Gradient Treatment - GT

DEFINITION

Step or terrace features created along the contour of steep or long slopes.

PURPOSE

Stepped slopes prevent slope erosion and the formation of rills or washes by:

- Decreasing runoff velocities.
- Trapping sediment.
- Increasing infiltration of water into the soil.
- Supporting the establishment of vegetative cover.

CONDITIONS

Stepped or terraced slopes, as well as any permanent slopes which are steeper than 3:1 (H:V), should be designed by a professional based upon actual site conditions. A stepped slope is not practical for sandy soils or other soils with low cohesiveness.

There are several ways to create a gradient terrace that will meet slope stability requirements. Factors to be considered are the steepness of slope, mowing requirements, and whether the slope is formed by fill or by excavation. If terraced slopes become unstable due to diverted flow, alternative measures should be considered. Alternative measures can include flow diversion, drains, and slope stabilization practices.

DESIGN CRITERIA

Contour Furrow – GT-CO: Contour furrows (Figure 1) may be used for slopes which are 3:1 (H:V) or less. Diversion berms or channels may be necessary at the top of slope and along the edges of the slope in order to prevent concentrated storm water runoff from eroding the slope. The maximum distance between furrows should be 40 feet, and the maximum slope length should be 200 feet.

Serrated Slope – GT-SE: A serrated slope (Figure 2) may be used for slopes which are

2:1 (H:V) or less. This type of gradient terrace is labor-intensive in that bladed equipment will be needed to make numerous passes along a slope, beginning at the top and working downward. The maximum slope length should be 100 feet.

Stepped Slope – GT-ST: Graded areas steeper than 3:1 (H:V), which will not be mowed, should preferably have a stepped slope as in Figure 3. The stair-stepping effect will help vegetation become attached and also trap soil eroded from the slopes above. Stepped slopes are particularly appropriate in soils containing rock. Each step catches rocky material, which sloughs from above, and provides a level site where vegetation can become established.

Steps should be wide enough to work with standard earth moving equipment. Preferably the horizontal distance should be at least 1.5 times the vertical cut distance. Slightly grade the horizontal bench inwards (e.g. back towards the top of slope). Do not make individual vertical cuts more than 24 inches high in soft materials or more than 36 inches high in rocky materials.

Terraced Slope – GT-TE: Terraced slopes (Figure 3) should be used on most slopes which are longer than those allowed for other methods. Designed drainage channels are located in the slope at regular intervals. The designed drainage channel has a regular cross-section including slope and depth requirements. It may be necessary to locate intersecting channels to convey storm water to the bottom of the slope. The maximum slope height between terraces shall be 30 feet for cut slopes and 25 feet for fill slopes. Terrace widths should be at least 6 feet wide.

INSPECTION

Inspections of the stepped slope treatment should be made before anticipated storm events (or series of storm events such as intermittent showers over one or more days) and within 24 hours after the end of a storm event of 0.5 inches or greater, and at least once every fourteen calendar days. Where sites have been finally or temporarily stabilized, such inspection may be conducted only once per month.

MAINTENANCE

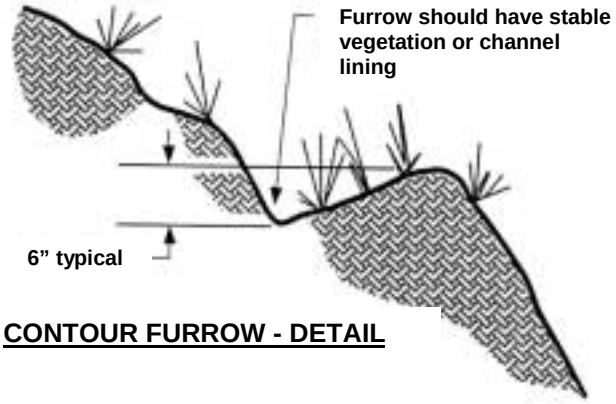
Maintenance needs identified in inspections or by other means should be accomplished before the next storm event if possible, but in no case more than seven days after the need is identified.

Contour Furrow – GT-CO

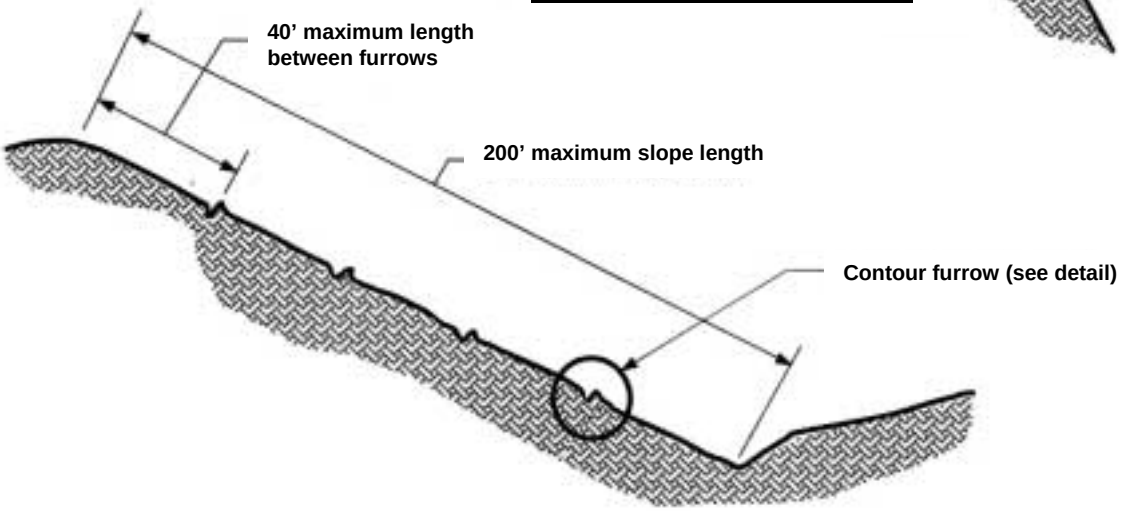
Notes:

1. **Contour furrows will catch fertilizer, seed, mulch, and rainfall to reduce storm water runoff.**

2. **Contour furrows should be designed with appropriate channel slope to safely convey storm water without excessive velocity.**



CONTOUR FURROW - DETAIL



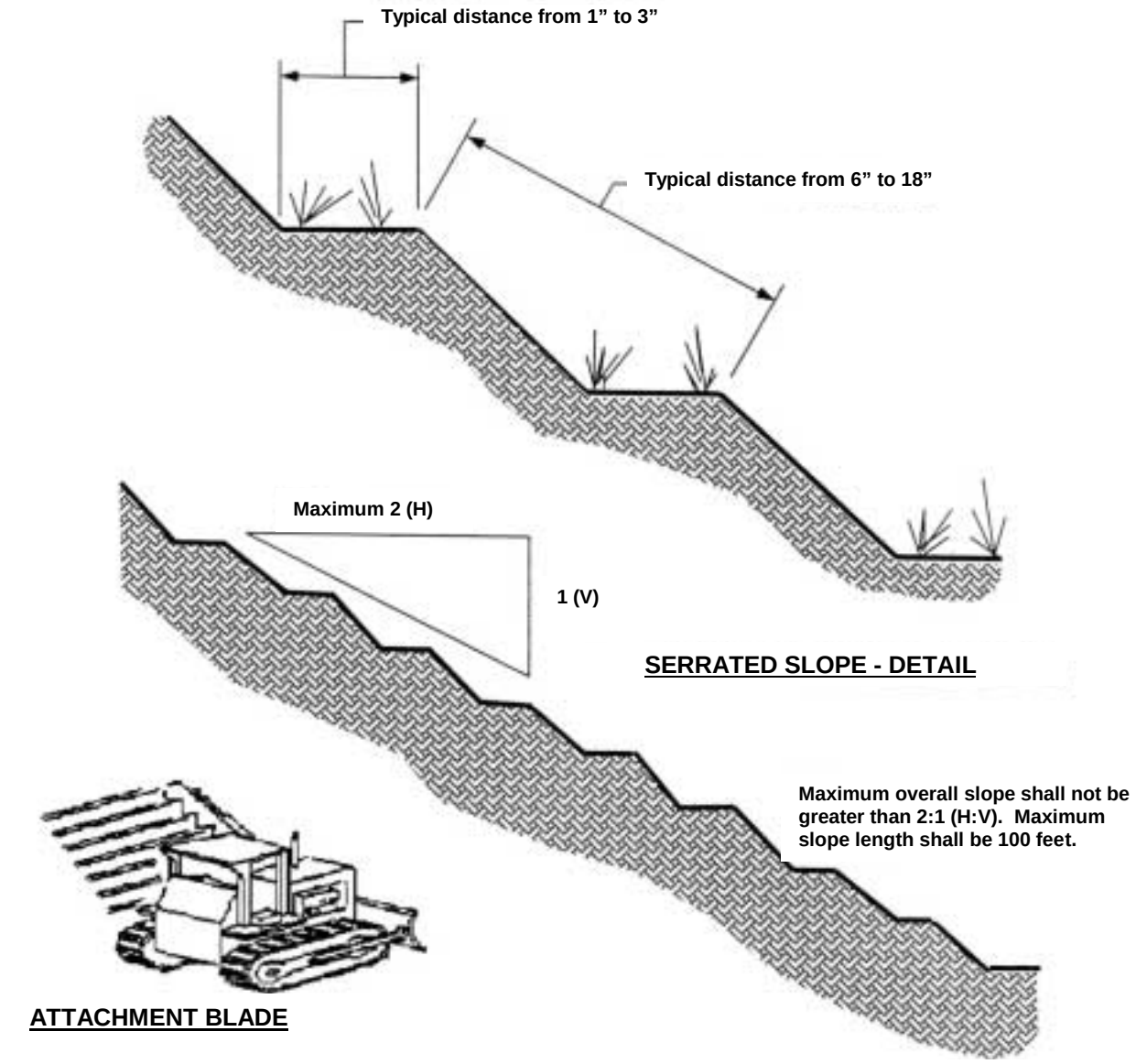
CONTOUR FURROW - SPACING

NOT TO SCALE

Figure 1

Source: Knoxville Engineering Department

Serrated Slope – GT-SE



Note:

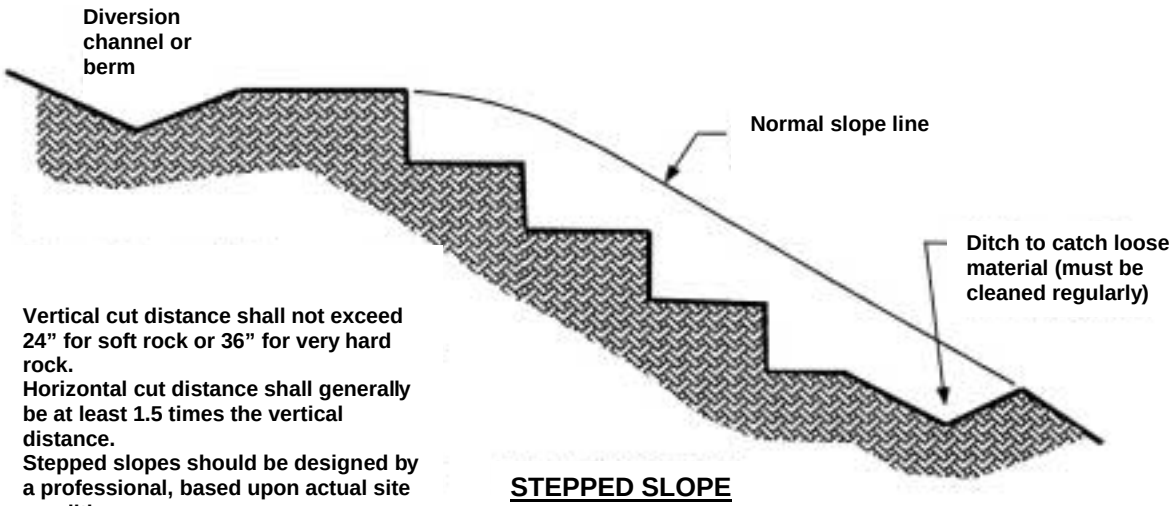
Serrated slopes will catch fertilizer, seed, mulch, and rainfall to reduce storm water runoff.

NOT TO SCALE

Figure 2

Source: Knoxville Engineering Department

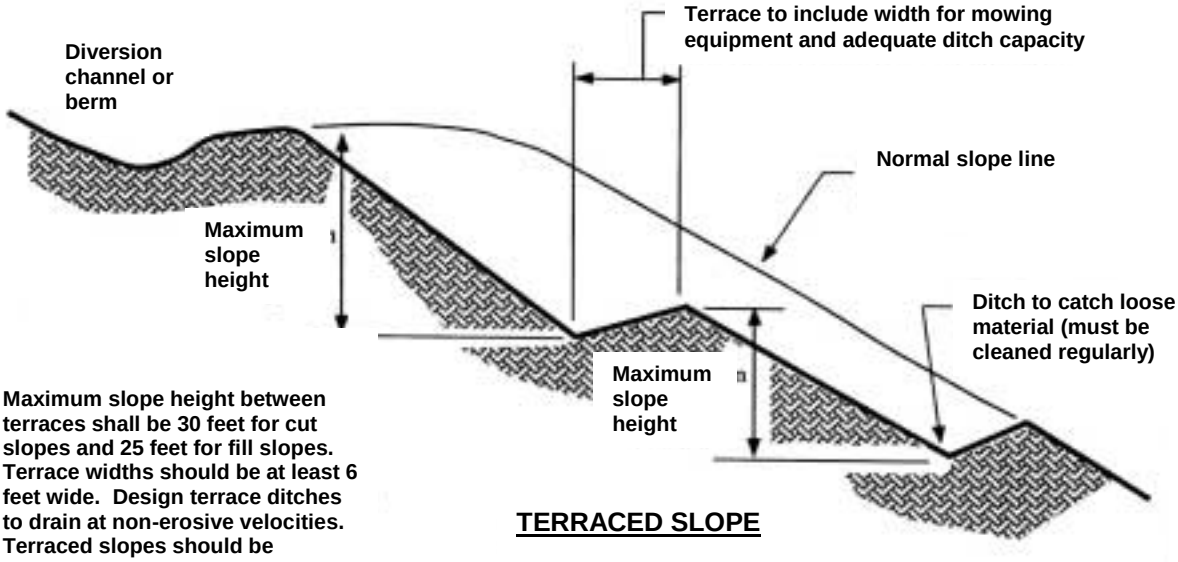
Stepped Slope – GT-ST and Terraced Slope – GT-TE



Notes:

1. Vertical cut distance shall not exceed 24" for soft rock or 36" for very hard rock.
2. Horizontal cut distance shall generally be at least 1.5 times the vertical distance.
3. Stepped slopes should be designed by a professional, based upon actual site conditions.

STEPPED SLOPE



Notes:

1. Maximum slope height between terraces shall be 30 feet for cut slopes and 25 feet for fill slopes.
2. Terrace widths should be at least 6 feet wide. Design terrace ditches to drain at non-erosive velocities.
3. Terraced slopes should be designed by a professional, based upon actual site conditions.

TERRACED SLOPE

NOT TO SCALE

Figure 3

Source: Knoxville Engineering Department