EROSION CONTROL OPTIONS & RECOMMENDATIONS

A BRIEF REPORT TO ACCOMPANY THE OBERNE SITE VISIT ON JUNE 3 2014

Funded by Murrumbidgee Landcare Inc. Cross property planning (CPP) project through the Australian Government Clean Energy Future Fund and NSW Environmental Trust

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Many solutions exist to combat erosion, and a wide range of materials can be utilised. In this report, to reduce costs for the landholder, suggestions are made utilising locally available materials where possible.

Timber and brush is one of the most readily available local materials, with stands of native regrowth the most abundant source, and coppiced/removed exotics such as willows and poplars another good option.

While providing a source of erosion repair material, studies have shown that the thinning of dense stands of native regrowth can actually improve a number of aspects of woodland by increasing the individual growth rate of trees and improving biodiversity in the understorey. Contact your local land services about allowable thinning rates under current legislation.

Site 1

Location: "Waddon", 3062 Westbrook Road, Oberne

Erosion feature: Incised gully.

Length: 540 m.

Depth: 0.6m to 3.5m, becoming progressively deeper upstream.

Grade: 2.5% (1 in 40) to 10% (1 in 10) becoming progressively steeper upstream.

Catchment: 102 ha at the base of the gully (See Appendix A)

Stream order: 2nd

Owner's concern: Active erosion is resulting in sediment deposition in dams at the base of the gully, requiring costly removal.

Present gully condition:

Stock have been excluded for 12 years resulting in good groundcover recruitment.

In the lower half of the gully (blue line figure 1.1) both the floor and walls have stabilised except for isolated minor erosion where tributary valleys enter (Figure 1.2).

In the upper half of the gully (red line figure 1.1) the floor has stabilised, but there is ongoing erosion of the walls caused by two separate issues, 1) self-battering of the banks and 2) undercutting and mass failure on acute bends (Figure 1.3).

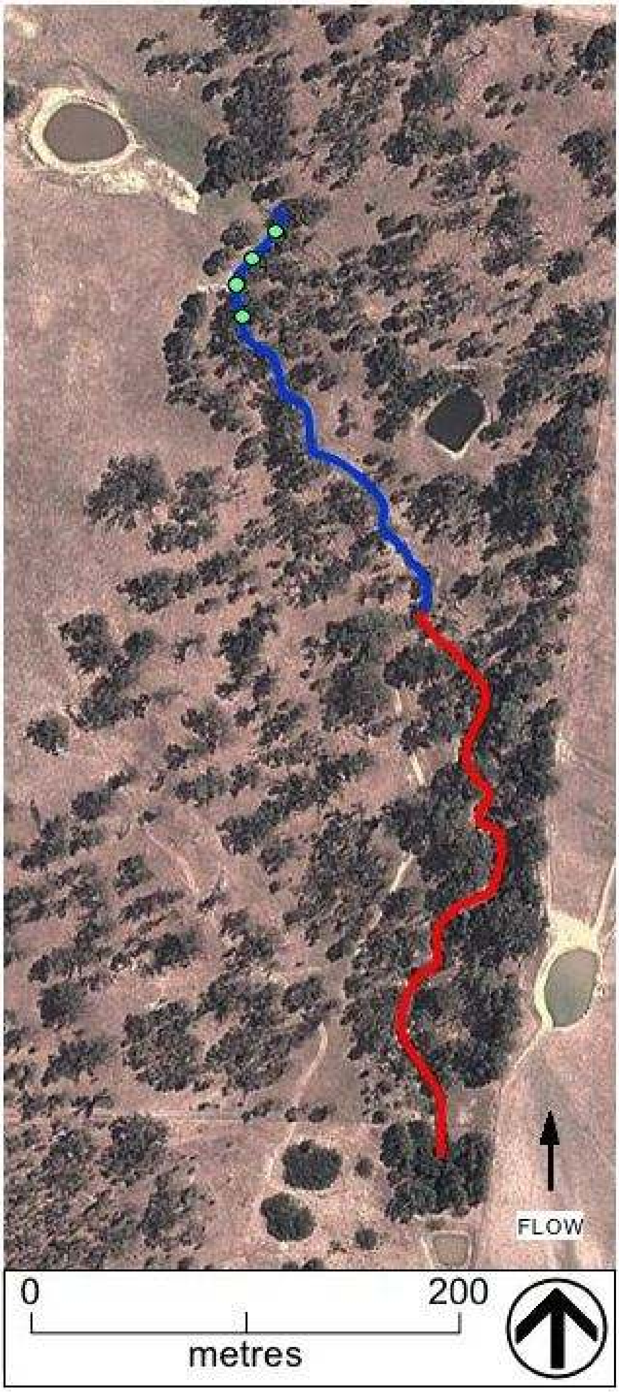


Figure 1.1: Site 1, erosion gully on Waddon

Figure 1.2: Waddon Incised gully – as a result of livestock exclusion, the floor and walls are largely stabilised in the downstream half.

Figure 1.3: Waddon incised gully – The floor of the gully has stabilised in the upper half but undercutting on acute bends followed by mass failure is a major source of downstream sediment.

Site 1 process: self-battering of gully walls

Active erosion resulting from the self-battering process is desirable from a management perspective. Over time the walls will naturally reach a shallower grade and, with sufficient management of grazing pressure, will stabilise with vegetation (as has already occurred in the lower section).

Management options

Much of the sediment resulting from this form of erosion will stay in situ but to reduce dam silting effects, two strategies can be adopted.

1. **Continued management of grazing pressure.** This ensures that good groundcover is present in the channel-bed to capture and stabilise any sediment washing downstream.
2. **Grade control structures.** These are low structures that span the width of the channel, creating a pool and encouraging deposition on the upstream side during times of flow. It is recommended that a series of 3-5 low brush weirs (< 250mm) be placed at the downstream end of the channel (green dots Figure 1.1). The shallow gradient in this location maximises the deposition potential behind the structures while also reducing the risk of failure due to the inherent reduced velocity. See Appendix C: Brush weirs for an overview.

Site 1 process: bend erosion

Erosion is occurring on acute bends in the upper section of the gully, with undercutting followed by slabs of sediment dropping to the gully floor and washing downstream.

Although this is a natural process following gully incision (as the channel finds a new equilibrium), this is both a major source of downstream sediment and, if this process extends in a downstream direction (figure 1.3) and breaks through into the gully further down, could initiate a new headcut as a result of the sudden change in base level.

Management options

Where severe bend erosion is occurring, some possible low cost strategies include:

1. Brush toe protection. Laying and pinning brush against the toe of the slope can minimise undercutting by deflecting flows and reducing velocity. See Appendix D for design recommendations.
2. Vegetation establishment. Tussock grasses established along the toe of the slope will play a similar to the brush will also binding the soil. A combination of brush (short term protection) and vegetation (long term protection) is ideal.

Site 2

Figure 2: Site 2, minor headcut on Waddon.

Location: "Waddon", 3062 Westbrook Road, Oberne

Erosion feature: Minor headcut retreating at rear of dam.

Headcut height: <0.5m

Catchment: 3.1 Ha (See Appendix A)

Stream order: 1st

Owner's concern: Upwards migration of headcut, sedimentation of dam.

Suggested Actions:

1. **Grazing protection upstream of headcut.** Placement of a 'tangle' of brush and logs in a 5m x 5m area upstream of headcut helps to protect grass growth and prevent grazing to < 0.5m. This helps to reduce flow velocity, while also supporting the growth of a deeper and more vigorous root system in this area (with the associated benefits to physical and biological soil characteristics). Ensure branches are placed with the butts downhill which helps to prevent flows from altering their course and shifting the problem area.
2. **Headcut armouring.** A rock rundown (Appendix E) is a simple solution for a low energy headcut like this. It simply involves battering the cut, laying down geotextile fabric, then covering with a layer of rocks (ute-load of ~100-150mm diameter rock), keyed together from the base up.

Site 3

Figure 3.1: Site 3, Headcut on Zenobia.

Location: "Zenobia", 2864 Westbrook Road Oberne

Erosion feature: Headcut.

Headcut height: 1.5m

Catchment: 71 ha (See Appendix A)

Stream order: 2nd

Owner's concern: Continued migration threatens the gully diversion dam.

Present gully condition: A headcut has retreated to the end of the contour outlet from a Soilcon gully diversion dam. When the dam and contour were constructed, the gully wall below the contour outlet would have been battered to disperse the flow. Since then, a nickpoint has commenced and flow is now concentrated. If left unchecked, the headcut will continue uphill along the blue line in Figure 3.1 towards the dam 30m uphill.

Management options

1. **Upstream vegetation establishment.** Whatever stabilisation option is chosen, appropriate vegetation establishment is recommended for the long term stability of the site. A dense fibrous root system is the most effective form of armouring. Although an exotic, the fibrous root system of Populus alba can provide an effective option when used as a tool for such purposes, as extensively demonstrated in New Zealand erosion control practices. Whichever species are chosen, armouring of the headcut is

recommended for short term stabilisation while the chosen vegetation establishes.

2. **Concrete flume:** A durable, long term engineering solution, but expensive for the landscape position ~ $6-8,000
3. **Rock armouring:** Similar to the rock rundown solution for site 3, but because of the scale of the headcut will require a 10m3 truckload of larger diameter rock and an excavator for a couple of hours for battering the cut and spreading the rock. Gypsum application is recommended above the cut to help stabilise the soil along with the establishment of soil binding vegetation.
4. **Brush packing:** Brush packing to armour the floor and walls of the headcut are not a permanent solution (the material will eventually rot), but could buy time while vegetation establishes upstream. Some battering of the cut would be carried out during construction with the brush/log material providing reinforcement. A cut of this size would require about a day's labour for two people (or could be completed during a workshop). There is plenty of woody brush material available nearby if thinning of the regrowth timber is carried out (See Appendix F for an example).
5. **Flow diversion:** The contour diversion outlet could be extended a further 8m to starve the existing headcut (Figure 3.2). This option would take only a couple of hours with an excavator, however, in the long run it would likely create a similar issue a little further downstream, threatening an area where trees and shrubs have been planted on Waddon.

Figure 3.2: Potential flow diversion path. Shrubs seen in the background, planted on by the owners of Waddon would be threatened if another headcut commenced as a result of the new flow path.

Site 4

Figure 4: Site 4, Headcut on Dellhaven.

Location: "Dellhaven", 53 Wilkinsons Road, Oberne

Erosion feature: Headcut.

Headcut height: 2m

Catchment: 8.4 ha (See Appendix B). The valley in which this headcut is situated is only 1.9 ha but the catchment has been increased by a drain which diverts flows to the north-east above the building infrastructure.

Stream order: 2nd

Owner's concern: The headcut moved rapidly during a large rainfall event in 2011.

Present gully condition: The change in base level as a result of the incision of the main creek has resulted in a large dropoff which instigated the headcut during intense rainfall in 2011 when the main erosion occurred.

The root system of a large Eucalypt, one of about a dozen which have been planted along the base of the flow line (Figure 4), has played a significant role in halting the headcut migration.

To armour the sizeable headcut using concrete would cost approximately $6-8,000. Because of the 50m long line of natural soil reinforcement in the form of the large established eucalypts, I suggest that it isn't worth going to this expense.

Some scour has occurred back in under the tree lowest in the valley. To prevent further undercutting it is suggested that the face of the headcut be packed with either brush or old rolls of fence wire to disperse the impact of the flow as it pours over the headcut (it will need to be fed in under the vertically hanging roots seen in Figure 4).

Contact between the brush/wire and the face of the cut is important. This intercepts and prevents low flows from running down the face and dispersing the sodic B horizon. Lining the face with geotextile fabric pre-packing will also assist.

The brush/wire in the base of the cut also helps to retain any A and B horizon which slumps into the cut, providing reinforcement to the natural battering process.

Lopping of the large branches which are angled towards the headcut/creek is recommended. This will help to take weight off the tree and reduce the chance of it toppling over. The branches would provide reinforcement and packing material at the base of the headcut.

All material should be staked and wired to prevent it floating off when the creek levels rise.

APPENDIX A

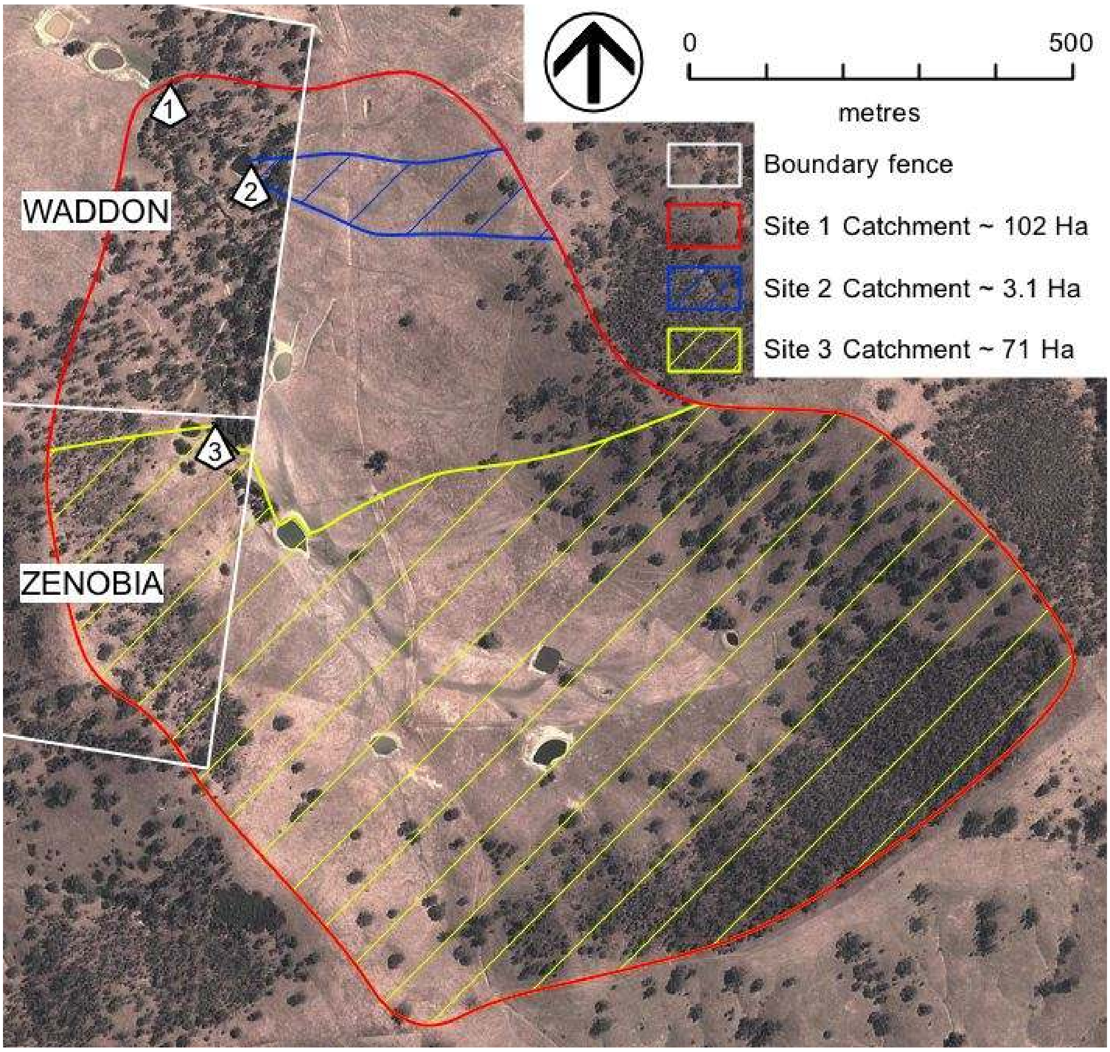


Figure A1: Erosion-site catchment areas on ‘Waddon’ and ‘Zenobia’.

APPENDIX B

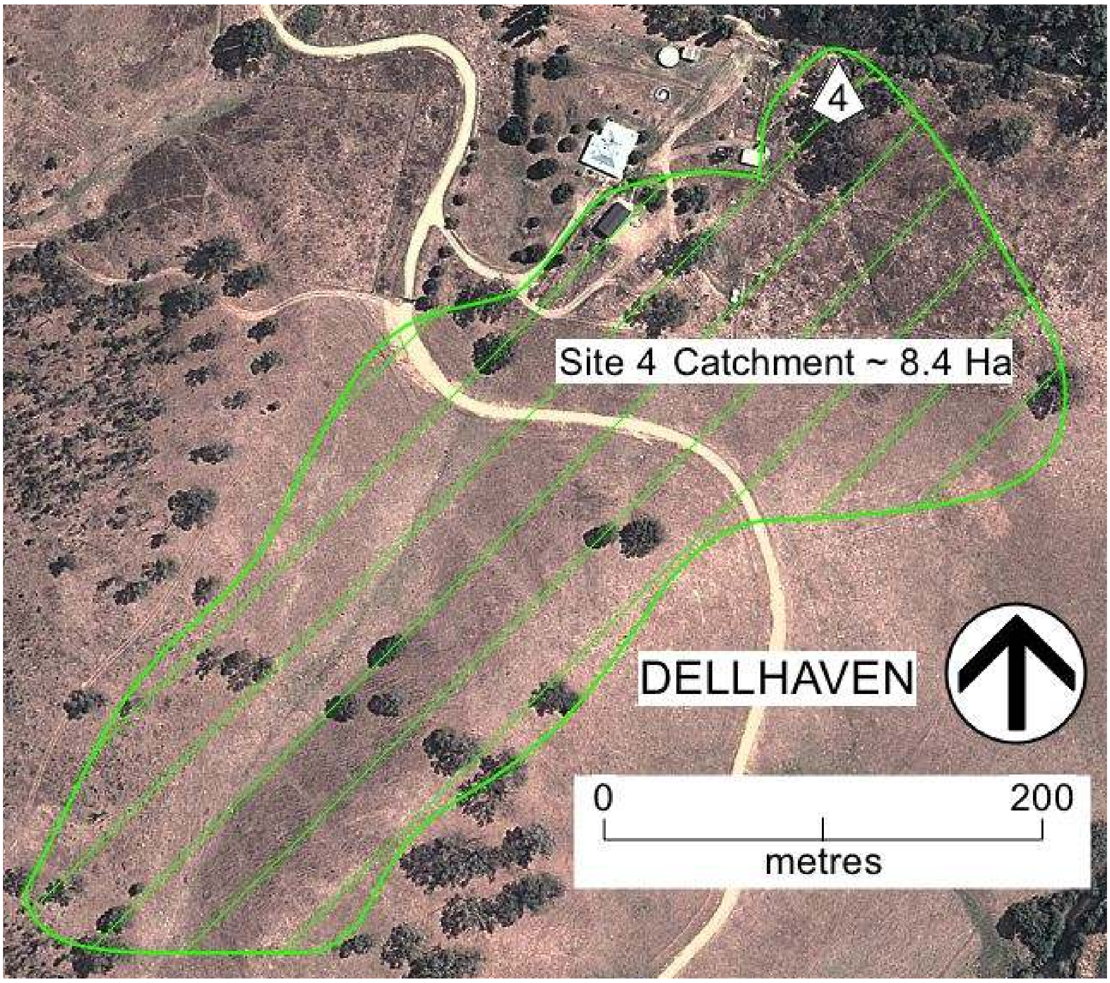


Figure B1: Erosion-site catchment area on 'Dellhaven'.

The following appendices are general guidelines only and not intended as a set of detailed design instructions. Seek professional advice prior to the construction of works.

APPENDIX C – BRUSH WEIR

Siting

A straight section of channel, mid-meader. This reduces the risk of the structure outflanking. The shallower the grade the greater the potential volume of deposition.

Step 1: Logs (see right)

1. If steep, channel walls are battered to an appropriate grade.
2. Logs of about 200mm diameter are arranged in a V pointing upstream, matching the channel and battered bank profile. This provides the footing for the structure.
3. Steep posts and wire keep the logs in place

Step 2: Brush

4. Brush material is arranged on the downstream edge of the logs, lowest in the centre and protecting the banks from outflanking. This is wired to the footing logs. Steps of <300mm reduce the chance of scour undermining the structure.

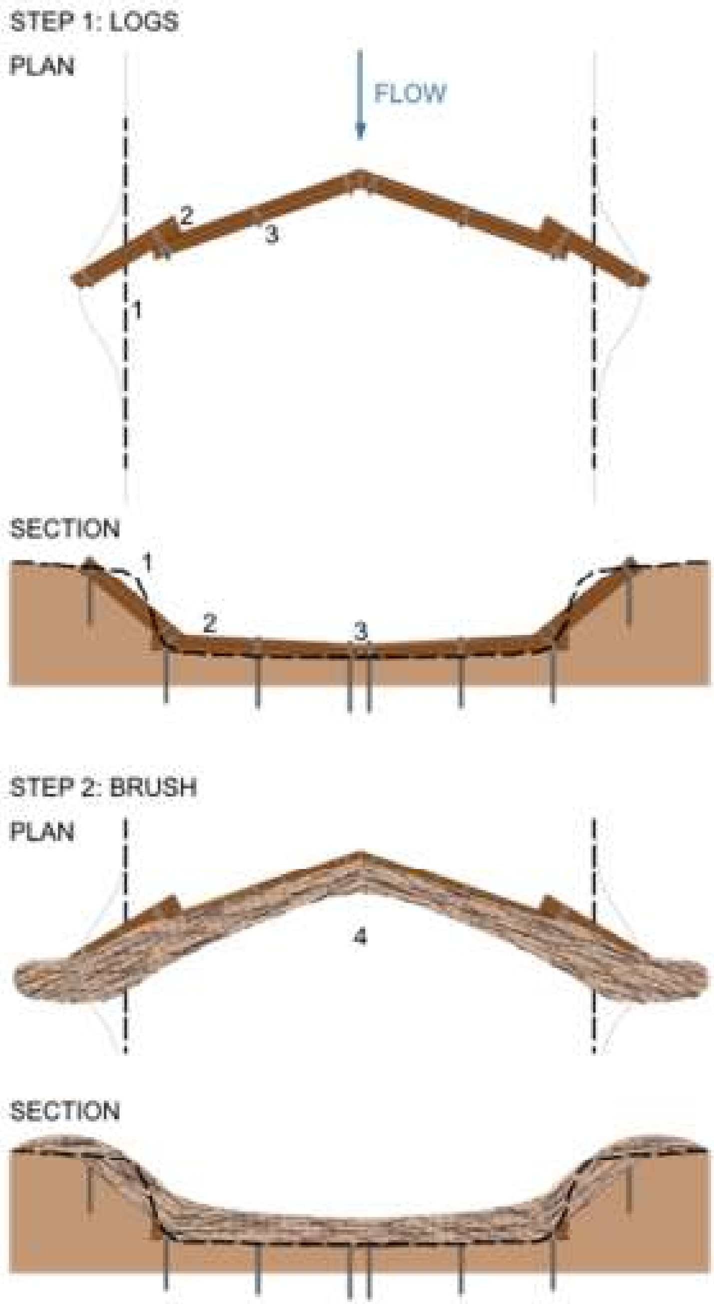


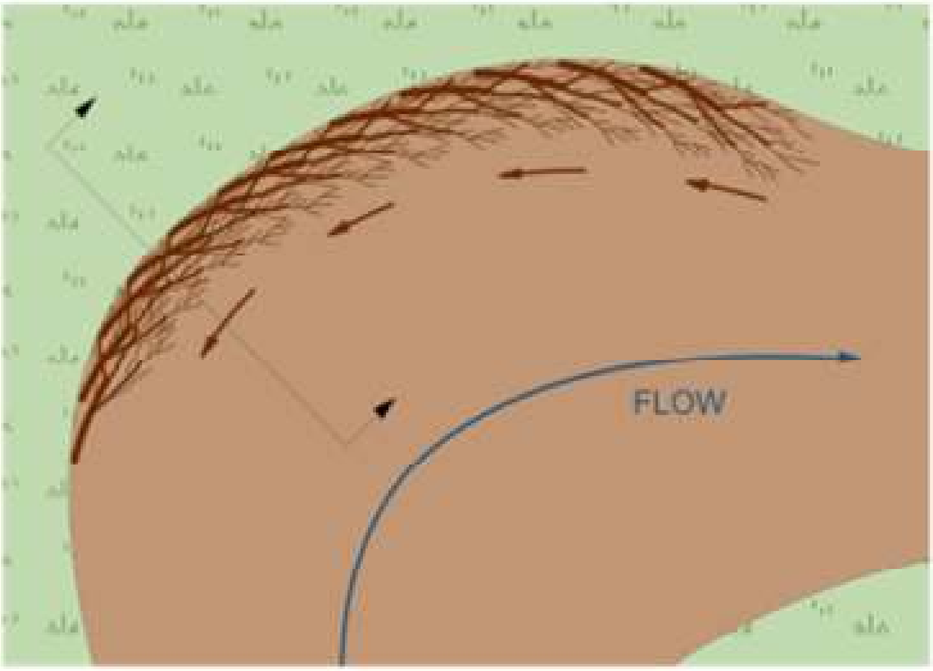
Figure C1: Plan and section of brush weir construction

Figure C2: Brush laying commences following the securing of the logs.

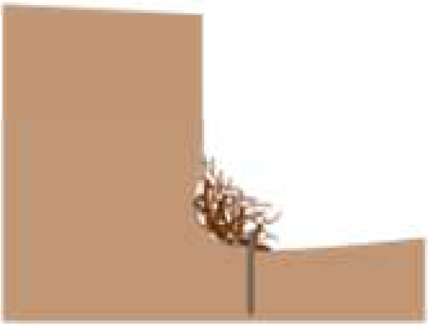
Figure C3: Brush in place ready for stomping down and wiring to the logs. The brush is laid in alternating directions and overlapped to ensure it binds together well. Any material can be used, but prickly material like this Hawthorn binds together particularly well.

APPENDIX D: BRUSH TOE PROTECTION

PLAN



SECTION



Brush is laid to protect an outside bend where scour is occurring. The brush is laid against the toe of the wall with the butt end upstream (blue line indicates flow). Laying begins at the downstream end, working up (brown arrows)

Stakes and wire help to keep the material in place.

APPENDIX E: ROCK RUNDOWN

A good option for armouring low energy headcuts.

The headcut is battered, compacted and lined with geotextile fabric (Figure E1).

Rock lining commences at the base with a solid footer that is level with the current channel bed. Rocks are keyed into each other working up to the top (Figure E2).

Wings help to ensure flow pours over the armoured face (Figure E2, top). Sod and good topsoil or compost is placed against the top of the structure to help secure this area. Compost scattered over the rocks assists with vegetation establishment.

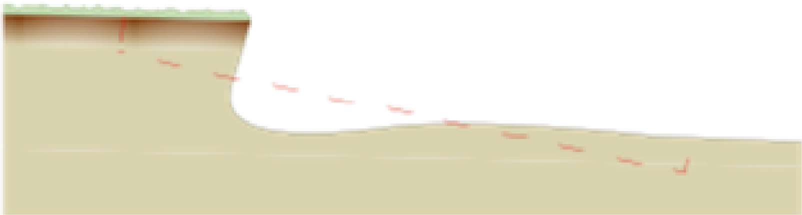


Figure E1: Headcut cross section and the battering profile (red)

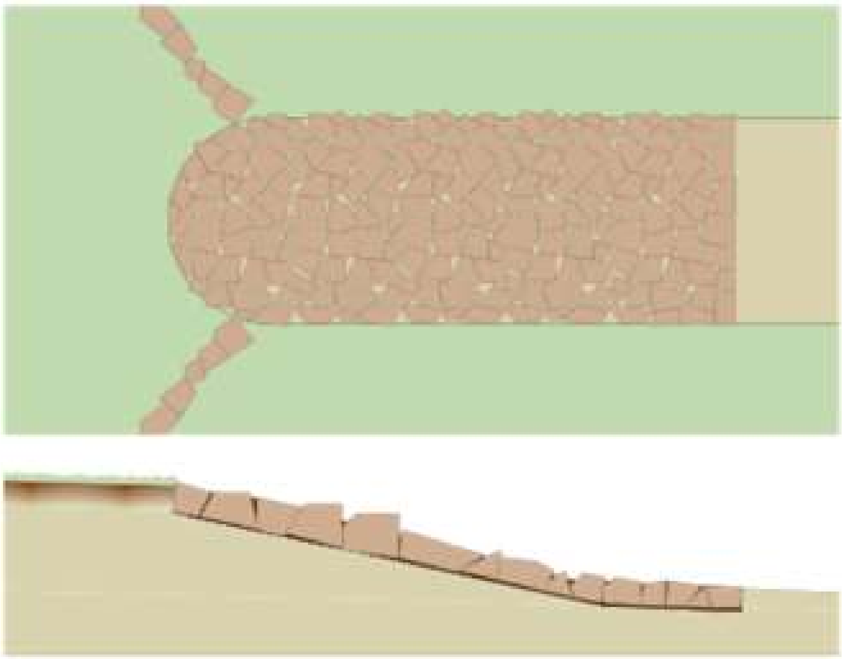


Figure E2: Plan and section of a rock rundown.

APPENDIX F: BRUSH PACKING

Figure F1: Brush is laid across the battered face, butt end upstream, working uphill. While battering, soil and brush laid in alternating layers helps to reinforce the soil.

Figure F2: Brush is carefully packed against the face and under the lip of the A horizon. This helps to intercept any undercutting flows and provides reinforcement if and when soil does break off. This process should be repeated on any damage in the future.

Figure F3: Heavier logs, wire and stakes help to weigh down and hold the surface brush-mattress in place. Logs staked on contour just below the face and a careful final packing are critical. A ‘tangle’ of branches above the face will protect both grass growth from grazing and the cuttings of poplar which have been planted in an offset pattern.