several metres above the high tide line and within the coastal flood defences at Penmaenmawr and provided by the railway. Coastal flooding from the sea can occur along the shoreline and in the flood plain of the Afon Gyrach which crosses under the A55 north east of Dwygyfylchi. Coastal flooding from the sea would not impact the A55 carriageway and the Proposed Scheme is unlikely to result in significant adverse effects on the environment as a result of the Proposed Scheme.
148. Similarly, fluvial flooding could occur in the Afon Gyrach floodplain upstream (south) of the A55 for a considerable distance. Flooding could be exacerbated if the river flow is impeded at high tides. Fluvial flooding could be exacerbated by coastal flooding by the sea.
149. Fluvial flooding impacting the A55 is unlikely to result in significant adverse effects on the environment as a result of the Proposed Scheme because a proposed bridge would

match the span of the existing bridges. However, fluvial flooding could exacerbate surface water flooding.

150. Surface water flooding can occur over several areas associated with the Proposed Scheme on low-lying land and in urban areas in Penmaenmawr, on the south side of the A55. The pattern of flooding suggests seasonal watercourses or flood paths flow down from the high land to the south-east and pooling in streets and against man-made obstructions. Obstructions include the railway sidings, Station Road West and East; land including the A55 between the Puffin Services and the Afon Gyrach, and further east where a seasonal watercourse flows under the A55.
151. Surface water flooding impacting the A55 is unlikely to result in significant adverse effects on the environment as a result of the Proposed Scheme. Areas that are more exposed towards the northern Atlantic experience the highest threat of winter storms. A severe event could cause flooding of the carriageway, severe gusting winds affecting vehicles, poor visibility due to rain or blown debris, falling trees or structures blocking roads. These results are likely to cause traffic congestion, speed reductions, vehicle collisions, injuries and fatalities and road or tunnel closures. These effects are already a risk associated with the baseline situation and so there would be no significant adverse effects on the environment as a result of the Proposed Scheme.
152. Areas that are more exposed towards the Northern Atlantic experience the highest threat of winter storms. Most of the British Isles lie within the ESPON mapping 'Very High Probability' category, but there is a low frequency of severe hurricanes, storms and gales occurring. A severe event could cause flooding of the carriageway, severe gusting winds affecting vehicles, poor visibility due to rain or blown debris, falling trees or structures blocking roads. These results are likely to cause traffic congestion, speed reductions, vehicle collisions, injuries and fatalities and road or tunnel closures. Coastal locations suffer more of these events due to exposure to the sea and the effects can be more severe than inland areas. Design of the Proposed Scheme to take account of severe weather would reduce the likelihood of these effects, however, extreme events could still cause temporary road closure. These effects are already a risk associated with the baseline situation and so there would be no significant adverse effects on the environment as a result of the Proposed Scheme.
153. The Proposed Scheme lies on a coastline that is prone to storm surges. Storm surges are often closely linked to winter storms. Between the Afon Gyrach and the Puffin Services, the A55 is at its lowest point relative to the sea. The presence of the railway embankments which act as sea defences, could deflect a wave surge and so the adverse effects of this on the environment is unlikely to be worsened.
154. High temperatures in this maritime context are a low risk hazard for the Proposed Scheme, but these events have become more frequent in recent decades with temperatures reaching record highs in the Summer of 2019. Thermal expansion and contraction of materials can affect the performance of surfaces and structures, while the

softening of road surfacing can occur in high temperatures. Bridge design for the new junction assumes a normal range of thermal expansion, but extreme conditions could result in damage to bridge abutments and joint bearings. In extreme circumstances the effects could result in temporary bridge closure. Bridge design would take account of predicted temperature ranges. Effects of extremely high temperatures could result in traffic being diverted to other routes for a short duration which would not be a significant impact.

155. Fog and the resulting poor visibility can increase the risk of fast-moving vehicles on the A55 being involved in collisions. The likelihood of fog occurring would be similar for both the existing A55 and the Proposed Scheme. Improving the junction will not result in increased risk of fog occurring.
156. Rapid slowing of high-speed traffic approaching the roundabout in conditions of poor visibility could result in collisions. Providing a free-flowing grade separated junction will reduce the risk of these accidents, but the higher speeds of vehicles on the Proposed Scheme could worsen the consequences of collisions if they do occur. Traffic Wales monitor traffic flows on the A55 and can mitigate or avoid the effects of fog by using electronic information signs to inform drivers of road conditions ahead, or by deploying Traffic Officers to manage traffic and reduce the risk and severity of collisions.
157. Road traffic accidents occur daily on Britain's roads. Major or severe accidents involving numerous fatalities or serious injuries are less frequent. Design of the Proposed Scheme to modern standards would avoid or mitigate some accidents by comparison with the existing road. This assessment is concerned with the major accidents that could occur despite these avoidance and mitigation measures.
158. Major accidents resulting in large numbers of casualties could occur in extreme circumstances. Such an event could block the A55 and cause damage to road surfaces and structures. Closure of the road for an extended period could adversely affect the communities by closing the only major road in and out.
159. While accidents could result in major spillages of pollutants such as fuels or bulk loads and the use of fire-fighting chemicals, there would be containment measures incorporated into the road drainage system to contain the spread of pollution and reduce the risk of harm to residents, road users, designated marine wildlife sites and other receptors.
160. Traffic Wales monitor traffic on the A55, and can use electronic information signs and / or deploy traffic officers to manage the speed and behaviour of traffic. The emergency services are trained and equipped to deal with the consequences of traffic accidents. While these events can result in temporary road closures, they are considered unlikely to cause significant adverse effects on the environment as a result of the Proposed Scheme.

161. During construction of the Proposed Scheme the contractor will be responsible for managing traffic through the works. They will also be responsible for liaison with the emergency services to ensure that they have free access into and through the works.
162. As assessed in Chapter 17, there are potential risks to the Proposed Scheme and to the environment as a result of the development. Most of these events arise from natural sources and would occur whether or not the junction improvements are carried out. The consequences of these events are associated with road traffic accidents. Wherever possible this risk is being addressed by a range of measures that include traffic management and design to current design to minimise the risk to people, property and the environment.
163. Some events will cause damage to elements of the Proposed Scheme which would require repair. Temporary, full or partial, closures of the road would be implemented, with consequential impacts on road users and adjacent communities.
164. As described in the Economic Assessment Report, the predicted number of motor vehicle accidents in the 60-year period for the study area under the Proposed Scheme is a net prevention of 32.2 total accidents. Of these, 0.5 fatal accidents would be prevented, 3.3 serious accidents would be prevented, and 39.3 slight accidents would be prevented.

## 6. SIGNIFICANT EFFECTS

165. There is no specific guidance on the assessment of significance in EIA in relation to HIAs. The evaluation of the HIA therefore broadly follows the approaches described above and takes the following into account:
- a. What is the nature of the impact? Explain how the Proposed Scheme might affect health and whether the impact will be positive or negative.
  - b. What is the likelihood of the impact? -Because this is a desktop assessment, all impacts are speculative.
  - c. What is the scale and significance of the impact? Occupational and community populations were considered. The severity or benefits of impacts were assessed in broad terms.
  - d. How does timing and duration affect the impact? Assessment takes into account Construction and Operational Phases, and considers whether short-term impacts on health may be worth the long-term benefits.
  - e. What is the distribution of impacts? Assessment takes into account occupational and community populations. Because the community is relatively homogeneous, subpopulations within the community were not considered.
166. The assessment will report only the potential significant effects from the Proposed Scheme and will be based on professional judgement, as described in the IEMA Primer on Health Impact Assessment. The assessment has been undertaken on a qualitative basis.

## 7. INDICATION OF ANY LIMITATIONS ENCOUNTERED

- 167. Since this HIA is a desktop review, it is limited by data already collected by the Project Team, supplemented by data readily available in the public domain.
- 168. One area posed limitations due to lack of readily available data: Air Quality.

### 7.1 Air Quality

- 169. Based on the guidance that has been followed, the Environmental Impact Assessment only examined NO<sub>x</sub> and PM<sub>10</sub>, with data on the latter quite limited. There is no PM<sub>10</sub> monitoring undertaken in close proximity to the J15 Scheme. However, PM<sub>10</sub> monitoring is carried out at 1 of the 6 local authorities that encompass the North Wales Combined Authority<sup>6</sup>. The annual mean PM<sub>10</sub> concentrations recorded at all stations were well below the annual mean objective of 40 µg/m<sup>3</sup>, with the highest measured concentration recorded being 13.3 µg/m<sup>3</sup> in 2017.
- 170. No PM<sub>2.5</sub> data was presented in the assessment, even though from a health perspective this is the more relevant size of particulate matter.
- 171. Although PM<sub>2.5</sub> monitoring is not undertaken in close proximity to the Proposed Scheme, it has been carried out at 2 of the 6 local authorities that encompass the North Wales Combined Authority. The annual mean PM<sub>2.5</sub> concentrations recorded at all stations were well below the annual mean objective of 25 µg/m<sup>3</sup>, with the highest measured concentration recorded being 8.6 µg/m<sup>3</sup> in 2017. Therefore, as outlined in Chapter 12, PM<sub>2.5</sub> was not included in the assessment<sup>7</sup>.
- 172. Furthermore, no data related to hazardous air pollutants (such as benzene) were compiled, since several hazardous air pollutants are anticipated from mobile sources, analysing these air pollutants would have been useful from a public health perspective.

<sup>6</sup> North Wales Combined Authority. 2018 Air Quality Progress Report. September 2018.

<sup>7</sup> Highways England. LA105 Air Quality. November 2019.

<http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf>

## 8. SUMMARY

173. Based on this Health Impact Assessment, the following general conclusions are drawn:
174. Soils and Geology: During the construction phase, there may be adverse impacts for workers if they are in confined spaces. A combination of best practice measures and mitigation (if confined spaces are needed) should reduce these impacts, leading to neutral impacts. No long-term significant effects are anticipated on the groundwater beneath the site from the Proposed Scheme and risks associated with the ground conditions can be adequately managed during Construction and Operation Phases. Overall, the impact from soils and geology is expected to be neutral.
175. Landscape: Potential adverse impacts on Landscape Character Areas (LCA's) were evaluated and judged as having neutral impacts or, at worse, moderately adverse for a limited duration of time (for example, during the Construction Phase or early in the Operational Phase while new plants are maturing). The most significant potential impact on the landscape character of the area is largely confined to the area immediately adjacent to the existing roadway. Localised changes to the character of the existing road corridor and immediate surroundings during the Construction Phase are anticipated. Following the Construction Phase, potential landscape effects would be associated with the widening of the existing road corridor, creating a more a highly urban and exposed environment. Overall, the impact from landscape changes are expected to be neutral.
176. Community Assets: The Proposed Scheme will result in temporary loss of four areas located within the Study Area, including a football pitch at the Maes Y Llan residential estate. The temporary removal of the existing open space area at Maes Y Llan would be a 'moderate adverse' impact, potentially achieving 'beneficial' on completion of the Proposed Scheme. When completed, the Proposed Scheme will reduce the severance of members the community from the coast and by enhancing active travel provisions for walkers and cyclists. Overall, with respect to community assets, the Proposed Scheme is beneficial.
177. Air Quality: Following regulatory mandates, very few air quality measures were evaluated. These conclusions are therefore limited to NO<sub>2</sub> and examining baseline concentrations of PM<sub>10</sub>. During the Construction Phase, there may be dust impacts on workers and nearby residents. However, much of this dust is in the coarse range and thus while a potential nuisance, the health effects are anticipated to be low. Furthermore, the introduction of mitigation measures should control this. During the Operational Phase, NO<sub>2</sub> and PM<sub>10</sub> changes are expected to be negligible and the health impacts are thus also considered to be negligible based on these two air pollutants. Overall, the impact from air quality is expected to be neutral.
178. Noise and vibration: Noise and vibration from the Proposed Scheme are anticipated to be temporary, and greatest during the Construction Phase. Of the noise-sensitive receptors evaluated, none were anticipated to be impacted significantly by noise during this phase.

Furthermore, significant vibrations may occur at several receptor locations during some construction activities (for example, finishing works). Noise is predicted to generally decrease at the majority of the receptors during the Operational Phase due to the diversion of traffic from Glan-Yr-Afon Rd in Dwygyfylchi into a new bypass road, and where noise is predicted to increase it is due to the increased speeds of the vehicles and some realignment of the roadway bringing it closer to some residences, but none of these receptors will experience noise greater or equal to 3dB, the cut-point of significance. For those properties identified as Priority Areas under strategic noise mapping, the incorporation of low noise thin surface system and the introduction of roadside noise barriers should mitigate the excess noise. Overall, the Proposed Scheme's impact in terms of noise and vibration are expected to be neutral, with only mild impacts on limited areas during the Construction Phase and no significant impacts during the Operational Phase.

179. All Travellers: Without mitigation, the Construction Phase of the Proposed Scheme would cause considerable disruption to drivers and non-motorised users. However, proposed mitigation measures during the Construction Phase should reduce these impacts. During the Operational Phase, there will be numerous changes that improve connectivity. This beneficial impact is greatest for foot traffic and cyclists. In addition, a new link road will provide connectivity between Penmaenmawr and Dwygyfylchi, increasing connectivity. Overall, the Proposed Scheme will address existing issues with resilience, delays, and safety. The net effect will be a reduction of driver stress and frustration. Overall, while there are several major-to-minor adverse impacts anticipated during construction, the total benefits during the Operational Phase are anticipated to outweigh these anticipated impacts, with a net result of a strong beneficial impact.
180. Risks of Accidents and Disasters: Several potential natural disasters were evaluated for the Proposed Scheme. Coasting flooding, river flooding, and surface water flooding risk would remain the same, but should they occur they might impact the Construction Phase, particularly along the shoreline and in the flood plain of the Afon Gyrach which crosses under the A55 north east of Dwygyfylchi. The likelihood of these natural disasters are similar to the existing roadway. The Proposed Scheme would not impact high temperatures, but extreme temperature conditions (which are anticipated to be rare in the Proposed Schemes maritime location) might soften road surfaces or damage bridges. Such effects of extremely high temperatures could result in traffic being diverted to other routes for a short duration which would not be a significant impact. Likelihood of fog conditions, with poor visibility increasing the risks of motor vehicle accidents, would remain the same under the Proposed Scheme. Providing a free-flowing grade separated junction will reduce the risk of these accidents, but the higher speeds of vehicles on the Proposed Scheme could worsen the consequences of collisions if they do occur. Mitigation measures include electronic information signs run by Traffic Wales. Importantly, modelling demonstrates that the number of motor vehicle accidents would decrease under the Proposed Scheme, providing a strong beneficial impact.

181. Based on the above assessment, it is therefore concluded that the Proposed Scheme has minimal potential to result in significant effects on human health, and includes several important health benefits.