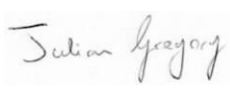
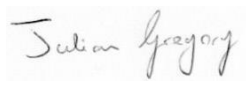


2021

Barmouth Viaduct Metallic Works Habitat Regulations Assessment (HRA)





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1. INTRODUCTION

1.1 ASSESSMENT BACKGROUND

- 1.1.1 This document provides information to support an Appropriate Assessment under The Conservation of Habitats and Species Regulations 2017 (hereafter referred to as the 'Habitats Regulations') for the scheduled refurbishment of the Barmouth Rail Viaduct is required by Network Rail (NR).
- 1.1.2 The proposed in/above estuary works are due to be undertaken from March ~~April~~ 2022 to February 2023. The exact start date of the works within the designated site will be dependent on the Marine License Assent.
- 1.1.3 This document also provides information to support determination of the Aber Mawddach Site of Special Scientific Interest (SSSI) Assent ~~for~~ by Natural Resources Wales (NRW).
- 1.1.4 Barmouth Rail Viaduct is within the boundaries of the Llyn Peninsula and the Sarnau Special Area of Conservation (SAC), and the Afon Mawddach Estuary Site of Special Scientific Interest (SSSI). Therefore, the main statutory designated site which requires consideration under the Habitats Regulations has been identified as:

- ◆ Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau (PLAS) Special Area of Conservation (SAC).

Also requiring consideration in relation to seeking SSSI assent for the works from (NRW). These are:

- ◆ Mawddach Estuary Site of Special Scientific Interest (SSSI).

- 1.1.5 There are several other designated sites within proximity to the project which are discussed further below in the following sections.
- 1.1.6 This document will be reviewed by the NRW SSSI Team responsible for this section of the Gwynedd Area. Following review and acceptance, this document will form part of the Band 2 Marine License Application, which will be submitted prior to the commencement of works along with a separate Water Framework Directive (WFD) Assessment.
- 1.1.7 EcoVigour Ltd have been commissioned to produce these documents for Alun Griffiths Contractors Ltd (AGC), the principal contractor, working on behalf of Network Rail.
- 1.1.8 Under the requirements of the European Council Directive 92/43/EEC 'The Habitats Directive', it is necessary to consider whether projects or plans may have significant effects upon areas of nature conservation importance designated/classified under the Directives. This requirement is translated into UK law through the 'Habitats Regulations'.
- 1.1.9 In addition, this assessment will compare the project objectives to the wider policies outlined the Welsh National Marine Plan (WNMP). The signpost document can be found in Appendix D.



1.2 PROJECT BACKGROUND

1.2.1 The Barmouth Viaduct Metallic Refurbishment project concerns the refurbishment of the existing steel structure section of the historic rail asset. Completed in 1867, the structure is a Grade II listed single-track wooden railway viaduct, carrying the Cambrian line across the Afon Mawddach Estuary South of Barmouth, Wales.

1.2.2 Network Rail condition surveys have concluded that the metallic structure, comprising 4 steel spans and a public footpath, show significant elements are exhibiting signs of distress. Consequently, requiring the entire 4 span superstructure to be replaced.

1.2.3 The Key relevant dates for the upcoming project are outlined below:

- ◆ Obtaining necessary licences and consents – **February-March 2022.**
- ◆ Establishment/Updating of site compounds – **March 2022 to June 2022.** The various compounds are established in phases over this period so that they are ready when required.
- ◆ Key date is commencement of site works on **28th March 2022.**
- ◆ Procurement and mobilisation of subcontractors for construction phase – **July 2021 to August 2022.**
- ◆ Pre-blockade works in the compounds including assembly of the steelwork – **April 2022 to August 2022**
- ◆ Rail possession to unload steelwork from a train to the Morfa compound – **18th to 19th June 2022** (Overnight)
- ◆ Rail possession to unload steelwork from a train to the Marine Parade compound – **25th to 26th June 2022** (Overnight)
- ◆ Substructure refurbishment – **April 2022 to August 2022.** The substructure refurbishment above includes refurbishment of the intertidal sections, which are planned to coincide with the lowest equinoctial spring tide on **14th August 2022.**
- ◆ Rail Blockade for replacement of the metallic spans - **12th September to 12th December 2022.**
- ◆ Snagging and demobilisation – **November 2022 to May 2023**

1.2.4 Greater details of these project tasks are provided in the following Methodology, Section 4.



2. LEGISLATIVE CONTEXT

2.1 OVERVIEW

- 2.1.1 The Habitats Directive, transposed into UK legislation through the Conservation of Species and Habitat Regulations (2017) (Article 6 of European Council Directive 92/43/EEC), any plan or project not directly connected with, or necessary to, the management of a European designated site but likely to have a significant effect, either alone or in combination with other plans or projects, shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives.
- 2.1.2 If the Appropriate Assessment concludes that the proposed works may have an adverse effect on the integrity of a European Site, or that such an effect cannot be ruled out (in line with the recognised precautionary principle), avoidance and mitigation measures to avoid such an effect must be considered.
- 2.1.3 If it cannot be concluded that the proposed works will not have an adverse effect upon the integrity of the site(s), further measures and assessments would be required. Potentially in the form of compensation.

3. METHODOLOGY

3.1 OVERVIEW

- 3.1.1 This assessment has been produced in-line with Habitats Regulations guidance published by the JNCC (2010), English Nature (now Natural England) (2001) and the Countryside Council for Wales (now Natural Resources Wales) (2008).
- 3.1.2 Barmouth Viaduct is located directly within the Llyn Peninsula and the Sarnau SAC. Regarding SSSI, the rail structure resides directly within the Aber Mawddach SSSI.
- 3.1.3 Additionally, there are several SSSI and a further SAC within proximity to the project which will be discussed in further detail within the scoping section below.
- 3.1.4 Non-European sites such as Ancient Semi Natural Woodland (ASNW) are within proximity to multiple sections of the rail corridor and proposed compound areas. However, as there is no requirement to impact on these areas directly or indirectly, it is considered that no impacts on these protected woodlands by the proposed works occur and thus will not be discussed further.
- 3.1.5 This HRA will focus on the potential likely significant effects (LSE) of the rail structure refurbishment on the Llyn Peninsula and the Sarnau SAC and Aber Mawddach SSSI designated sites. Information (copies of documents in Appendix A – Ecology) on these designated sites was obtained from the following sources:
 - ◆ YGC - 6919 Initial Environmental Appraisals 2018-2019.
 - ◆ NIRAS - UKL3460 Barmouth Viaduct Intertidal Survey - 20/12/2018
 - ◆ NIRAS - UKL3460 Barmouth Viaduct Fish Ecology Literature Review v1 – 14/11/2018
 - ◆ ECUS – EIA Screening Letters – NRW Reference SC1811 – 09/12/2018
 - ◆ ECUS - 11493 Barmouth Viaduct Refurbishment Habitats Regulations Assessment Screening - 08/08/2019
 - ◆ Avian Ecology - Barmouth Viaduct Urgent Habitats Regulations Assessment – 02/06/2017
 - ◆ CCW/NRW Core Management Plans, Designated Site Citations, Indicative Condition Reports and mapping via the NRW Designated Sites Finder Portal and Interactive Map Resources.
 - ◆ EcoVigour & Pryce Preliminary Ecological Appraisal, April 2020
- 3.1.6 Correspondence with the CML2016 NRW Marine Case Office, has confirmed that although some data is beyond 2 years in age. The documents contents are still representative and able to support the new Marine License application.



4. DESCRIPTION OF THE PROPOSED ACTIVITIES

4.1 SITE CONTEXT

- 4.1.1 The Barmouth Viaduct Metallic Refurbishment project is situated adjacent to the North shore of the Afon Mawddach Estuary (Grid Ref: SH 61971 15466 & SH 62041 15376 respectively). Several project compounds will be utilised to support the project, which are already situated within Barmouth to the North and a single larger compound is situated to the South in Morfa Mawddach, West of Fegla Fawr (Grid Ref: SH 62736 14623). The figures below illustrate the projects' location in relation to the wider area and PLAS SAC.

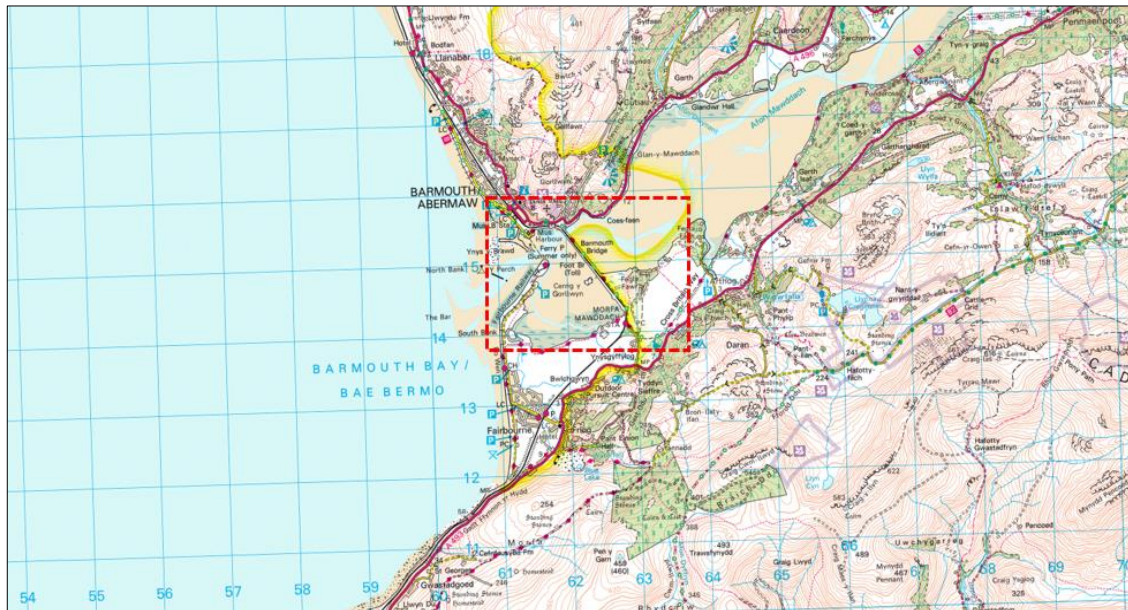


Figure 1: Location in context to the wider Area.

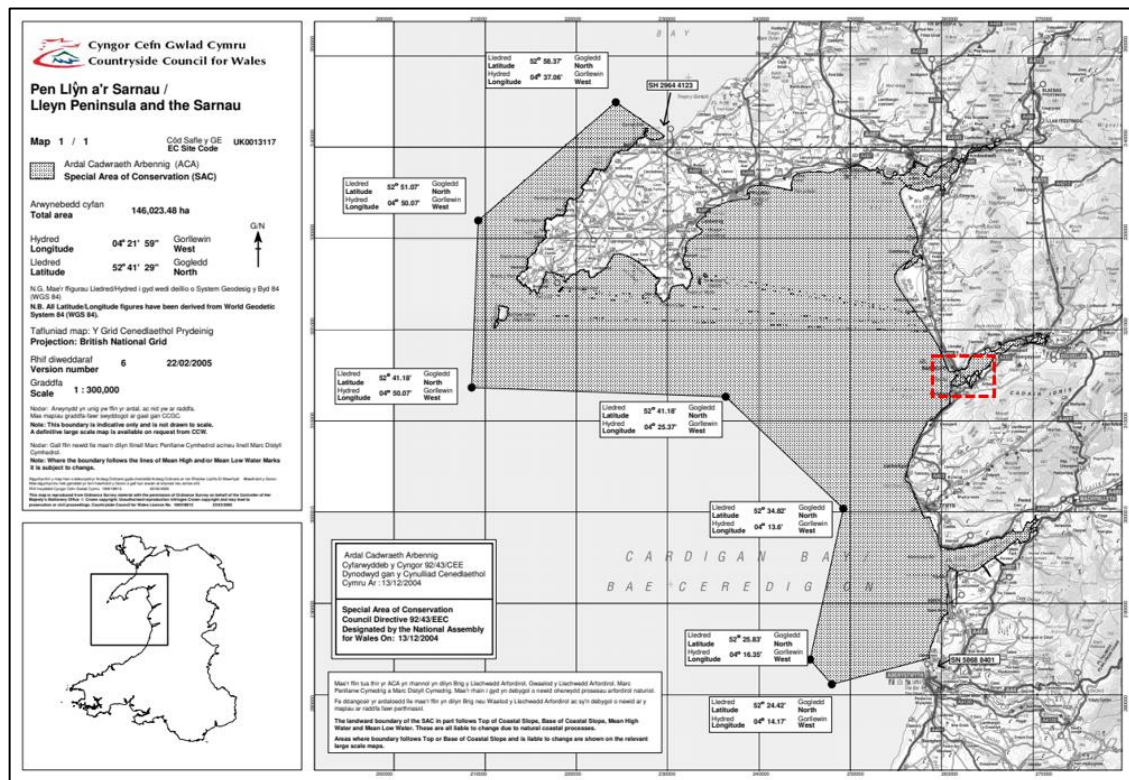


Figure 2: Boundary of SAC in relation to the project area. West Wales Marine & Aber Mawddach boundaries overlap.



4.2 METHODOLOGY PROGRAM OUTLINE

4.2.1 The table below highlights the broad program for the metallic works, with further details outlined in the sub sections below. The full unabridged methodology can be found in Appendix B, while the tender video presentation is available in Appendix F (the tender video illustrates the entire refurbishment process).

Table 1: Estimated Project Program.

Tasks	Years & Months																		
	2021		2022												2022				
	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February -	March	April	May
Marine License Application																			
Compound Improvements																			
Cable Diversion																			
Scaffolding Installation																			
Grit Blasting & Painting																			
Pre-blockade preparation																			
Main Blockade/ Bridge Replacement																			
Final checks and handover																			
Demobilisation/ reinstatement.																			

Calendars

- 4.2.2 The majority of activities in the main construction programme are on a standard calendar (made project specific) that allows working 5 days /week for 8-10 hours /day with bank holidays and a 2-week period at Christmas as non-working days.
- 4.2.3 Any activities that need to be carried out within a 'rules of the route' possession are on a project specific calendar that allows Saturday night working (8-hour shift) only.
- 4.2.4 All activities in the blockade programme are on a calendar that allows working 6 days /week for the duration of the blockade.



4.3 COMPOUNDS IMPROVEMENTS

- 4.3.1 The compounds to be used are the same as those used under Marine License CML2016. With the addition of Aberamffra Harbour (location 3, figure 3).



Figure 3: Project Compounds.

- 4.3.2 The compound at Ornamental Gardens (location 4) has been chosen to be as close to the structure as possible whilst minimising disruption to Barmouth. The additional parking (location 5) has been chosen to avoid having cars parked within the compound area due to lack of available space and the reduced sighting distance when leaving the compound onto the main road.
- 4.3.3 This compound will be utilised for the advanced works, with Aberamffra harbour used to take scaffold, new steelwork and painting equipment to and from the substructure.
- 4.3.4 The Marine Parade (not within map, figure 3) area is located adjacent to the track and provides an expansive area for the storage of deck panels and for all components of Bridge. Its location benefits the delivery of all these components by Rail.
- 4.3.5 The Morfa Compound (location 1) allows access along straight track to the structure, it also allows bridge components to be delivered using trains rather than roads.



4.4 CABLE DIVERSION

- 4.4.1 Prior to site set up at Morfa the 33kV cable running between the compound and the track will be diverted underground, this will need to be included within the access agreement with the landowner.
- 4.4.2 To ensure the risk to power lines as a result of heavy material movement between Morfa and the structure is mitigated against. Scottish Power (SP) have agreed to divert the 33kV Overhead Cable. This will be carried out in advance of any proposed siteworks.
- 4.4.3 SP have confirmed that a period of 4 months is required to plan the works and that the works will be carried out during summer months of 2022 to take advantage of the lower power usage. Scottish Power will arrange its own consents to sanction the works and a responsible for contacting Natural Resources Wales.

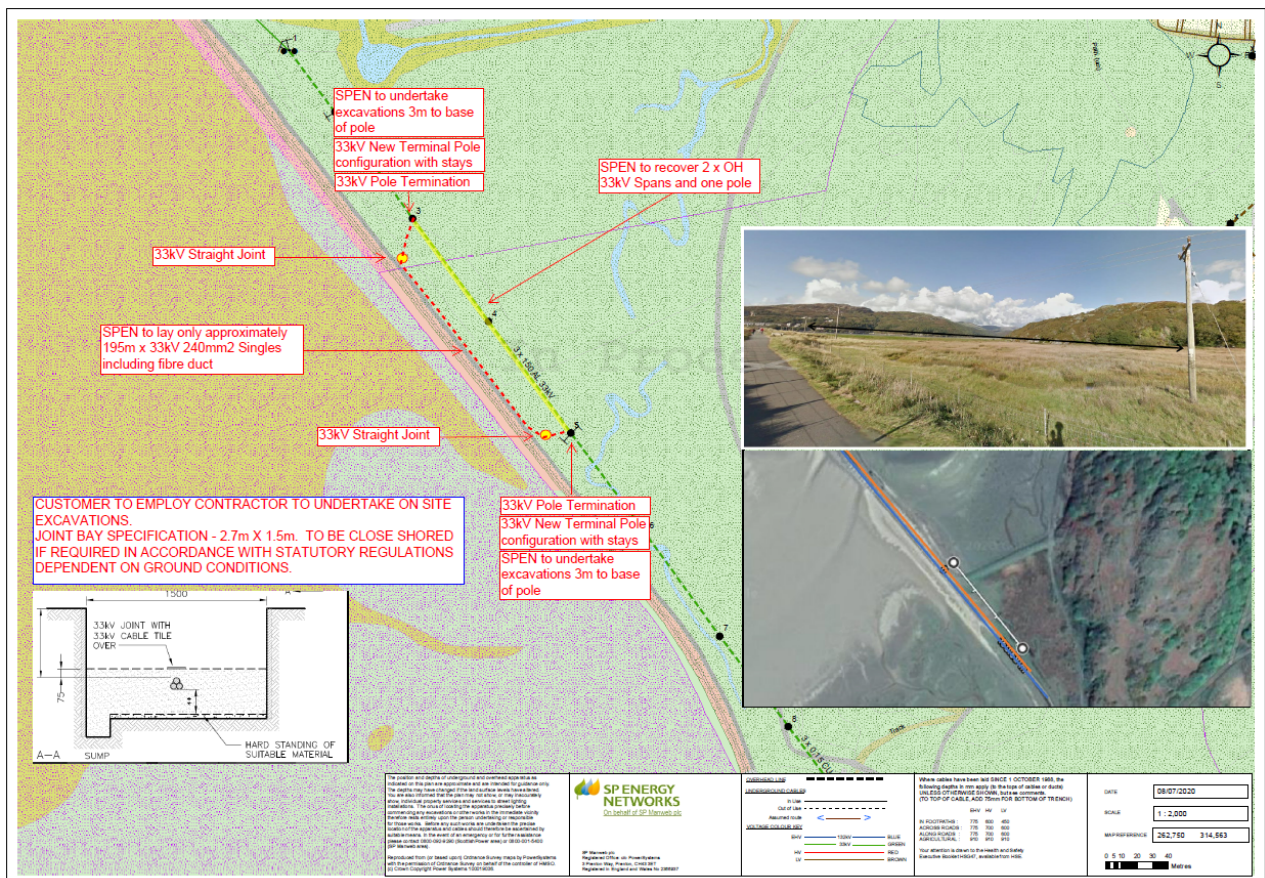


Figure 4: Northern Power Cable Diversion.



4.5 SCAFFOLDING INSTALLATION AND PIER WORKS (GRIT BLAST & PAINT)

- 4.5.1 During the summer of 2022 the substructure will be painted and repaired. The painting will consist of grit blasting (please refer to Appendix C for grid blasting technical information) above the tidal splash zones i.e., above MHWS with access gained via scaffolding fixed to the cylinders using shear plates.



Figure 5: Example of scaffolding above high waterlines.

- 4.5.2 The upper section of this scaffolding will include encapsulation and ply boarding to catch spent grit. The encapsulation will likely be of a Monarflex design or equivalent (see figure below for example)



Figure 6: Example of Monarflex sheeting used in an urban setting.



- 4.5.3 The lower scaffold will not be encapsulated and will be specifically designed to allow tide to pass over and through and will include steel 'haki' boards. The pontoons will be 'wrapped' around the piers. Blasting will utilise either a mechanical removal of degraded paint or vacuum blasting techniques.



Figure 7: Example of pontoon wrapped around pier.

- 4.5.4 The blasting will follow the tide and will be planned to end around the Lowest equinoctial spring tide which will be 0.47m on 14 Aug 2022. The painting will be Jotun Marathon 550 or similar Network Rail approved equivalent (please refer to Appendix C).
- 4.5.5 The works will include repairs as per the detailed design for the substructure, the higher (non-tidal sections) will be carried out off a scaffold system supported from the pier. This scaffolding will remain in place to facilitate the reconstruction during the blockade. The new components will be delivered from beneath via the old harbour on pontoons.
- 4.5.6 The scaffold which will be designed for both the preparation works and the main works will include access to the top of the abutment to facilitate the installation of the new components.



4.6 PRE-BLOCKADE PREPARATION

On site fabrication within Morfa compound

- 4.6.1 Following the fabrication, the bridge components will be transported from Darlington via Rail and delivered to Morfa within a Saturday night possession by DB Schenker. The train will be unloaded using an all-terrain crane positioned in the Morfa compound. This will be carried out early summer 2022,



Figure 8: Upgraded compound to support new metallic sections.

- 4.6.2 The loads will be arranged in construction order so that as each load arrives it is able to be added to the trusses and minimises the required construction footprint.
- 4.6.3 Once all components have been erected, the bolted connections as well as any other areas requiring touch-up will receive their final coats of paint ready prior to installation during the blockade.

Slew Ring Mechanism Preparation Works

- 4.6.4 Using the pier top access, advance works to the caisson tops will be carried out consisting of the installation of in-situ concrete and temporary works.
- 4.6.5 Prior to this being installed, the deck plates above the slew ring will be removed and FRP open mesh panels installed with a hinge and lock mechanism for easy access and the introduction of air flow. In addition, sections of the cowling will be removed to allow greater access, alter the area to remove the confined space risk and to allow installation of permanent steelwork within the blockade.



Installation of Concrete to Slew Ring

- 4.6.6 Following the erection of access and removal of sections of cowling, which will be carried out during rules possessions, the formwork for the concrete will be constructed. This can be carried out in dayshift with access via the scaffolding and from the pedestrian walkway through our pre-installed locked gate.
- 4.6.7 The concrete will be installed in a series of rules possessions, a Road Rail Vehicle (RRV) with concrete skip will gain access at Morfa and will be loaded with concrete in the compound under controlled conditions.

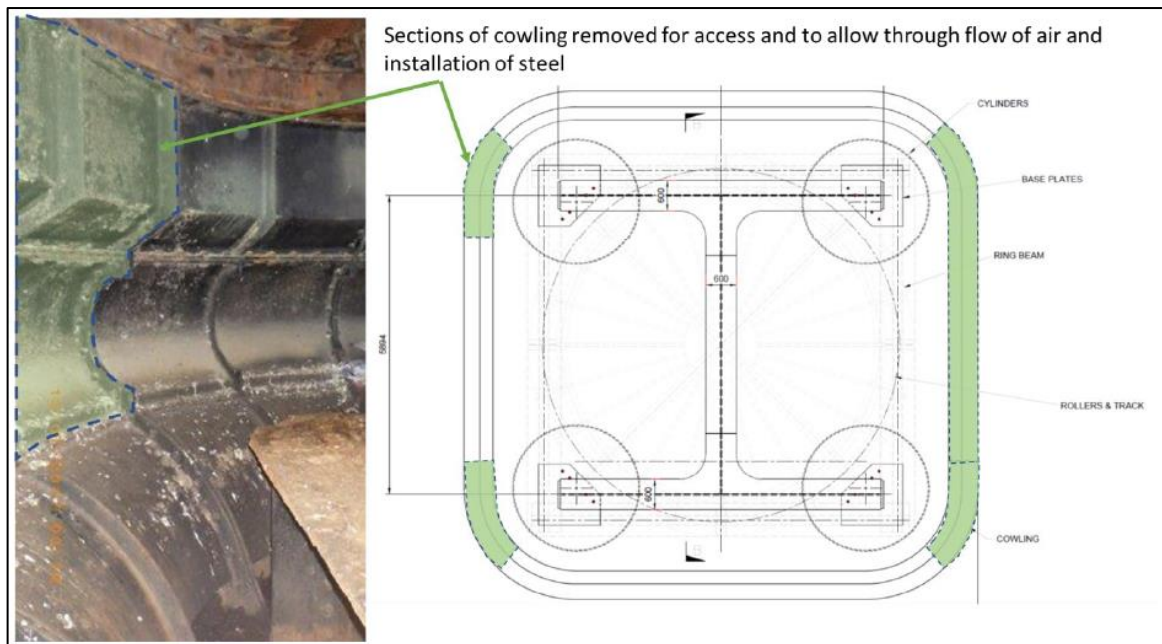


Figure 9: Strengthening of old swing gear house.

- 4.6.8 The RRV will then travel to the structure and pour concrete within the formwork. It should be noted that, in order to ensure correct bond with the existing steel and to ensure no early cracking from the passage of trains the concrete will include an accelerator.

Installation of Temporary Support Beams

- 4.6.9 Following the curing of the concrete, specially designed temporary support beams will be installed on the top flange of the existing grillage and anchor bolts will be drilled through into the new concrete to secure a fixing.
- 4.6.10 Should it be deemed necessary following detailed inspection, sections of the existing slew ring will be cut away to allow installation. These will be cut using burning equipment into manageable sections. It should be noted that these sections are not load bearing as they are outside the cross-girder support zone. This work will be carried out within possessions accessing through deck and via scaffold access as required.



4.7 BLOCKADE WORKS

- 4.7.1 The programme has been developed such that there are 2 weeks float between all preparation work being completed and the start of the blockade. By the time the blockade starts the following will be in place:
- ◆ Scaffold access will be in place at pier heads
 - ◆ Piers will have been painted
 - ◆ Repairs to piers will have been completed
 - ◆ Sections of the cowling to the swing span mechanism will have been removed
 - ◆ Deck plates above the swing span will have been replaced with FRP open mesh
 - ◆ Existing elements to be retained will have been removed, repaired and painted
 - ◆ Temporary works will have been installed within swing span mechanism and pier heads
 - ◆ New temporary wind bracing installed at higher level with existing wind bracing removed
 - ◆ New beams for fixed and swing span will be complete within the Morfa compound
 - ◆ Temporary Mabey Hire MU boxes for swing span and fixed span constructed
- 4.7.2 A 500T crawler crane will be set up within the Morfa compound ahead of the start of the blockade and trail lifts of key components carried out. This is based on detailed discussions with the suppliers to provide the required radius from compound to track of circa 36m with a 40tonne maximum lift weight, and the ability to lift from the compound over the footpath and to the rail line.
- 4.7.3 At the start of the blockade a Unimog will be on tracked at the RRAP near Morfa station, 8No 20T trailers will be loaded onto the track and connected to the Unimog. The configuration will be tracked by the Unimog to the compound at Morfa with the trailers facing towards Barmouth.
- 4.7.4 Starting with the cess girders, both girders will be placed either side of the truss on the jacking system and connected to the MU truss. Once the main beams are secured to the MU truss the jacking system will be lowered off such that the weight of the main beams and MU truss is taken by the trailers.

Removal of Wind Bracing.

- 4.7.5 In order to facilitate the use of gantry system the wind bracing will be removed. Working from the MU truss, which will be boarded out with required handrails to the ends. the overhead bracings will be unbolted, placed on skates on the gantry rails and moved to the North end of the structure.
- 4.7.6 From here they will be removed using an RRV and taken to the Northern site compound. This will give the advantage of full access across the structure at all times.
- 4.7.7 Once the fixed span new beams are positioned this will create a full-length gantry rail system. The fixed span overhead bracing will be removed in the same manner as the swing span and will be moved to the North end and removed with the RRV.
- 4.7.8 The fixed span main beams will arrive with 2No gantry systems already in place on the gantry rails, the Northern gantry will be moved to the swing span as the rails will be connected together.



Dismantling of Existing Bridge

- 4.7.9 The existing spans will then be cut into pre-determined sections (generally 3-4m depending on nodal positions). As the sections are fully supported all cutting can be carried out from the deck without the need for open edge working.



Figure 10: New bridge sections and loading beams driven into space between existing outer frames.

- 4.7.10 The new beam will be protected from the cutting operation using fire resistant sheeting and shielding. The steel pontoons have the additional benefit of being able to stop any debris falling into the estuary whilst ensuring other vessels don't venture into the area. The support vessels will also ensure that safe passage is maintained. Back-to-back radios with the cutting team will ensure that if required the operation can be ceased at short notice.
- 4.7.11 Once a section is ready to be lowered the overhead gantry winches will be attached to agreed locations within the section and the support system unbolted. The section will then be lowered to an awaiting steel pontoon.
- 4.7.12 There is an allowance for 4No steel pontoons in order to ensure that sections can be lowered without waiting for removal of a loaded pontoon. Both spans will be dismantled simultaneously in a predetermined sequence as to ensure a balanced transfer of loading onto the new girders.



Figure 11: Removal of outer steel work and existing decking.

- 4.7.13 One section of cross girder behind the temporary new beam support system cannot be removed in this manner and will therefore be cut into smaller sections of approximately 1m in size, prior to being slid using a telford to the outside edge of the structure, lifted with the gantry system and then lowered on to pontoons.
- 4.7.14 The sections within the central area of the swing span and the swing span mechanism will be removed sideways from either side of the Mabey support beam located between two cross girders prior to lowering on to awaiting pontoon.

Pontoons

- 4.7.15 The pontoons will consist of 9 No (4.2m x 2.1m) NATO pontoons bolted together to form a 12.6m x 6.3m stable pontoon with solid handrail capable of holding 25 tonnes. This will then be moved to the old harbour using two small vessels each acting as redundancy to the other should any issues occur. Using these methods will provide the benefit that work can continue at almost all states of tide due to the low draft.



Figure 12: Example of metal pontoon platforms.



- 4.7.16 Once the pontoons are positioned against the harbour wall the bridge sections will be cut down into manageable sections and lifted off the pontoon using a Hiab wagon on the harbour – this activity is not tide dependant as the pontoons have the ability to be able to be beached as the tide drops.
- 4.7.17 It should be noted that the pontoons are road deliverable and will be constructed off the old harbour ahead of the blockade. They have a maximum height of 770mm with a draft of 570mm fully loaded ensuring that they can work at all locations of the structure even at low tide. The proposed support craft have drafts of 0.45 and 0.6m again ensuring that work can continue on all but the lowest of tides.
- 4.7.18 There will be no disruption to Barmouth or Barmouth Harbour as the pontoons and support craft will run between the structure and the old Aberamffra Harbour. This methodology also minimises any impact to pleasure craft using the upper reaches of the estuary.

Initial Reconstruction

- 4.7.19 Following the removal of all wind bracing using an RRV from the Northern approach the dismantling of the bridge can commence.
- 4.7.20 The scaffold system giving access to the underside of the structure will also act as a propping system to pier 2 to remove the risk of articulation. Prior to lifting, the bridge will be jacked up to ensure its release from the foundations and also to act as a check on the structure's weight.
- 4.7.21 Working off the full scaffold system the cross girders, bearers and deck plates will be cut and lifted up through the deck using the TXM monster crane positioned on the structure.
- 4.7.22 Following the removal of all decking, the TXM crane will lift the individual main beams off and pass to RRV and trailers behind the crane.
- 4.7.23 Once span 1 has been removed, the scaffold will be removed with just the scaffolding around the Northern pier remaining. The above procedure will then be repeated for the removal of Span 2 (Northern span).
- 4.7.24 Once completed the TXM machine will leave site. The track and top of abutment will then be removed at the Northern abutment, this will be carried out using the Griffiths RRV.
- 4.7.25 An extended in-situ concrete run-on slab will be formed, this will also be designed for and act as an outrigger foundation for the Road Rail AC55 T crane. The road rail crane will access the track at Barmouth level crossing or an installed temporary RRAP at the Marine Parade compound.
- 4.7.26 Once in position the crane will lift in the new impost units, these will be in two sections, one under the track and another beneath the footpath to reduce weight for lifting.
- 4.7.27 Following the removal of the existing crosshead the new crosshead will be installed in the same manner, this will be designed in sections to suit lift capacity of the crane.
- 4.7.28 As with all bridge components these will be brought to site on RRV trailers loaded by separate crane at the trackside compound.
- 4.7.29 Following the installation of the main beams the cross girders, bearers and deck panels will be installed. The design of these elements has been developed to allow installation in panel format, from above, and also to suit the crane capacity.



- 4.7.30 Once the first span has been completed the AC55T crane will derig and leave site. The bearings will be grouted, and the span fully completed and signed off as ready to use. The track will then be reinstated up to and including the span with a stop block installed at the end of the span.
- 4.7.31 At this stage the TXM monster crane will return to site, again accessing at Barmouth level crossing or RRAP within the site compound.
- 4.7.32 Whilst the first span work and track reinstatement works to the North are being carried out, the crossheads will be replaced on pier 2. Following installation of new crossheads the scaffold to the span will be reinstated.
- 4.7.33 The TXM crane will be positioned at the very end of the new span, the new beams will be installed followed by installation of cross girders, bearers and deck panels.

Full Construction of Bridge

- 4.7.34 Prior to the start of the reconstruction of bridge spans, the crossheads and bearings to pier 2 be replaced. The new main beams and gantry rails will include a cantilevered section and, following the removal of span 1 and the removal of scaffold, the crossheads will be replaced.
- 4.7.35 Once all of the existing bridge has been removed, including the swing span mechanism and existing bearings, the new bearings will be installed. The gantry will lift these up individually from the pontoon and place on prepared area, they will be bolted and grouted as stipulated in the design.
- 4.7.36 Once all bearings are correctly in position, including new crossheads to pier 2, the new beams will be slid into their final locations.
- 4.7.37 The gantry cranes will be taken to the south end of the structure and lifted off using the TXM crane, these will be returned to the Morfa yard and extended to suit the final width of main beams, once the beam expansion has been completed, they will be returned to the structure and lifted back onto the gantry rails.
- 4.7.38 The main beams move will be carried out one beam at a time using jacks against the MU truss. Stainless steel and PTFE will be placed at the interface between the bottom flange and the temporary support/new bearings.
- 4.7.39 Once the main beams are secured into their final position the extended gantries will be reinstalled, using the TXM monster crane at the south end of the fixed span. Once in position the new deck panels complete with viper base plates and slave rail will be lifted from pontoons and secured to the deck.



Figure 13: New outer structure supports, and frame widened, and new decking raised and fixed into place.

- 4.7.40 The new deck panels will include a suspended scaffold deck below as they are lifted which will connect to the scaffold in place at pier heads. This gives the benefit of continuous access for bolting up and touch up paintwork.
- 4.7.41 Once all decks panels have been installed the previously installed temporary wind bracing system will be removed in the reverse order, i.e., the RRV will bring to components to the North end of the swing span and place these on skates on the gantry rails. They will then be pushed along both spans and installed in similar positions to that on original spans. This bracing will be adapted to bolt to the sections of the gantry rail system.
- 4.7.42 During the track installation works the bolted joints (cross girder to main girder and deck splice plates) below the deck will be receive their final coats of paint using the scaffold access installed during deck panel installation. Once completed this scaffold will be lowered to pontoons and removed – note this has the benefit that it can be carried out post blockade if required.

4.8 FINAL CHECKS AND HANDOVER

Following final inspections, the bridge will be handed back to Network Rail and opened for traffic and pedestrians.

4.9 DEMOBILISATION & REINSTATEMENT

- 4.9.1 Demobilisation of the sites will be carried out and the areas returned to their former status. The reinstatement will follow the same agreements within marine license CML2016. This is due to the CML2016 license works scheduled being extended to March 2022 (CML2016v1), as to allow the reinstatement stage on both licenses to match and avoid schedule conflict.



5. HRA METHODOLOGY OBJECTIVES

- 5.1.1 Habitats Regulation Assessment is an assessment of the potential effects of a proposed project / maintenance activity on a European site(s) (alone and/or in combination with other plans and projects). The Habitats Regulations promotes a hierarchy of avoidance, mitigation and compensatory measures. First, the project should aim to avoid significant adverse effects by identifying potential measures to avoid these effects.
- 5.1.2 Where adverse effects remain, mitigation measures should be applied to a point where these effects are no longer significant. If sufficient mitigation measures cannot be applied, the project should not be taken forward in its current form. In such a scenario, the project will require an assessment to identify alternative solutions that deliver the project in a form that avoids any significant adverse effects.
- 5.1.3 Where significant adverse effects remain, compensatory measures will be required if the project is to proceed. However, the application of such measures will only be permitted if no alternative solutions exist, and the project is required for imperative reasons of overriding public interest (the 'IROPI' test).



6. DESIGNATED SITES WITHIN PROXIMITY TO SITE

- 6.1.1 There are several statutory designated sites within proximity to the Viaduct.
- 6.1.2 Site of Special Scientific Interest:
- ◆ Afon Mawdachh (SSSI)
 - ◆ Barmouth Hillside (SSSI)
 - ◆ Ty Bach Ystlumod (SSSI)
 - ◆ Glannau Tonfanau I Friog (SSSI)
 - ◆ Arthog Hall Woods (SSSI)
 - ◆ Cregennen a Pared y Cefn Hir (SSSI)
- 6.1.3 Special Area of Conservation:
- ◆ Llyn Peninsula and the Sarnau (SAC)
 - ◆ West Wales Marine (SAC)
 - ◆ Meirionnydd Oakwoods and Bat Sites (SAC)
- 6.1.4 As Barmouth Hillside, Glannau Tonfanau I Friog, Arthog Hall Woods, Cregennen a Pared y Cefn Hir SSSI's are designated by their respective in situ features that are a significant distance from the project area. They will not be considered further in this assessment. The remaining Llyn Peninsula and the Sarnau and West Wales Marine SAC and Aber Mawdachh SSSI site will be discussed further in their own sections below.
- 6.1.5 Meirionnydd Oakwoods and Bat Sites & Ty Bach Ystlumod will be discussed together as their designations overlap in regard to the protection of bats and their habitat.
- 6.1.6 The West Wales Marine (SAC) site boundary is located a significant distance away from the structure, however due to the highly mobile Annex II feature (1351: Harbour Porpoise – *Phocoena Phocoena*), it will be discussed further in the sections below.
- 6.1.7 The assessment recognises that sites such as Glannau Tonfanau I Friog (SSSI) would be sensitive to a large pollution event. However, as pollution control measures will be implemented for the remaining SAC & SSSI features, protection to this site and others further afield will be inferred from the measures to protect the main SAC & SSSI sites being discussed.



7. MEIRIONNYDD OAKWOODS AND BAT SITES (SAC) & TY BACH YSTLUMOD (SSSI)

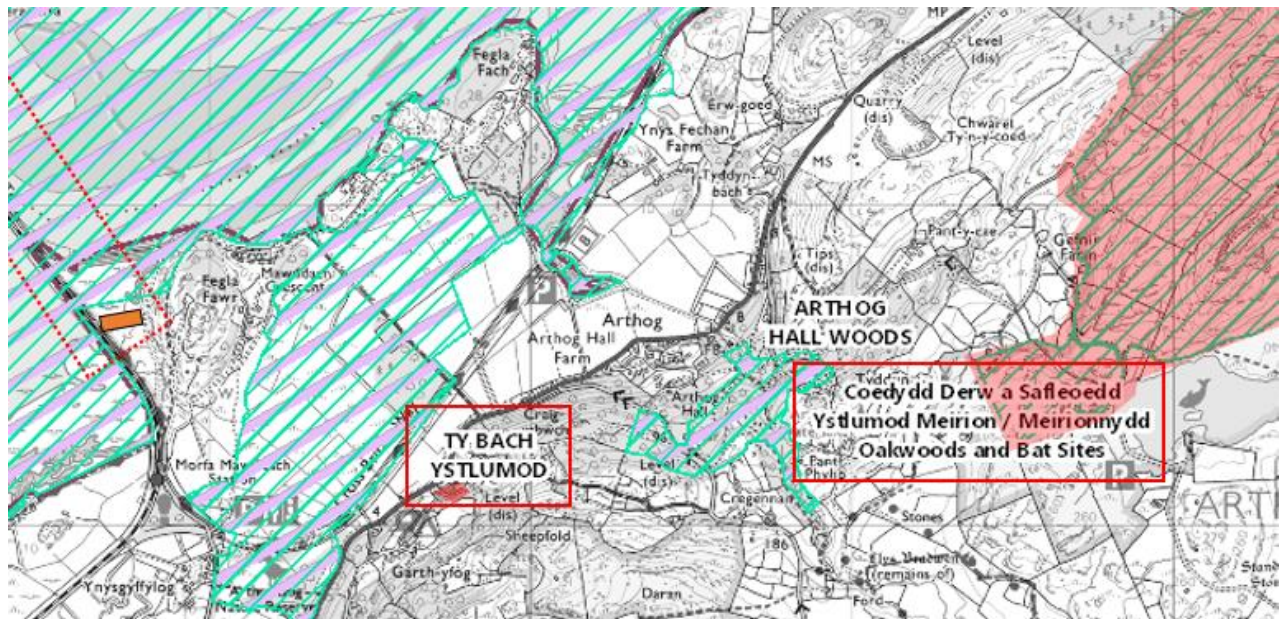


Figure 14: Designated Bat Sites in relation to project.

- 7.1.1 The Coedydd Derw a Safleoedd Ystumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC (see figure 18 above) is made up of a series of woodlands, from Eryri in the north to Dolgellau in the south. The majority of the site is classified as Old sessile oak woods with Ilex and Blechnum in the British Isles. Lesser horseshoe bats have over 20 known roosts and forage widely within the SAC. The SAC includes maternity roost sites in various types of buildings and structures, and winter hibernation sites, especially in mines (Countryside Council Wales; CCW, 2008).
- 7.1.2 Tŷ Bach Ystumod is of special interest as a breeding roost for lesser horseshoe bats (*Rhinolophus hipposideros*). The site is situated behind Arthog village hall, near Fairbourne. The bats use Tŷ Bach Ystumod during the summer months, to raise their young. The bats use walls extending from the roost as flight lines to access the adjacent mature broadleaved woodland, which provides extensive feeding habitat.
- 7.1.3 The overarching objective for the lesser horseshoe bat features is for it to be in a Favourable Conservation Status (FCS). Although in Ty Bach's case the considerations are far more localised, the broad objectives are compatible. In order to satisfy FCS:
- ◆ The population of lesser horseshoe bats should be maintained at its current size and encouraged to increase
 - ◆ Ensure there are sufficient breeding roosts (buildings, structures and trees) and hibernation roosts (mines and buildings) of appropriate quality. Including other types of roost such as night, transitional, leks and swarming sites
 - ◆ Foraging or feeding habitat in the SAC and importantly, surrounding countryside, including grasslands and some gardens, is of appropriate quality, extent and connectivity across the range
 - ◆ The range of the population within the SAC/Gwynedd is stable or increasing; and
 - ◆ All factors affecting the achievement of these conditions are under control.
- 7.1.4 Consequently, these FCS objectives require a level of consideration within the mitigation matrix below, predominantly in regard to light pollution and temporary reduction in habitat.



8. AFON MAWDDACH (SSSI)

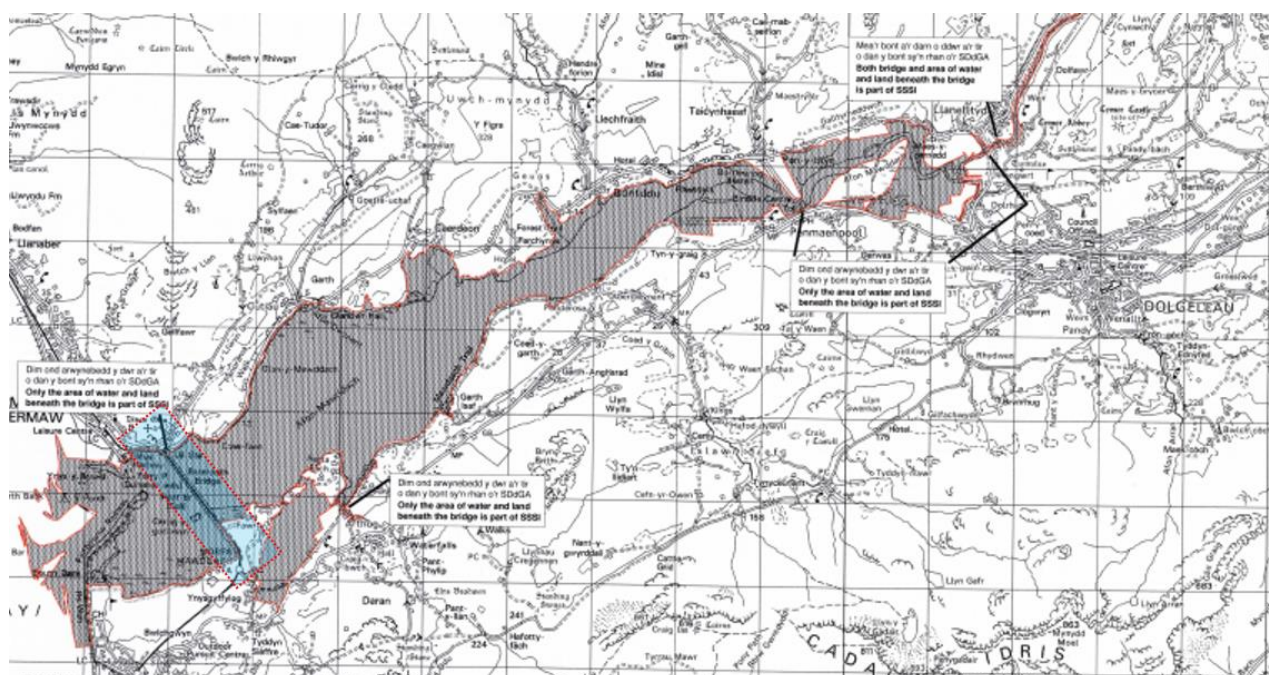


Figure 15: SSSI Designated Site boundary in relation to project area (blue overlay)

8.1.1 Aber Mawddach (Estuary) is designated as a SSSI due to its diverse biological features. Situated west of Dolgellau in Meirionnydd, the site includes the Mawddach estuary itself, a large shallow estuary draining south westwards into Cardigan Bay, and adjacent habitats (see figure 15 above).

8.1.2 The estuary is wide with extensive sandflats throughout its length, areas of muddy sediments and large areas of saltmarsh. The mouth of the estuary is protected to the south by Fairbourne Spit, a sand and shingle spit, and on the north side is the small town of Barmouth.

8.1.3 The special features of the site are the estuarine habitats, particularly muddy sediments and saltmarshes, reed beds and raised mire. There is also a substantial species interest, including breeding wading birds, scarce vascular plants, bryophytes and invertebrates.

8.1.4 Within the Site Management Statement (SMS), the features below are listed which form the overall status of the designated site:

- | | |
|----------------------------|-------------------------------|
| ◆ The estuary | ◆ Rare plants |
| ◆ Intertidal muddy gullies | ◆ Otter |
| ◆ Bog | ◆ Redshank and snipe |
| ◆ Salt marsh | ◆ River shingle invertebrates |
| ◆ Coastal fen | ◆ Rare liverwort |
| ◆ Swamp | ◆ Salmon |
| ◆ Wet woodland | |

8.1.5 From the extended Phase I survey, the relevant habitat from the SMS in relation to the project area remaining are:

- ◆ The estuary
- ◆ Intertidal muddy gullies



- 8.1.6 No works undertaken by AGC Rail associated with the Metallic works will require access and egress to the structure which will come into close proximity to the Salt Marsh. Southern Power will be responsible with agreeing the appropriate methodology for the aforementioned undergrounding works relevant to the Salt Marsh feature near Morfa Mawr.
- 8.1.7 There is a list of potential damage vectors to the designated site highlighted within the SMS Potentially Damaging Operations (PDO) list. Below are the activities considered relevant to the proposed project (Table 2 below).

Table 2: PDO list from NRW Designated Site Finder Tool.

SMS Ref No:	Type of operation
11.	Destruction, displacement, removal or cutting of any plant or plant remains, including tree, shrub, herb, hedge, dead or decaying wood, moss, lichen, fungus, leaf-mould, turf or peat.
12.	Tree and/or woodland management, the introduction of tree and/or woodland management and alterations to tree and/or woodland management including planting, felling, pruning and tree surgery, thinning, coppicing, changes in species composition and removal of fallen timber.
21.	Destruction, construction, removal, rerouting, or regrading of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, including soil and rock exposures.
22.	Storage of materials.
23.	Erection of permanent or temporary structures or the undertaking of engineering works, including drilling or the laying, maintenance or removal of pipelines and cables, above or below ground.
24.	Modification of natural or man-made features (including cave entrances) and clearance of boulders, large stones, loose rock or scree and the battering, buttressing or grading of geological exposures.
26.	Use of vehicles or craft.

- 8.1.8 The rare plant species reference in the SMS (e.g., lesser marsh wort, lesser bulrush, cyperus sedge) were not found during the Phase I Habitat survey. This is not to suggest that these species are conclusively absent from the area, but the likelihood of encounter is lower.
- 8.1.9 Grimmia Arenaria and Pallavicinia lyellii moss and liverwort features appear to be highly localised to their described locations which are outside of the project footprint.
- 8.1.10 Mitigation measures for animal species such as otter which overlap SAC, Redshank, Snipe, River shingle invertebrates and Salmon are discussed further in section 13.



9. LLEYN PENINSULA AND THE SARNAU (PLAS) SAC

9.1 PLAS ANNEX FEATURES OVERVIEW

- 9.1.1 The Llyn Peninsula and the Sarnau SAC is comprised of sea, coast and estuary that supports a wide range of marine habitats and dependant wildlife. The nature of the seabed and coast including the range of environmental conditions present vary throughout the SAC - See figure 2 for project location in relation to the SAC boundary. For the qualifying habitats and species listed in the table below (table 3), the Llyn Peninsula and the Sarnau SAC is one of the best areas in the United Kingdom.

Table 3: Annex I & II features of the PLAS SAC.

EU Code	Feature
Annex I habitats that are a primary reason for selection of this site	
1110	Sandbanks which are slightly covered by sea water all the time
1130	Estuaries
1150	Coastal lagoons (* Priority feature)
1160	Large shallow inlets and bays
1170	Reefs
Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site	
1140	Mudflats and sandflats not covered by seawater at low tide
1310	Salicornia and other annuals colonizing mud and sand
1330	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)
8330	Submerged or partially submerged sea caves
Annex II species present as a qualifying feature, but not a primary reason for site selection	
1349	Bottlenose dolphin (<i>Tursiops truncatus</i>)
1355	Otter (<i>Lutra lutra</i>)
1364	Grey seal (<i>Halichoerus grypus</i>)

- 9.1.2 As the projected refurbishment works occur directly within the SAC, it is necessary to identify the Annex I & II features that will be found directly within the project footprint.
- 9.1.3 Annex II species will be assumed as these species are highly mobile. The Annex I habitat however are discussed in the following subsections.



9.2 ANNEX I HABITAT WITHIN PROJECT AREA

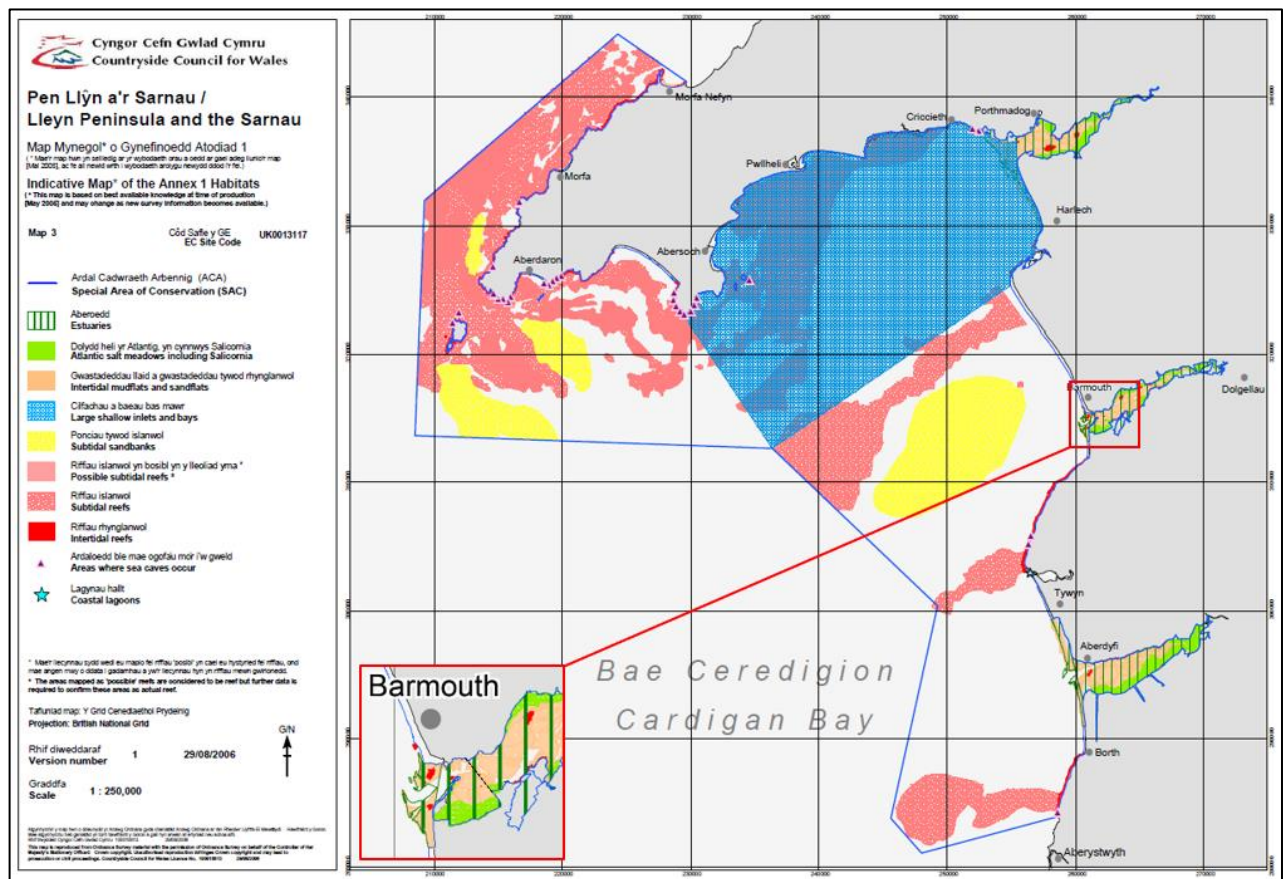


Figure 16: PLAS SAC Habitat Map with Barmouth Snapshot.

9.2.1 Using the available data from the CCW (now NRW) Designated Habitat Map (Figure 16 above), the relevant Annex I Habitats in relation to the project footprint are:

- ◆ 1130 Estuaries
- ◆ 1170 Reefs
- ◆ 1140 Mudflats and sandflats not covered by seawater at low tide
- ◆ 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

9.2.2 Again, as previously conceded in this assessment, there are designated habitat features further afield such as large shallow inlets/bays and subtidal sandbanks which would be vulnerable to pollution events, which could impact the FCS of these features. However, as the immediate features to the structure will be protected by robust measures, these further afield features will benefit from the proposed measures in this assessment.

9.2.3 Within the footprint of the structure, two intertidal reef points are noted. To further substantiate the habitat, present within the project area, intertidal habitat surveys were undertaken and are discussed in the following sub section.

9.2.4 To further understand the potential impact on the Annex I Habitat within the direct project area, intertidal survey undertaken by NIRAS Consulting during 2018. These surveys support the timber stage works under CML2016. It has been agreed that this data is still suitable to inform this new assessment.



9.3 NIRAS INTERIDIAL SURVEY RESULTS

9.3.1 During November 2018, NIRAS conducted an Intertidal Survey to evaluate the previously recorded intertidal biotopes from available NRW/CCW 2005 data sets and update upon them. (see figure 18 below)

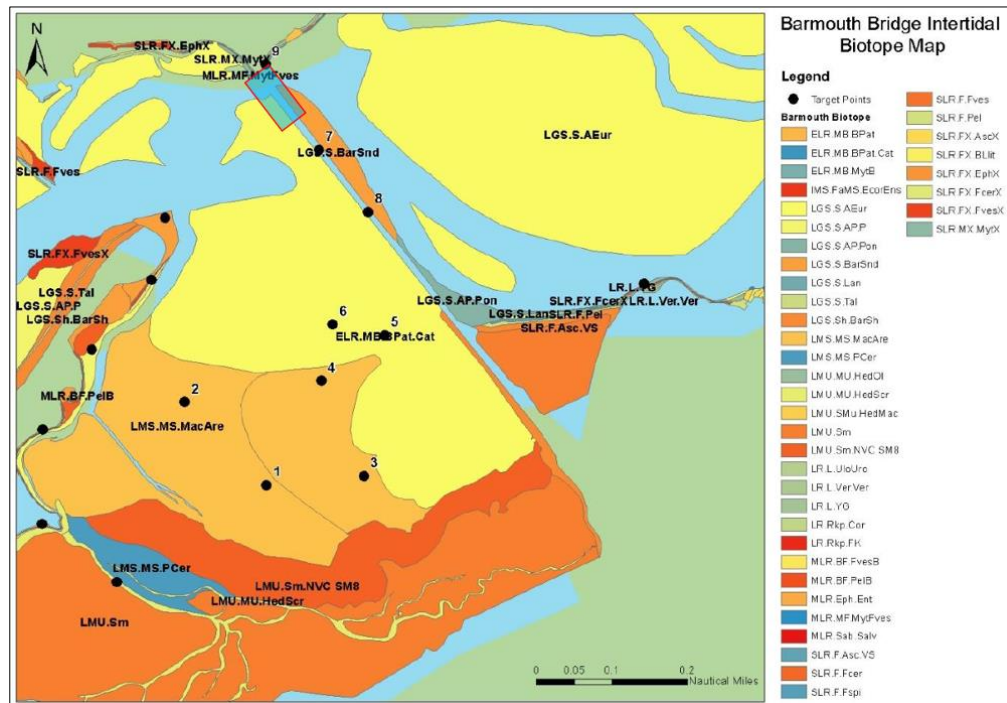


Figure 17: CCW/NRW 2005 Intertidal Survey habitat map from NIRAS 2018 report.

9.3.2 Upon this information the habitat directly below the entire structure was identified and evaluated within the 2018 study (see figure 18 below, is within the purple highlighted area is related to the metallic works).

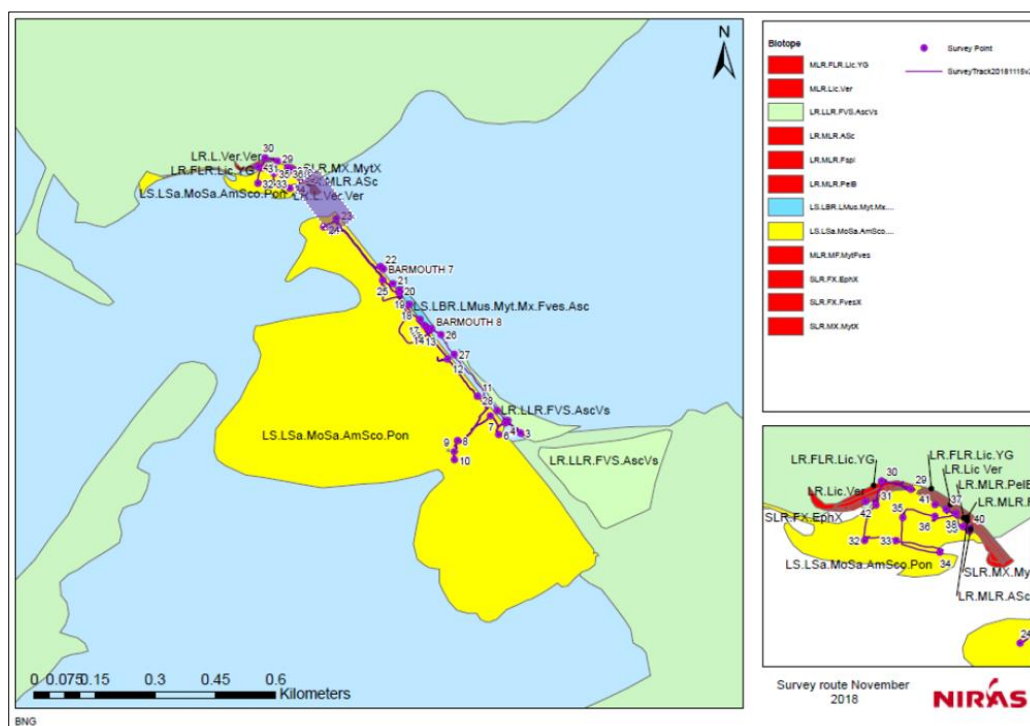


Figure 18: NIRAS survey information with direct project footprint above (purple area).



- 9.3.3 The project is focused on the refurbishment of the timber section of the structure and not the steel section, which spans the main channel of the estuary that flows at slow tide. Therefore, the area of direct impact can be further narrowed down. As a result, the following intertidal features were observed within the project footprint in relation to the SAC Habitats.

Table 4: NIRAS waypoints in relation to the metallic structure footprint.

NIRAS Waypoint	Description
022	Covered by tide not possible to access – Sand and loose cobbles, small <i>Mytilus edulis</i> pool visible
023	LS.LSa.MoSa.AmSco.Pon – sand, some coarse sand broken shells of <i>Mytilus edulis</i> , <i>Cerastoderma edule</i> , <i>Littorina obtusata</i> , <i>Macoma balthica</i>
032	LS.LSa.MoSa.AmSco.Pon - Sand, <i>Pontocrates arenarius</i> in sand
033	LS.LSa.MoSa.AmSco.Pon - Sand, <i>Pontocrates arenarius</i> in sand. Slightly more muddy
034	LS.LSa.MoSa.AmSco.Pon - Sand, <i>Pontocrates arenarius</i> in sand. Slightly more muddy
035	LS.LSa.MoSa.AmSco.Pon - Sand, <i>Pontocrates arenarius</i> in sand. Slightly more muddy
036	LS.LSa.MoSa.AmSco.Pon - Sand, <i>Pontocrates arenarius</i> and <i>Cerastoderma edule</i> in sand
037	MLR.PBel.Fspi.Asc – Mid littoral rock, Y/G algae, <i>Verrucaria maura</i> , <i>P. caniculata</i> followed by <i>F. Spiralis</i> , then <i>A. nodosum</i> . Rocks colonised by <i>S. balanoides</i> , <i>L. obtusata</i> , <i>Patella vulgate</i> , some <i>Ulva intestinalis</i>
038	LR.MLR.YG.VerPelB.Fspi.Asc - Mid littoral rock, Y/G algae, <i>Verrucaria maura</i> , <i>P. caniculata</i> followed by <i>F. Spiralis</i> , then <i>A. nodosum</i> . Rocks colonised by <i>S. balanoides</i> , <i>L. obtusata</i> , <i>Patella vulgate</i> , some <i>Ulva intestinalis</i>
039	LR.MLR.YG.VERPelB.Fspi.Asc - Mid littoral rock, Y/G algae, <i>Verrucaria maura</i> , <i>P. caniculata</i> followed by <i>F. Spiralis</i> , then <i>A. nodosum</i> . Rocks colonised by <i>S. balanoides</i> , <i>L. obtusata</i> , <i>Patella vulgate</i> , some <i>Ulva intestinalis</i>

- 9.3.4 From the Niras report, the document referenced two points which were classed as Annex I under the Habitats Directive by the NRW (2005) Phase I intertidal survey. These were marked as two-way points on the viaduct struts previously known as waypoint 008 and 007 (see Figure 21 and 22).
- 9.3.5 *“The biotopes in Barmouth Viaduct correspond to the estuarine habitats typically observed in the North Wales coast, with the input of sediment from the river leading to the presence of extensive intertidal sediment flats and a limited extent of rocky habitat present (JNCC, estuaries accessed 14/11/18). The biotopes observed all have a high resilience and recovery rate (Please refer to the following text for more details on the resilience of the biotopes in this study). Within LR.LLR.FVS.AscVs, *Fucus vesiculosus* recruits readily to cleared areas of the shore and the habitat recovers fully within 1-3 years in British Waters (Marlin: *Fucus vesiculosus* on mid eulittoral mixed substrata, accessed on 14/11/18). LS.LSa.MoSa.AmSco.Pon is a biotope already subjected to high levels of abrasion resulting from sediment mobility. The few species present such as the amphipod *Pontocrates arenarius* can withstand some physical disturbance and recover rapidly (Marlin: Barren littoral coarse sand accessed on 14/11/18). As such, this mobile habitat should be able to recover quickly from the impacts of plant accessing the Viaduct struts. No invasive species were observed or recorded from this survey.”*
- 9.3.6 Based on the report it can be proposed that this mobile substrate of habitat should be able to recover quickly from the impacts of pontoons resting on bed habitat during low tide conditions.



9.4 INTERIDAL SURVEY AND SPACIAL DATA COMPARISON WITH WIDER SAC ANNEX I HABITAT AVAILABILITY

- 9.4.1 As the NIRAS survey was not able to conclusively define the previously indicated Reef Habitat within the 2005 NRW/CCW data sets, this assessment will assume that these features are still intact in the original scale they were recorded.
- 9.4.2 The drawing below (figure 19) illustrates a portion of the broad Intertidal Phase I Habitat below the structure where data can be abstracted from. The following figure and table below provide further information on the Biotope ID and location in relation to the works.

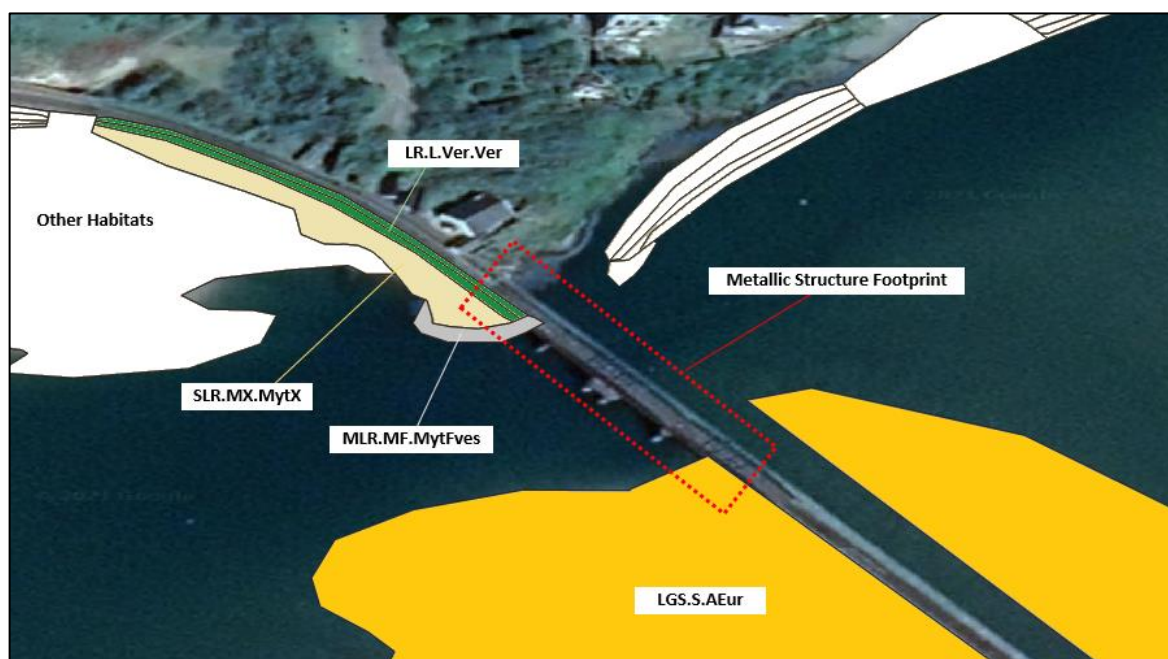


Figure 19: NRW 2005 Intertidal Data in Raw GIS Format. Project area overlaid in red.

Table 5: Biotope Descriptions from NRW 2005 data sets.

Biotope ID	Description
LR.L.Ver.Ver	Upper littoral fringe bedrock and stable boulders on very exposed to very sheltered shores are typically characterised by the black lichen Verrucaria maura and littorinid molluscs
SLR.MX.MytX	Moderately exposed to very sheltered mid and lower eulittoral mixed substrata (mainly cobbles and pebbles on muddy sediments) with dense aggregations of the mussel Mytilus edulis.
MLR.MF.MytFves	Mid eulittoral exposed to moderately exposed bedrock, often with nearby sediment, may be covered by dense large Mytilus edulis which form a band or large patches and support scattered Fucus vesiculosus and occasional red algae.
LGS.S.AEur	Well-draining beaches of medium- to fine-grained mobile sand, often (but not always) well sorted. Occasionally, a small fraction of coarse sand may be present.

- 9.4.3 Regarding the above biotopes, the habitat broadly reside within 1140 - Mudflats and sandflats, especially in reference to LGS.S.AEur. Regarding the potential footprint of impact. This will be limited to the square meterage of a static pontoon during low tide, as no plant machinery is possible below the structure in this location. The potential impact to this Annex I feature is likely very low on a local and wider SAC scale.
- 9.4.4 The latter biotopes which are features of bedrock and exposed areas are also likely to impacted minimally by static low-tide positions of pontoons.



9.5 ANNEX I – NRW INDICATIVE CONDITION REPORT

9.5.1 The tables below are extracted from the PLAS SAC - Indicative site level feature condition assessments 2018, NRW Evidence Report No: 234. These tables describe the current status the Annex I features relevant to the project (Tables 7-10 below).

Table 6: Reef Habitat Condition

Date		May 2017			
Site name		Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC			
Site feature assessed		Reefs			
Component of habitat feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (Monitoring data, reports or expert judgement)	Level of agreement	Confidence in evidence	Component confidence level
Distribution & Extent (within site)	Unfavourable	Monitoring data (limited) and expert judgement	High	Low	Low
Structure & function	Unfavourable	Monitoring data (limited), WFD data and expert judgement	High	Low	Low
Typical species	Unfavourable	Monitoring data (limited) and expert judgement	High	Low	Low
Relevant activities (activities directly impacting condition of the feature on this site)			Historic fishing damage, previous illegal activity has caused long term damage that has not yet recovered (see notes section). Water quality issues		
Overall Indicative Assessment			Overall Confidence Level		
Unfavourable			Low		

Table 7: Estuaries Habitat Condition.

Date		May 2017			
Site name		Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC			
Site feature assessed		Estuaries			
Component of habitat feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (Monitoring data, reports or expert judgement)	Level of agreement	Confidence in evidence	Component confidence level
Distribution & Extent (within site)	Unfavourable	Some monitoring data, expert judgement	High	Medium	Medium
Structure & function	Unfavourable	Some monitoring data, WFD waterbody assessments, expert judgement	High	Low	Low
Typical species	Favourable	Some monitoring data, WFD data, expert judgement	High	Medium	Medium
Relevant activities (activities directly impacting condition of the feature on this site)			Historic pollutants Works on Pont Briwet and Dwyryd Pylon		
Overall Indicative Assessment			Overall Confidence Level		
Unfavourable			Medium		

**Table 8: Mudflats and Sandflats Condition.**

Date		May 2017			
Site name		Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC			
Site feature assessed		Mudflats & sandflats not covered by seawater at low tide			
Component of habitat feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (Monitoring data, reports or expert judgement)	Level of agreement	Confidence in evidence	Component confidence level
Distribution & Extent (within site)	Unfavourable	Some monitoring data, expert judgement	High	Medium	Medium
Structure & function	Unfavourable	Expert judgement, WFD assessments	Low	Low	Low
Typical species	Favourable	Monitoring data, expert judgement & WFD assessments	High	Medium	Medium
Relevant activities (activities directly impacting condition of the feature on this site)			Development issues Water quality issues		
Overall Indicative Assessment			Overall Confidence Level		
Unfavourable			Medium		

Table 9: Saltmarsh Habitat Condition.

Date		May 2017			
Site name		Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC			
Site feature assessed		Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)			
Component of habitat feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (Monitoring data, reports or expert judgement)	Level of agreement	Confidence in evidence	Component confidence level
Distribution & Extent (within site)	Unfavourable	Expert judgement (knowledge of historical modification to the estuaries), reports, expert judgement based on casework.	High	High	High
Structure & function	Unfavourable	Expert judgement (knowledge of historical modification to the estuaries), WFD assessments, Expert judgement based on casework.	High	High	High
Typical species	Unfavourable	Monitoring data, expert judgement	High	Medium	Medium
Relevant activities (activities directly impacting condition of the feature on this site)			Grazing Infrastructure development: Pont Briwet and Dwyrdd Pylon Coastal defence and erosion control		
Overall Indicative Assessment			Overall Confidence Level		
Unfavourable			High		



9.6 ANNEX II SPECIES – NRW INDICATIVE CONDITION REPORT

9.6.1 The tables below are extracted from the PLAS SAC - Indicative site level feature condition assessments 2018, NRW Evidence Report No: 234. These tables describe the current status the Annex II features relevant to the project (Tables 11-13).

Table 10: Bottlenose Dolphin population condition.

Date	May 2017				
Site name	Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC				
Site feature assessed	Bottlenose dolphin (<i>Tursiops truncatus</i>)				
Component of species feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (monitoring data, reports or expert judgement)	Level of agreement	Confidence in evidence	Component confidence level
Population (e.g., size, structure, production, condition of species within site, contaminant burdens)	Favourable	Monitoring data, report	Medium	Medium	Medium
Range (within site)	Favourable	Monitoring data, report	Medium	Medium	Medium
Supporting habitats					
<i>Distribution & extent</i>	Unknown	Expert judgement	Medium	Not applicable	Not applicable
<i>Structure & function</i>	Unknown	Expert judgement	Medium	Not applicable	Not applicable
<i>Prey availability and quality</i>	Unknown.	Expert judgement	Medium	Not applicable	Not applicable
Relevant activities (activities directly impacting condition of the feature on this site)			No activities identified as having a direct impact on feature condition.		
Overall Indicative Assessment			Overall Confidence Level		
Favourable			High		

9.6.2 Described in NRW PLAS SAC Regulation 33 Advice February 2009, Bottlenose dolphins are adapted to living in the marine environment and are adapted to the many challenging aspects of that environment. However, artificially introduced hazards and reductions in the natural quality and suitability of the bottlenose dolphin habitat in the SAC can occur through:

- ◆ the presence and persistence of artificial inert or toxic materials (e.g., plastics, synthetic fibres, hydrocarbons) causing entanglement, smothering or ill-health.
- ◆ competition with human activities for space causing displacement, collision, noise and visual disturbance and increasing density dependent pressure on sites and increased stress rendering animals susceptible to the effects of normally dormant endemic viral diseases.
- ◆ contamination of prey.

9.6.3 The principal contactor will adopt the Gwynedd Marine Code regarding Bottlenose Dolphins, Porpoises & Seals in relation to project and distribute a copy of the code to the work force (see Appendix E -Marine Code).

9.6.4 The pressure vectors on this species including hydrocarbons and entanglement will be addressed in Section 12 – Project Mitigation.

**Table 11: Otter population condition (Feature overlaps with SSSI).**

Date	May 2017				
Site name	Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC				
Site feature assessed	Otter (<i>Lutra lutra</i>)				
Component of species feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (monitoring data, reports or expert judgement)	Level of agreement	Confidence in evidence	Component confidence level
Population (e.g., size, structure, production, condition of species within site, contaminant burdens)	Favourable	Monitoring data, reports & expert judgement.	High	Medium	Medium
Range (within site)	Unknown	Expert judgement	High	Not applicable	Not applicable
Supporting habitats					
<i>Distribution & extent</i>	Unknown	Expert judgement	High	Low	Low
<i>Structure & function</i>	Unknown	Expert judgement	High	Not applicable	Not applicable
<i>Prey availability and quality</i>	Unknown.	Expert judgement	High	Low	Low
Relevant activities (activities directly impacting condition of the feature on this site)			No activities identified as having a direct impact on site condition.		
Overall Indicative Assessment			Overall Confidence Level		
Favourable			Medium		

- 9.6.5 Surveys indicate regular Otter use of the Glaslyn/Dwyrdd and Dyfi estuaries as well as signs of Otters by the Mawddach estuary. Otters living on the coast must have access to freshwater streams and pools for drinking and washing. Otters need to wash in freshwater in order to maintain the insulating properties of their fur. The lack of available freshwater might explain the restricted distribution of Otters living along the coast in some areas of the UK, however the SAC is well served with rivers and streams throughout its length.
- 9.6.6 Habitat essential for Otters, i.e., well vegetated stream and river valleys, access to the shore, access to freshwater, secluded resting habitats, is high throughout much of the site. The structural and functional integrity of this essential habitat is considered to be good.
- 9.6.7 Whilst good quality essential habitat is available within the SAC and adjacent area, the quality and suitability of this habitat can be reduced in a variety of ways, including:
- ◆ the presence and persistence of artificial inert materials (e.g., plastics, synthetic fibres, static fishing gear) leading to entanglement and smothering
 - ◆ decrease in seclusion because of noise and visual disturbance as a result of increased human access, habitation and waterborne activities
 - ◆ the presence and persistence of toxic contaminants, including the risk of fur contamination from oil discharged into freshwater and marine environments
 - ◆ availability and quality of prey.

**Table 12: Grey Seal population condition.**

Date	May 2017				
Site name	Pen Llŷn a'r Sarnau / Llyn Peninsula and the Sarnau SAC				
Site feature assessed	Grey seal (<i>Halichoerus grypus</i>)				
Component of species feature assessed	Indicative Assessment (Favourable, unfavourable, unknown)	Key evidence type used (<i>monitoring data, reports or expert judgement</i>)	Level of agreement	Confidence in evidence	Component confidence level
Population (e.g., size, structure, production, condition of species within site, contaminant burdens)	Favourable	Reports & expert judgement	Medium	Medium*	Medium
Range (within site)	Unknown	Reports & expert judgement	Medium	Medium*	Medium
Supporting habitats					
Distribution & extent	Unknown	Expert judgement / Casework	High	Not applicable	Not applicable
Structure & function	Unknown	Expert judgement / Casework	High	Not applicable	Not applicable
Prey availability and quality	Unknown.	Expert judgement / Casework	High	Not applicable	Not applicable
Relevant activities (<i>activities directly impacting condition of the feature on this site</i>)			No activities identified as having a direct impact on site condition.		
Overall Indicative Assessment			Overall Confidence Level		
Favourable			Medium		
Noted activities:					
◆ No planned activities or plans/projects are considered to adversely affect the feature of the SAC (e.g., Adverse Effect of Site Integrity). The population (at least at those sites monitored) is stable or increasing, reflecting a good quality, functioning supporting habitat, despite present levels of human activity and plans & projects. ◆ Seals in the SAC are part of a wider population, considered to be at the scale of the SW England and Wales Management Unit. Bycatch in this management Unit (from gillnet fisheries in SW approaches) is high. Despite this, the population is increasing.					



10. WEST WALES MARINE (WWM) SAC

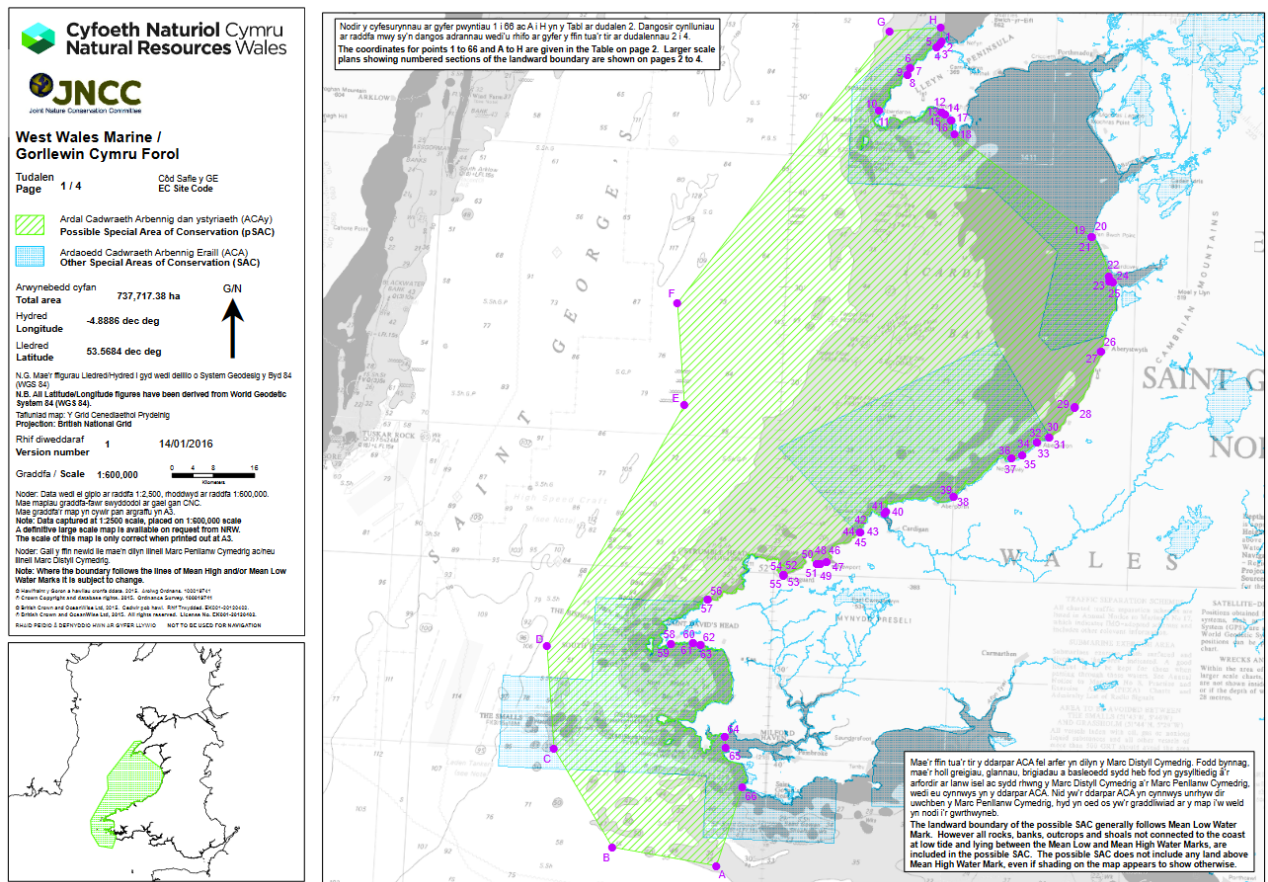


Figure 20: WWM SAC Location.

- 10.1.1 Designated in February 2019, the site is now at full SAC status. The Conservation Objectives (COs) and Advice on Activities (AoA) are set out for the West Wales Marine, Annex II (reason for designation) species harbour porpoise (*Phocoena phocoena*).
- 10.1.2 The site covers both inshore (within 12 nautical miles of coast) and offshore (beyond 12 nautical miles of coast) waters where Natural Resources Wales (NRW) and the Joint Nature Conservation Committee (JNCC) have respective advisory responsibilities.
- 10.1.3 The boundary of the SAC has been defined based on population modelling and habitat mapping. The range is based from winter and summer population movements.
- 10.1.4 As the boundary is based on the general range of the species it is unlikely that this species will be encountered and in turn impact the defining feature of this SAC.
- 10.1.5 The mitigation measures to be set in place regarding other Cetaceans within the PLAS SAC will be sufficient to infer protection to this species.



11. PHYSICAL PROCESSES

11.1 RELEVANT POLICIES WITHIN THE SHORE MANAGEMENT PLAN 2 (SMP2)

- 11.1.1 As part of the Appropriate Assessment, it is necessary to compare the proposed works against the long-term policies outlined within the Shore Management Plan 2 (SMP2). Within the SMP2 there are several policy units relevant to this section of coastline. The structure is contained within Coastal Area D – PDZ II, specifically 11.14 and 11.8.

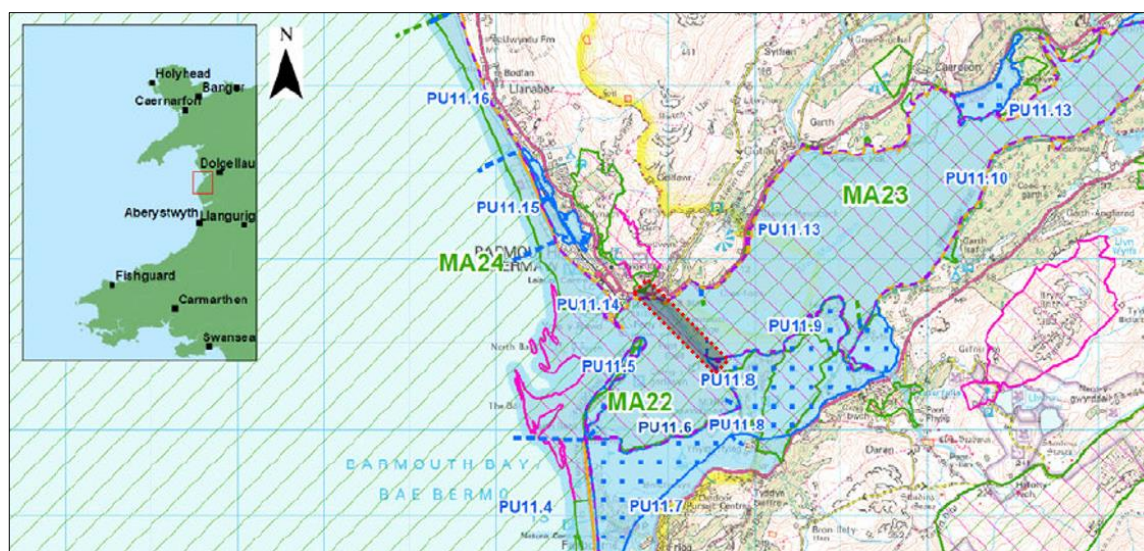


Figure 21: SMP2 Policy Unit Map.

Table 13: Below shows the current SMP2 policy units relevant to the project.

Policy Unit		Policy Plan			Comment
		2025	2055	2105	
11.8	Morfa Mawddach	HTL	HTL	HTL	This would secure a cut off defence to the back of the area to the rear of Fegla Islands, maintaining transport routes.
11.14	Barmouth South	HTL	HTL	HTL	
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

- 11.1.2 As a result of the preferred policy there will be a reduction in the intertidal habitat (sandflats) within the boundary of the SAC. There will, however, be no adverse effect on the integrity of the other SAC features.
- 11.1.3 In regard to coastal squeeze related to this project, as the works are constrained to the bridge structure itself and not the adjoining estuary defences which is described within Policy Unit 11.8, a coastal squeeze assessment for the project is not required as the structure itself does not represent a contributing factor to this long-term issue.

11.2 PHYSICAL PROCESSES IN RELATION TO PROJECT FOOTPRINT WITHIN THE MARINE ENVIRONMENT.

- 11.2.1 Unlike the timber works contained within CML2016. Scaffolding will be situated outside of the high tide range and attached to the existing metallic piers. Consequently, these temporary platforms will not interact with the physical process associated with the movement of water and sediments.



11.3 SCAFFOLDING SUPPORTS

- 11.3.1 Scaffolding will be erected on the 12 metallic piers to support the under-deck works, such as the paint system renewal on the areas above the High Tide Water Line. To safely support these working areas, scaffolding tubes may extend down into the tidal area of influence, but should not extend to the estuary bed.
- 11.3.2 Therefore, for periods of the rising and falling tides the lower sections of the scaffold tubes and the fixing clamps will be submerged, effectively reducing the area of the estuary available for water to flow.
- 11.3.3 The pier vertical piles are circa 4000mm in diameter. Scaffold poles are approx. 75mm to 100mm diameter. There will be scaffold poles attached each pier in several locations (dependant on specific pier requirements, minimum of 4 poles will be assumed), hence the cross-sectional width of each pier will be temporarily increased by the thickness of scaffold poles i.e. 100mm.
- 11.3.4 As an individual pier is circa 4000mm in diameter, the additional 100mm equates to less than 1% increase in temporary surface area. In terms of rudimentary flow restriction, the 12 piers are split either side of the structure. Viewing the structure on a linear plain, therefore 4000mm x 6 equates to the flow inhibition of 24000mm or 24m.
- 11.3.5 The length of the bridge supported by piers along its entire length across the estuary is approx. 750m in total. Therefore, the normal restriction of the water is 3.2% of the overall estuary as a result of the current metallic structure footprint. This will be increased temporary less than 1%.
- 11.3.6 This is a simplified view as it does not consider the period in the tide when water levels are below the scaffold, the effect of the clamps, or the potential effect of debris such as seaweed hung up on the scaffold. However, with all of these factors, as the scaffold does not extend to bed level, we believe that a reduction of less than 1% due to the presence of the scaffold, represents a worst-case scenario.



12. NIRAS & NRW FISH SURVEY DATA

12.1 SPAWNING AREAS AND NURSEY GROUNDS

12.1.1 Along with the Intertidal Survey, Niras Consultants also undertook a Fish Ecology Survey. The survey assesses commercial and protected fish species. Although not Annex II species within the SAC designation, they are supported by the Annex I habitats.

12.2 PROTECTED SPECIES

12.2.1 Table 14 below features extracts from the Fish Ecology Report. The descriptions are summarised by a high low probability of an individual species likelihood of proximity to the project.

Table 14: Comments on protected fish species from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Common and sand goby,	Both the common goby and sand goby will likely be present in the vicinity of the Project site.	✓	
Allis and twaite shad	According to the JNCC (2018), there is no significant presence of allis and twaite shad occurring in the vicinity of the Project site.	✓	
Smelt,	This species is listed as UK BAP Priority Species and a species of principal importance for the purpose of conservation of biodiversity under the Natural Environment and Rural Communities Act (2006). Smelt are not commonly found in the Mawddach Estuary or local vicinity (JNCC, 2018).		✓
Sea lamprey	River, Brook and Sea lampreys are not commonly observed in the Project site (JNCC, 2018). However, the Teifi river on the Southern part of Cardigan Bay does support a large population of the river lamprey <i>Lampetra fluviatilis</i> (JNCC, 2018).	✓	
Common Skate	The North Wales coast is known to have ideal conditions for skates and rays and this includes the benthic habitat of the Project Site and common skate is recorded as present in the Sarnau of Cardigan Bay (CEFAS tech report no 147).	✓	
Angel Shark	Angel sharks prefer sandy habitats which are close to rocky reefs, as recorded within the Pen Llyn a'r Sarnau SAC. Further information on distribution of this species includes sightings concentrated around Harlech, in particular Shell Island (Pen Llyn a'r Sarnau Liaison Group, Meeting Minutes, 2017) located to the north of the Project site.		✓
Basking shark	Although Cardigan Bay is not a recognised hot spot for basking shark it is quite likely that they do frequent local coastal waters (although unlikely to occur within the estuary itself), if not feeding at the surface then transiting between favoured areas north (e.g., Isle of Man) and south (the Celtic Sea) (Scottish Natural Heritage Report No 908).		✓

12.2.2 Species indicated as high likelihood require further assessment. The table below (Table 15) illustrates the general spawning period of these species.

Table 15: Spawning periods (blue highlight) of fish species indicated as occurring within project vicinity from Table 14 above.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sand Goby												
Allis shad												
Twaite shad												
Sea lamprey												
Common Skate												

12.2.3 From the table above it is evident that the vast majority of these species spawning period occurs outside of the project window. Works within the estuary itself would occur in July as indicated in the methodology above. While the blockades utilising vessels is later in the year and further less likely cause disturbance.



12.3 MIGRATORY SPECIES

Table 16: Comments on Migratory fish species from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Salmon	Salmon concentrate on the mouth of the Mawddach Estuary during settled weather between October and the end of March, although the peak activity takes place between November and January, awaiting rising river levels to make their way upstream. This indicates that the poor catchments of freshwater tributaries	✓	
Sea trout	Trout fry densities have improved in the Mawddach estuary compared to previous spatial surveys undertaken in 2010. Several sites across the catchment had the highest densities on record during the NRW 2017 survey while other sites remained consistent with the historic data. Trout parr have also improved across the catchment and numbers are expected to increase in the coming years due to the improved fry densities.	✓	
European eel	European eels have been recorded in the Mawddach Estuary in the vicinity of the Project site in a 4-year programme to establish the status and stocks in England and Wales. Eel stocks in the Mawddach Estuary are thought to be still at or near to carrying capacity with male-dominated populations (Bark et al., 2007).	✓	

Table 17: Spawning periods (blue highlight) of fish species indicated as occurring within project vicinity from Table 17 above.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Salmon												
Sea trout												
European eel												

- 12.3.1 The migratory species above will be spawning during the 2022 Autumn blockade. However, at this stage the works (CML2016) requiring physical estuary access during low tide will be completed by this time.
- 12.3.2 The only equipment physically interacting with the estuary bed following the completion of CML2016 will be resting of the barge at low tide.
- 12.3.3 As the portion of the estuary that remains flowing during low tide will not be impeded upon at any stage, it is unlikely that these species will find their natural range reduced. Vessel traffic will occur during the works; however, this will not be dissimilar to current water traffic around Barmouth dock at present.
- 12.3.4 Furthermore, once the completion of CML2016 related tasks is achieved, the vast majority of the structure will feature no works with only rail machine movement and personnel using the public footway will occur, with no static concentration of activities outside of the metallic working footprint.



12.4 TRANSIENT (VAGRANT) SPECIES

Table 18: Comments on Transient fish species from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Sunfish	This species feeds on jellyfish, plankton, brittle stars, molluscs and crustaceans. It is found in warm and temperate regions of the Pacific and Atlantic oceans (Froes & Pauly, 2011). Sunfish have been reported in the vicinity of the Project site about one mile off the coast situated between Harlech and Barmouth in Cardigan Bay (JNCC, 2018).	✓	
Pilotfish	There appears to be no accounts of it being recorded in the vicinity of the Project site. It may travel with sharks or other large marine animals or sometimes along with large ships (Froese & Pauly, 2011).		✓

12.4.1 Although it is possible this species may be in the vicinity of the project, the proposed works methodologies are unlikely to impact Sunfish feeding habits.

12.5 SPAWNING AREAS AND NURSERY GROUNDS

Table 19: Comments on Spawning Areas and Nursery Grounds from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Anglerfish	Anglerfish spawning grounds are located outside Cardigan Bay and outside of the Project site. As such, no spawning ground maps for Anglerfish have been drawn. Nursery grounds on the other hand are ubiquitous located throughout Cardigan Bay, including the Project site and the Mawddach Estuary.		✓
Cod	Cod spawning grounds are located in Cardigan Bay and the Project site, including part of the Mawddach Estuary. Nursery grounds on the other hand are limited to Anglesey and about 75km west of Cardigan Bay in the Irish Sea. Therefore, cod nursery grounds are not present in the vicinity of the Project site.		✓
Ling & Mackerel	Ling spawning grounds are limited to 25km west off the Pembrokeshire coast and not in the vicinity of the Project site. Likewise, Mackerel spawning grounds are located north of Cardigan Bay and not in the vicinity of the Project site. No Nursery grounds for either species have been identified close to Cardigan Bay and as such, nursery grounds for the species have not been drawn.		✓
Norwegian prawn	Both the spawning and nursery grounds of Nephrops are located in the central Irish Sea to the north west of the Cardigan Bay and not in the vicinity of the Project site		✓
European Plaice	Plaice spawning grounds include most of the coastal eastern Irish Sea including Cardigan Bay, the Project site and part of the Mawddach Estuary. The main nursery grounds for juvenile plaice have been identified along the coastal waters of North Wales (Ellis et al., 2012) including the Project site, where the newly benthic-orientated juveniles spend between 1 and 3 years before migrating offshore into deeper water (Fox et al., 2007).	✓	
Sandeel	Spawning grounds are located in Anglesey and Cardigan Bay, including the Project site and most of the Mawddach Estuary. Nursery grounds on the other hand are limited to Anglesey and further west of Cardigan Bay, about 75km west into the Irish Sea. Sandeel nursery grounds are therefore not present in the vicinity of the Project site.		✓



Sole	Sole spawning grounds are located mainly in the shallow water of the eastern Irish Sea including Cardigan Bay (Symonds et al., 1995) and the project site, spreading as far as out as 50km from the Project site. Sole nursery grounds are not located within Cardigan Bay and are restricted to the north eastern Irish Sea (Liverpool Bay and the Fleetwood coasts). As such, sole nursery grounds are not located in close proximity to the Project site.	✓	
Sprat	Sprat spawning grounds are located about 25km from the Project site to the west of Cardigan Bay towards the central Irish Sea and North towards Anglesey but not in the vicinity of the Project site. Nursery grounds are not located in the vicinity of Cardigan Bay and as such, no nursery ground maps have been drawn.		✓
Spotted Ray	Given the lack of data available, no spawning ground maps have been drawn for spotted ray as the data is either not available or the spawning grounds are outside the Project area. Nursery grounds on the other hand are located throughout Cardigan Bay and Anglesey, including the Project site and the Mawddach Estuary.	✓	
Thornback	As such, no spawning data is available, and no spawning maps have been drawn for this species. With regards to the nursery grounds however, Cardigan Bay is considered an area of importance to juvenile thornback rays (CEFAS Technical Report No 147). Nursery grounds are recorded around Anglesey and Cardigan Bay, including the Project site and Mawddach Estuary.	✓	
Tope Shark	Tope shark nursery grounds are located in the south of Cardigan bay off the Pembrokeshire coast and north of the Project site off the north coast of the Llyn peninsula and the coast of Anglesey. Nursery grounds are not located in the vicinity of the Project site.		✓
Whiting	Whiting nursery grounds spread as far as 75km offshore from the Project site and again include most of the eastern Irish Sea.	✓	

- 12.5.1 From table 19 above the assessment notes that European Plaice, Sole, Spotted Ray, Thornback and Whiting nursery and spawning encompasses areas in the which the Viaduct resides. However, from the available information the habitat below the structure does not appear to be essential area for the species listed, but as a component of a much wider range.
- 12.5.2 The scale and duration of impact on the habitat below the structure is limited and relatively short in duration. The likelihood of substantial impact to the population dynamics of these species above is low when considering their continued presence in an otherwise busy estuary. Once all works associated with CML2016 and these new Metallic Works are completed, it is unlikely the structure will require such another significant intervention for a significant period.
- 12.5.3 The mitigations in relation to pollution and bio security measures in the sections below will ensure that the project does not cause a reduction in the vitality of these fish species population.



12.6 NRW – TIMING, FISH SPECIES AND RELATIVE RISK OF HARM/DISTURBANCE

12.6.1 NRW Biological Specialist have provide a traffic light graph illustrating fish Vulnerability on the Mawddach over a 12-month period. Please note: shad spawns during mid-May to mid-July near Llanelltyd.

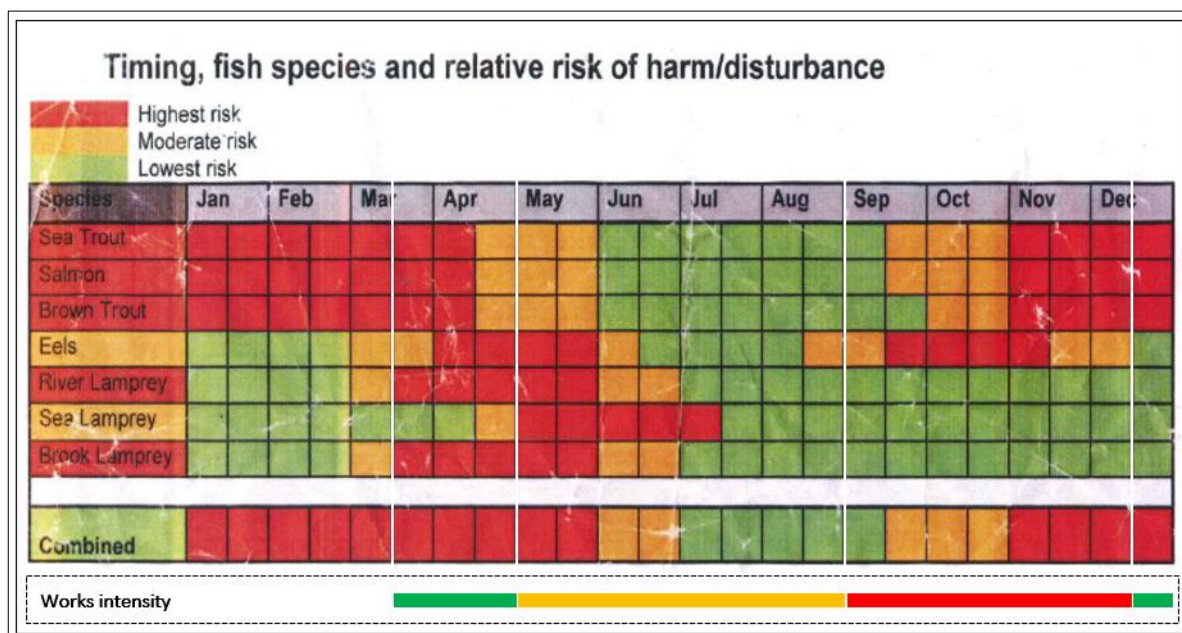


Figure 22: Fish spawning risk matrix in relation to works intensity.

- 12.6.2 The figure above illustrates the period of works and relative intensity, in relation to the traffic light system provided by NRW. The works outlined in green are lower intensity and predominantly land based preparation works or demobilisation during latter 2022, early 2023.
- 12.6.3 The yellow bar consists of tasks being undertaken during low or favourable tide conditions within the estuary environmental below the structure (e.g., scaffolding, prep/paint and pre blockade preparations). As with the above, these works will predominately be done during daylight hours. Any night shifts will normally be on a single Saturday night shift.
- 12.6.4 The red line indicated the main blockade between 12th Sept to 12th Dec 2022 which will feature periods 24hr working at the metallic structure to ensure all components are replaced and the structure is returned for operational service before Christmas 2022.

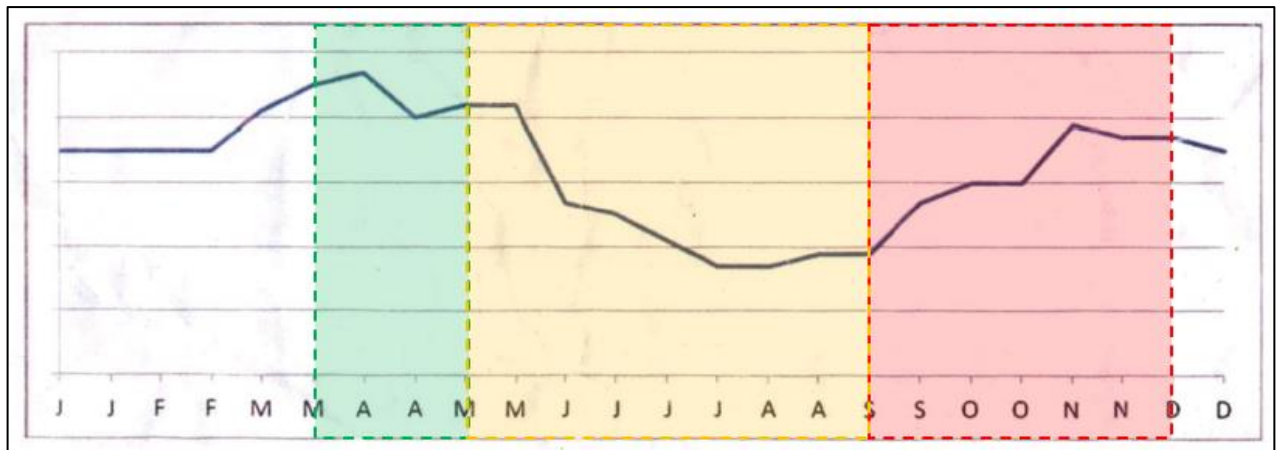


Figure 23: Overall NRW Risk chart with project intensity overlayed.

- 12.6.5 This final figure provided by NRW illustrate the combined fish sensitivity, which has been overlaid with the previous works intensity colour code system. From the previous figures above, it is evident that some works will occur during elevated periods of sensitivity however works will not occur within the marine environment during the absolute peak fish population sensitivity.
- 12.6.6 Not all tasks associated with CML2016 have been completed due to project complications and challenging weather conditions. The remaining tasks, which will occur in tandem with some of the Metallic work's tasks time, will be discussed in Section 15 – In Combination Impacts.
- 12.6.7 Note: Although the latter blockade works occur within a period of elevated fish sensitivity, there will still be significant opportunities for migrating fish to move along the entire length of the estuary. Preparation tasks such as grit blasting, and painting will have been completed by the commencement of the blockade works (red). Furthermore, although the works will be over increased intensity, the works will be localised to the metallic structure predominantly. Consequently, it is envisaged there will be significant periods of time where fish can move below the structure away from any other works occurring.



13. ASSESSMENT OF POTENTIAL IMPACTS RESULTING FROM SPECIFIC ACTIVITIES AND PROPOSED MITIGATION MEASURES – BARMOUTH VIADUCT METALLIC WORKS

This section outlines the receptors of potential damaging vectors as a result of the proposed works and proposes appropriate mitigative measures to ensure that there is not a significant likelihood of impacts.

13.1 ANNEX I HABITATS – IMPACTS & MITIGATION

Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
Estuarine habitat	SAC/SSSI	Loss of habitat from project activities.	Overall, there will be a short-term superficial impact to the estuarine habitat during the metallic works project. There will be no plant movements along the exposed estuarine bed related to works below the metallic structure. All heavy machinery is to be situated with the rail corridor and temporary hard standings within the corridor footprint during the brief period rail is removed to construct a crane pad. The only physical interaction with the estuary bed will be during the low tide periods where pontoons will essentially beach on areas of sand / silt below the structure (not rocky areas, see below) while material is loaded from the viaduct, before being transport to the nearby Aberamffra Harbour. As the pontoons will be required to remain level to operate safely, it is unlikely that they will impact exposed outcrop features as the pontoons will be moved before waters become too low, and thus cause instability on the pontoon surface. It is unlikely that the beaching of pontoons on sandy areas of the estuary bed, beneath the structure would cause damage, however, the NIRAS intertidal survey suggests that habitat associated within the estuary below the structure, if disturbed, would re-establish readily.	Negligible likelihood of significant impacts.
Salt marshes (also part of estuarine habitat)	SAC/SSSI	Loss of habitat from project activities.	No loss of habitat is projected in relation to these works. No access along the estuary during low tide is required to support the works related to the Metallic Structure.	Negligible likelihood of impacts.



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
Reefs	SAC/SSSI	Loss of habitat from project activities.	Unlikely to occur as reef is not known to occur below the metallic structure in combination with no plant movement below the structure at any point during the metallic works.	Negligible likelihood of impacts.
Mudflats and sandflats not covered by seawater at low tide – muddy gullies in the Mawddach estuary	SAC/SSSI	Loss of habitat from project activities.	NIRAS report suggest that mobile habitat will be regenerated readily, with re-establishment completed over 1-2 years following completion of project. The footprint of the structure will not change.	Negligible likelihood of impacts.
Habitat outside Designated sites.	NA	Loss of habitat from project activities.	The Habitat in Morfa Compound Site 1 will be impacted until 28/03/2023 The compound is located in a position outside of the protected site boundary. Following the completion of the project all site assets and materials will be removed and land reinstated. The de-mobilisation for both the metallic works and original CML2016 will occur at the same time as the compounds are shared.	Negligible likelihood of impacts.



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
All identified within the project area and proximity.	SAC/SSSI	Contamination of the estuary from spillage of hydrocarbons during refuelling of rail mounted plant and equipment or due to equipment failure.	All plant machinery movement will occur within the confines of the rail corridor. No movement of plant machines along the estuary bed is required to support the metallic works. No refuelling of plant machinery or equipment will occur within the estuary habitat. All items of static plant will be placed within a plant nappy when not in use. Fuelled equipment will be checked for defects and leaks prior to the start of each shift. Within the compound, a refuelling procedure will be implemented, whereby plant nappies will be placed beneath fuelling apertures during fuelling and refuelling will only be undertaken by designated, trained individuals using equipment specifically designed for that purpose. AGC have a spillage plan and specialised contractor in place to respond to and clean up any significant spills should they occur. The project ESMP/CPP will support this document with the relevant copies of GPP's available on site and references to the ESMP which supports this document. The Contractor will develop and implement an updated Emergency Awareness and Response Plan, to support the specific tasks associated with the metallic works. This will describe how spills will be contained and cleaned up. The emergency plan will appoint an Incident Coordinator, define roles and responsibilities during an incident, detail response procedures and contain an inventory of response equipment to be maintained on site.	Negligible likelihood of impacts with mitigation in place.
All identified within the project area and proximity.	SAC/SSSI	Contamination of the estuary from release of concrete during disused gear house strengthening works.	Use of concrete and its pouring will only occur within the control environment of the rail corridor and within the now defunct swing gear cavity within the central steel super structure. No concrete in relation to these works will be exposed to the wider environment.	Negligible likelihood of impacts with mitigation in place.



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
All identified within the project area and proximity.	SAC/SSSI	Release or spread of INNS into the estuary	All machines, vessels and equipment will undergo biosecurity control measures before entering the estuarine environment. Please see attached Biosecurity Management Plan in Appendix A.	Negligible likelihood of impacts with mitigation in place.



13.2 ANNEX II SPECIES – IMPACTS & MITIGATION

Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
Aggregations of non-breeding birds such as Red Shank & Snipe	SSSI	Noise Disturbance / Visual Disturbance / Habitat Destruction.	Project activities will create a source of light and noise over 6-10 hours during the day. Times will vary due to the variation in the tide and weather. As working hours are not continuous there will be periods where birds are not disturbed by site activities. However, it is likely that local bird populations are habituated to a level of disturbance from human activities, due to large numbers of pedestrians walking across the viaduct and trains crossing the viaduct. The Saltmarsh habitat adjacent to the access route / compound is heavily grazed and thus does not provide an abundance of nesting locations / foraging opportunities. Consequently, the project is unlikely to significantly impact these species.	Negligible likelihood of impacts with mitigation in place.
Individual wintering birds	SSSI	Noise Disturbance / Visual Disturbance / Habitat Destruction.	The main blockade ends mid-December with a gradual reduction of manpower and equipment occurring during the New Year. It is unlikely that these works will have a long-term impact on overwintering birds present within the SSSI area.	Impact Not Likely to be Significant
Potential Bat species	SAC & SSSI Bat Sites	Noise Disturbance / Visual Disturbance / Habitat Destruction.	No trees require removal for the project to take place. Site lighting will be limited to lighting of safety critical areas and task lighting. Other lighting will be PIR activated and will hence operate for short durations only. Task lighting will be low level flat glass LED luminaires and will be focused onto the task area, with minimal light spill. The project footprint occurs a significant distance away from the defined bat Sites.	Impact Not Likely to be Significant, with appropriate mitigation.
Otters	SAC & SSSI	Noise Disturbance / Visual Disturbance / Habitat Destruction.	Toolbox Talks (TBTs) will inform site personnel on identifying the Annex II Species. No otter holts have been noted to date within proximity to the structure, access route or Morfa Compound area. The project does not represent a hard boundary preventing access to the wider estuary by this species.	Impact Not Likely to be Significant, with appropriate mitigation



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
			Habitat impact is limit, however there may be a temporary impact to prey species disturbed by ongoing works. It is not anticipated that these works will have an impact on the population. Additionally, no equipment will be left in such a manner that an animal could become snared and trapped within the working area. Should an Otter be encountered during works, personnel will temporarily stand down until the animal has vacated the immediate area under its own volition. The contractor will abide by the Gwynedd Marine Code of Conduct. Salmon, which are a prey of Otter will not be prevented from travelling up the estuary during the project. Although there will be an elevated human presence around the structure, it is unlikely that this will present an impassable barrier to salmon migrating to spawn. Directional lighting measures as with those proposed for bat species will be implemented for Otter population to limit disturbance. Task specific lighting will be used, and the use of flood lights will be avoided. Rail Vehicles along the viaduct and pontoons, will be loaded during the day as often as possible to reduce overall night-time disturbance. Steps should be undertaken to ensure that otters, mammals and birds do not become trapped within working and storage areas. This will take the form of compound barriers reaching ground level and attachments to gates to prevent access by otters or other mammals such as badgers from entering the compounds. This will also be reference in the attached EMP. 24hr working is projected to be limited to only the autumn rail blockade from 16th September to 16th December 2022. Normal pre-blockade night shifts will generally be limited to a Saturday night with some mid weekday nights. These works will only take place from the structure itself.	



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
Bottle Nose Dolphin	SAC	Noise Disturbance / Visual Disturbance / Habitat Destruction.	See above. It is likely that this species is habituated to a level of marine traffic along this section of estuary as a result of the nearby fishing dock and leisure craft using the estuary. Additionally, as the bridge is an active railway and pedestrian route, consistent levels of vibration, noise and visual disturbances are already emitted from this area. There is potential for disturbance from the use of barges, particularly at night. These activities will be occasional however and short in duration. These sorts of activities have been shown to be of interest to animals but be perceived as non-threatening.	Impact Not Likely to be Significant, with appropriate mitigation
Grey Seal	SAC	Noise Disturbance / Visual Disturbance / Habitat Destruction.	See above.	Impact Not Likely to be Significant, with appropriate mitigation
Fish Assemblage	SAC/SSSI	Noise Disturbance / Visual Disturbance / Habitat Destruction.	The majority of in/above channel works will be undertaken outside of the fish spawning season for migratory fish such as salmon, trout and eel (mid Oct – Mid April) but will fall within the spawning season for several species of fish which are offered protection under the Natural Environment and Rural Communities Act. Spawning periods for these species are generally between March and July. Works within the estuary in relation to the steel works are not programmed until April, avoiding March, which is a peak month. No works within the designated sites will occur until formal assent has been granted by Natural Resources Wales. Works will be undertaken within the estuary during the 2022 spawning seasons for protected and migratory fish. Mitigation of impacts from these works will be difficult but the largest mitigating factors are:	Impact Not Likely to be Significant, with appropriate mitigation



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
			◆ The works will not present a barrier to the permanent flowing portion of the estuary below the metallic structure. During high tide, it will be possible for fish to migrate along multiple portions of the structure without coming into proximity to any tasks being undertaken at that particular moment. ◆ Works within the estuary during low tide at bed level will be localised and low impact and will not involve deep excavation or dredging. No increase in structure footprint is envisaged. Only the pontoons will come into contact with the estuary bed below the metallic structure. ◆ The viaduct is commonly used by trains and a significant number of pedestrians, particularly during the summer months. This implies that fish within the estuary are habituated to noise and vibration from the structure. Noise and vibration during the works will be of a greater magnitude and longer duration, particularly during the final autumn blockade (Sep 2022 – Dec 2022). ◆ Complete mitigation of these impacts will be difficult but best practice will be used in terms of the construction methodology to limit this i.e., no site radios, modern well silenced plant, use of the Maybey Bridge Temporary Works System to lift sections of the bridge intact to reduce the need for disassembly of elements of the structure and minimise the duration of the works, use of hydraulic cutters as opposed to disc cutters. ◆ Night works are likely during rail blockades. Task lighting will be designed to illuminate the works area but limit light spill into the estuary. This will be achieved through the use of LED flat glass luminaires set at a low level to the viaduct.	
Fish Assemblage	SSSI	Contamination of the estuary from spillage	See comments under estuarine habitat and reference to project EMP.	Impact Not Likely to be Significant



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact
Individual fish species (e.g., Salmon)	SAC/ Ramsar/ SSSI	Contamination of the estuary from spillage	See comments under estuarine habitat and reference to project EMP.	Impact Not Likely to be Significant
Blue Mussels		Contamination of the estuary from spillage and increased sediment loading.	See comments under estuarine habitat and reference to project EMP.	Impact Not Likely to be Significant
Vascular plant assemblage associated with salt marsh (part of estuarine habitat)	SAC/ SSSI	No impact	See comments under estuarine habitat.	No impact
All aquatic species	SAC/ SSSI	Contamination of the estuary from use of protective paint system.	Prior to repainting of the structure, it will be necessary to remove the existing paint system and areas of corrosion. This will be done through a combination of shot blasting and mechanicals methods such as abrasive brushes and grinding. Prior to the commencement of these works, crash decks will be constructed into the scaffold beneath the structure, which will be sealed using heavy duty plastic sheeting, cut around the elements of the structure. The entire structure will then be encapsulated using heavy duty Monarflex or equivalent. This system will contain surplus shot/grit blasting material and removed paint. Waste materials will be removed from the crash deck / encapsulation area prior to the dismantling of the scaffolding. Removal of paint from the lower levels from pontoons wrapped around the pier will use mechanical or vacuum blasting technique. Mechanical methods would involve the use of small hand tools, while vacuum blasting involves the use of a smaller grit blasting unit support by a powerful vacuum adjacent to the outlet nozzle, capturing a significant portions the material being broken away. Any remaining material will be captured by the pontoon surface and collected using the vacuum.	Impact Not Likely to be Significant, with appropriate mitigation



Receptor	Affected Site	Potential Hazard	Mitigation Measures	Likelihood of Impact																														
			The most likely method of protecting the metallic piers will be spray coat a marine resistant paint system. It is envisaged that Jotun Marathon 550 or equivalent will be utilised (See appendix C for Jotun technical information). The paint system if released into the environment by accident is noted for its potential to be "Very toxic to aquatic life with long lasting effects." Consequently, control on how the system is applied is essential. <table><tr><th>Substrate temperature</th><th>5 °C</th><th>10 °C</th><th>15 °C</th><th>23 °C</th><th>40 °C</th></tr><tr><td>Surface (touch) dry</td><td>15 h</td><td>11 h</td><td>9 h</td><td>4 h</td><td>1.5 h</td></tr><tr><td>Walk-on-dry</td><td>26 h</td><td>18 h</td><td>14 h</td><td>8 h</td><td>3 h</td></tr><tr><td>Dry to over coat, minimum</td><td>26 h</td><td>18 h</td><td>14 h</td><td>8 h</td><td>3 h</td></tr><tr><td>Dried/cured for service</td><td>14 d</td><td>10 d</td><td>10 d</td><td>7 d</td><td>3 d</td></tr></table> Within the technical sheet extract above, the curing rate, will require the paint system to be applied at earliest opportunity as the tide recedes, allowing for the recommended curing times to be achieved. As the works are occurring during the spring/early summer, is it highly likely that the paint will have cured to a level that would be unlikely to leach its toxic properties readily into the environment (e.g., dry to the touch). Additionally, painting won't occur during high winds as to avoid unnecessary loss of paint into the environment. Furthermore, visual inspection of the paint system as the tide gradually covers the recently painted areas will be required, with photographic evidence taken and reported to the project Environmental Clerk of Works (ECoW). This process will also be required to support the quality management system for the project and demonstrate correct application of the paint system.	Substrate temperature	5 °C	10 °C	15 °C	23 °C	40 °C	Surface (touch) dry	15 h	11 h	9 h	4 h	1.5 h	Walk-on-dry	26 h	18 h	14 h	8 h	3 h	Dry to over coat, minimum	26 h	18 h	14 h	8 h	3 h	Dried/cured for service	14 d	10 d	10 d	7 d	3 d	
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Dried/cured for service	14 d	10 d	10 d	7 d	3 d																													



14. POTENTIAL IN-COMBINATION EFFECTS

14.1 OVERVIEW

- 14.1.1 It is necessary to consider the potential for significant effects from this project in-combination with other plans or projects.
- 14.1.2 In addition, the plan or project must have been subject to an HRA, which has confirmed that the plan or project is not likely to have a significant effect or demonstrates that the effects have been sufficiently assessed so as to be reasonably understood.
- 14.1.3 The assessment of in-combination effects must also focus on other projects that have the potential to cause the same types of effects as the proposed maintenance (so that these effects may occur in-combination) and where similar potential impact pathways may exist.
- 14.1.4 Therefore, this assessment has focused on other projects that could give rise to noise, visual or physical impacts on the SAC species and does not consider projects that could cause different effects.

15. KNOWN PROJECTS WITHIN THE WIDER AREA

- 15.1.1 The metallic works are a portion of the overall Barmouth Viaduct refurbishment project. The majority of works in relation to CML2016 Timber works has been completed. However, due to project complications and adverse weather conditions, there are remaining concrete shrouds and timber components yet to be replaced. Consequently, CML2016v1 original license period will be extended to from 01/02/2021 to 28/03/23 to match that of the metallic works application.
- 15.1.2 This is to ensure that the final portion of the CML2016 agreements (e.g., demobilisation and reinstatement) coincide at the same time between both licenses, which share the same compounds.



Figure 24: Marine License Areas

- 15.1.3 The figure above illustrates how boundaries of the licenses once impended. Both licenses will be supported by the same project compounds. The only addition is the use of Aberamffra harbour for the metallic works.



- 15.1.4 In terms of overlapping works, the remaining works will occur during January to end of March 2022 which involves replacement of shrouds and pedestrian handrails. The shroud works will occur during low-tide conditions using the same methodology previously agreed in CML2016. Handrail replacement will occur during normal daytime hours. As these works will occur before the Metallic works, there is no cumulative overlapping during this period.
- 15.1.5 Between April to July 2022 there will be no plant machinery access beach works, occurring in relation to the Metallic works or CML2016 timber works (regarding the former there will be no beach/estuary plant movement whatsoever).
- 15.1.6 During the summer (August 2022) 9x remaining shrouds at the high mileage locations (high mileage being closer to the metallic structure) will be worked upon during spring low tides during the summer months as to work with the lowest possible water levels. It is envisaged that these tasks will be completed over several spring low tides, with no remaining shroud work required after this point.
- 15.1.7 Finally, during the September to December 2022 rail blockade, there are 4x remaining piles associated with the CML2016 works which will occur during the Metallic works. However, as the pile works require low tides for the tasks to be undertaken. It is envisaged these works will be completed by the end of October 2022.
- 15.1.8 Consequently, although there will be overlap between the original CML2016 scope of works. Physically, there will be no overlapping of works in the same location and furthermore, the overlapping objectives require different working conditions.
- 15.1.9 The metallic works are relatively flexible in relation to tide times while the remaining lower timber structure works overrunning from the CML2016's original timetable must be undertaken during low-tide conditions and therefore will not create a situation in which migrating fish or other aquatic species would be deterred from the entire length of the estuary.
- 15.1.10 As both works are being undertaken by the same principal contractor, there is a lower chance of program complications or the need for separate compounds or accesses which would otherwise increase the project footprint.



16. HRA CONCLUSION

- 16.1.1 Encountering Annex II species during the project is a possibility, however it is likely that these occurrences will be infrequent. The contractor will abide by the Gwynedd Marine Code in relation to encounters with species such as Otter, Bottlenose Dolphin and Grey Seal, avoiding as much as possible any close contact with these species.
- 16.1.2 Work schedules will work around the tides and weather conditions predominantly. The working pattern will, generally be organised on a 5–6-day calendar with Saturdays and/or Sundays off. The hours of those days will favour daylight hours, however there will be night working (normally Saturday nights) with the occasional mid-weeknights due to possession access (e.g., periods where rail equipment can be moved from other areas).
- 16.1.3 The overall footprint of the project is relatively low and is largely limited to the footprint of the structure. As the scaffolding is to be support above the high-water marks, there is to be no increased structural footprint in terms of tidal flows or sediment transport dynamics.
- 16.1.4 Pollution control measures and emergency response plans will allow for robust controls over hydrocarbon pollution events, which are unlikely. These are further detailed in the attached Environmental Management Plan (EMP), which references GPP supporting documentation.
- 16.1.5 In relation to the paint system, although the final product is not decided upon, it will very likely be similar to Jotun Marathon 500 (see appendix C) for indicative data sheet. Consequently, the careful application during optimum temperatures and low wind conditions will ensure the product is dry to the touch before the returning tide comes into contact with the metallic piers.
- 16.1.6 Fish species are also unlikely to be heavily impacted with the limited scale of the works in relation to spawning and nursery habitat, combined with the duration of the works falling outside a significant portion of most sensitive species spawning periods.
- 16.1.7 At no point will the permanently flowing portion of the estuary be impeded. Migrating fish species will have the vast majority of the estuary to navigate freely during the project as whole.
- 16.1.8 Control of invasive species is ensured using the Risk Assessment Plan and Management Plan. Furthermore, additional information on the location of *Gracilaria vermiculophylla* currently known in the estuary will be briefed to on-site personnel. In addition, toolbox talks (TBTs) on Slipper Limpet identification will be disseminated to the project team as part of the Biosecurity Brief.
- 16.1.9 Visual identification of this invasive species will be disseminated to personal working within the marine environment to assist NRW in documenting where this species occurs.
- 16.1.10 Regarding long term SMP2 policy and Coastal Squeeze. As the project concerns only the metallic structure, there will be no contribution to coastal squeeze as a result of the refurbishment of this structure.
- 16.1.11 Mobilisation of sediment is likely to be highly limited as only the pontoons will come into contact with the estuary bed during low-tide and will essentially beach in-situ, reducing the likelihood of agitating the bed and sediment.
- 16.1.12 Biosecurity measures in place at the compound will make sure that all equipment and vehicles delivered to site have been cleaned and disinfected prior to deployment into the SAC/SSSI environment. This forms part of the guidance outlined in the Biosecurity Risk Assessment & Management Plan (see appendix A).



- 16.1.13 Potential otter movement within the area will always be assumed, however the location of the works in relation to otters is unlikely to impact overall habitat availability, especially as the distance to the upstream river/riparian habitat confluences is significant. The use of vessels within the estuary will be limited to the specific works locations and will not deviate further upstream than Aberamffra Harbour.
- 16.1.14 The majority of work will occur from predominantly above the estuary, from the bridge itself during the autumn blockade, further reducing physical pressure and potential direct disturbance vectors to the estuary.
- 16.1.15 The period of 24hr working is projected to only occur during the specific periods within blockade, representing a small portion of the overall project's duration.
- 16.1.16 Lighting control and robust compound fencing will lower disturbance to species such as otter and bats, while the appropriated fencing will prevent local badgers or otters entering the compound area and potentially become trapped or in a state of panic.
- 16.1.17 From the available information, it is not evident that the Annex I Habitat & Annex II Species that compromise the designate sites overall, will be significantly impacted during the proposed refurbishment. There will be a temporary reduction in available habitat and quality during the project undertaking and a short period of re-establishment afterwards. Viewing scope of this project, this assessment suggests that Likely Significant Impacts the PLAS SAC is unlikely.



17. APPENDIX A - BIOSECURITY MANAGEMENT PLAN & RISK ASSESSMENT





18. APPENDIX B- PROJECT ESMP





19. APPENDIX C – TECHNICAL DRAWINGS & INFORMATION





20. APPENDIX D – WELSH NATIONAL MANAGEMENT PLAN (WNMP)



21. APPENDIX E - GWYNEDD MARINE CODE





22. APPENDIX F – METALLIC WORKS REFURBISHMENT VIDEO OVERVIEW

