# Delliefure Burn: Flood Plain Re-connection and Habitat Enhancement

Project Report, October 2021

**Summary**

The Delliefure Burn is a relatively small tributary on the north side of the Spey about four miles downstream of Grantown-on-Spey. In common with many burns draining agricultural land in the catchment, a reach of approximately 330m was historically straightened and embankments constructed along it, resulting in degraded physical and ecological diversity in the channel and a disconnect between the burn and its flood plain. The project restored the hydrological connection with the flood plain by lowering sections of the embankment, and created new and improved habitat both in the water course and on the flood plain itself. The overall effect of holding water in the sub-catchment for longer periods will contribute to reducing flood peaks downstream and act as a reservoir to supplement base flows under drought conditions.

The project was developed during spring 2021 and completed in September 2021. It was funded by The Macallan and the Cairngorms National Park Authority.

Spey Catchment Initiative e: p.lawson@speyfisheryboard.com m. 07909 533344

**Objectives**

- Increased water-logging of peaty soils to preserve and enhance carbon storage.
- Increased deposition of particulates and nutrients on flood plain to retain and store soil organic carbon.
- Expansion of wetland and wet grassland habitat.
- Storage of flood water on flood plain during medium to high flows, reducing intensity of peak flows and flood risk downstream.
- Increased retention of water in wetland areas and ground water, acting as a reservoir to recharge the burn and mitigate very low flows during drought conditions.
- Restoration of natural river processes in burn, creating more morphological features and improving in-channel structural and habitat diversity, eg more pools, riffles, shingle banks.

**Background**

As a result of historic straightening and embankment for agricultural purposes, this reach of the Delliefure Burn was identified as having sub-optimal morphology and as being functionally disconnected from its flood plain under all but the highest flow levels. The dual aims of the project were to re-connect the burn to its flood plain and to improve in-channel physical and ecological conditions.

By creating breaches in the embankment, the project aimed to re-instate the regular exchange of water and fine sediments which occurs between naturally functioning flood plains and rivers at medium to high flows. Through increased retention of particulate organic matter and keeping the peaty soils wetted, the carbon storage function of the flood plain will be protected and enhanced. Blocking of current drainage pathways and construction of shallow scrapes to form wetland features on the flood plain will increase water storage potential and retention time for flood waters, helping to 'slow the flow' to reduce peak flood flows downstream, and also to retain water during periods of drought, acting as a reservoir to recharge the burn and mitigate very low flows.

Both these outcomes will have increasing value in the future in mitigating the detrimental effects of the predicted more frequent and intense storm and drought events due to climate change. In addition, the new wetlands will provide new high quality habitat for wildlife, including invertebrates, amphibians, birds and wetland plants. The Strathspey area is especially important as a stronghold for wading birds, which are in rapid decline at a national level, and the wetlands will add to locally available wader habitat.

Due to straightening and embankment the burn has been constrained within a narrow channel causing a degree of incision and fairly uniform morphology, lacking in features such as pools and riffles which provide habitat for river biodiversity. Large Wood Structures (LWS, i.e. entire tree trunks, including root plate) were strategically placed in the channel with the aim of helping to 'kick-start' natural physical processes and provide a catalyst for morphological evolution within the channel. Spey Fishery Board monitoring indicates that there are reasonable numbers of Salmonid fish both upstream and downstream of this reach, and morphological restoration should improve longitudinal connectivity and expand the area of breeding and juvenile fish habitat available. Increased morphological diversity will also benefit aquatic invertebrates and potentially enhance habitat for Spey SAC qualifying species including Freshwater pearl mussels, otter and lamprey. An additional function of some of the LWS is to encourage flow out of the channel on to the flood plain through one of the embankment breaches during high water levels.

The site is under a farming tenancy and the flood plain is currently used for grazing cattle. The project was delivered within the necessary constraints to accommodate on-going farm activities and respect the wishes of the tenant farmer and landowners.

**Design Development**

Consultants cbec Eco-engineering were appointed to provide topographic survey, hydrological and hydraulic modelling and design services. Development of the design was based on outputs from the existing conditions model and applied expert judgement, informing the location and design re-profiling of embankment breaches and estimating wetland connectivity/ flow paths.

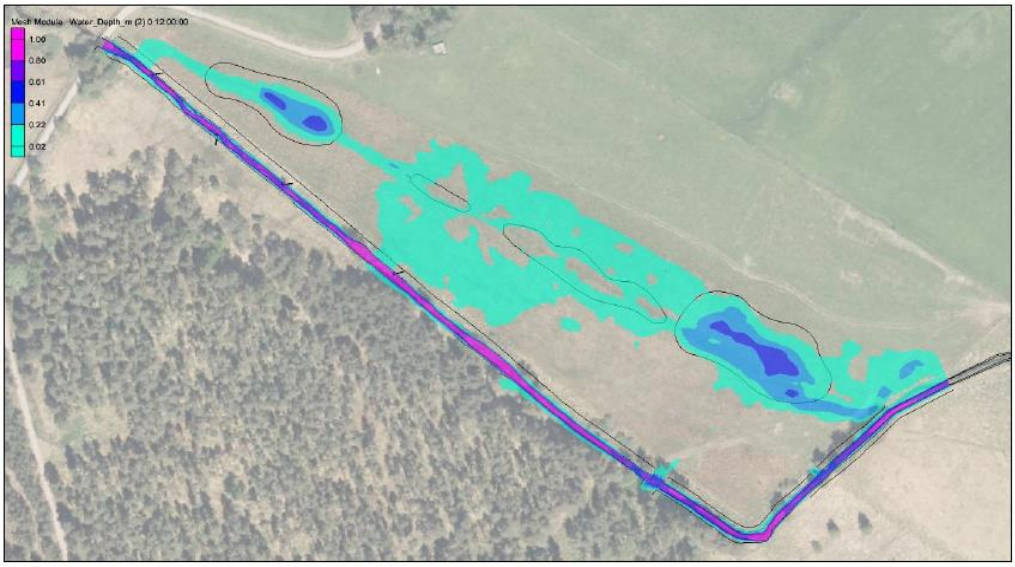
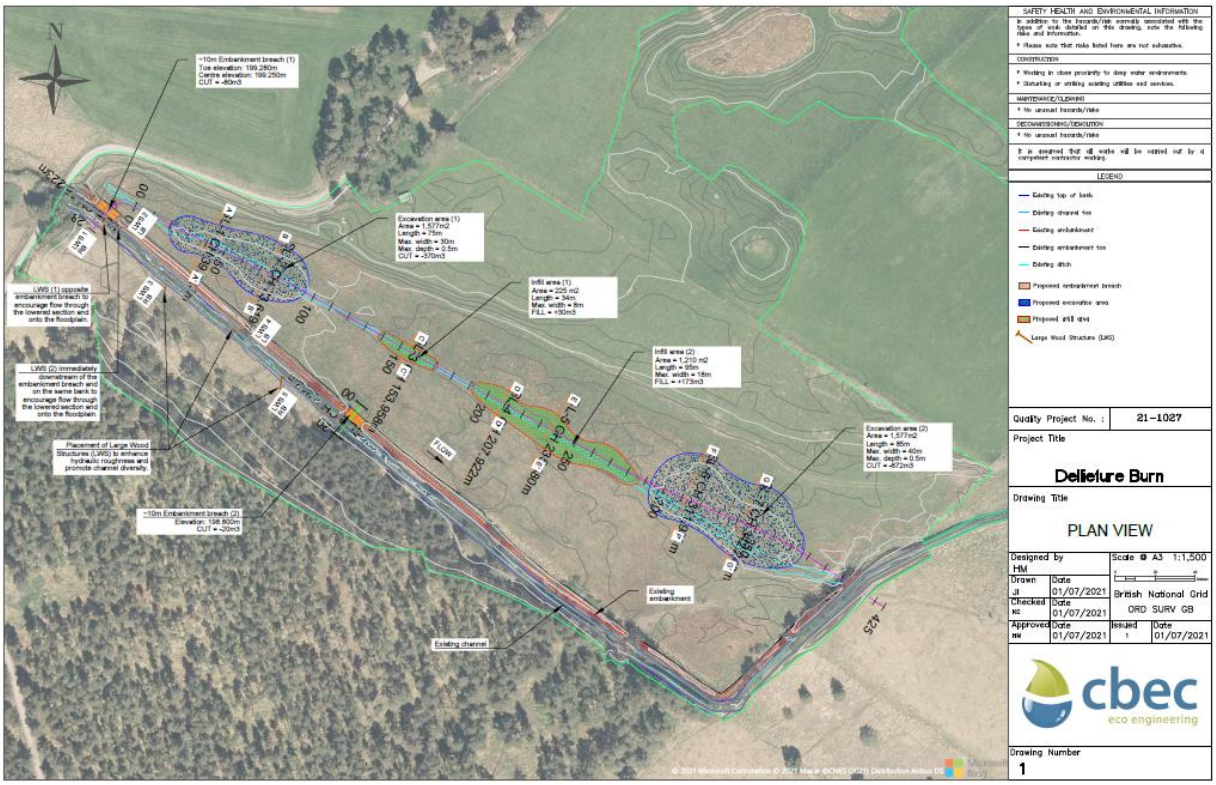



**Figure 4.4. Established connection to floodplain and wetlands, 2 $m^3/s$, design conditions.**



The identified design consisted of embankment lowering/reprofiling approx. 10m in length at two locations along the project reach, excavation of two wetland scrapes of maximum depth 500mm and associated ditch in-filling on the flood plain, and installation of five in-channel LWS. The lowest flow where the model predicts channel floodplain connection for design conditions is reduced from 2.0 m3/s to 1.2 m3/s. This is close to Q2% - approximately half the discharge where overtopping occurs under pre-project conditions. Additional modelling indicated that direct rainfall runoff is also likely to inundate the wetlands.

The modelling included outputs which provided assurance that there would be no increased flood risk or interference with borehole water supply for a neighbouring property.

**Permissions**

Full agreement from the two riparian land owners and tenant farmer was obtained at an early stage.
A Controlled Activity Regulations (CAR) Simple Licence for the embankment reprofiling was issued by SEPA (CAR/S/SEPA2021-376).
The project was approved by NatureScot, who confirmed that formal consent was not needed. A walkover survey for protected species was recommended and carried out prior to commencement of groundworks, along with an electro-fishing survey of the reach.

**Groundworks**

The two embankment breaches were formed and wetland areas on the flood plain excavated, taking care to minimise ground disturbance and re-instate affected areas with turf. The spoil was used to fill in the remains of an existing ditch on the flood plain in two areas to partially block flow pathways, with the remainder transported to an adjacent field as agreed with the farmer.

A total of five LWS were placed in the channel and secured into the banks. Trees of diameter 400 – 600mm with root plates attached and trimmed to approx. 4m length, were harvested from an adjacent Scots pine plantation in agreement with the estate. The LWS were positioned at approx. 45 degrees to the flow with root plates facing upstream and the trunks buried in the bank to secure them in position. To minimise disruption to the banks of the burn and consequent sediment release, an innovative technique was used for some of the LWS involving forming a blunt point at the end of the trunk and driving it directly into the bank at the specified angle and height.

The work was completed over 13 days during September 2021 by local contractors G.S. Campbell Ltd.

**Monitoring and Evaluation**

*Ecology*

Long term fish data from regular Spey Fishery Board surveys is available and will be compared to future surveys at annual intervals. Electrofishing and redd counts will be undertaken. The site will be included in the on-going programme of wader surveys by the Strathspey Wetlands and Waders Initiative (SWWI), and a camera trap has been positioned at the edge of one of the wetlands to monitor the arrival of other wildlife.

*Photographic record*

Detailed fixed point photography of the river channel and flood plain was used to establish a visual baseline and will be repeated at regular intervals to record change, for example in channel morphology and flood plain vegetation.

Extraction of whole trees for LWS

Excavation of shallow wetland/water retention area

LWS positioning, showing 'sharpened' end of stem

LWS installation by driving into right bank close to breach

Formation of lower embankment breach

Formation of upper embankment breach

**Early indicators of success**

As groundworks were coming to a close in late September there was a period of heavy rain causing the burn to rise sharply. Water flowed through the newly formed breaches and into the excavated wetland areas as planned (see YouTube video). After several weeks there was a good level of water retention on the flood plain forming shallow pond areas. Wetland bird species have already been seen utilising the area.

The delivery of this project brought to light opportunities for wider conservation action on the land holding. SWWI took advantage of the contractors being on site and have created 6 wader scrapes on a nearby field, further enhancing the value of the area for waders. Opportunities have also been identified for protection and enhancement of biodiverse hay meadows and species rich grasslands on the farm.

**Publicity and knowledge dissemination**

A short video commissioned by The Macallan to explain and document the project is currently in production. There is an intention to repeat filming, including aerial shots, to demonstrate achievement of the project's objectives in time as the site develops.

The site is compact and easily accessed and will therefore be a useful demonstration site to illustrate the approach to visiting parties. The project will also be used by SCI as a case study for small scale river/flood plain restoration and will be publicised via social media, sector events, national knowledge exchange databases, etc.

**We would like to gratefully acknowledge funding support from The Macallan and the Cairngorms National Park Authority, the kind permission of Seafield and Tulchan Estates and the tenant farmer, and the support and assistance of our other partners.**

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**Penny Lawson, SCI Project Officer**
**October 2021.**