

Managing Gully Erosion

Prevention is definitely better than cure. Repairing a gully once it has developed can be expensive, requiring a long-term investment. Unless gully repairs are properly designed, constructed and maintained, they can be unsuccessful. Regular monitoring is needed to prevent gullies from starting. It is important that the early stages of gully formation are detected and action is taken quickly, before a gully develops into a problem. The key to preventing gully formation is managing water movement. Some common measures to prevent the development of gullies include:

- **Planning and developing agricultural properties so that:**
 - Land is managed to ensure runoff is not increased.
 - The capability of land is assessed and its use does not exceed its capability.
 - Roads, fences and laneways are located and constructed so that they do not divert and concentrate runoff.
- **Manage grazing land so that:**
 - Stock are excluded from land that is vulnerable to gully erosion until the area is completely rehabilitated, then grazing can occur with careful management to maintain adequate groundcover.
- Water points, stockyards, shade areas and gates are located away from gully-prone areas.
- Contour banks (if present or where existing ones are not required) are properly maintained or levelled or gaps created to safely disperse runoff. Contour banks are normally not necessary on well-managed pasture land. Poorly maintained banks in such situations may lead to rilling and gullying.
- Grazing pressure is managed to ensure adequate cover is maintained throughout the year.
- **Manage crop land so that:**
 - Stubble is retained.
 - On sloping cultivated land, contour banks and waterways are constructed to the correct specifications and are stabilised and maintained.
 - Contour banks discharge into waterways in safe locations.
 - Practices that concentrate flood flows are avoided, particularly on cultivated floodplains.



Image 1: Eroding gully.

Controlling Gully Erosion

Vegetation is the best long-term tool for preventing and controlling gully erosion. Designed structures may be required in conjunction with revegetation to stabilise a gully head or to deposit silt and promote vegetation on the gully floor. However, if structures are poorly maintained, they will progressively deteriorate, becoming less effective over time. By comparison, vegetation can be self-sustaining or even improve over the years.

Designed gully control structures may be made of concrete, masonry, wood or other building material. However, designing and constructing such structures requires specialised skills and may be expensive.

When deciding what action to take to control a gully the following factors should be considered:

- **The cause of the gully.** There is little point investing heavily in a structure to control a gully without doing anything to address the root cause of the problem.
- **The impact of the gully.** What are the consequences of taking no action and how does that weigh up against how much time and money it will cost to control the issue.
- **The size of the gully catchment.** The larger the catchment, the more complex the problem.
- **The type of soil in which the gully occurs.** Vegetation will establish more easily and grow more rapidly in fertile soils. Erosion problems are more likely to occur in poor soils.
- **The components of the gully.** Is the gully head, the floor or the sides eroding most actively? Does the gully have branches? What is the height of the gully head?
- **The potential to divert runoff away from the gully.** Is there an option to divert runoff flowing into the eroding gully to a safe disposal area?

The key to success with most gully stabilisation is choosing the right time of the year to do the work. Autumn is generally the best time for most of Queensland as there is less chance of high volumes of runoff. Autumn also offers the best prospect of sufficient soil moisture and warmth to successfully establish and grow vegetation.

Using vegetation

The right sort of vegetation in a gully slows the flow of water, protecting against further scouring and minimising the risk of erosion. Once vegetation becomes established it can change conditions in the gully to be conducive to further growth. This is because as the flow of the gully is slowed by the initial vegetation, sediment is deposited forming an ideal environment for more vegetation to establish. However, gullies can be a harsh environment in which to establish vegetation in the first place. They dry out very rapidly and the substrate is usually infertile subsoil.

Vegetation that grows vigorously with a spreading, creeping habit is preferred for gully control. This is because plants with these characteristics do a better job of stabilising the soil. When choosing species, preference should be given to local native plants, especially in areas where exotic species are undesirable, such as natural vegetation or areas near waterways from which weeds may readily spread. However, in agricultural areas there is usually a range of exotic grasses and other species already well established that are suitable and/or have been used with success for controlling erosion. For example, stoloniferous or creeping grasses such as kikuyu or Rhodes grass. It is always advisable to seek the opinion of local experts as to whether a plant you are thinking of using has potential to become a weed.

It is recommended that gullies being treated are fenced for stock access management. Stock are attracted to gullies, especially if they include shade trees. This can expose the area to excessive grazing pressure which can damage vegetation, compact the soil and expose it to further erosion. If water is available, it should be used to irrigate the vegetation to help it establish. An initial application of a mixed fertiliser can also assist vegetation cover to establish quickly.

Gully reshaping and filling

The practicality of using earthworks to restore a gully depends largely on its size and hence the amount of fill needed to restore it to the desired shape. When using earthworks to treat a gully, topsoil should be stockpiled to be later respread over exposed areas to assist vegetation to rapidly establish. Steep gully sides can then be reshaped and topsoil replaced. Annual crops such as millet (summer), oats or barley (winter) can be used to provide a quick cover.

Where gullies occur in cultivation paddocks they can be filled at the same time as contour banks are being constructed or maintained to manage the runoff that is contributing to the gully. When doing this, particular care is required to ensure that the banks have sufficient capacity where they cross old gully lines as this is a common site for contour bank failure.



Image 2: Gully rehabilitation works in North Queensland.

Controlling gully heads

Gully head erosion can be controlled with:

- **Diversion banks:** these divert runoff from the gully head to a stable outlet. Unfortunately, such outlets can be difficult to find and if insufficient care is taken, instability may simply be transferred from one area to another.
- **Chutes:** these are formed by battering gully heads to a stable slope. The role of a chute is to convey runoff safely to a lower level. Chutes are lined with erosion-resistant materials such as stoloniferous grasses, reinforced turf, erosion control mats, rock, rock mattresses, concrete, rubber or PVC sheeting.
- **Drop structures:** these allow runoff to drop vertically to a lower level, where the energy is dissipated before flowing down the watercourse. Drop structures can be made of formed concrete, concrete blocks, gabions, timber or steel plates. Gabions and rock mattresses have an advantage of being flexible and permeable.
- **Gully dams:** these are situated so that they 'drown' the gully head when the spillway is operating. Runoff is then returned to the watercourse at a safer location or directed onto a grassed area via a diversion bank. To successfully stabilise gullies, the dam by-wash and outlet must be stable. This can be difficult to achieve in erosion prone soils.
- **Battering:** earthworks are carried out to form a soil/earth ramp from the natural land surface above the gully head to the gully floor downstream. The earth ramp needs to be quickly revegetated.



Image 3: Rock chute construction.

Stabilising the gully floor

Long-term success in stabilising a gully requires that a good vegetative cover be established on the gully floor. This vegetation prevents further gullying and allows the gully floor to gradually fill with silt, reducing the height of fall over the gully head.

A series of small weirs made by wire netting, rocks or logs can trap sediment in the gully floor and encourage the growth of vegetation. The same effect can be achieved with vegetation by establishing species with erect growth forms such as vetiver grass (*Chrysopogon zizanioides*) and lomandra (*Lomandra longifolia*). Branches of dead shrubs or trees can also make a useful contribution to stabilising a gully floor, retarding runoff flows and encouraging further sedimentation. These will also restrict access by grazing animals. However, old car bodies (which are often used for this purpose), are not recommended for gully stabilisation. They divert flows against the sides of the gully and increase the erosion.



Image 4: Chute for controlling eroding gully head.

For more information on gully erosion, refer to *Gully Erosion: Options for Prevention and Rehabilitation* and Chapter 13 of the *Soil Conservation Guidelines for Queensland*.