Farm track construction

Principles and practices

Sustainable Land Management Programme 12

Introduction

Tracks are essential on a hill country farm. A well-constructed track, in the right place, speeds vehicle access and stock movement. If it is badly constructed or wrongly placed, it will cost money to keep open, and may damage the environment by triggering landslides or discharging sediment into waterways.

Farmers and contractors sometimes do not realise:

- the need to avoid constructing tracks on too steep a grade
- the importance of water-tables and cut-offs
- correct design of stream crossings.

In the Taranaki hill country, many tracks can be seen where these aspects of construction have been neglected. Rectifying them is worth-while.

Figure 1: Eroding farm track

Farmers and contractors know how to construct tracks with a tractor and blade or bulldozer. It is not the Council's intention to say how to do the job, which is why it has not written any rules about farm tracks into the *Regional Soil Plan*.

The *Regional Fresh Water Plan* has two rules (24 and 25) classing discharges from soil disturbance activities to water or onto land in circumstances where the discharge may enter water, as permitted provided that the conditions in the rules are met. The conditions require adherence to industry-recognised guidelines. Current guidelines are summarised in the Council's ***Guidelines for Earthworks in the Taranaki Region***. Much of the document relates to earthworks in general, so the Council has prepared this information sheet as a summary of the parts that relate to farm tracks in particular.

Route

Farm tracks are generally routed along terraces or footslopes as long as possible, then up stable spurs and ridges where country becomes steep. Even so, many tracks are cut by slips during winter rain.

This can usually be avoided by shifting the route just a few metres when a track is cut or repaired. Places to avoid are:

- Outside bends on creeks - the banks here will be scoured by floodwater
- Steep-gradient watercourses on slopes - they gully during heavy rain
- Damp hollows on slopes - they are potential slips
- Places where soil, although currently vegetated, has been rucked-up - a sign that slips or earthflows may re-activate.

Grade

Grade is a track's upward slope. For instance a track cut at a grade of 1 in 6 slopes 1 m up in 6 m length. If a track is cut at a grade steeper than 1 in 6, its surface will generally rill during heavy rain. This means that annual blading, to maintain a passable surface for vehicles, will be necessary. Keep track grade as low as possible, and try not to exceed 1 in 6.

Camber is a track's slope sideways. A track cut at a camber of 1 in 25 slopes 4 cm sideways every 1m width. A camber of at least 1 in 25 is needed to divert rainwater, so that it doesn't run down the track and rill its surface.

Side-cuts

A side-cut is the bank formed where a track is cut up a hillside. Collapses are triggered if a side-cut is so high that the force of gravity exceeds the bank material's residual strength. This is particularly likely where :

- Side-cuts are in soil or weathered rock, as opposed to bedrock
- Water pressure builds up behind the bank after rain.

It is good practice to avoid excessive height. The *Earthworks Guidelines* allow up to 20 metres on a 25% slope on construction sites, but such heights are generally unnecessary - and dangerous - if attempted on farm tracks. Here it would be unwise to exceed :

Loose soil - 1.5 metres
Compact soil - 3 metres
Weathered or shattered surface rock - 5 metres

At points where water seeps from a side-cut, pressure can be dropped by installing horizontal drains - small, perforated PVC pipes drilled several metres into the bank. This has to be done by a contractor with specialised drilling equipment, but may not add greatly to total cost of track construction.

Side-cast

Side-cast is material excavated in the course of track construction. It is generally tipped on the track's downhill side where it spills downslope. This is generally not a problem, as in Taranaki's wet climate, side-cast quickly revegetates.

However, there is one circumstance where side-cast should be avoided - where a watercourse lies a short distance downslope, side-cast will be washed into it. Apart from polluting the water, the side-cast is likely to be deposited on top of good pasture somewhere downstream.

It is usually impractical to truck soil from a track under construction, to somewhere elsewhere on the farm. Perhaps the only way to avoid this problem, is to route new tracks well away from watercourses.

Water-tables

A water-table is a shallow drain cut alongside a track, to intercept rainwater running off adjacent land. A lot of farm tracks are constructed without any water-tables at all, so runoff makes them greasy or boggy. Others have water-tables installed, but they often scour during the next few winters, reducing the width of track passable by four-wheeled vehicles.

Install a water-table where-ever a track is side-cut, so that runoff from the bank doesn't flow across the track and rill it. For farm tracks, a shallow water-table about 0.5 metres wide and 0.2 metres deep will suffice on gentle grades of less than 1 in 10. At grades between 1 in 10 and 1 in 6, runoff will scour a water-table. This can be averted by lining steep grades with small-diameter rock (about 0.1 m); worth doing on an otherwise unmetalled track. Another option is to place sand-bags at intervals of about 5 metres, to act as sediment traps.

Cut-offs

Cut-offs are the places where runoff is discharged downslope from water-tables. Cut-offs are typically small, open drains curving outwards away from a track, where there are gaps in its side-cut. They may discharge into hillslope watercourses, or scrubby hollows, or simply onto grassed slopes.

Tracks do not always have cut-offs installed in the right places. In the wrong place, a cut-off may scour back across a track, or trigger a drop-out. Vehicle access is cut, and major earthworks accompanied by drainage and stabilisation measures may be needed to restore it.

On grades exceeding 1 in 10, install cut-offs every 40 to 80 metres. At grades less than 1 in 10, cut-offs will be needed every 50 to 120 metres. Cut-offs should be no more than 1 metre deep; on farm tracks, 0.5 metres will generally suffice. Where there is no natural gap in the side-cut, run the cut-off through a small-diameter pipe (200 mm) to the outside of the track.

Do not discharge cut-offs into hollows next to the track - these turn wet from natural runoff during heavy rain, and extra water may trigger a gully or slip. Straight even slopes, where the water can disperse through vegetation, are better. It is a good idea to place some small-diameter rock (100 mm) or a sand-bag at the cut-off's outlet. This dissipates water energy, and reduces the risk of scour. A geotextile mat (about 1m2) is another option, as is heavy polythene, but both must be secured by burying the edges.

On steep slopes, timber or corrugated iron flumes are sometimes used to conduct runoff downslope from cut-offs, particularly where loose soil has been side-cast from a track. If installing one of these, secure it with stakes or fencing standards every 2 metres, and place small-diameter rock, geotextile mat, or heavy polythene where it discharges.

Small culverts

Where a track winds up a hillside, it usually crosses a few hillslope watercourses. These are usually passed under the track in small culvert pipes. If the culvert outlet is not armoured with small rocks or a concrete sill, it scours, undermines the pipe, and takes out part of the track.

If a concrete sill is infeasible, spread medium-diameter rock (200-300 mm) over an area of at least 1m2 in the channel under the pipe outlet. Geotextile or polythene may also be used, but should be well-secured e.g. by steel pegs with earth over the textile edges.

Figure 4 : Cut-off with outlet protected

Headwalls around the culvert inlet and outlet are a good idea, to prevent floodwater from scouring the track. Inexpensive headwalls can be constructed from H4 treated timber planks held in place with iron fencing standards. Alternatively use sandbags.

Remember to use a pipe size big enough to take floodwater. The *Earthworks Guidelines* recommend :

Pipe diameter (mm)	Catchment area (ha)
150	0.05
300	0.2
450	0.6
500	1.0
600	>1.0

Figure 5: Culvert with headwalls and energy dissipater

Stream crossings

In valley bottoms, tracks generally ford small streams. This results in considerable disturbance of the bed by vehicles and stock. The disturbed sediment is more easily eroded by floods, and annual maintenance work is needed to keep the crossing passable.

A concrete sill is a good way to minimise bed disturbance, without going to the expense of a bridge or culvert. Other options are to :

- Armour the crossing with a layer of small-diameter rock (100 mm)
- Place heavy-duty geotextile, held in place by steel pegs, with the edges folded down and buried in the
- streambed.

Figure 6: Concrete or gravel stream crossing

Bridges and large culverts

Large streams are frequently bridged, or culverted with large-diameter pipes. It is not unknown for these structures to deflect floodwater against banks immediately downstream, triggering bank collapses. Another problem is the lodgement of debris on upstream side of the bridge or culvert, causing scour through one or other abutment, and cutting the approach to the structure.

Many old farm bridges and culverts are 'existing uses' which pre-date the 1967 Water and Soil Conservation Act. Since that date, legislation has required landowners to obtain a consent before disturbing the bed of a stream with earthworks, or erecting any structure in the channel. The Taranaki Regional Council will issue a permit so long as the bridge or culvert has been properly designed, to a standard that the Council considers will not impede floodwater or cause bank erosion. The Council's River Control Officer is able to provide advice to landholders undertaking these activities.

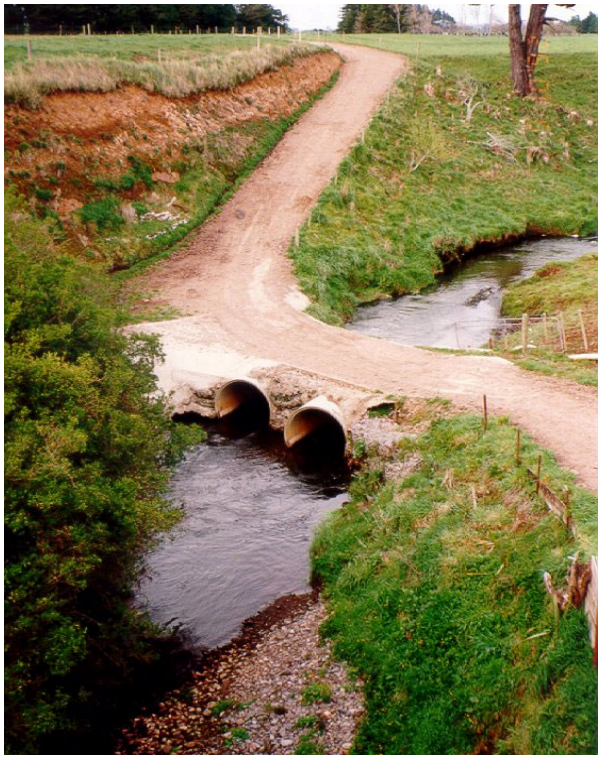

Figure 7: Stream bridge or culvert

Other things landowners can do to minimise track erosion

Revegetated - side-cuts, side-cast fill, and the track surface itself can be oversown with grass-seed. Spreading mulch e.g. old hay-bales or pine slash will help protect soil from surface erosion while the grass emerges through it.

Light metal - on parts of the track that are prone to rill or sheetwash, light metalling at a rate of 1 cubic metre per 10 metres length will improve the situation.

Stabilise - where tracks are cut through ground that is obviously unstable, plant poplar or willow poles either side of the track. As the trees grow, their roots will help to hold the track.

Figure 8: Revegetated track with tree plantings alongside

For further advice or information contact:

The Land Management Section, or
Taranaki Regional Council,
Private Bag 713
Stratford
Ph: 06 765 7127 Fax: 06 765 5097
www.taranakiplants.net.nz