

Chapter 2

DITCHES

Description

Ditches are constructed to convey water from storm runoff to an adequate outlet. A good ditch is shaped and lined using the appropriate vegetative or structural material and does not cause flooding, erosion, or sedimentation. Energy dissipating structures to reduce velocity, dissipate turbulence, or to flatten flow grades in ditches are often necessary.

Importance to Maintenance & Water Quality

Efficient disposal of runoff from the road will help preserve the road bed and banks. Well vegetated ditches slow, control, and filter runoff providing an opportunity for sediments to be removed from the runoff water before it enters surface waters. In addition, a stable ditch will not become an erosion problem itself. Ideally, “turn-outs” (intermittent discharge points also called “tail ditches”) will help maintain a stable velocity and the proper flow capacity within the road ditches by timely outleting water from them. This will help alleviate roadway flooding, reduce erosion, and thus reduce maintenance problems. In addition, properly placed “turn-outs” help distribute roadway runoff and sediments over a larger vegetative filtering area, helping to reduce the amount of road ditch maintenance required to remove caught-up sediment.

Ditch Profile and Grading

General

Roadway ditch location, profile, shape, lining and outlets effect how efficiently water will be removed from the roadway. Ideally ditches should resist erosion, be self cleaning, and discharge onto nearly level vegetated areas, thus maximizing the length of time between regrading, thereby reducing maintenance costs. As shown in figure 2-1, ditches should be located on the uphill side of the roadway to prevent runoff water from flowing onto and over the road surface.

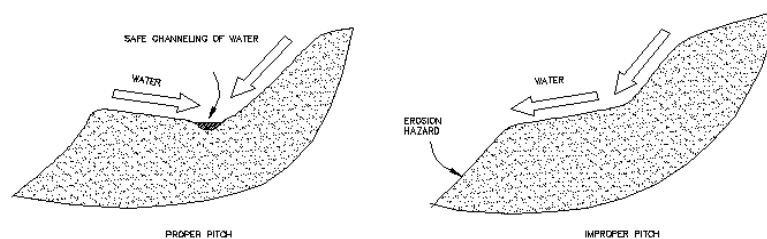


Figure 2-1. Hillside Pitch of Roadway and Proper Ditch Location

Excavate roadway ditches at a bottom elevation 1 to 2 feet below the road base. The ditch bottom should be rounded-V shaped (preferred), parabolic, or flat, as shown in figure 2-2, and at least 2 feet wide to disperse the flow and slow the velocity. Do not construct U-shaped ditches. U-shaped ditches actually have up to 30 percent less drainage capacity than other shapes and they tend to look messy. Their steep sides make maintenance difficult and the sides tend to cave in, compounding maintenance problems and adding to erosion and sedimentation.

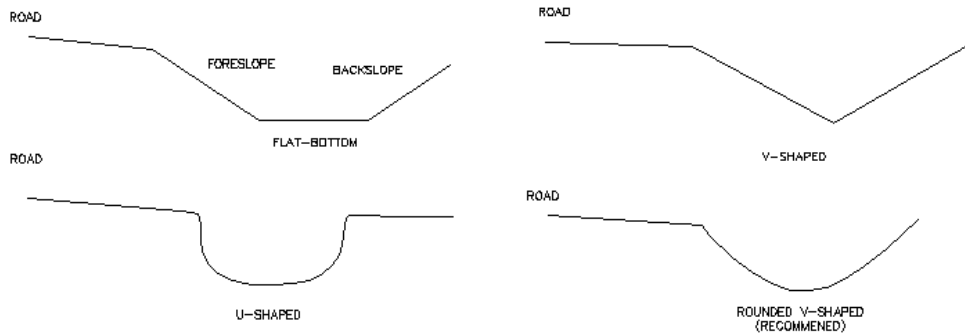


Figure 2-2. Common Ditch Shapes

Where possible, install “turn-outs” (“tail-ditches”) to help maintain a stable velocity and the proper flow capacity within the road ditches by timely outletting water from them. See Figure 2-3 below. These structures are critical elements in establishing and maintaining a stable unpaved roadway drainage system. It is imperative that landowners adjacent to these roadways allow water to be discharged in this manner at crucial points. Correspondingly, these turn-out points must be stabilized to prevent creating worse erosion problems such as gullies. In many cases, the discharged runoff can be spread to reduce the erosive energy of concentrated flows.

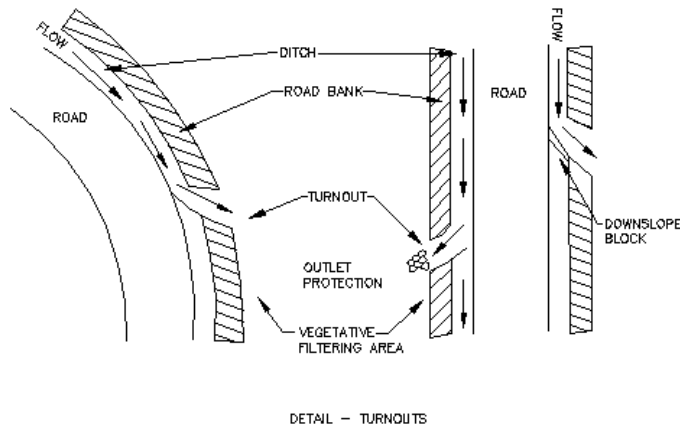


Figure 2-3. Typical Locations for “Turnouts” (“Tail Ditches”)



No ditch on the uphill side of the roadway can allow runoff to overflow the roadway. This leads to surface erosion of the roadway, such as these corrugating rills, and often to complete washouts. Road surface overflow is a significant contributor to sedimentation, especially during high runoff events.

Exhibit 2.1 - Proper Ditch Location



Flat Bottom (Trapezoidal) Shaped Ditch



V-Shaped Ditch



U-Shaped Ditch



Rounded V-Shaped Ditch

Exhibit 2.2 - Common Ditch Shape Examples



Motor graders can be used to create and maintain tail ditches, however, backhoes and dozers can be more efficient and leave much less loose and disturbed soil which is easily and readily washed out.

Exhibit 2.3 - Tail Ditch/Turn-Out Construction with a Motor Grader



Turn-out to a drop inlet.



Turn-out at gradient changes.



Turn-out before bridges.



Turn-outs into filtering areas.



Turn-outs/Tail ditches outlet water from roadway ditches to maintain a stable flow volume and velocity within the ditches. They can be placed at specific and selected sites to protect down gradient structures such as bridges and culverts, or to utilize specific erosion control or storm water discharge facilities.

Exhibit 2.4 - Turn-outs/Tail Ditches

Line ditches which have a channel slope less than 5% with grass, and line those which have a 5% or greater channel slope with geo-fabric or aggregate filter underlain riprap or other material (*Concrete lining is not recommended on unpaved roads in the CPYRWMA area due to the highly erosive sandy soils and the potentially volatile nature of unpaved road degradation during intense storms common to this area*). Line ditches as soon as possible to prevent erosion and to maintain the ditch profile. Whenever possible, excavate ditch only as far as lining can catch up before the next expected or potential rainfall event.

All ditches should have appropriate outlets which allow water to completely drain from them. Standing water in ditches against road fill weakens the roadway. The preferred equipment for creating ditches is a rubber-tired excavator with an articulated bucket. A well designed and constructed road ditch can be cleaned with a grader or excavator making maintenance quicker, easier, and less costly.

Other Applications

Diversion ditches and berms may be used as structures to intercept, consolidate, and direct or redirect runoff at the top of a slope to prevent gullies and rills on slopes, or across the slope to break up the slope length or redirect water flow. These ditches and berms should be located where the outlet will empty onto a stable disposal area. Ditches and berms may be used in combination where runoff is significant and/or hard to control.

Cleaning & Maintenance

Check all ditches, including “tail-ditches” and “turn-outs”, after major storm events, as the storms may have caused obstructions, erosion, or bank collapse. Have a post-storm plan for checking for damage and determining maintenance needs.

Clean out ditches, when they become clogged with sediments or debris, to prevent ponding, bank overflows, and road washouts. Re-grade ditches only when absolutely necessary and line with vegetation or stone as necessary. Re-grading of ditches should be limited to late spring or summer, after spring rains have diminished and drier weather has set in, and when vegetation can re-establish itself. Other times may be suitable depending on weather patterns, work to be performed, and exigency of work to be done. The main concern is to limit disturbance to the ditches during times of high erosion potential.

