



DWR – NPDES-SOP – G – 16 –Erosion Prevention and Sediment Control Handbook – 01092026
Erosion Prevention and Sediment Control Handbook

4.3.1 Benching and Terracing



Source: TDEC

Definition and Purpose

Benching and terracing reshape land surfaces based on engineering plans. Benching creates horizontal steps (benches) on steep slopes to stabilize them during construction, while terracing forms level strips (embankments) that interrupt and slow the flow of water, thereby reducing its erosive power. These intermittently sloped surfaces decrease runoff velocity, trap sediment, promote infiltration, and support vegetation growth (Nashville – Davidson County, 2021).

Appropriate Applications

Benching and terracing are best applied on steep (3H:1V or greater) or extended slopes taller than five feet where erosion risks are high and traditional grading is not feasible (TDOT). Such slopes are at greater risk of generating concentrated flow during rainfall. These measures are particularly useful when slopes are composed of cohesive soils, rather than sand or rock (ITD, 2011). For shorter or more gradual slopes, other measures may be more economical.

Benches and terraces require sufficient space for proper widths, maintenance access, and a stable outlet constructed (Hamilton County, 2008). Refer to Table 4.2.4-A for guidelines on spacing for breaks in slopes.



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Limitations and Maintenance

Avoid benching and terracing on slopes with sandy or rocky soils, non-cohesive slopes, or slopes lacking structural integrity to support reshaped landforms and construction equipment (ITD, 2011). Decomposing rock and materials with thin, unstable layers can lead to slope failure, especially with excessive water infiltration. Additionally, infiltrated water without proper drainage outlets can saturate the soil, leading to instability and erosion.

Maintenance is critical for success while vegetation is establishing. After significant rainfall, inspect for rills, gullies, and washed-out seed and mulch as they indicate the need for prompt repair. Surface roughening (Section 4.3.8) can enhance terracing but may need to be reapplied after heavy rainfall.

These practices are usually permanent and should be designed by a professional engineer.

Planning and Design Considerations

When planning and designing benching or terracing on slopes, it is important to move beyond aesthetics and focus on functionality. While a smooth, uniform slope might look "finished," it often leads to poor infiltration, increased runoff, and erosion issues. In contrast, roughened, intermittent, or "stair-stepped" slopes are more effective at slowing water, capturing sediment, and establishing vegetation (Hamilton County, 2008).

Incorporating diversion channels or berms (Sections 4.2.1 and 4.2.2) at the top of the slope limits the amount of runoff traversing the slope. Additionally, limiting the overall length of a slope will reduce runoff velocity and erosive power. When slopes are very long, slope drains (Section 4.2.5) or a combination of stabilization practices (Section 4.2.6) may be more beneficial than benches and terraces.

Benching is beneficial for excavating and creating geotechnically stable slopes, either as a method of initial slope construction or final slope grading and stabilization. Design features of benches include (Figure 4.3.1-A):

- Horizontal spacing;
 - Wide enough for a bulldozer (TDOT)
- Vertical cuts;
 - At least 30 inches in soft soil
 - No more than 40 inches in rocky soil (TDOT; VDEQ, 2024)
- Cut ratio;
 - 1.5H:1V or shallower (TDOT)
- Slight backslope on the horizontal cuts; and



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- Allows runoff to drain toward the vertical cut, thereby increasing infiltration (TDOT; VDEQ, 2024)
- Horizontal, longitudinal slopes channeling runoff to a stable outlet.
 - 2 to 3% (MDE, 2011)

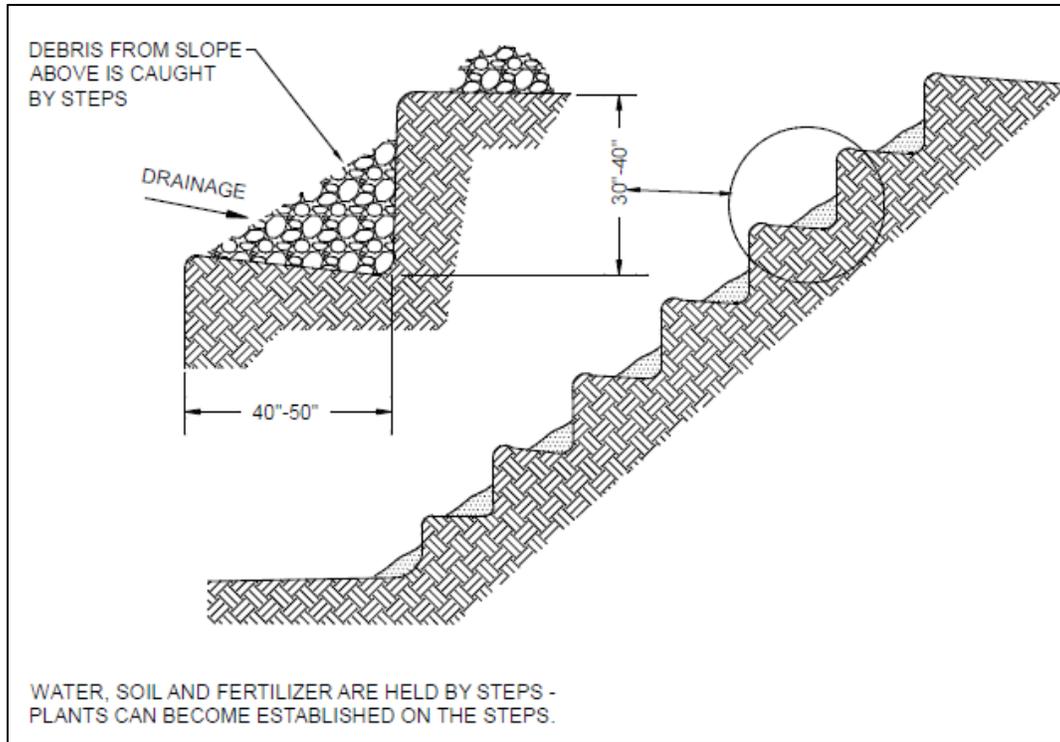


Figure 4.3.1-A: Benching details. Adapted from VDEQ (2024).

Terracing may be the preferred option when adequate space is available, on longer slopes, and when time is a constraining factor. Design features of terracing include (Figure 4.3.1-B):

- Horizontal spacing;
 - Wide enough for a bulldozer (TDOT)
 - At least six feet (MDE 2011)
- Regular breaks in slope;
 - TDOT recommends spacing less than 30 vertical feet for cut slopes or 25 feet for fill slopes
 - MDE (2011) recommends breaks every 20, 30, or 40 vertical feet, based on slope
- Overall slope length;
 - Less than 800 feet (MDE, 2011)
 - Unless other EPSC measures are incorporated



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- Slight backslope on the terrace cuts; and
 - Reverse slope of 6H:1V (MDE 2011)
 - Allows runoff to drain toward the original grade, thereby increasing infiltration
- Horizontal, longitudinal slopes channeling runoff to a stable outlet.
 - Two to three percent (MDE, 2011)

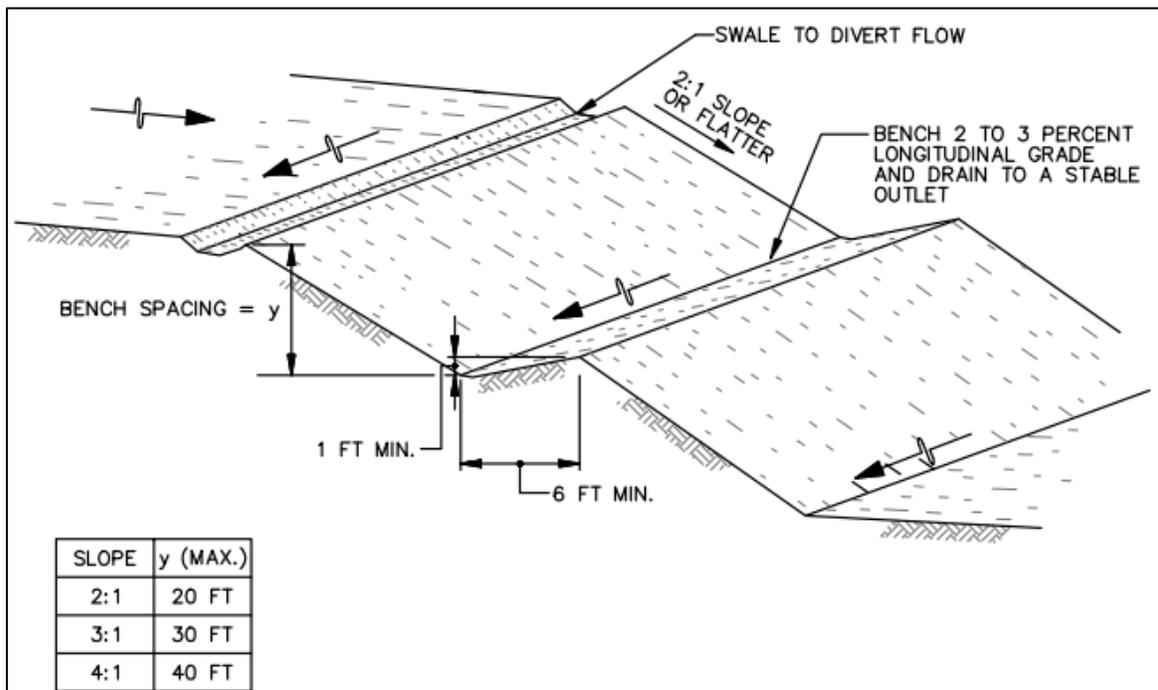


Figure 4.3.2-B: Terracing details. Source: MDE (2011).

Example Application

No formal design or quantities are required for this measure and, therefore, are not presented here.

References

- Hamilton County. (2008). *Stormwater BMP Manual Best Management Practices*.
- ITD. (2011). *Best Management Practices Manual*.
- MDE. (2011). *Maryland Standards and Specifications for Soil Erosion and Sediment Control*.
- Nashville – Davidson County. (2021). *Stormwater Management Manual Vol 4*.
- TDOT. *Drainage Manual Ch10*.
- VDEQ. (2024). *Virginia Stormwater Management Handbook*.