

Dovey Junction Viaduct Lighting Management Plan

1. Introduction

The purpose of this Lighting Management Plan (LMP) is to outline the use and operation for the control of artificial light emissions associated with the construction works at Dovey Junction Viaduct.

The use of external lighting provided at the site compound and at the Viaduct (construction site) must provide safe lighting for staff on-site and functional lighting to allow safe construction. It must also be both energy efficient and designed as far as reasonably practicable to minimise the impact on the surrounding environment and wildlife.

1.1 Site location

Dovey Junction Viaduct is located on the Dovey Junction to Pwllheli line (DJP) over the River Dovey approximately 5 miles south-west of Machynlleth (Grid Ref: SN 69465 97892).

A single project compound is to be utilised, which is situated near an existing Network Rail, Road Rail Access Point (RRAP), approximately 300m west of the Viaduct at Ynys Crossing.

The site extents are shown below.

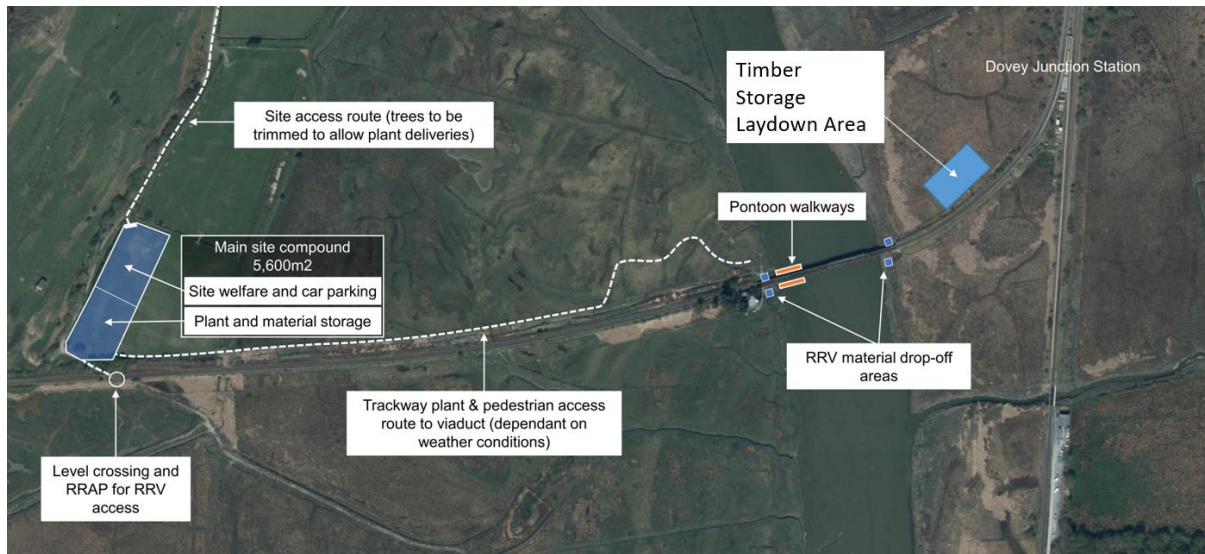


Figure 1: Access routes, Site compound and location of construction works over Afon Dyfi.

There are 6 statutory environmental designated sites within 2km of the site boundary.

Table 1: Statutory Designated sites within 2km

Site Name	Designation	Reason for Designation	Distance from Site (km)
Cors Fochno and Dyfi	RAMSAR	Bird Species Assemblage	0.0 (South)

Dyfi	Site of Special Scientific Interest (SSSI)	Biological	0.0
Cwm Llyfnant	Site of Special Scientific Interest (SSSI)	Biological	1.0 (Southeast)
Pencarreg-gopa a Moel Hyrddod	Site of Special Scientific Interest (SSSI)	Biological	1.3 (Southeast)
Pen Llyn a'r Sarnau	Special Area of Conservation (SAC)	Biological	0.0
Dyfi Estuary		Special Protection Area (SPA)	

There are also three non-statutory designated sites within 2km of the site boundary.

Table 2: Non-statutory sites within 2km.

Site Name	Designation	Reason for Designation	Distance from Site (km)
Montgomeryshire – Morben Isaf	Wildlife Sites	Mixed	1.6 (North East)
Dyfi	National Nature Reserve	Biological	0.0
Ynys-Hir	RSBP Reserve	Biological	2.0

1.2 The surrounding area

The area surrounding the site is rural with the Viaduct spanning the Afon Dyfi, of which the western half falls within Snowdonia National Park.

The immediate habitat surrounding the Viaduct is saltmarsh; a priority habitat and there are also several Ancient Semi Natural Woodland (ASNW) and Restored Ancient Woodland sites within 1km.

MAGiC

Dovey Junction Viaduct

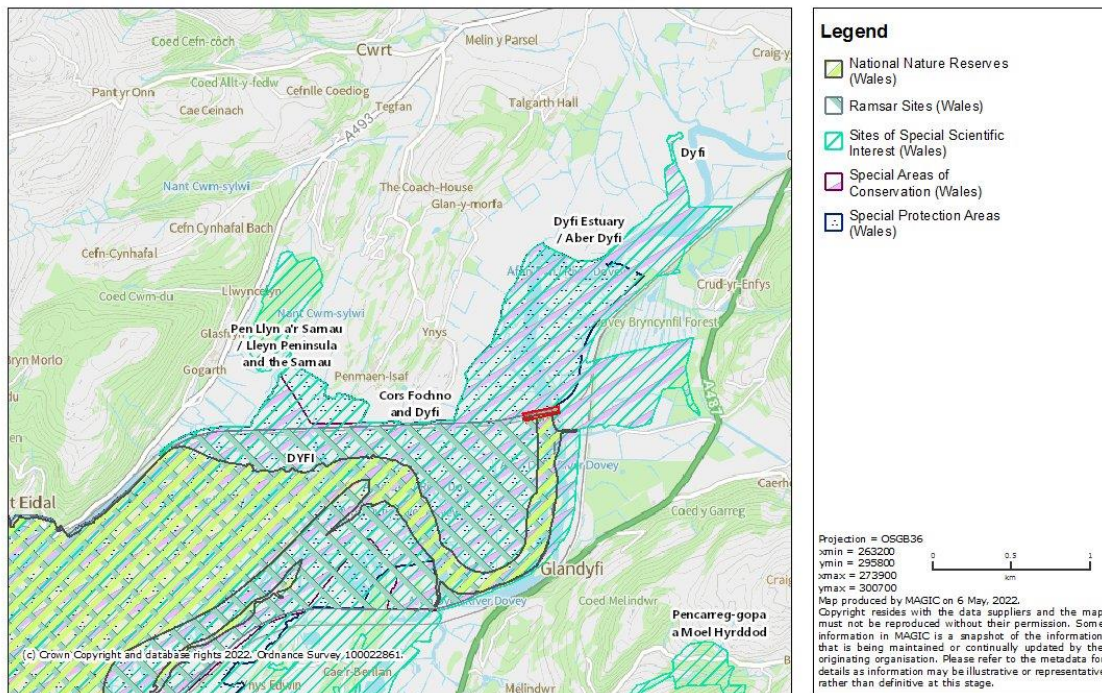


Figure 2: MAGIC Map showing location of Statutory Designated Sites in relation to Dovey Junction Viaduct.

2. Legislation controlling light pollution

The Environmental Protection Act 1990 was revised on the 6th April 2006 by a supplementary section of the Clean Neighbourhoods and Environmental Act 2005 (CNEA) adding “artificial light emitted from premises as to be prejudicial to health or a nuisance” to a list of statutory nuisances.

Artificial light emitted from an airport, harbour premises, railway premises, tramway premises, a bus station and any associated facilities, a public vehicle operating centre, a goods vehicle operating centre, a light house or a prison are exempt from these changes.

It should be noted that although the works are being carried out to railway infrastructure, the Dovey Junction Viaduct project does not fall into any of the exempt premise types.

For other premises to comply with the legislation the operator shall employ “best practicable means” to prevent, or to counteract the effects of any light nuisance in respect to:

- Artificial light emitted from industrial, trade or business premises

2.1 Preventing light nuisance

Through the careful consideration and selection of lighting equipment prior to works starting on site it is possible to ensure that the required lighting levels for the various tasks that will be undertaken in the compound and construction areas of the site can be achieved whilst controlling light pollution.

2.2 Environmental considerations

There are various environmental considerations that need to be taken into account when considering the installation of exterior lighting. These are the direct energy usage, the visual impact of the lighting equipment, the effect of light spillage on surrounding areas, the spill of light into the night sky, and the effects on human receptors, animal, plant life and surrounding landscape.

From the point of view of the impact of artificial lighting on wildlife, there have been a number of reports published over the years with the main focus being on bats, however a document that looks at the broader wildlife '*Wildlife and Roads, The Ecological Impact*' which incorporates a section regarding 'The ecological effects of road lighting on wildlife' by A. Outen. The book investigated the general impact of artificial lighting on wildlife and in conclusion has found that the colour temperature of the light source used is significant to its impact on wildlife.

Outen's research shows that the use of:

- Low Pressure Sodium (SOX) light sources, an orange monochromatic source, has a negligible affect;
- High Pressure Sodium (SON) lighting, a more golden light source, has minimal effect and attracts insects;
- White Lighting (Metal Halide, CDO, CPO, PLL,) has a significant effect on wildlife, disrupting its 24 hour cycle in part due to the high ultraviolet (UV) content of the light to which insects in particular are very sensitive.

2.3 Bats

The Institution of Lighting Professionals (ILP) in collaboration with the Bat Conservation Trust have published *GN 08/18 Bats and artificial lighting in the UK, Bats and the built environment series*. This document is aimed at lighting professionals / designers, planning officers, developers, bat workers / ecologists and anyone who specifies lighting. It is intended to raise awareness of the impacts of artificial lighting on bats and suggests mitigation measures for various scenarios, rather than to replace a site specific ecological and lighting assessment / management plan.

Additional research has furthered the understanding of how artificial lighting impacts bats. Some of the key findings are:-

- Artificial lighting is thought to increase the chances of predation and so bats may modify their behaviour.
- Different types of luminaires and light sources emit different spectrums of light. This has an impact on the amount of insects that will be drawn to the light source.
- Lighting may also impact on flight paths and commuting
- Illumination of drinking resources such as water ways, ponds and cattle troughs can stop bats from drinking.
- Illumination of a bat roost can cause disturbance and may result in the colony abandoning the roost or even becoming entombed within it.
- Illumination of the entrance to a bat roost may delay bats from emerging and will potentially shorten foraging times.
- routes
- Lighting in addition to disturbance at the roost may also affect feeding behaviour. There are two elements to this; a) certain light sources attract a range of insects and this may alter foraging habits and b) the presence of lit conditions may act as a barrier to movement.

The diagram below is an extract from 'Bats and Lighting – Overview of Current Evidence and Mitigation' and provides a good guide for the impacts of light types on bats.

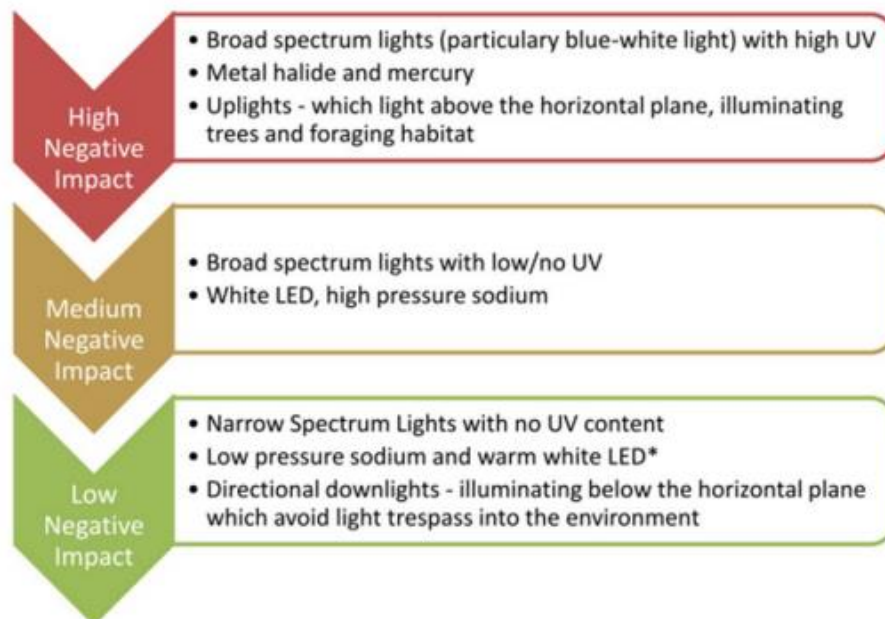


Figure 3: Relative impact of types of lights on bats (guidance only)

2.4 Sensitive Areas at Dovey Junction Viaduct

There are several areas within and adjacent to the project site as a whole that are particularly important for a number of protected species; namely otters, migratory wetland birds, fish and foraging bats.

The below extracts are taken from the *Dovey Junction Viaduct PEA* (EcoVigour, 2022):

- **Bat Species** - No definitive features pertaining to the presence of bats were identified within the surveyed areas. However, the riparian habitat, which are commonly rich in invertebrate numbers, would provide ample foraging locations.
- **Otter** have been recorded and potential prints noted upstream of the structure.

Using long-wavelength lights such as amber and red lamps can provide enough lighting for humans to see but as it is not the optimal wavelength for many wildlife species to notice. Amber and red lighting will not disturb nocturnal animals and will prevent them gravitating towards an area.

As the construction works are taking place within a railway environment, the use of red lighting will be forbidden. Therefore amber lights will be more appropriate for illuminating the temporary structures in use on and over the Afon Dyfi.

3. Construction Lighting Management Plan

3.1 Lighting Objectives

The primary objective of lighting during the construction phase is to provide illumination for construction activities providing a safe working environment in the absence of natural light, allowing workers and site traffic to safely undertake various construction-related tasks, as well as providing security lighting.

The site also supports a number of protected species such as bats, otters, fish and migratory wetland birds. The required lighting therefore needs to minimise impact to these species and on the surrounding environment.

The objectives of this section of the LMP are to achieve the following:

- Provide a safe working environment, meeting statutory requirements and standards;
- Allow 24hr working during the railway blockade;
- Provide site security lighting; and
- Mitigate the impact of artificial lighting on the surrounding environment as far as reasonably practicable.

3.2 Required Lighting Levels

Due to the dynamic nature of a construction site, there will be a requirement for different levels of illumination needed for certain tasks or stages in the construction process in order to provide a safe working environment. Some areas will require suitable task lighting while other areas will require a level of ambient lighting.

3.2.1 Task lighting

Task lighting will be provided for construction activities and the required levels will vary depending upon the type of activity being undertaken.

In general task lighting will only be used during specific times at the specific locations listed in Table 3. They will typically be provided by portable units which will have manual switching and head torches worn by personnel. 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 with a directional fixture that will be set at a low level to the Viaduct. The luminaires will be fitted with manufacturer's custom shields to further limit light spill beyond the working area. Choosing this type of lighting should also allow for fewer luminaires to be used since the light is distributed in a specific way and not floodlighting an entire area.

3.2.2 Ambient lighting

Ambient lighting will be used where there is a requirement to provide constant (excluding during day-light hours) to aid the safe navigation for areas such as access track, footpaths, site compound and welfare areas. Where ambient lighting is identified as 'required', it will be implemented whenever natural light levels are insufficient. As with task lighting the luminaires used for ambient lighting will also be fitted with manufacturer's custom shields to further limit light spill.

The criteria for selecting lighting should use the following British Standards as demonstration of best practice. a) BS EN 12464-2:2014 Light and lighting – Lighting of workplaces Part 2: Outdoor Work

Places. This Standard sets out required lighting levels for the various tasks that will need to be undertaken.

For the construction phase, the zones detailed in Table 3 have been identified, along with the associated activity or task being undertaken that requires lighting.

Table 3: Construction zones and activity/tasks being undertaken

Area	Description	Activity	Comments
Site Compound and car parking area	Compound area housing site offices and welfare cabins.	Temporary accommodation during construction, including car parking.	Ambient lighting will mainly be limited to parking area, compound walkways and external to welfare cabins. PIR activated lighting to operate for short durations when motion detected. Warm white LED or white LED luminaires.
Access track from compound to Viaduct	Route for telehandlers from access point to Viaduct.	Driving to and from construction area	Ambient lighting required in this area, set to low-level. Warm white LED or white LED luminaires.
Pedestrian access route	Route from site compound to Viaduct.	Personnel walking to and from construction area.	Ambient lighting required in this area, set to low-level. Warm white LED or white LED luminaires.
Dovey Junction Viaduct	Main construction area	Construction works to the timber and metallic elements of the structure	Task and ambient lighting will be required in this area. Warm white LED or white LED luminaires.
Dovey Junction Viaduct	Pontoon walkways	Access from landward side to and underneath structure	Amber coloured beacons fixed at regular intervals to identify position of pontoon during low light and night-time hours.
Dovey Junction Viaduct	Fixed scaffolding to Viaduct	Access and working at height on the structure	Amber coloured beacons fixed at regular intervals to identify scaffold structure during low light and night-time hours.

Dovey Junction Viaduct	On track	Use of Road Rail Vehicles (RRVs) to facilitate some of the repair works	Fixed lighting to the RRVs. Light will be directed in the plane of motion.
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3.3 Lighting Mitigation Measures

The use of lighting on this project cannot be eliminated due to safety considerations, therefore a number of mitigation measures can be taken to address the potential impact from the construction lighting. These range from equipment choice, use of site topography and competent design and site management.

The following mitigation measures shall be adopted for temporary lighting during the project:

- Adopt the lowest safe lighting levels possible for tasks being undertaken;
- Limit the hours of lighting where practicable;
- Use a luminaire where lamp can be moved and adjusted;
- Use the lowest possible mounting height for the luminaire based on the required level of illumination needed for the task being undertaken;
- Direct luminaires into the area to be lit (light from the boundary inwards) to avoid over-lighting a wider area;
- Ensure the luminaire is mounted at zero degrees to the horizontal and avoid tilting the luminaire upwards to prevent light spill;
- Make use of lighting shrouds/shields; and
- Ensure that task and ambient lighting is switched off when there are no work activities taking place on the structure.

In addition to the physical equipment, lighting is to be positioned so that the existing topography of the site is taken into consideration and controls on use implemented.

- Keep mounting heights in the compound lower than the site offices and welfare cabin, where practicable.
- Make use of any natural screening and position equipment so it that is not visible to sensitive receptors in the wider environment.
- Prior to first use of any lighting on-site during the construction phase, the lighting shall be inspected to ensure it has been installed as per this lighting management plan and the specified equipment and luminaires are installed.
- All lighting shall be periodically inspected during the project to ensure the correct aiming directions are maintained throughout the duration. If any equipment is found to be incorrectly aligned, modifications shall be made to ensure it is restored to 'as designed' and, if required, re-inspected.
- This monitoring procedure shall ensure that, during the time the site is occupied, the levels of lighting are maintained in accordance with current best practice and standards whilst ensuring the potential impact associated with the introduction of temporary lighting on identified receptors is controlled and minimised as far as practicably possible.
- All lighting installed shall have some form of operational control (either local switch or PIR activated) to suit the tasks being undertaken and ensure energy is not wasted.

3.4 Otter specific mitigation measures

Additional measures to prevent any barriers to otters accessing upstream and downstream of the viaduct will be introduced, such as:

Ensuring that a dark corridor is established on the eastern side of the structure, where no lighting or work activities' will take place. This will provide free, unhindered and safe access for otters to the eastern shoreline. In addition, when there are no works taking place at the eastern end of the structure, lighting will be reduced to further limit any light disturbance on the eastern shore.



Figure 4: Map to depict introduction of dark corridor on eastern shore (indicated by dot & dashed lines)

As well as lighting considerations prior to works starting on site an Ecological Clerk of Works will be on site to:

- Undertake an otter survey at least 6-weeks prior to works starting on site;
- Carry out a pre-works inspection to check on suitability of the mitigation measures;
- Ensure that there is a means of safe access for otters to move between upstream and downstream;
- Undertake a tool box talk with all personnel to make them aware of ecological constraints and mitigation measures in place; and
- Undertake periodic inspections during the works programme to check for any entrapment risks for otters and ensure mitigation measures are still fit for purpose and in place.

References

1. *Wildlife and Roads - The Ecological Impact*. Edited By: Bryan Sherwood (Linnean Society of London, UK), David Cutler (Royal Botanic Gardens, Kew, UK) and John A Burton, Consultant. June 2002
2. *Dovey Junction Viaduct PEA*. EcoVigour. June 2022.
3. *Bats and artificial lighting guidance note*. Institution of Lighting Professionals (ILP) in collaboration with the Bat Conservation Trust. 2018.
4. *'Bats and Lighting – Overview of Current Evidence and Mitigation'*: Stone, E.L. University of Bristol. 2013.

Appendix A

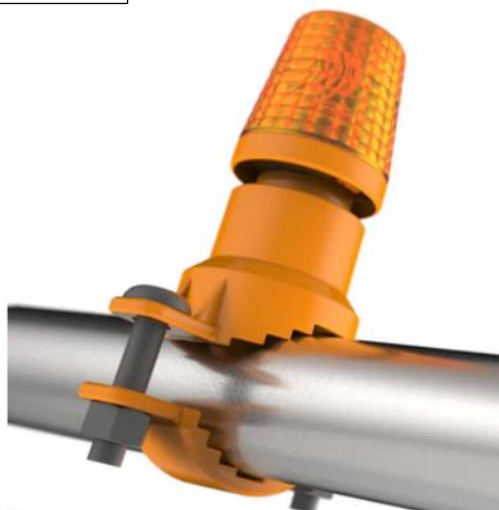
Examples of lighting



Flat faced LED portable light



LED Adjustable lighting towers



*Amber lights
attached to scaffold*