

Project Description

The Llyn Tegid Reservoir Safety project consists primarily of protection to the Llyn Tegid northern lake embankment, and left bank of the River Dee, to ensure its long term stability and to allow safe overtopping during the design storm event. This will include reinforcement of landward embankment faces with a buried 3D geotextile mat ('Enkamat' or similar) and replacement of the existing upstream slope stone wave protection (rip-rap) on the lake embankment.

The proposed layout is shown on Drawing 122918-BVL-Z0-00-DR-I-10002 to 10009 (Site (Block) Plans).

Protection of the River Dee embankment (left bank) will include:

- A 6m wide berm installed on the landward / dry side toe along some sections of the embankment, increasing the ground levels typically by 300-400mm.
- Embankment protection will consist of a 3D geotextile membrane installed under the topsoil surface on the landward / dry side of the embankment, upon completion the surface will be grassed as existing. The protection will extend over the berm where present, or otherwise approximately 2m beyond the existing embankment toe line.
- There are no expected significant changes in the physical scale of the embankment itself, despite minor changes in crest levels to reinstate the 'as-built' levels where necessary, and the formation of the berm noted above (see cross sections on drawings 122918-BVL-Z0-00-DR-C-10012 – 10014).
- There will be tree and vegetation clearance required to enable works, mainly as a result of the construction of the berm.

Protection of the northern lake (Llyn Tegid) embankment will include:

- A 6m wide berm installed on the landward / dry side toe along some sections of the embankment, increasing the ground levels typically by 300-400mm.
- Embankment protection will consist of a 3D geotextile membrane installed under the topsoil surface on the landward / dry side of the embankment, upon completion the surface will be grassed as existing. The protection will extend over the berm where present, or otherwise approximately 2m beyond the existing embankment toe line.
- 'Rip-rap' works: rip-rap is artificially placed rock used to protect shorelines and river banks against scour and erosion. The existing slate stone rip-rap protecting the upstream (wet side) of the embankment will be removed and replaced with locally imported granite (or similar) stone, while existing granite may be re-used. Investigations have been undertaken to identify suitable sources of imported granite, with two sites in North Wales (one in Snowdonia) identified as potential sources. The removed slate may be reprocessed for use elsewhere on the site, such as infilling the bandstand area or constructing the berm. Proportionally the imported stone will make up approximately 80%-100% of the overall stone rip-rap. Visually this face of the bank will become harder (existing vegetation to be removed)

and the stone will be 'rougher' / more angular, as required to improve performance in reducing wave energy.

- There are no significant changes in the physical scale of the embankment, however its appearance from some viewpoints will be 'harder' as a result of the replacement of rip-rap, the rip rap will be deeper and extend slightly further into the foreshore, and it will be part of a more open expansive landscape due to the loss of trees. Other aspects of embankment protection work will have very little visual impact and include minor changes in crest levels to reinstate the 'as-built' levels where necessary, and the formation of the berm noted above.
- The embankment at the 'bandstand' seating area will be realigned; currently the alignment causes a concentrating effect of wave energy increasing stress on the embankment during storm events. This will result in some incursion into the ecologically protected lake foreshore (SSSI, SAC and Ramsar).
- The majority of existing trees, scrub and hedges will need to be removed to enable the works, including all trees growing within the rip-rap. Where possible trees which have been assessed to have particularly high landscape and amenity value (see Arboricultural Impact Assessment (Tree Solutions, 2019)), or particularly high ecological value (see Section 8 for list of ecological reports produced), have been retained.

Environmental mitigation and enhancements integrated within the project

The project will deliver a range of environmental mitigation and enhancement works, which are summarised below.

- Existing footpaths along the lake embankment (i.e. the PRoW 'Y Bala Rhif 4'), River Dee embankment and Afon Tryweryn embankment (i.e. the PRoW 'Y Bala Rhif 1'), will be improved in relation to good practice guidance for accessibility, including 'By all Reasonable Means' (BARM) (NRW, 2017), and the British Standard 'BS 8300-1:2018 - Design of an accessible and inclusive built environment (Part 1 – External Environment)'. These works have been informed by a comprehensive Access Audit for the works area, undertaken in accordance with BS8300-1 and BARM. Further details of these access improvements are provided below:
 - Y Bala Rhif 4 is currently surfaced with tarmac, and will be re-surfaced in tarmac, with regularised levels, improved surface quality (eliminating existing problems of tree roots damaging / uplifting surfacing) and reducing gradients where possible.
 - Y Bala Rhif 1 is currently surfaced with unbound stone, and will be resurfaced in tarmac, to a consistent 2m width.
 - Pedestrian access control barriers, where present within the construction area, will be removed where practical to do so, or replaced with more accessible solutions where possible.
 - Additional waymarker signage and seating will be provided for users of the PRoWs.
 - Where ramps branch off the PRoWs to provide access to the lake foreshore and other adjacent spaces, the gradients and widths of these will be optimised as much as possible, within site constraints.
 - An improvement will be delivered in terms 'clear walking tunnel' requirements, i.e. BS8300-1 and BARM specify vertical and horizontal clear space

requirements for accessible routes, which are currently not achieved along Y Bala Rhif 4 due to low and overhanging branches; as a consequence of the required vegetation clearance works Y Bala Rhif 4 will become compliant with both BS8300-1 and BARM in this respect.

- Focus is given to footpath and access improvements between Penllyn Leisure Centre and the lakeshore car park, as a particularly popular and intensively used area, exploiting the benefits of the more open views created by the scheme. The open space to the south of the leisure centre will be enhanced with new hard and soft landscaping, new seating, and improved steps and ramped access; linked to this an existing ramp to the foreshore will be re-aligned and reconstructed to a significantly reduced gradient.
- The lakeshore overflow car park (adjacent the Bala Adventure & Watersports building) is to be re-organised and re-surfaced, with a more efficient layout designed to optimise parking capacity within reduced hard surfacing, and new soft landscaped / planted areas. There will be a net increase in soft landscape / decrease in hard surfacing as a result, delivering visual enhancements as well as practical improvements.
- Associated with the re-organisation of the lakeshore overflow car park, areas of wetland habitat within the protected SAC/Ramsar site which are currently in sub-optimal condition due to compaction from vehicles will be protected from further compaction enabling improvement to habitat condition.
- Tree and hedgerow planting will be delivered to mitigate for the tree and hedgerow clearance works.
 - More trees will be planted than are removed; the location of all tree planting is still to be confirmed, subject to on-going land owner discussions.
 - The species used will be native to the area and similar to those removed.
 - Replacement planting will focus on replacing the ecological function and value of the existing tree lines, with the aim to ensure no net loss in ecological resilience or connectivity.
- Management and long-term removal of invasive non-native plant species from the lakeshore and river embankments (Japanese knotweed and Himalayan balsam).
- Changes in grassland management to encourage greater floristic species diversity
- Installation of new and enhanced replacement seating and interpretative signage at key locations.
- Proposed integration of artwork with the creation of a series of features carved from felled timber, using a local artist to create a locally meaningful narrative.