Llangloffan Fen Wildlife Trust Phase 1 Proposal

Llangloffan Fen is a lowland wetland in the upper part of the part of the River Cleddau SAC. The river through the fen has been extensively straightened and dredged, so now lacks sinuosity and morphological diversity. The modifications to the watercourse are also believed to impact on the hydrology of the fen. Due to this incision/dredging, the river has become disconnected from its floodplain within the fen. This in turn has had an impact on the quality of the fen habitat and the river habitat.

There are, however, questions around eutrophication in the river due to agriculture upstream, and so care must be taken before re-wetting the fen with water from the river, as it may lead to impacts of the quality of the fen habitat. For this reason, the 4 Rivers for LIFE project is proposing a phased scheme to restore the river through the fen, focussing on in-channel habitat in the first phase, and then approaching re-connecting the fen floodplain once the water quality questions have been answered.

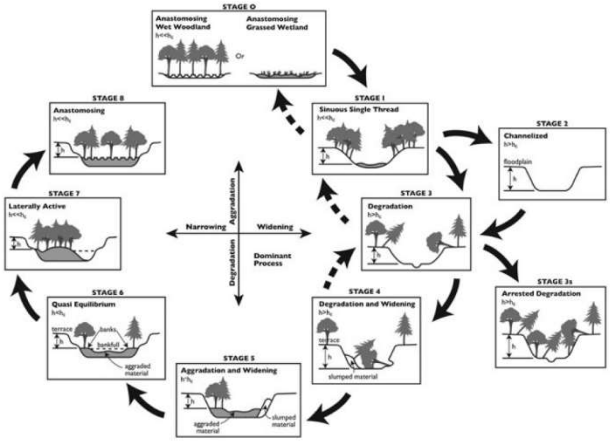

Figure 4. Stream Evolution Model based on combining the Channel Evolution Models in Figures 1–3, inserting a precursor stage to better represent pre-disturbance conditions, adding two successor stages to cover late-stage evolution and representing incised channel evolution as a cyclical rather than a linear phenomenon. Dashed arrows indicate 'short-circuits' in the normal progression, indicating for example that a Stage 0 stream can evolve to Stage 1 and recover to Stage 0, a Stage 4-3-4 short-circuit, which occurs when multiple head cuts migrate through a reach and which may be particularly destructive. Arrows outside the circle represent 'dead end' stages, constructed and maintained (2) and arrested (3s) where an erosion-resistant layer in the local lithology stabilizes incised channel banks

The channel currently sits between stages 2 and 3(s) "Arrested Degradation".

Phase 1 will focus on the western part of the site (Wildlife Trust managed) and will involve the placement of large woody material in the river channel to raise bed levels and reconnect the river to the adjacent floodplain. The work will involve felling some small trees on site and a machine tracking to place these in channel. The works are proposed for summer 2023.

Phase 2 will involve re-meandering of the historically straightened channel at the western end of the site and reconnection of old cut off meanders at the eastern end of the site. This work will be informed by a hydro-ecological study of the fen to better understand the likely effect of different restoration scenarios on the fen hydrology. Works are proposed during summer 24 and summer 25.

Phase 1 will cover in channel enhancements, that will create a greater morphological diversity by promoting lateral erosion and allowing natural process to accelerate the recovery of the channel from incision. This phase is not intended to create extensive re-wetting of the fen.

The Western Cleddau at Llangloffan fen is significantly incised with bed levels typically 1-2m below the level of the floodplain. Combined with the structural starvation in such a low energy environment, this has meant that recovery although apparent will be particularly slow. There is some evidence of recovery: -. the upstream end of the river has some gravel bar formation and where there is any structural forcing from natural processes, or the banks are weakened by the presence of livestock, the river has already started widening and aggradation.

The goal of phase 1 will be to stimulate process-based recovery from incision by activating natural processes. First adding in structure in the form of large woody debris to stimulate the lateral erosion, aggradation and formation of channel features. We will use large woody debris in targeted areas to accelerate natural processes that are already occurring.

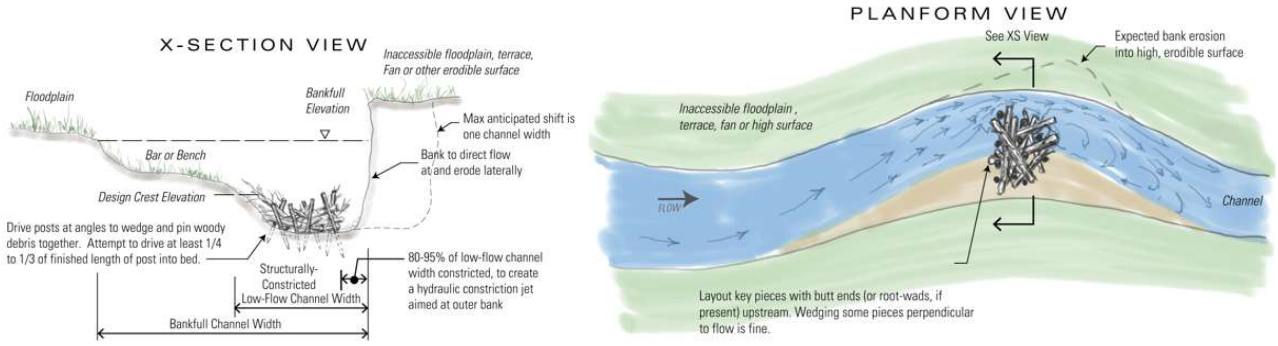

Figure 1: Bank Attached Log Structure

The Wildlife Trust have previously installed some woody debris in the channel, which has forced the river to move laterally, however as the river has adjusted to these structures it has neared a new equilibrium. Over time the wood that makes up these structures has rotted and their effectiveness has been greatly reduced.

Where natural process is evident, we will aim to enhance it, accelerating the natural change. This will be done by decreasing the width of the channel using large woody debris. By decreasing the width and creating a “pinch point” we will be increasing the relative stream power as the force of the water is concentrated over a smaller area.

As lateral erosion occurs widening the channel, we will see a reduction in the relative stream power. This means that until we are satisfied with results structures will need to be adapted and enhanced to keep stimulating the natural processes.

We will install water gates at the top of the treatment reach where there is currently a fence that catches woody debris that would otherwise flow into the site and create further morphological diversity. Another water gate is needed where a fence crosses the river on the downstream side of the ford.

One additional way to reduce the “draw down” of the fen, without leading to more out of bank flow would be to encourage in channel vegetation growth during the summer. In areas without shade from bankside trees there is already abundant growth in the channel of both submerged and emergent macrophytes. Increasing the vegetation in channel will slow down the water and raise the water levels, which will maintain a higher river level, decreasing the water gradient in the affected part of the fen.

As the growth of vegetation is greatest in the spring and summer, and not in winter, this could be an effective way of increasing the summer water table without risking re-wetting the fen with nutrified water.

To achieve this vegetation growth we plan to selectively thin branches overhanging the shaded sections of the channel. We will re-use this woody material as woody debris.

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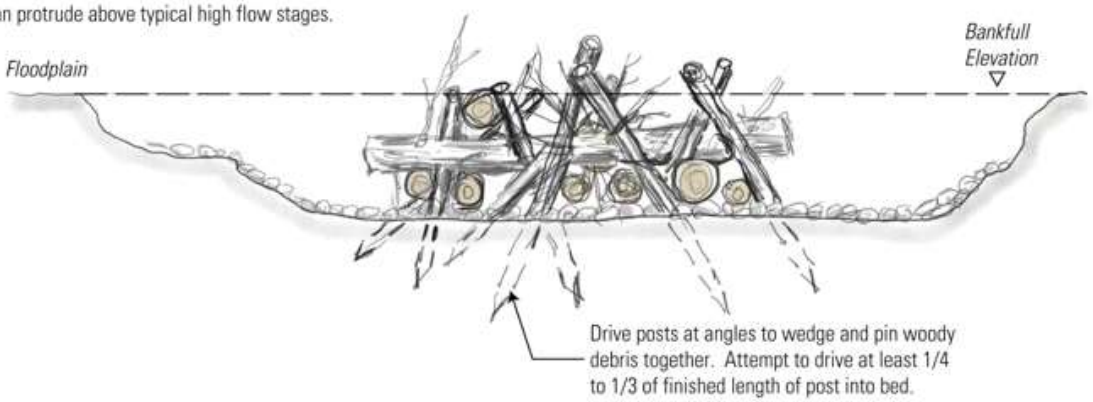
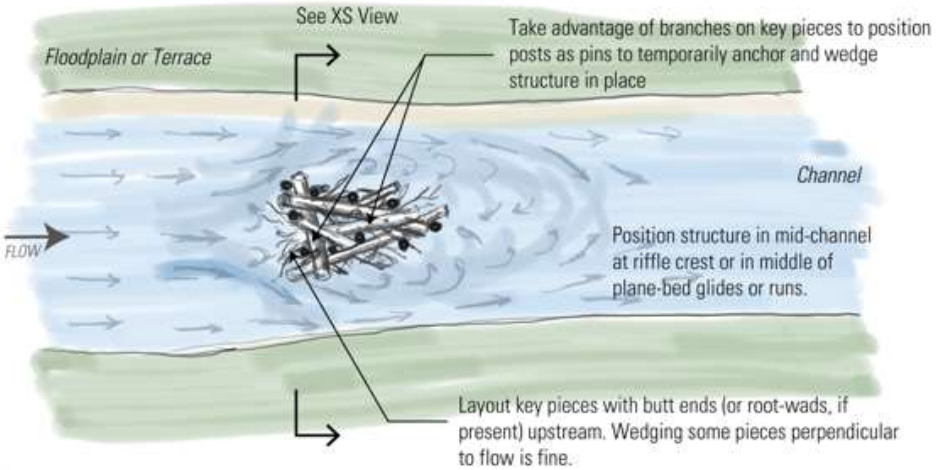
X-SECTION VIEW

Design height for mid-channel structures relative to high-flow stage is less important as flow is diverted both sides around it. Structure can protrude above typical high flow stages.



PLANFORM VIEW



Utah State University Restoration Consortium

NOT-TO-SCALE

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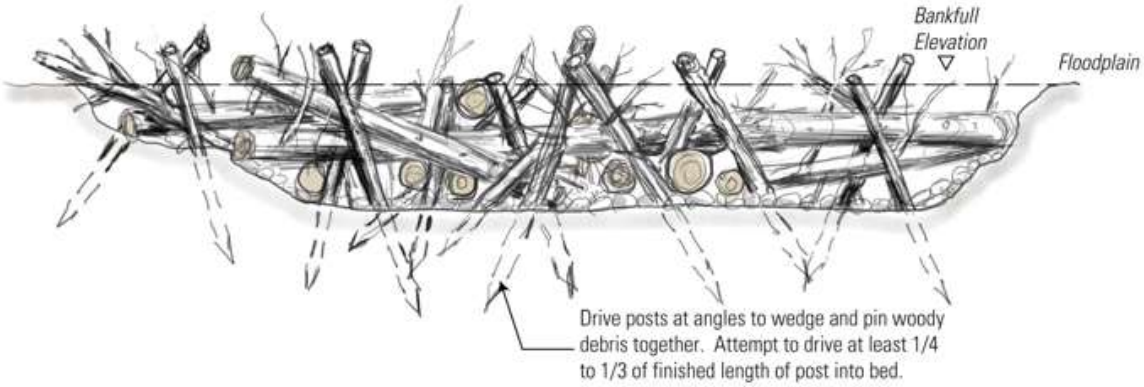
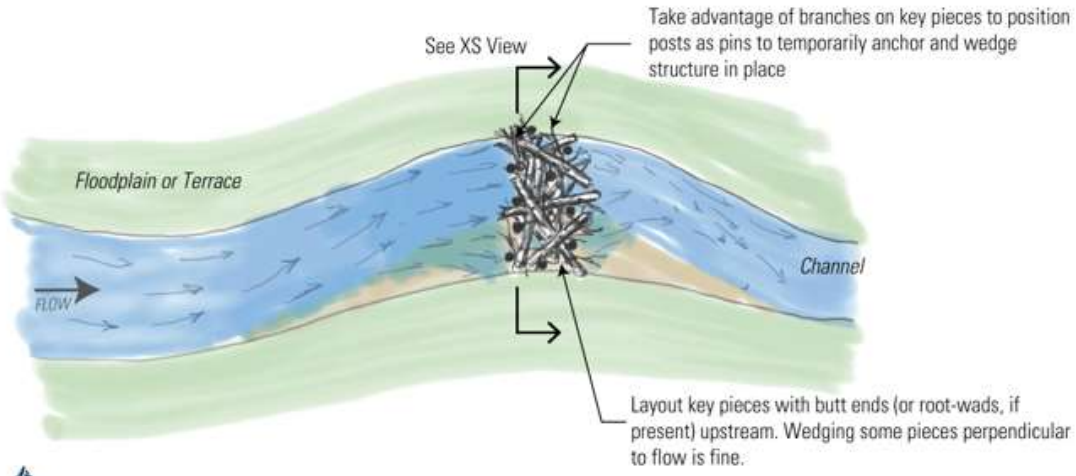
X-SECTION VIEW

Design height for channel-spanning structures is important. If it is intended Structure can protrude above typical high flow stages.



PLANFORM VIEW



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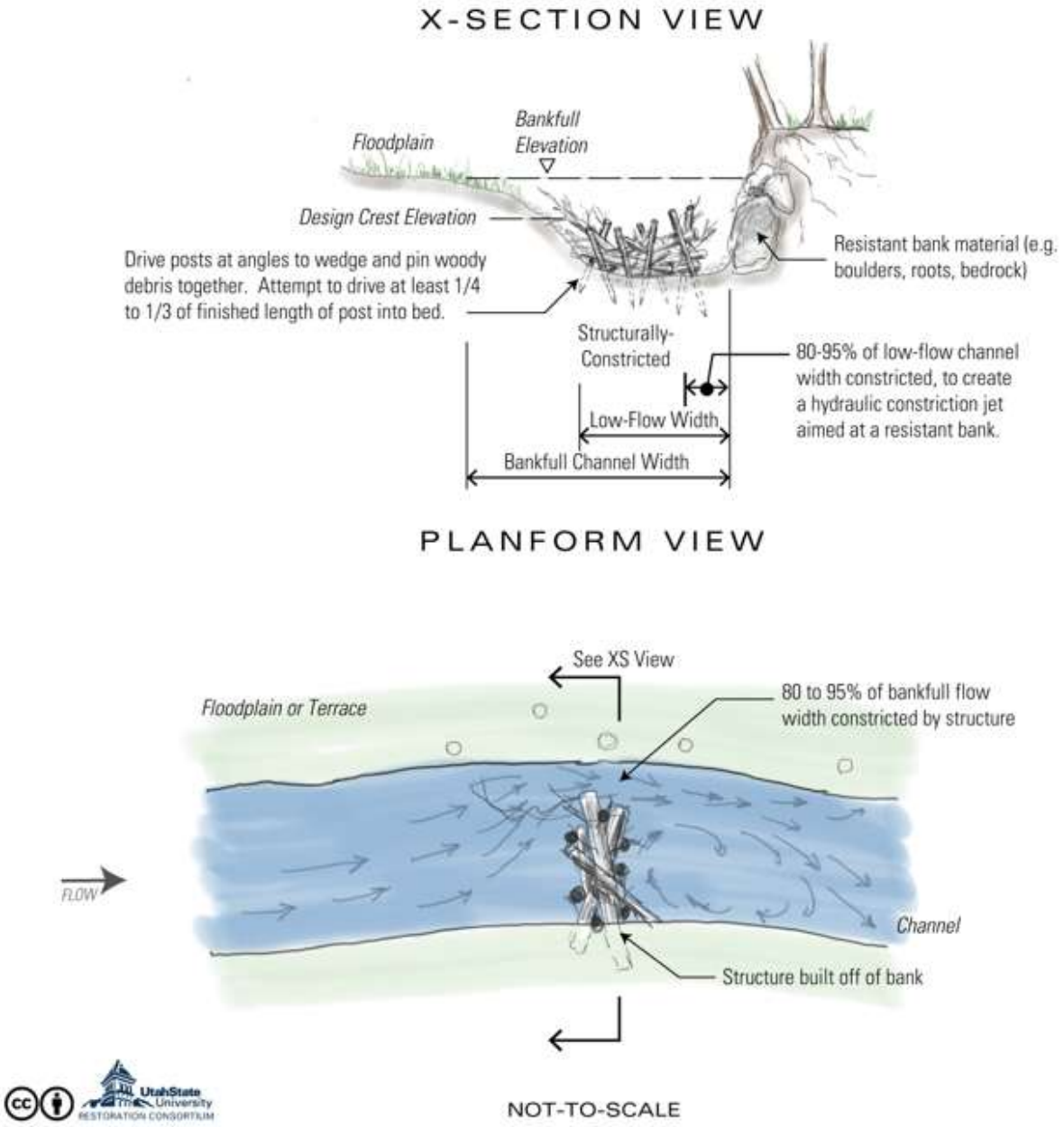
X-SECTION VIEW
Floodplain
Bankfull Elevation
Design Crest Elevation
Drive posts at angles to wedge and pin woody debris together. Attempt to drive at least 1/4 to 1/3 of finished length of post into bed.
Resistant bank material (e.g. boulders, roots, bedrock)
Structurally-Constricted
80-95% of low-flow channel width constricted, to create a hydraulic constriction jet aimed at a resistant bank.
Low-Flow Width
Bankfull Channel Width
PLANFORM VIEW
See XS View
Floodplain or Terrace
80 to 95% of bankfull flow width constricted by structure
FLOW
Channel
Structure built off of bank
NOT-TO-SCALE