Mitigation of sediment impacts to rare lowland wetland ecosystems in the Upper Lunan Water, Angus – A concept note. Andy Vinten, James Hutton Institute.

The upper Lunan Water, contains a range of wetland and open water habitats surrounded by intensive mixed farmland. These include Rescobie and Balgavies Lochs, Fonah Bog, Chapel Mires and Restenneth Moss. These wetlands are under pressure because of inputs of sediment and nutrients from surrounding farmland, and several farms have participated in sediment control plans, funded by Nature Scotland. The upper Lunan Water has also been the subject of intensive water quality, water level and flow monitoring over recent years, as well as participative stakeholder engagement through workshops, interviews and surveys as part of research to underpin diffuse pollution mitigation for the Water Framework Directive. Prior to COVID, it was designated to become a diffuse pollution priority catchment. More recently, strategic research has explored potential for using a Payments for Ecosystem Services approach to deliver benefits to the water environment and its users. Proposed actions that have emerged from this engagement and monitoring have now been identified. These include:

1. **Proposed modification of spillage zone of the Lunan Water into Chapel Mires (see Figure 1).**

Downstream of Balgavies Loch, the Lunan Water runs in a single channel which feeds a lade leading to a restored water mill at Milldens. The main flow of water runs via a spillage zone, which feeds into the margin of Chapel Mires wetland. The wetland has been mapped according to the National Vegetation Classification, which shows that the proximal part of the wetland contains quite uniform stands of species such as Burr Reed, Phragmites and Canary Grass, which favour a sediment rich environment. Further away from the river, biodiverse Carex wetland dominates. The spillage zone was moved upstream in the 1970's to the existing site, coinciding with the rapid intensification of arable agriculture in the area and restoration of the water mill to working order. This combination has led to a risk that the Carex wetland area will further diminish at the expense of the other, more aggressive species.

By moving the spillway described to its original position (which is now blocked up by an earth bank reinforced with corrugated iron sheet), sediment rich storm event waters, which carry sediment especially from the Newmills Burn, feeding into the very bottom end of Balgavies Loch, would be diverted downstream of Chapel Mires. The benefit of such action in diverting sediment-rich storm event water away from Chapel Mires has been demonstrated through modelling and monitoring of water levels and flows. It may also provide limited relief from flood risk upstream of Rescobie and Balgavies Lochs.

This action is likely to be approved by riparian owners, whereas previous proposals involving a tilting weir were not favoured because of the challenges of responsibility for active management.

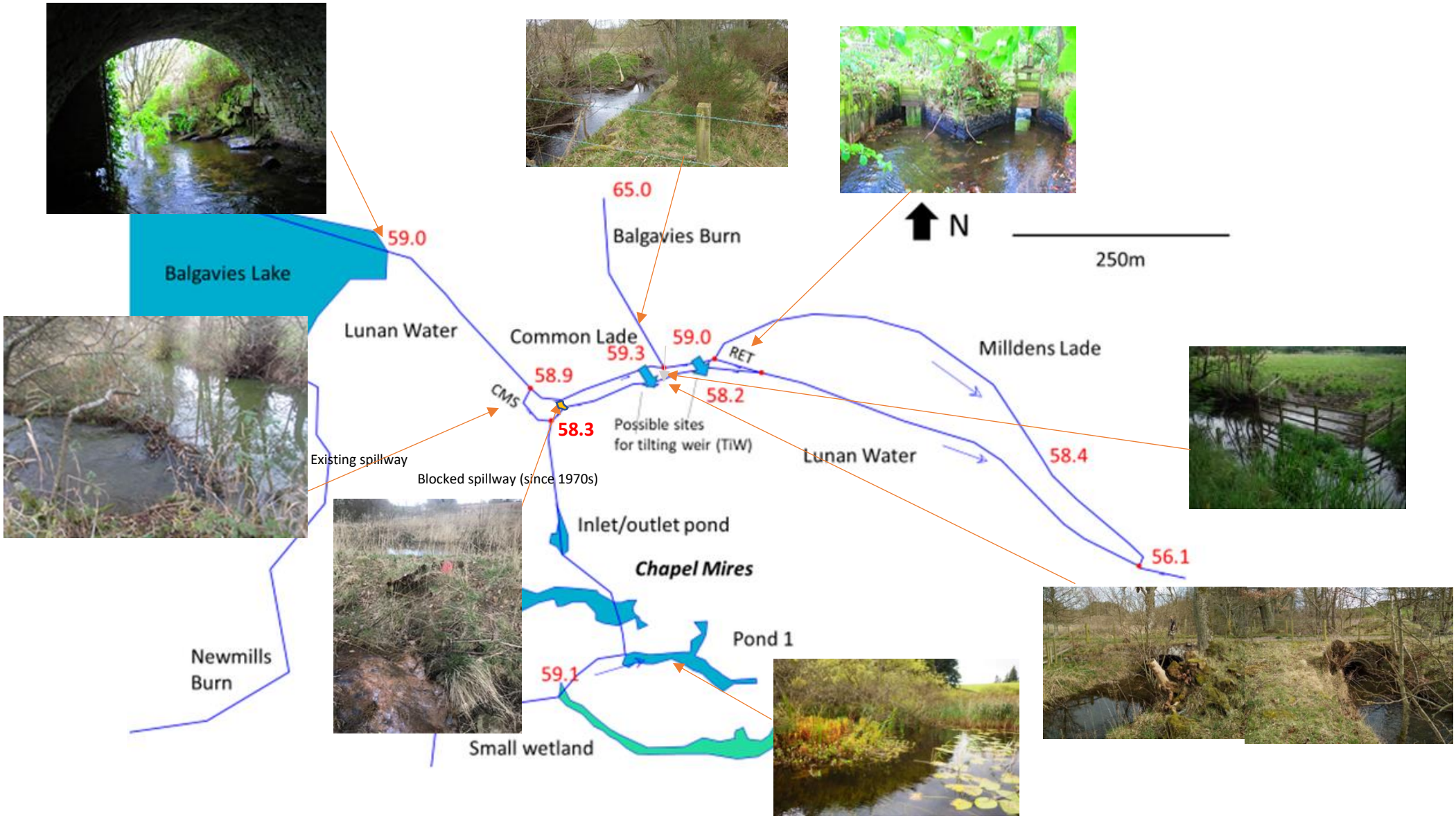
Funding would be required to commission the spillway restoration by SEPA procurement of options appraisals, designs and groundworks and to maintain and enhance site monitoring.

2. **Sediment trapping and erosion control mitigation in margins of arable land adjacent to Balgavies Loch**

A report for Nature Scotland is being prepared by Moir Environmental on this topic, which will mitigate sediment impacts to Fonah Bog. Measures to trap sediment from the Newmills Burn at the outlet to Balgavies Loch are also being drawn up by Lockett Agri-Environmental for consideration.

Possible funding sources:

The ***Biodiversity Challenge Fund*** (BCF) specifically encourages applicants with innovative projects that improve biodiversity and address the impact of climate change, by increasing the resilience of our most at-risk habitats and species and creating large areas of new or restored habitat, so may be a suitable funder for such action. The Water Environment Fund . Working in partnership with local authorities, The ***Water Environment Fund*** can be used to create a better environment for wildlife and people, by restoring damaged river corridors to enhance the ecological value of the river and improve public amenity and well-being, including the reduction of flood risk.



OUTLET STRUCTURES OF BALGAVIES LOCH/LUNAN WATER. BED LEVELS SHOWN IN RED IN M ABOVE SEA LEVEL. RET=RETURN GATE FROM COMMON LADE TO LUNAN WATER; CMS = EXISTING CHAPEL MIRES SPILLWAY; TIW1, TIW2 = POSSIBLE SITES FOR INSTALLATION OF TILTING WEIR TO MANAGE FLOW ROUTING AND UPSTREAM WATER LEVELS.

Sedimentation reduces micro-topography of Carex tussocks making them vulnerable to invasion by Phalaris

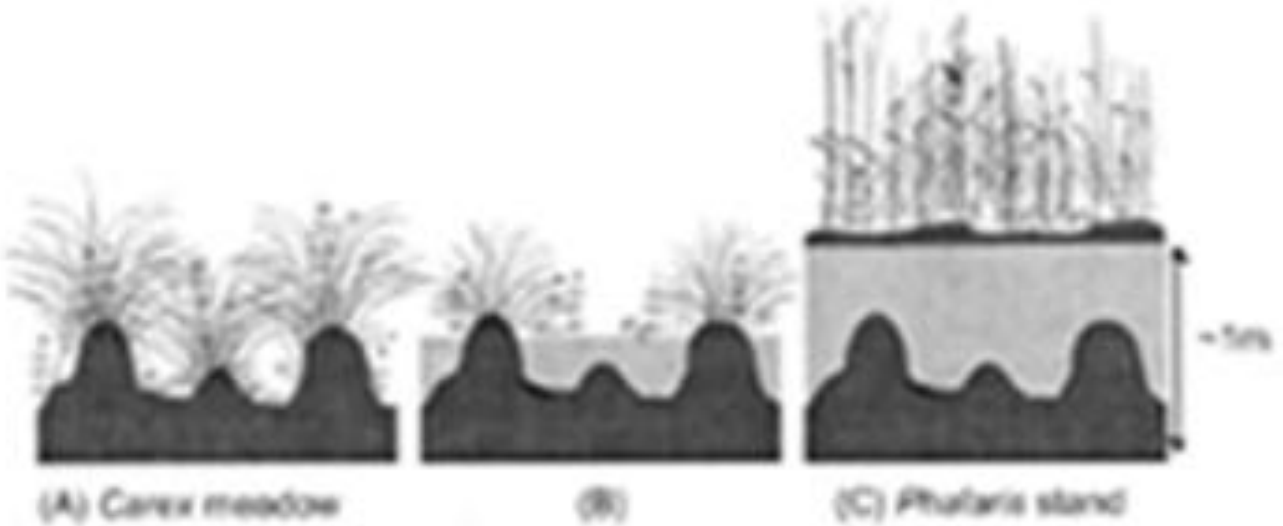


Figure 7. Illustration of a sedge meadow experiencing (A) minimal accumulation whose robust, tall *Carex* tussocks occur with high microtopographic variation, organic-rich soil, high species richness, and a high floristic quality index (FQI = 26.2); (B) partial smothering by sediment that decreases microtopographic variation, reduces organic content in soil, and reduces species richness and floristic quality, and (C) complete burial by sediment. Where *Phalaris* replaces *Carex*, microtopographic variation is minimal, soils are mineral-rich, and only 1–2 opportunistic species remain (FQI = 4.1).

- Werner KJ, Zedler JB (2002) How sedge meadow soils, microtopography, and vegetation respond to sedimentation. Wetlands 22:451–466