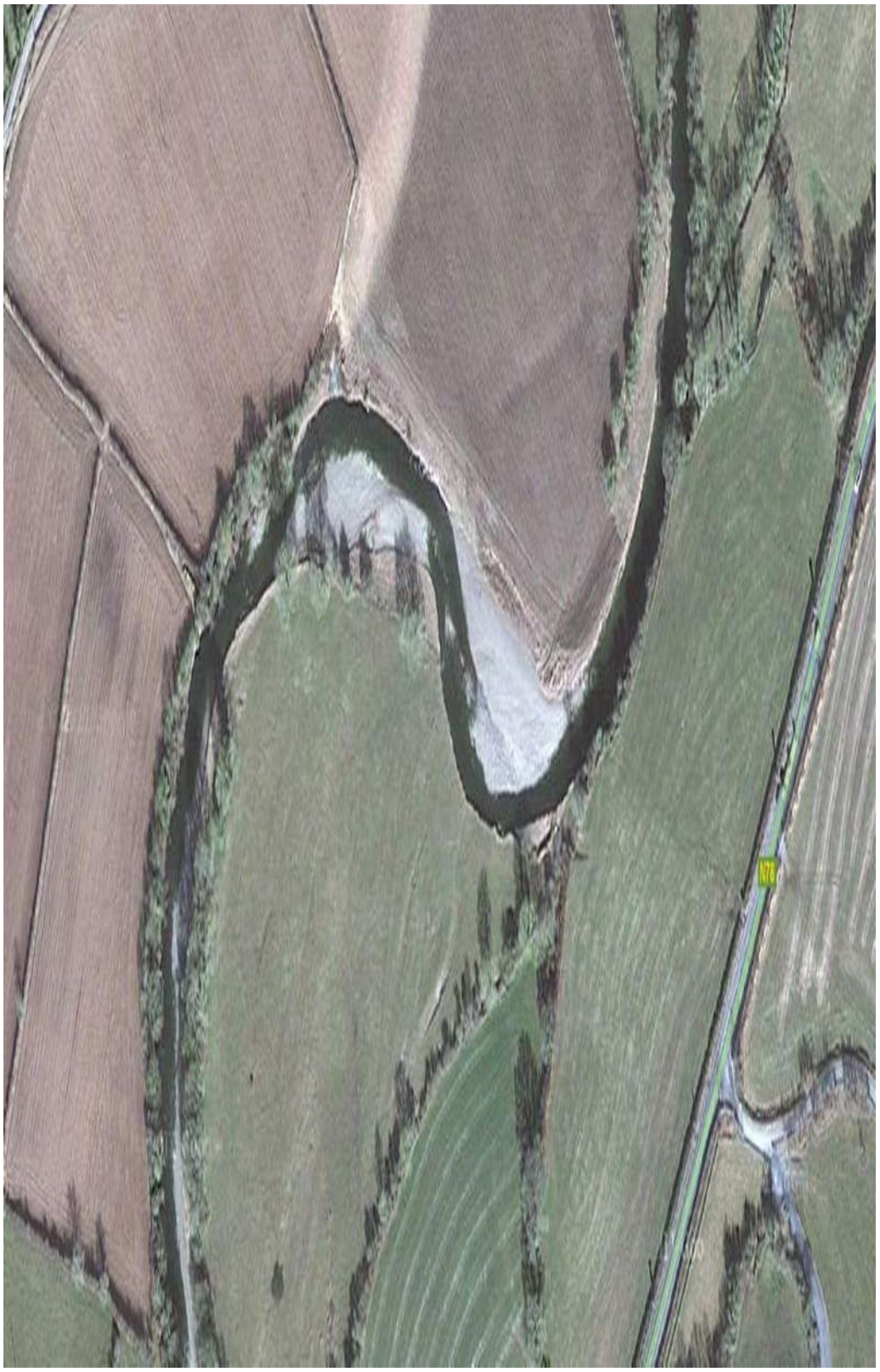
Dinin River Catchment
Agriculture and Sustainable River Management



Introduction

In 2011, the Dinin Farmers Action Group was formed in response to an alarming increase in the rate of erosion and land loss of agricultural land in the riparian zone and floodplain of the Dinin River. It is the remit of the group to engage in a multi-disciplinary approach with statutory and non-statutory organisations to facilitate a mechanism by which a long-term process combining site specific and catchment based protocols can be applied to stabilising the riparian zone of the river in a manner that is cost effective, reasonable maintenance and possibly provide a supplementary income.

Outline of Proposal

On the basis of this brief the Dinin River Riparian Rehabilitation Programme has been formulated. The proposal is designed to formulate an action plan that will assist and compliment obligations under the WFD, undertaken by various statutory organisations including IFI, NPWS and EPA staff. The programme aims to provide a framework of sustainable and cost effective riparian management whilst providing protection to the natural infrastructure of the river floodplain and an income for the farming community in the project area along the main channel of the Dinin River. The outcome of the program will be enhanced resilience to flood and riverbank erosion risks in the project area in conjunction with the enhancement and protection of the river corridor for all flora and fauna.

The anticipated outputs are:

(i) Enhanced integrated flood and riverbank erosion risk mitigation measures, which will consist of non-structural and bio-engineered structural measures for selected priority river reaches, effective measures to sustain infrastructures involving local agricultural communities, support for enhancing local agricultural communities flood/erosion risk management capacity in the project areas, and livelihood enhancement for project zone of influence; and

(ii) A strengthened flood and river erosion risk management system, including an improved knowledge base in sustainable operation and maintenance and long-term river erosion management through education and onsite tutorials in both riparian management and soft engineering principals for bank stabilisation.

The progression of a required programme of river restoration on the Dinin SAC initially will require the prioritisation of actions, logical sequencing, costing, and securing delivery mechanisms. The programme will be based on multi- partner working, time horizons suited to the nature and scale of each site's problems and solutions (ranging from 3 to 50 year time horizons), a negotiated settlement to any disagreements, and a best endeavours approach to implementation. Assisted natural recovery will always be encouraged wherever possible, rather than implementing costly, high-intervention measures.

Detailed reach-level plans will be produced and agreed with landowners, and communicated between other users of the river and the wider local community. It is important to stress that the willingness of the farming community to engage on such an organised and unified manner has contributed greatly to the progress that has been made and will ultimately facilitate the long-term success of the project.

Funds need to be secured to maintain best endeavours over time, including rolling bids to obvious budgets such as the SCF (Salmon Conservation Fund, WFD River Basin Management Plan (RBMP) delivery, the Riparian Woodland Afforestation Scheme and the Agri-Environment Options Scheme (AEOS), but also opportunistic bids to a range of other funding sources including European programmes. Work in-kind from third parties, including 'third sector' partners such as the Nore River Trust, Universities and Institutes of Technology is also a critical part of best endeavours that forms an important part of the proposed design and implementation of the plan.

It is hoped that within the farming and local community on the Dinin, that the roll out of a river restoration plan will greatly increase confidence in a large-scale, strategic approach to river restoration and their stewardship, and feed into decision-making about restoration of the wider river network under the EC Water Framework Directive.

Proposals for 2012

<u>Application to the Salmon Conservation Fund for Site Specific Treatments Workshop</u>

The Dinin Farmers Action Group have had a series of meetings with representatives of the NPWS and the Nore River Trust; and through these meetings and site visits it has been established through the personal experiences of the farmers that the current riparian and floodplain management techniques historically applied by the farming community along the river corridor of the Dinin are not protecting their land nor facilitating their logistical needs. Fords and crossing points are being washed away or causing collateral damage to the banks, large areas of riverbank and fields are being lost, fencing has often been ineffective and of most concern is the braiding or the movement of the river channel following flood events. It is proposed through a series of initiatives, onsite workshops and catchment specific information, to work with the farming community and together, facilitate a range of both management options and onsite works to reduce the impact of flood events and in turn provide a sustainable long term solution to the problems associated with farming the riparian zone and floodplain of the Dinin River.

Site Specific Treatments in Bioengineering and Revegetating the Riparian Zone

In 2012 it has been proposed that two landowners who have experienced considerable land loss and channel braiding would act as a test site to showcase a range of techniques aimed at stabilising the bank of the river and establishing a vegetated zone between the bank of the river and their fields. It is the aim of this workshop to show that not only do river engineering schemes that work with rather than against the natural processes and forms of a stream produce fewer negative impacts, but they will in the long term also require less intensive operational maintenance and are therefore generally more sustainable.

Specific Sites 2012

It is proposed to engage a range of options of treatment on this section of the riverbank to prevent further erosion and to stabilise the river channel and prevent its further migration into the field. The techniques to be employed will be:

Site 1

Site 1

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Site 1

Site 1 is a total of 135m of bank on the true left hand bank of the Dinin at Muckalee (gps reference N52 45.683, W7 13.733)

The first section of Site 1:

- 75m of reprofiling, regrading, willow mattress and panelling. A range of treatments will be applied to this section as the nature of the bank substrate is primarily clay and clay based loam and will respond well to a range of techniques. The work will involve grading sections to an angle of repose of 1:3 and applying an erosion mattress with a willow fascine overlay. A small section only requires a slight regrade and the application of willow fascines to establish vegetative cover. The end of the first section of site 1 will require willow panelling as it is the transition area into the high erosion area of site 1 and the bank material is changing from 100% clay loam to a higher percentage of alluvial gravels.

The second section of Site 1

- 60m of rock armour and willow panel revetment in a hybrid system; essentially a rock armour toe with stone of a D50 of with a coir erosion mattress liner behind the stone and the bank re-profiled using terraced willow revetment. This work will be undertaken just above, through and beyond the apex of the outside of the bend in the river where the rate of attrition and shear stress is greatest. This is the vital section of the work and the highest rate of investment relative to the total works programme.

It is anticipated to undertake all the work on sites 1 and 2 as part of a workshop for the farmer's action group and produce written material on design techniques, maintenance and fencing, statutory and legal obligations and timing of works etc.

Site 2

Site 2 is a classic high bank cliff face that is depositing large amounts of both soil and alluvial gravels into the Dinin River. These are notoriously difficult to treat and unfortunately are a regular occurrence within the Dinin catchment.
The site has been surveyed to understand the issues relating to the initial collapse of the bank and it has been established that it is not as a result of land practices on the land above nor piping of water through the bank nor slumping. It has been caused by attrition and shear stress at the base of the bank, where poorly developed riparian vegetation at a transition point 10m upstream of the centre point of the landslide, caused the bank to unravel and erode and the bank became undercut and collapsed.

It is proposed to set a rock armour toe with boulders of a D^{50} of 1.1m on the historic line of the bank prior to the collapse of the bank. The rock armour transition points will be protected by well established vegetation on the downstream side of the landslide and by previous bank protection works on the upstream side of the landslide. A coir erosion mattress will be inserted behind a wall of rock armour and back filled with cobble deposits from a large deposition bar on the inside of the bend of the river at this location. The river channel in this section as become very wide and the deposition of cobble is continuing to exacerbate the erosion problems in this vicinity.

Erosion mattress will be locked in behind the stones and clay will be set and compacted on top of the cobble and a line of willow panels will be set into the clay and topsoil set between the willow panels and the cliff face. The top of the soil bank will be protected by an erosion mattress and willow fascines will be pinned into the soil, through the erosion mattress to create a brush mattress.

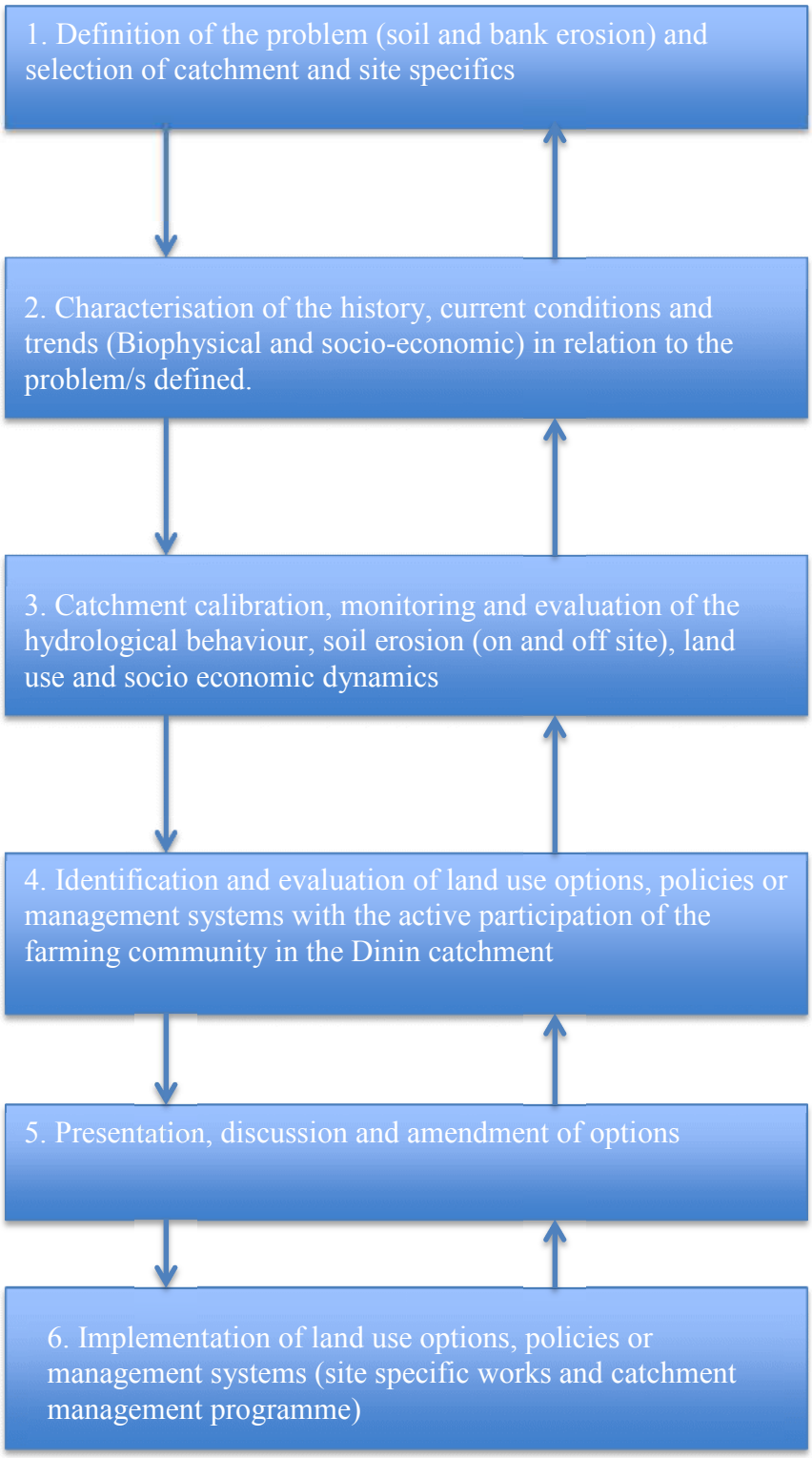
The elevation of the top of the willow panels will correspond to the elevation of the flood profile in a ten year event and it is envisaged by protecting the toe of the structure and establishing a thick base of vegetation that the bank will stabilise and in turn the river channel will stabilise.

Site 2

Feasibility Study and LEADER

It is proposed to seek funding from LEADER to undertake a feasibility study in respect of establishing a core of baseline information within the catchment. It is hoped through the feasibility study to clearly delineate the specific requirements of the programme and to set out in detail short, medium and long-term goals. It is also expected as an outcome from the study to find sources of funding from the agri-foods sector through corporate sponsorship. It is also expected to develop the framework for an outreach strategy within this phase of the programme to further highlight the proposed works and involve as many people from the local community as possible. It is proposed to also engage two BSc students undertaking theses to assist in information acquisition and processing and take an active role in conjunction with their faculties in specific components of the project proposals from 2012 to 2014.

The following flow chart outlines the key components of the project



What are we trying to achieve?

- A mechanism by which farmers can achieve long-term sustainable income from the riparian zones on their farms.
- The protection and stabilisation of the riverbanks, which is critical in preventing the loss of agricultural, land and protects the aquatic ecosystem.
- The long term protection of valuable spawning and nursery rivers to provide a sustainable supply of salmon and trout to the River Nore for the tourism market…protect the supply chain and increase productivity…these are the keys.
- Enhance the potential of the Dinin River to the rural communities and how they view river systems. Amplify the good that can be achieved and how to protect against the nature of flood events.
- Establish how a revenue stream can be generated by riparian zone afforestation…and investigate how corporate responsibility and their environmental programmes can be utilised between agriculture and the river environment.

Four Main Parameters to be addressed:

1. The management of the riparian zone in relation to livestock and land management
2. The impact of drainage and utilising established methodologies for instigating buffers to reduce the rate of conveyance and create attenuation within defined areas of the catchment
3. The management of the floodplain and the establishment of engineering works to alleviate damage to the riparian zone and floodplain utilising a suite of peer reviewed methodologies including soft engineering techniques, the establishment of sustainable broadleaved forestry and other riparian buffer zone techniques.
4. Hydrogeology; it will be vital to understand both the movement of water above and below ground and the nature of the geology within the catchment to assess exactly why the nature of the recent flood events have created landslides, investigate riverbank attrition rates relative to the transportation of materials and analyse precipitation patterns in the catchment over a defined period of time.

A Brief Overview of the Dinin River Sub-Catchment

The Dinin system is one of the major tributary rivers of the River Nore catchment. It can be described as a high-energy river and the physical and geological nature of the river catchment in conjunction with socio-economic practices has given rise to changes in channel morphology in sections of the system resulting in areas of high erosion, land and fluvial habitat loss and channel braiding. The Dinin sub-catchment consists of the River Dinin, River Deen, Killeen River, Clogh River and a number of smaller named streams.
The Dinin was a renowned Atlantic salmon spawning and nursery catchment but in recent years the impact of local, European and possibly global factors has reduced the efficacy of this river system as a major producer of salmon.

Fig: 1 Lower reaches Dinin River. Winter flood events throughout 2007 and 2008 caused extensive damage to the natural structure of both the channel morphology and riparian vegetation.

Fig: 2 The natural substrate composition of the Dinin River is very suitable for Atlantic salmon and historical information sources imply that the Dinin was a highly productive aquatic ecosystem. Habitat degradation in the Dinin River is one of the negative limiting factors for indigenous fish species the river ecology

Fig: 3 This extensive landslide is one of a number of such events identified in the Dinin sub-catchment in 2007.

Fig: 4 The Dinin River immediately downstream of the 'Metal Bridge', where riparian vegetation has been maintained and managed the channel remains intact and high quality physical habitat for salmonids, and river and brook lamprey is abundant.

Fig 5: This carving set into a bridge crossing a tributary of the Dinin River indicates the importance of the species to the local community in this area. This particular tributary had runs of hundreds of salmon every year and historically in times of hardship; the fish were caught on the spawning beds to provide a food source.

DININ RIVER

ECOSYSTEMS AND **BIODIVERSITY (NPWS Perspective)**

The problems and issues referring to the Dinin River are underscored by the impact on the ecosystem. These are: -

- Siltation – affecting the gravel beds
- Channel widening and braiding – affecting water temperature and water levels
- Nutrient loading – affecting oxygen levels and increased algal growth.

An integrated approach to addressing these issues will have a lasting affect on the entire ecosystem. The National Parks and Wildlife Service (NPWS) are concerned about the losses to both species and habitat diversity and are committed to reversing the decline.

The current discussions incorporate a number of biodiversity related solutions to the underlying issue of habitat stability including: -

- Riparian Woodland afforestation Scheme – this recently established, Forest Service funded scheme is ready to be field-tested. In the past the Forest Service has not funded planting within 10m of Special Areas of Conservation (SAC) rivers due to the potential for damage to the freshwater system from traditional forestry practises. In recent years Forest Service and NPWS have combined to address some of the previous difficulties. It is now proposed to fully fund, at the highest available rate, establishment of native woodland within the riparian zone. The woodland would be managed sustainably both for commercial and ecological purposes. Woodland establishment is essential to the long-term stability of the fragile riverbanks within the Dinin system.
- Agri-Environment Options Scheme (AEOS) – this Department Of Agriculture scheme is the follow-on from the Rural Environment Protection Scheme (REPS) and is targeted at creating and enhancing on-farm biodiversity hot spots such as riparian zones. Options include establishing and managing species-rich hay meadows on the flood plain, planting of riparian woodland strips or planting wild bird crop mixtures. SAC's immediately qualify for the scheme as they meet all the set targets.

NPWS have identified the potential benefits to the river ecosystems of adopting a sustainable approach to riparian zone management. These include: -

- Reduction in siltation resulting from the stabilisation of the riverbanks.
- Decrease in summer water temperature (prompted by an increase in river depth and an increase in shading from bank-side vegetation).
- Establishment of a habitat mosaic, which can be sustainably managed.
- Introduction of a degree of ecological stability into a chaotic ecosystem.

Overview of Some of the Problems Identified on the Dinin

- The loss of riparian vegetation
- The impact of catchment wide land drainage
- The historical dredging of riverbed and bank gravels
- The use of hard revetments and instream works associated with farming logistics
- The change in weather patterns particularly precipitation events

<u>Outline of Localised Land-based Impacts and Current Practices</u>

Agricultural:

1. Arterial Land drainage within the Dinin Catchment

   Agricultural drainage impacts on the water and sediments of the river system. Land drainage has been used since the mid 18th century in Ireland to increase the suitability of land for cultivation. As a consequence, it has been suggested that in times of flooding or heavy rain, water levels have risen and fallen much faster (i.e. floods have become more flashy) as a result of drainage.

   Drainage and ditching lower the water table to enable agriculturally desirable plants to grow more productively. Water falling on the land is transported away more effectively. Thus, in drained catchments, river flow matches the rainfall profile more closely than in a natural catchment (although there will be a time-lag relating to catchment characteristics and the preceding soil saturation level). Drainage reduces the natural buffering capacity of the catchment against floods, so the magnitude and frequency of floods downstream will be increased. Conversely, as the natural 'sponge' effect of the land is reduced, drained land may be drier for longer. Lowering of the water table is also detrimental to wetland communities.

   Drains (in filled ditches with plastic or clay pipes in them, either with or without gravel backfill) are used in fields to encourage subsurface flow, whereas open ditches are more common in upland areas where overland flow predominates. Generally, field drains are not responsible for large sediment inputs, but do cause an accelerated throughput of water. They constitute a long lasting alteration of the natural flow regime and have become part of the 'natural' process of surface water run-off

   The construction of flood embankments to protect agricultural land from inundation is noticeable, particularly in the upper reaches of the Dinin catchment. The river invariably breaches these banks in periods of high flood, often repeatedly at the same point. Flood damage costs to the farmer include loss of crops and topsoil, embankment reconstruction costs, and unnaturally high rates of channel change. Embankments will cause the height of flooding to be increased downstream since they

prevent water occupying the floodplain, therefore increasing the likelihood of damage to neighbours property.

2. Livestock

   Trampling by cattle and sheep can compact the soil causing increased run-off. Livestock also trample and feed on vegetation, the root systems of which bind soil together. The destruction of vegetation reduces both the interception of rainfall by plants, and the resistance to run-off created by the plants themselves. This means that more of the rain falling on the land runs off into the watercourse immediately after it has fallen, increasing soil erosion and sediment transport. Heavy grazing of the riparian zone will affect the plant community, reduce shading for fish and perhaps reduce beneficial inputs to the stream

   Livestock can break banks down by trampling. They can increase bed roughness by repeatedly crossing the stream at certain points (this locally increases flow height), and they disturb the bed, temporarily increasing suspended sediment concentrations Increased bed roughness and loose soil from trampling, increases the susceptibility of banks to erosion, particularly during flood flows. In addition, the shear weight of livestock on a heavy saturated bank could cause slumping

   Livestock can be excluded from riverbanks by fencing off erosion prone areas. This also allows a natural riparian zone to develop, improving marginal shading of the stream and riparian habitat diversity. There is however, some concern that larger riparian shrubs increase flood damage by increasing frictional resistance and roughness, producing eddying Some managed access or riparian zone grazing may form an effective compromise and allow livestock continued access to water

Piecemeal Bank Revetment and Historical Perspective

Historically, it has to be noted that piecemeal bank protection has often been undertaken on the Dinin at sites where farmland is being eroded. Methods include dumping boulders, concrete and car bodies against the eroding bank. The use of such 'hard' material tends to alter instream flow dynamics, deflecting the main current and causing bank erosion immediately downstream. These types of bank protection works are now widely questioned on environmental grounds, as they are visually intrusive, reduce bankside habitat availability and alter natural instream and bankside processes. Other 'hard' bank protection methods include, the use of current deflectors (though this may cause erosion on the opposite bank), the use of gabions, and occasionally the use of built stone or concrete walls. Conversely soft engineering involves planting and the use of geotextile and natural filter layers, and aims to dissipate rather than deflect the river's energy. It is generally cheaper, has a longer life span, better for the environment and is less obtrusive than 'hard' engineering.