Tennant Canal Association
History & Sustainability

Position Statement:

Weir abstraction arrangement at Aberdulais

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1. Background

a) Weir operation

The Tennant Canal has historically been fed from a weir located at the confluence of the Rivers Neath and Dulais at Aberdulais. Until recently this was achieved using a weir to raise upstream levels and provide sufficient hydraulic head to allow flow to gravitate to the Tennant canal through two manually adjustable penstocks. The weir was in place and functioning, coincident with the canal construction, and thus has been in place for almost 200 years. Flow from the Neath/Dulais passed through a dual penstock arrangement and flow was conveyed into the Tennant Canal via a short open channel (see Fig 1). A degree of flow control was afforded by manual adjustment of the penstocks. The channel contains a removable weir at the downstream end to maintain a minimum water level – presumably to allow flow to be measured.

Fig 1 - Tennant Canal Feeder Channel.

It is assumed that the penstocks were manually modulated to regulate the flow from the Neath/Dulais and that they were completely closed at times of high river level to avoid contributing to flooding risk.

b) Failure of weir

The weir failed due to damage in 2015.

Prior to failure, the weir on the Neath/Dulais was in poor condition but functional. Most of the weir is still in place but a section on the Eastern side of the river Neath has been washed away. This has unfortunately compromised the ability of the remaining weir to elevate river levels and allow flow to be readily supplied to the Tennant Canal as has been the case historically.

Subsequent to the weir being damaged the arrangement has fallen into disuse. The channel and forebay leading up to the penstocks are blocked with stones and sediment preventing any flow entering the feeder channel regardless of river levels (Figure 2 and Figure 3).

Figure 2 - View of remaining weir and inlet channel showing sediment build up.

Figure 3 - Penstocks at inlet to channel feeding the Tennant Canal – clearly non-functional due to stone/sediment accumulation.

The implications of the damage to the weir, silting of the channel and blockage of the penstock forebay are that the Tennant Canal no longer has a source of water from the Neath/Dulais confluence.

This is apparent during summer months when levels in the Tennant Canal drops alarmingly, threatening cherished environmental habitat all the way along the canal, including the Internationally important and protected RAMSAR site & SSSI (Crymlyn Bog) and the very rare species that exist in this ecosystem. The Eastern section of the canal is particularly impacted by low water levels, far lower than designed Canal operating levels.

The Tennant Canal Association (TCA) is committed to the urgent restoration of a sustainable water supply to the Tennant Canal from the Neath/Dulais. TCA's view is that this should be achieved by fully restoring the weir. However, TCA are also open to considering other options that achieve the same outcome.

c) Fish Pass construction and impact on weir

A fish pass was constructed on the Eastern side of the weir in 2002 (see Figure 4). The construction of this fish pass involved working on and alongside the weir and integrating the fish pass into the weir arrangement. Concerns regarding the impact of the fish pass on the impact on the weir and aqueduct were raised by Peter Ricketts of the Neath and Tennant Canal Preservation Society at the time of construction.

There is no indication from construction drawings, or visual inspection on-site, of proper provision for adequate tying in of the structure of the fish pass to the weir. Evidence from witnesses also suggests that very large tracked excavators were observed to be tracking on the top of the weir during the construction of the fish pass.

Site observations indicate that the weir failed at the interface between the original weir and the reconstructed section (believed to be the remaining length shown in Figure 4). This suggests that there was inadequate tying in of the original weir. There is no reference to tie bars on the drawings, and no evidence of such an arrangement on the remains. This suggests that a proper structural tying in detail was not utilised.

TCA's view is that the construction of the fish pass has contributed to the failure of the weir.

Figure 4 - View of remaining weir alongside the fish pass.

2. Implications or restoring the weir

d) Weir repair and associated maintenance

The Tennant Canal has historically been fed from a weir located at the confluence of the Rivers Neath and Dulais. Full restoration of the weir and clearance of the penstock forebay and channel would reinstate the water feed arrangement to its previous state.

The section of weir on the Eastern side of the river was damaged in 2015. This prevents a full weir effect forming across the whole river. The weir is effectively breached (see Figure 5). As such the water levels at the entrance to the penstocks are not as high as required to ensure consistent flow through the penstocks into the canal.

The damage to the weir also currently negates the intended purpose of constructing the fish pass.

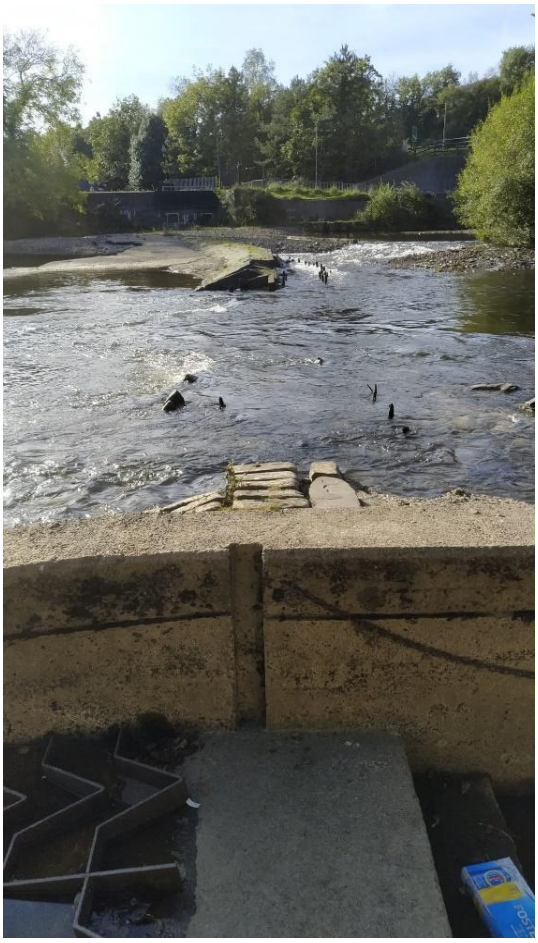


Figure 5 - View along the damaged weir from the fish pass on the Eastern bank showing breach of the weir.

Most of the remaining weir is in poor condition.

> *TCA's primary position is that the weir should be fully reinstated to a condition that will provide a reliable water feed arrangement for years to come.*

The concrete channel leading to the Tennant Canal will also require cleaning out to prevent large quantities of silt and mud entering the Tennant canal upon re-commissioning of the arrangement. Some repair work to the channel sidewalls is also required where masonry has failed. It is envisaged that some maintenance of the penstocks would be needed as they appear to have been inoperable for several years.

e) Hydraulic effect of the weir

Whilst the restoration of the weir will bring a clear benefit to the Tennant canal and preservation of the biodiversity therein, there have been concerns expressed previously by Natural Resources Wales (NRW) that a rebuilt weir may contribute to increased flooding in the area.

TCA's position on this is as follows:

i) The intention is to reinstate the weir to provide the same function as prior to the flood damage. The weir had been in place for almost 200 years and was not intended to be a temporary structure, being part of the permanent canal infrastructure. It is only reasonable that it should be returned to its former state without the need to validate flood consequences.

ii) The weir is set at a relatively low level in relation to the flood embankment. Due to the variance in height of the weir relative to river bed and variable nature of the weir along its length, it is difficult to provide a 'drowned out' weir calculation to evidence the impact of the weir. However, it is clear by observation that the hydraulic loss that would be generated by the full weir is negligible at times when the river level approaches the upper embankment.

TCA's opinion is that the weir provided no or negligible restriction to river flow under imminent flood conditions. This is partially evidenced by a view across the weir (in its current state) in a reasonably high river level (well before risk of flooding to property occurs). Whilst this photograph (Figure 6) was taken prior to the weir damage, it does illustrate that there is no evidence of any significant hydraulic impact on upstream river levels across the remaining length of the weir.

As river levels rise further the effect will decrease even further as the weir gets increasingly drowned out.

Figure 6 - View across weir from Eastern back illustrating negligible hydraulic impact of current arrangement in partial flood conditions.

3. Temporary solutions to restore water supply to Tennant Canal

a) Sheet pile weir across exit from River Dulais

Most of the weir structure across the River Dulais exit is still in place and can function as a weir. There is a potential option to install a short length of sheet pile weir across the point where the River Dulais and River Neath meet (see Figure 7). This would effectively elevate the outlet level from the Dulais slightly, allowing the penstock forebay to flood in all conditions. It is likely that this weir could be set lower than the existing weir or curtailed for a short distance at one end to facilitate passage of migratory fish.

TCA view this as an expedient temporary solution and would still be seeking the full reintroduction of the weir.

Figure 7 – Potential location of sheet pile weir

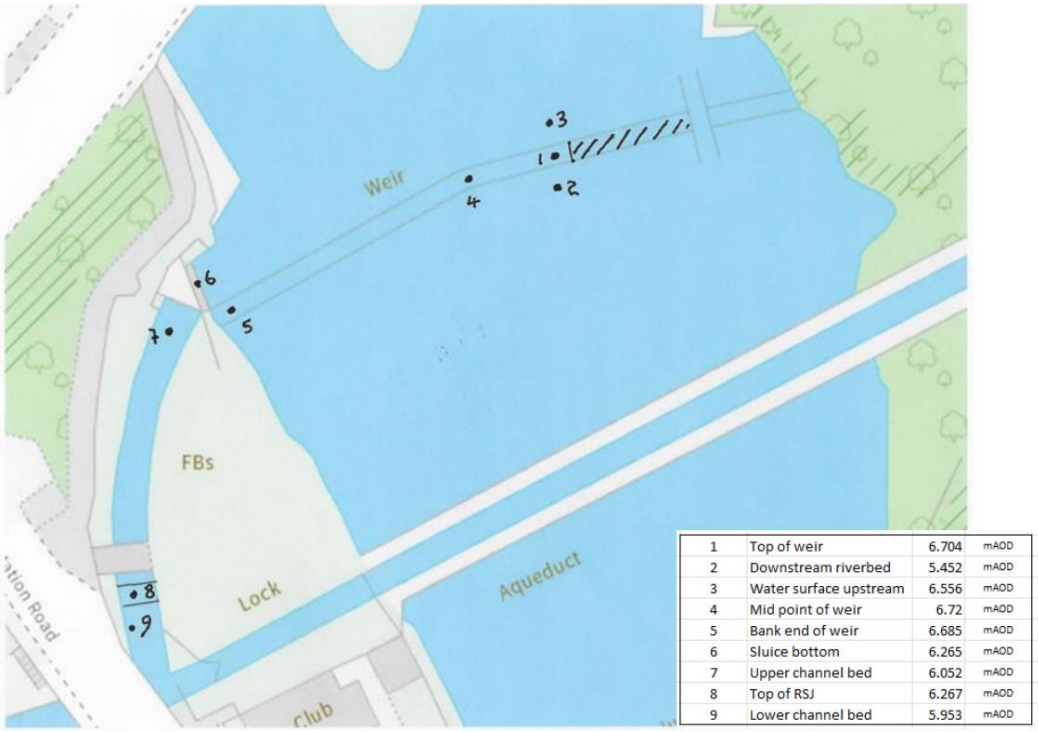
b) Maintenance of current arrangements to provide some passage of flow.

A basic level survey has been undertaken on the existing weir and channels (See Figure 8). This indicates that the existing arrangement currently has the ability to provide water to the Tennant Canal in most, and possibly all conditions.

During relatively low flow conditions the level of the River Dulais appears to be at sufficient top water level to enable flow to enter the channel that feeds the penstock forebay.

This is due to a weir effect at the exit of the River Dulais due to build-up of shale, stone and sediment, raising the water level at the exit from the Dulais above that of the River Neath. This build-up is likely transitory in nature, so it is not clear whether this is a

reliable longer-term solution without considering the sheet pile reinforcement described in Section 3 a.



1	Top of weir	6.704	mAOD
2	Downstream riverbed	5.452	mAOD
3	Water surface upstream	6.556	mAOD
4	Mid point of weir	6.72	mAOD
5	Bank end of weir	6.685	mAOD
6	Sluice bottom	6.265	mAOD
7	Upper channel bed	6.052	mAOD
8	Top of RSJ	6.267	mAOD
9	Lower channel bed	5.953	mAOD

*Figure 7 – Survey showing key levels**

* Levels were taken during a survey in February 2022. All levels relate to the weir crest level of 6.72m AOD indicated on record drawings of the fish pass.

Unfortunately, the channel feeding the penstocks is currently completely blocked with stone and sediment, as is the penstock forebay. These should be cleaned out at the earliest opportunity as has been customary to allow flow to reach the penstocks. The inlet channel leading to the Tennant also requires cleaning out.

Levels indicate that the Dulais top water level is typically at least 500mm above the level of the bed of the channel feeding the Tennant Canal. The concrete channel feeding the Tennant also contains a small removable control weir immediately before flow enters the canal (see Figure 9). This provides an additional hydraulic loss of around 300mm. However, the remaining 200mm (approx.) head would be still enough to provide flow into the Tennant Canal and the weir could potentially be lowered, or even removed to increase passage of flow.

Figure 9 – View of exit of channel feeding the Tennant Canal and removable control weir.

4. Abstraction of water

TCA recognise that reinstatement of the supply to the Tennant Canal involves a licenced water abstraction being in place. Previously such a licence was maintained by the Tennant Canal Company and was financially viable due to industrial customers buying the water. This business no longer exists and funds are not available to secure that water supply on the same basis.

If the supply to the Tennant Canal is reinstated it is important to recognise that the water transferred into the canal is transitory in nature and returned back into the River Neath and estuary at various locations such as the Bridge Street overflow. The water would have no other use, other than to serve to preserve the Tennant Canal and ecosystem before returning to the river/estuary. The water is simply 'borrowed' in that respect.

Consequently, TCA's expectation is that the license provisions do not seek cost for the actual water entering the canal, only the costs associated with administering the license.

Natural Resources Wales (NRW) advises that a '*Transfer License*' would meet this need.

5. Conclusion

There are three distinct options for a solution to reinstate flow to the Tennant Canal of ascending complexity, cost and reliability. These are referred to as immediate, interim and complete solutions, each could be implemented individually or in sequence. None of the three solutions impact water levels upstream in the River Dulais to any notable degree as they are all based on undertaking work at the confluence with the River Neath.

Immediate Solution

The first '*Immediate Solution*' option is that the long-standing, documented routine maintenance be reinstated by Leeder Property Consultants. This involves clearing out the shale & sediment in the feeder channel leading to the sluice gates, and in the feeder channel behind the gates.

Maintenance and possible repair of the penstocks would be required, together with a review of the manual operating procedures to ensure adequate, reliable flow control, and closure of the penstocks at times of high river levels.

Interim Solution

As an '*interim'* solution, TCA proposes the consideration of the installation of a short sheet pile containment supporting the naturally occurring bank of stones. This is to ensure that the water level of the River Dulais at the location of the weir is surcharged sufficiently to allow flows to gravitate to the Tennant Canal. The naturally occurring bank of stones means that this is currently the case.

The long-standing maintenance and operating procedures described for the 'immediate solution' would be required to continue.

Complete Solution

Thirdly TCA proposes as the '*Complete'* solution, reinstatement of the weir to its historically correct condition (pre 2015).

The long-standing maintenance and operating procedures described for the '*immediate solution'* would be required to continue.

None of the three solutions impact water levels upstream in the River Dulais.