Soil Save

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Erosion Control Workshop

Economics of Erosion Control Measures

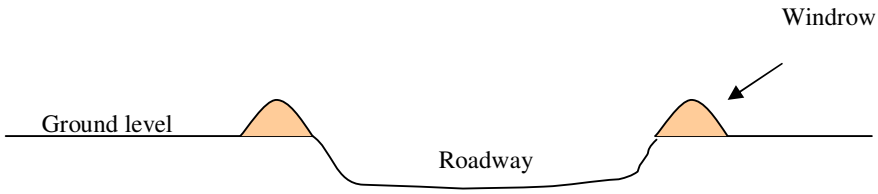
The financial benefits of erosion control measures can be very unobtrusive. What may seem time consuming in the short-term will alleviate many costly repairs in the future.

Studies in the NT Pastoral Areas Indicate:

1. A reduction of between 30% and 50% in maintenance time required for access tracks.
2. Travelling time reduction of 5 – 10%.
3. Vehicle maintenance costs decreased by 5 – 10%.
4. Fire break effectiveness increased by 2 – 5%.
5. Fence line erosion control works are approx. 15% the cost of replacing 1km of fenceline.
6. Erosion control works can decrease the risk of stock escaping from paddocks.
7. Erosion control works will decrease soil and silt levels flowing into stock watering dams, waterholes and watercourses.
8. Erosion can contribute to Occupational Health and Safety concerns.

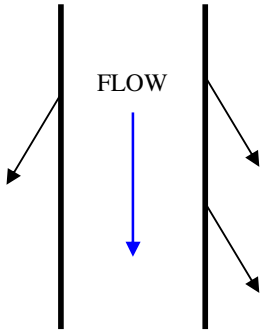
NORMAL PROPERTY ROAD

Normal property roads can be up to 30cm below ground level before any erosion controls are attempted.

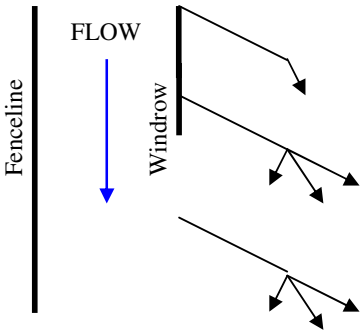


TRADITIONAL TREATMENT

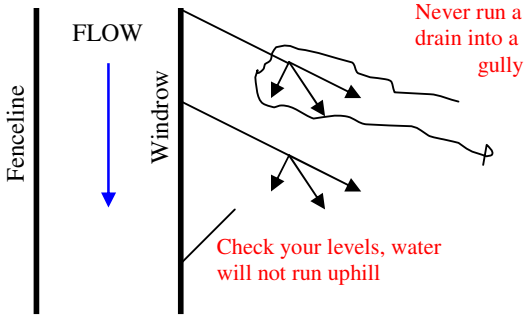
- Drains are installed with toe of grader blade – soil is removed from roadway end, forming "V drain".
- Often the roadway is below the level of the drain, and the drains are bypassed.
- Traditional methods of V drains have the potential to cause soil erosion, on long slopes.
- Drains are usually far longer than needed, especially on down-slopes.



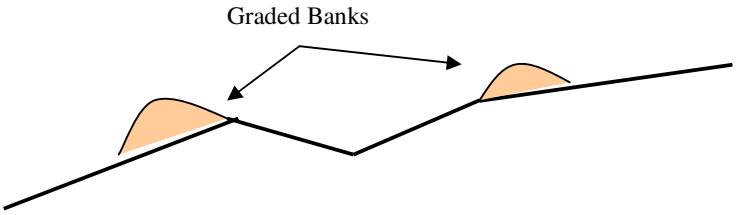
✓ Slopes of drains up to 0.03% will reduce the potential to erode.



× Drains with slopes greater than 0.05% have the potential to cause soil erosion.



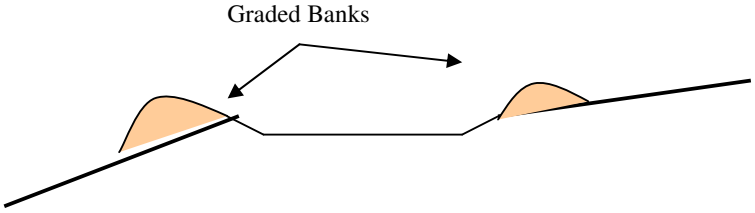
V drains restrict water flow to a confined area, don't assist in reducing the velocity of the water flow, and are difficult to maintain.



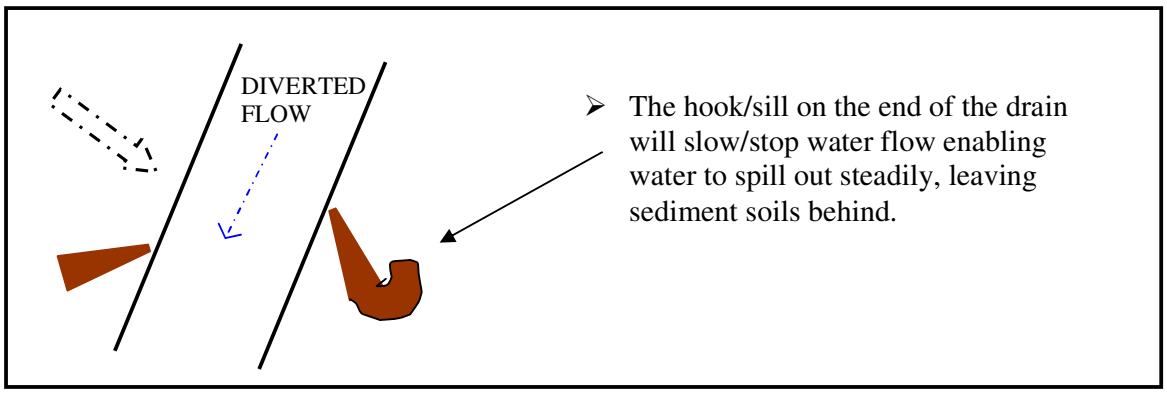
CURRENT RECOMMENDED TREATMENT

Flat drains;

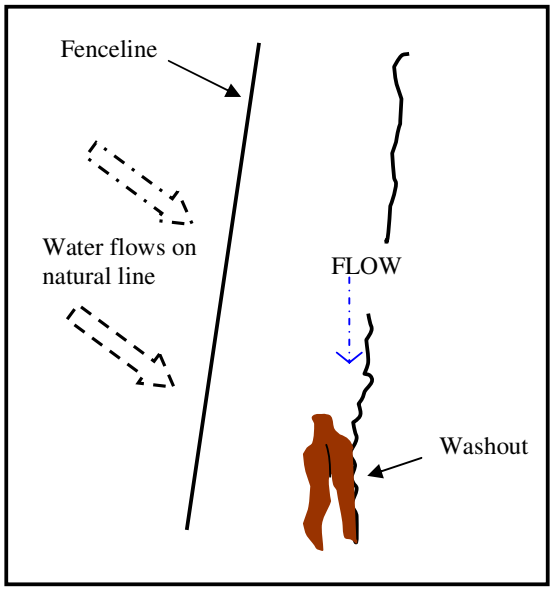
- Reduce the velocity of the water flow
- Carry a greater body of water
- Are easier to install and maintain.



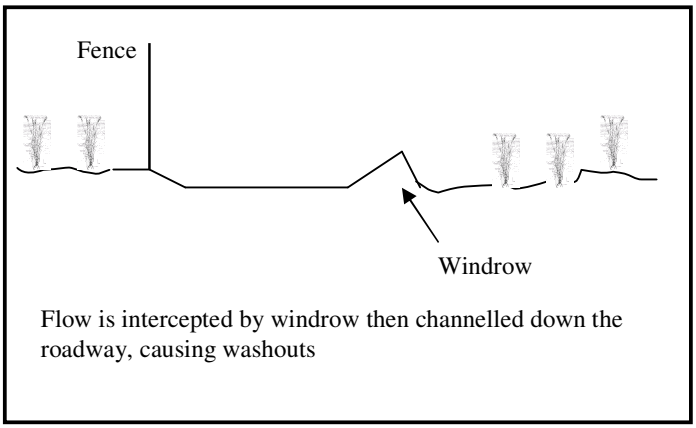
- Installing flat bladed drains from down-slope up can result in excess soils left in a short bank over roadway.



COMMON COMPLAINT

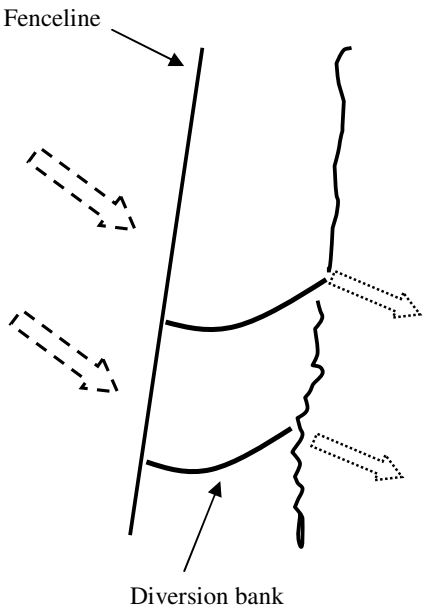


The washout is the result, not the problem



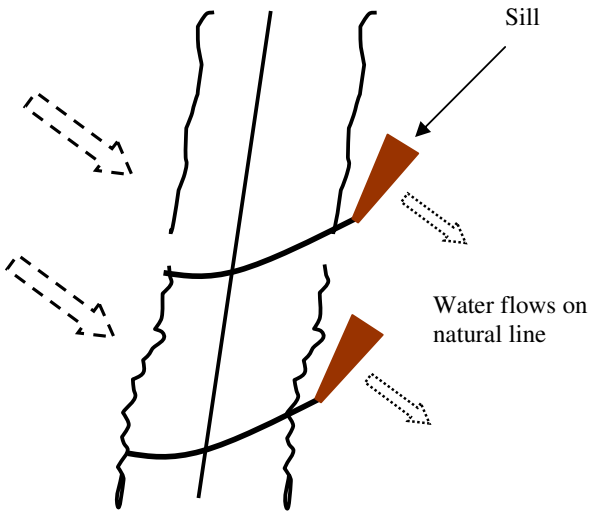
Flow is intercepted by windrow then channelled down the roadway, causing washouts

TREATED FENCE LINES



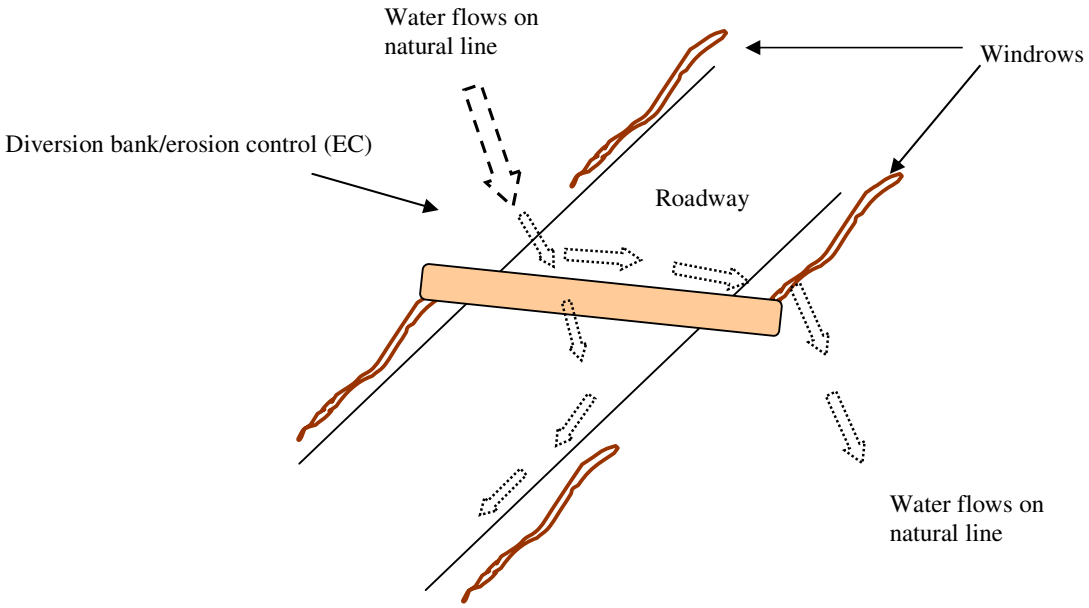
- Graded both sides of the fence line with speed bumps (diversion banks) installed.

- Single track with speed bump (diversion bank) installed.



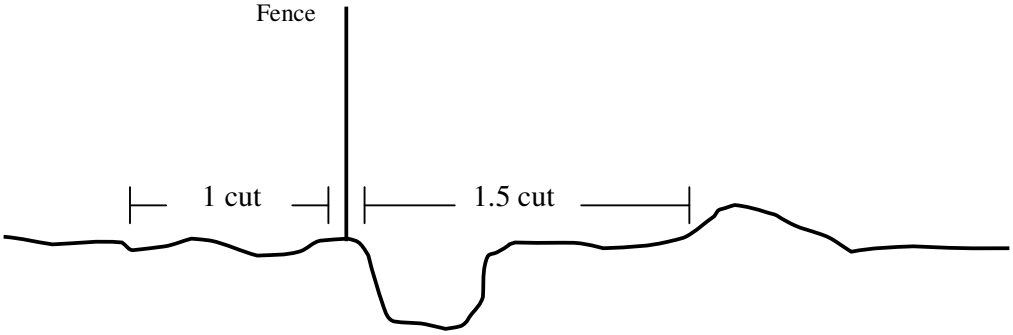
The greatest cause of fenceline and access track erosion is that the windrows channelling waterflows in directions away from the natural drainage line.

On some occasions, usually where the roadway is not excessively eroded, these windrows/soils can be used to form small "check" banks. These banks will divert water flows away from the roadway.



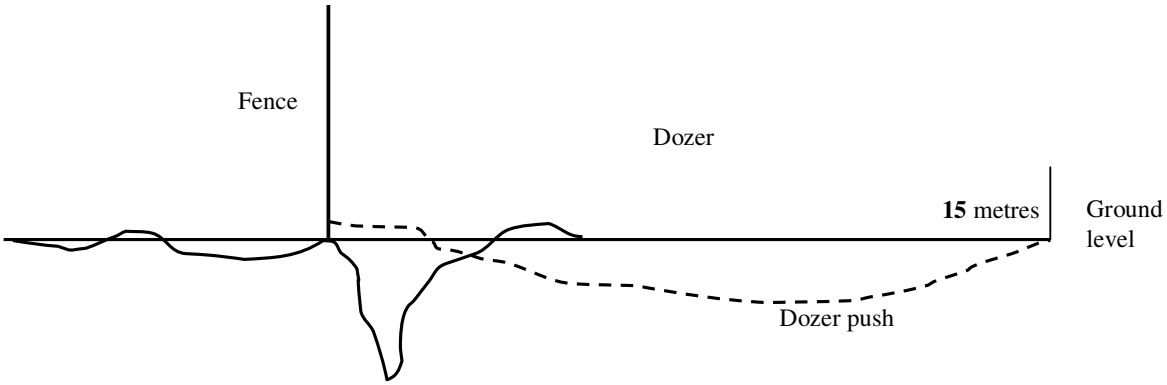
A grader/loader can often scrape/push these unused soils into small banks across the roadway, thereby enabling water flows to get back to their original direction. This method clears away the windrows and provides necessary soils without having to cut into further ground levels.

COMMON ERODED FENCELINE

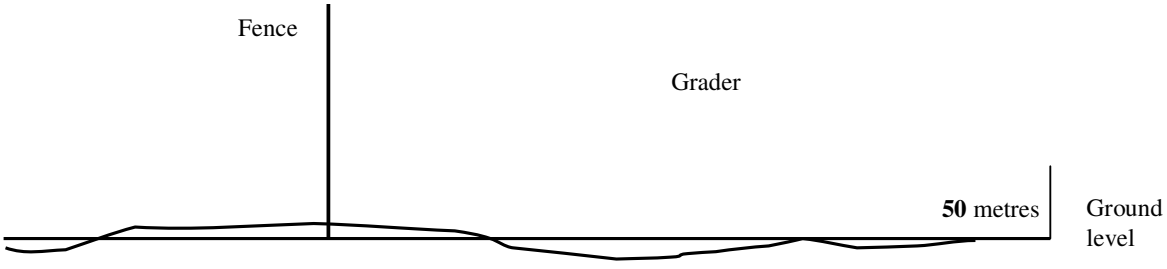


- Cross-section before treatment. As erosion occurs, operators widen grading.

COMMON METHOD OF TREATMENT



- Dozers tend to work over a short distance resulting in a deep depression parallel to the fence.

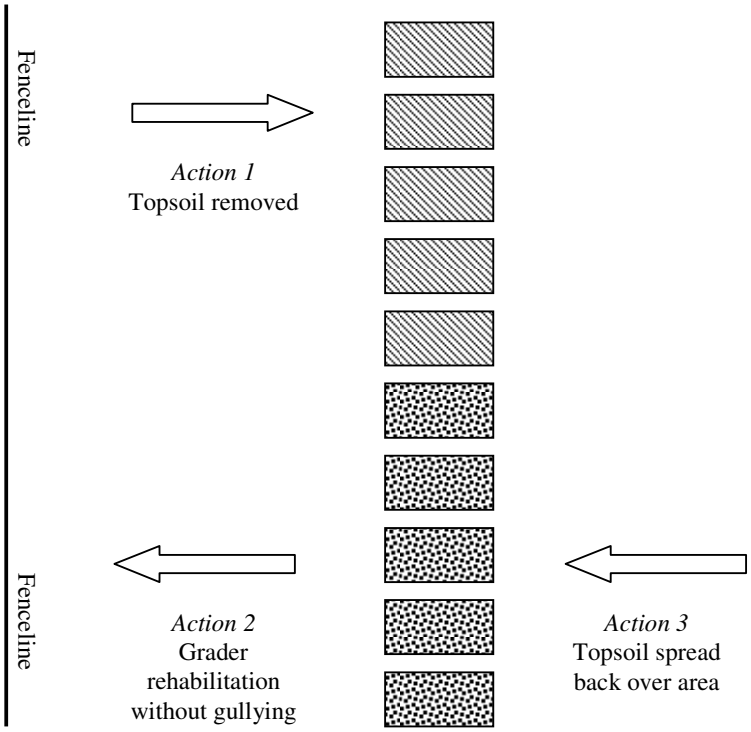


- Grader can move soil over a bigger area, resulting in less erosion potential and better rehabilitation works.

WASHOUT FILLING

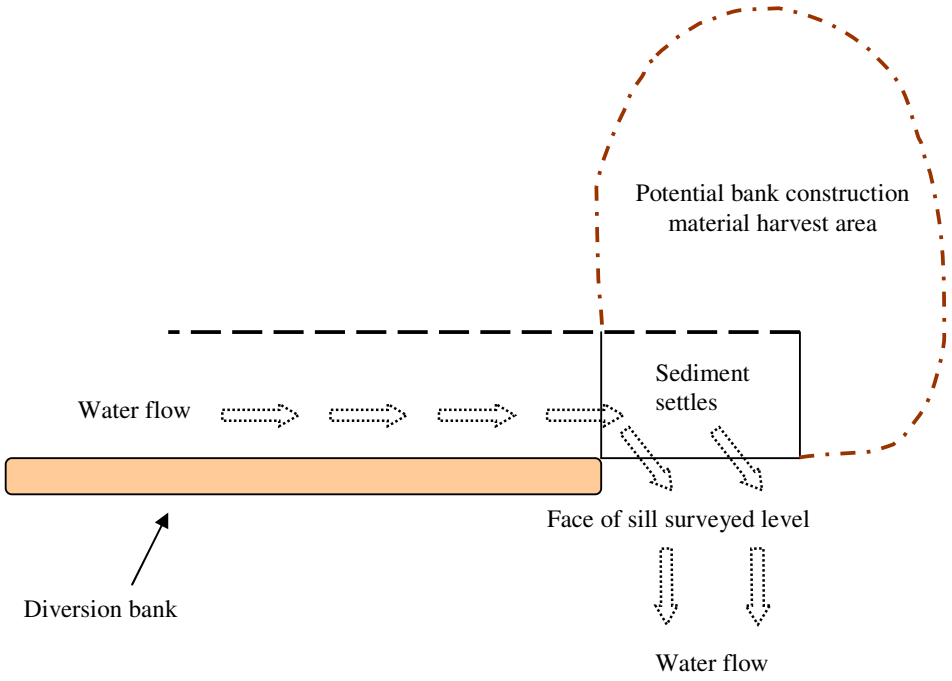
- It is often uneconomical to fill washouts, other than for aesthetic purposes. If erosion control measures are installed, a washout will usually rehabilitate itself over following wet seasons.

- Where large amounts of soil are needed to fill a washout, it is good practice to push topsoils away from the washout first. Once subsoils have been used to fill the washout these topsoils are then spread out over the subsoils. This method enables a faster rehabilitation of the treated area.



CONSTRUCTING SILLS

- Sill is a term used to name a borrow pit which supplies soils needed in diversion bank and ramp construction.



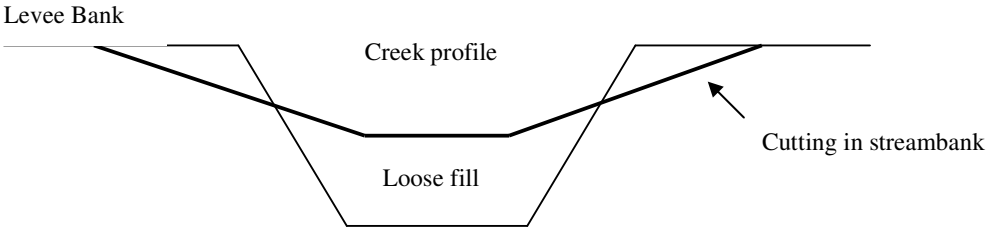
- A common problem with bank construction is insufficient soils near roadway to construct bank. The average length of a sill is usually 10 metres and approximately 6 –9 metres in width. Depth will vary with the amount of soils required. Extra length and width can be added if further soil from the upslope area of the sill is needed.

- Sills act as a sediment trap, by allowing soils/sands and debris carried in the water flows to settle, thereby rehabilitating the borrow pit. Also, this action takes any force out of the water flow, enabling the flow to follow the natural drainage slowly.

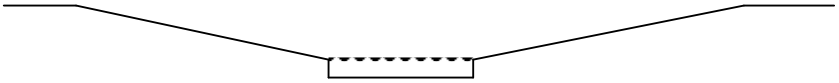
- Surveyed level sill edge, should never be disturbed by wheel tracks etc, as these disturbances may allow water to concentrate and flow, nullifying the effect of the sill.

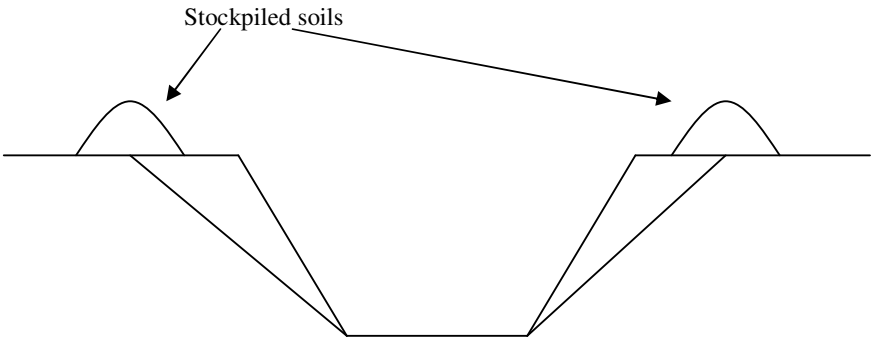
OPENING A CREEK CROSSING

- The standard method of opening a creek crossing usually involves pushing excess soils into the creek bed whilst compacting these soils at the same time.



- After wet season; loose fill removed, leaving steep banks which vehicles are unable to cross





- Once machine has initially opened gully crossing, all loose excess soils should be pushed up and out of gully crossing, leaving cuttings from lowest level of gully back up to ground level.

- These soils can either be stockpiled for future repairs or used in diversion bank construction to prevent cutting eroding.

FORMED ROADS IN THE RANGELANDS

For a number of reasons, eg. wet weather access to stock trucking yards, formed roads on pastoral properties are becoming more common. Unfortunately, the majority of these roads are installed by unskilled operators and endorsed by managers inexperienced in long-term maintenance problems associated with poorly constructed roads.

Initially, the concern is to provide safe, dry access over wet periods, and yet it is these wet periods that cause most maintenance and erosion concerns.

Usually it is rainfall that is blamed for the erosion, not realising that the roadway may be the cause.

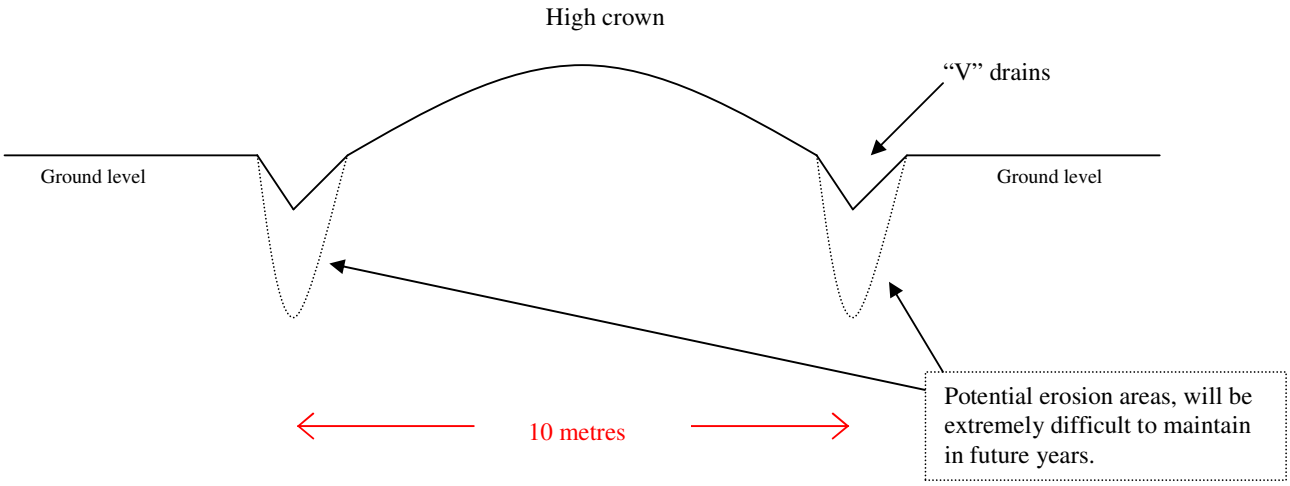
Quite often the formed road is within the confines of the preceding flat bladed track and usually built with the view that the roadway needs to be above ground level.

A formed road can be below ground level, as long as effective drainage can be installed.

Some of the most common problems encountered with pastoral formed roads include:

- Roads formed too narrow *(Diagram 1)*
- Roads formed across watercourses *(Diagram 2)*
- No drainage installed *(as in Diagram 1)*
- Roads installed by staff with no prior knowledge of area, ie. no access to topography maps, unable to envisage wet season water flows
- Incorrect drainage on roads traversing slopes *(Diagram 3)*
- Roads formed too close to fencelines

Diagram 1: Road formed too narrow, with no drainage.

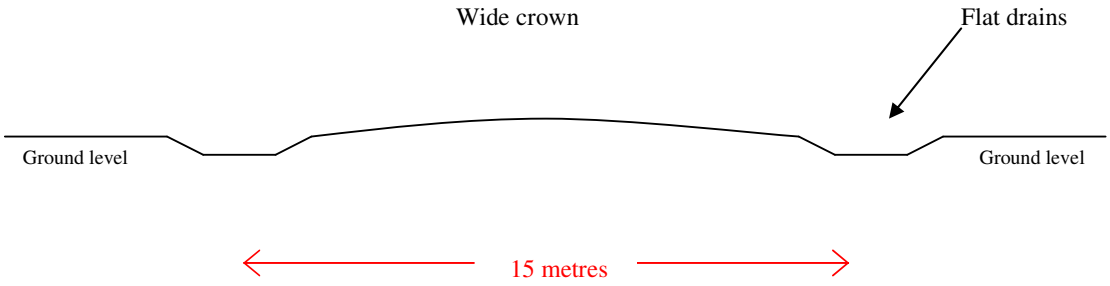


A high crown can be very unstable for traffic when slippery and traffic is usually confined to set "tracks" which assist in erosion of the roadway crown.

Drainage is difficult to install due to the depth of the "V" drains.

A formed road can be below ground level, as long as its shape sheds water and effective drainage can be installed.

Diagram 1.1: Wide formed road with flat drains.



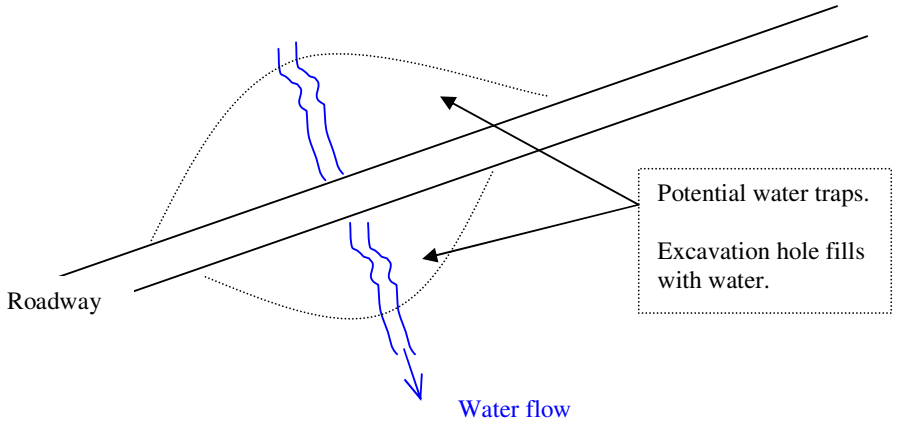
Wide formed roads are easier, quicker and cheaper to maintain. Water flows are less confined and there is less soil loss.

It is easier to divert the water flow as less depth is required for drains.

There are similar amounts of soil obtained from shallow, flat drains as deep, "V" drains.

More emphasis must be placed on soil types in forming roads.

Diagram 2: Formed roads across watercourses.

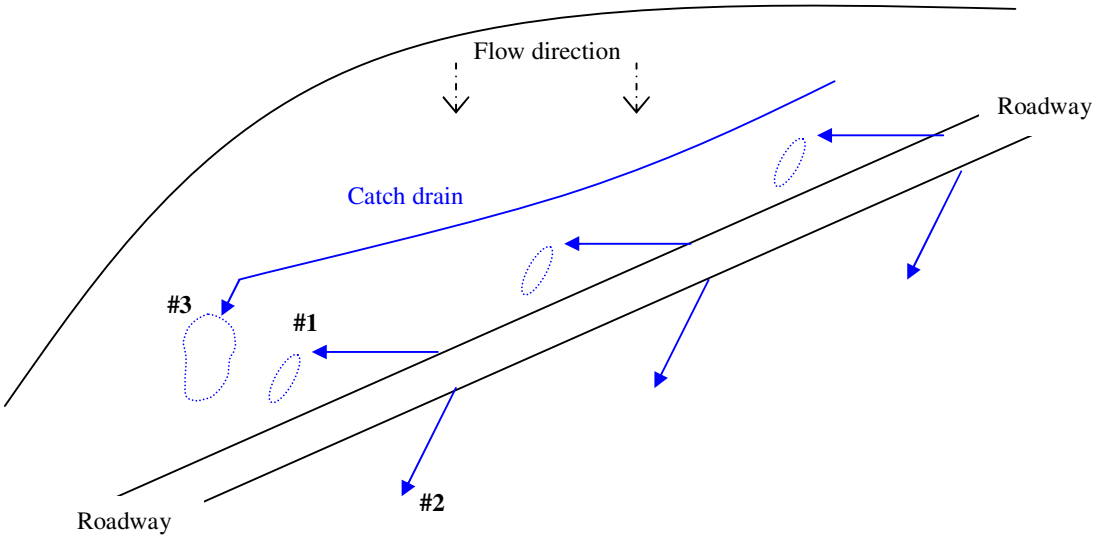


A formed road across a watercourse will often trap water (similar to a small dam) and is often more boggy than the original flat bladed track.

It is advisable to keep the watercourse as flat or open as possible, seek opportunities to encourage the flows away, and remove vegetation or anything that may impede the flow. A causeway installed using good roadway material or a culvert should be installed at these locations.

It is common for formed roads to concentrate flows, resulting in a defined gully rather than a natural depression. These, in turn, erode and "eat" back towards the roadway.

Diagram 3: Roads formed across slopes.

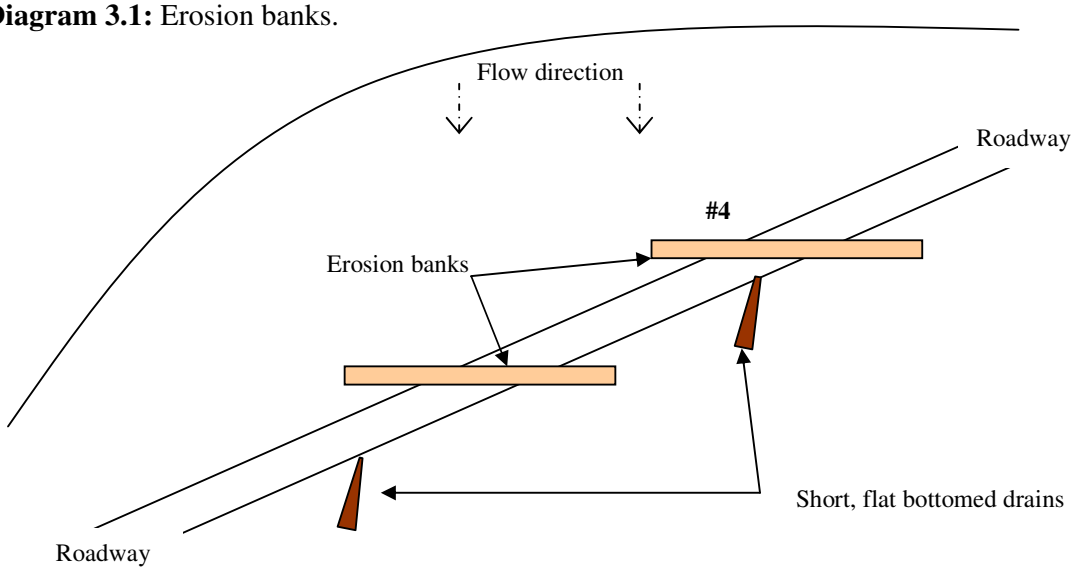


#1 Drains installed upslope merely divert water away from the roadway for a brief period, and usually concentrate flows back onto the road. Quite often the drain below fails to cater for this excess water.

#2 Drains installed downslope are often far longer than needed, just opening the windrow may suffice.

#3 Catch drains are often installed above roadways. These are usually installed with steep slopes with no "anti-erosion" thoughts.

Diagram 3.1: Erosion banks.

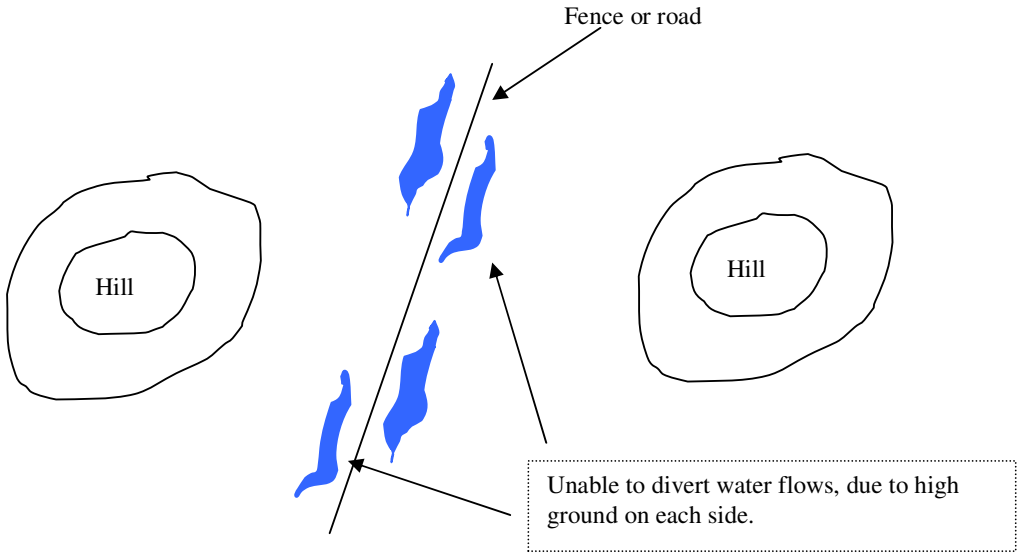


Erosion banks can be installed over a formed road, but care must be taken to ensure area **#4** is level/flat so that no water is contained.

Equally, culverts or causeways could be installed, as the above methods enable water flows to continue in their natural direction with minimal concentration.

It is very common for installation of formed roads to take far longer than expected (thereby costing more?) and drainage is often left to "later".

Diagram 4: The most difficult problem to "fix".



Solution: Often the only method is to relocate the infrastructure and follow the contour line closer, enabling water flow to "cross" the line.

APPENDIX

INTERVALS BETWEEN EROSION CONTROL BANKS ON FENCELINES & FIREBREAKS

Low to Moderate Soil Erodibility	
Slope (%)	**Bank Spacing (m)**
2 – 4	200
5 – 9	100
10 - 15	30
>15	15

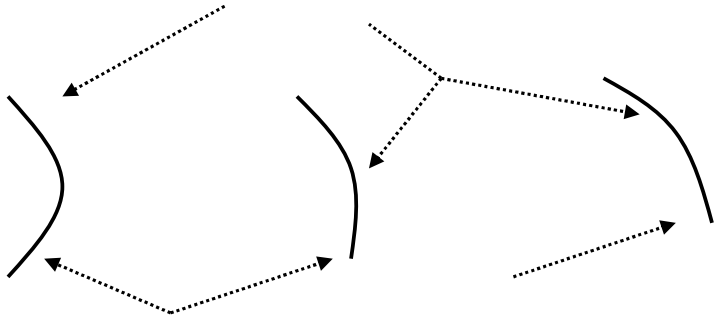
High Soil Erodibility	
Slope (%)	**Bank Spacing (m)**
1	130
2	90
3	75
4	65
5	60
6 – 10	40
11 – 15	30
>15	15

Reference: Australian Road Research Board Limited

- Spacing will depend on local factors, but a rule of thumb measure is every 50m for slopes less than 3% and every 25m for slopes greater than 3%.
- Drain construction should commence at the top of the catchment and proceed at regular intervals downhill.

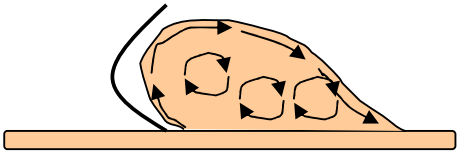
USE OF GRADER BLADE INCLUDING MOULDBOARD

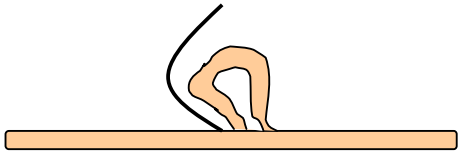
Cutting blade



Cutting edge

Cutting Action	*Scraping or Planing*	*Dragging*
Cutting edge leads into ground.	Blade leans forward. Cutting edge vertical.	Blade leans forward. Cutting edge lags.





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