

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**

**TERRACE**

(Ft.)

**CODE 600**

**DEFINITION**

An earth embankment, or a combination ridge and channel, constructed across the field slope.

**PURPOSE**

This practice is applied as part of a resource management system for one or more of the following purposes:

- Reduce erosion and trap sediment

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where:

- Soil erosion caused by water and excessive slope length is a problem
- Excess runoff is a problem
- The soils and topography are such that terraces can be constructed and reasonably farmed
- A suitable outlet can be provided

**CRITERIA**

**General Criteria Applicable to All Purposes**

**Spacing.** Space terraces at intervals across the slope to achieve the intended purpose. The maximum spacing of terraces for erosion control is that necessary to achieve the soil loss tolerance (T) or other soil loss criteria that is documented in the Field Office Technical Guide. Include both the terrace system with planned as-built slopes and cultural practices such as residue management when determining soil loss. The slope length used when checking soil loss for a proposed terrace spacing is the distance from the terrace ridge to the next lower terrace channel measured along the natural flow direction. Maximum spacing for erosion control based on soil loss tolerance may be increased by as much as 10 percent to provide better location, alignment to accommodate farm machinery or to reach a satisfactory outlet.

The methods that may be used to determine terrace spacing include the current NRCS accepted erosion prediction technology, the Vertical Interval Equation. Refer to the current NRCS accepted erosion prediction software and user guide to determine soil loss. Refer to the Engineering Field Handbook, Chapter 8, Terraces for use of the Vertical Interval Equation.

**Alignment.** To accommodate farm machinery and farming operations, design cropland terraces with long gentle curves, where feasible. When multiple terraces are used in a field, design the terraces to be as parallel to one another as practicable.

**Capacity.** Design terraces to have enough capacity to control the runoff from a 10-year frequency, 24-hour storm without overtopping. For terrace systems designed to control excess runoff or to

function with other structures, choose a larger design storm that is appropriate to the risk associated with the installation.

For terraces with underground outlets, the capacity to contain the design storm can be a combination of storage and out flow through the underground outlet. For terraces that store runoff (storage or level terraces), increase the storage capacity by the estimated 10-year sediment accumulation, unless the Operation and Maintenance Plan specifically addresses the periodic removal of sediment.

For terraces with open outlets, base the terrace channel size on the capacity using the densest and longest vegetation. Base the capacity of the channel on a bare earth channel for cropped fields or in the case of a permanently vegetated channel, the appropriate vegetation. For bare earth channels use a Manning's n value of 0.035 or greater to calculate capacity. For permanently vegetated channels, refer to Conservation Practice Standard (412), Grassed Waterway for design criteria to determine capacity.

**Terrace cross section.** Proportion the terrace cross section to fit the land slope, the crops grown, and the farm machinery used. Avoid the use of terrace cross-sections that result in disturbance of all of the soil in the spacing between terraces. Add a minimum of 5% to the ridge height to provide for settlement, channel sediment deposits, ridge erosion, the effect of normal tillage operations, or safety. At the design elevation, the ridge must have a minimum width of 3 ft. For terraces with open outlets, design the capacity of the outlet to be equal to or greater than the capacity of the terrace channel.

Design all farmable terrace slopes no steeper than 5:1 in order to allow safe operation of farming equipment. For non-farmable terrace slopes, the steepest slopes allowable are 2 horizontal to 1 vertical unless an analysis of site-specific soil conditions indicate that steeper slopes will be stable.

**Topsoiling.** Salvage topsoil from the footprint of the construction area of the terrace to spread over the excavated slopes and terrace ridges to facilitate restoration of the field unless the excavated slope or ridge surface is of similar texture as the available topsoil.

**Channel grade.** Design the terrace channel to be stable with non-erosive velocities but with sufficient grade to prevent damage to crops or to prevent delay of farming activities from prolonged ponding.

For cultivated terraces, base the channel stability on a bare earth condition using a maximum Manning's n value of 0.030. For permanently vegetated channels, base the channel stability on the appropriate vegetation. Refer to Conservation Practice Standard 412, Grassed Waterway and Engineering Field Handbook, Part 650, Chapter 7 for design criteria and procedures to determine stability for both bare and vegetated conditions.

In the upper reaches of a channel, grades may be increased to improve alignment. For terraces with an underground outlet, channel grades can be steeper within the impoundment area.

**Outlets.** All terraces must have adequate outlets. The outlet must convey runoff water to a point where it will not cause damage.

Vegetated outlets are suitable for gradient or open-end level terraces. Grassed waterways or naturally vegetated drainage ways may be used as a vegetated outlet. Install and stabilize grassed waterways prior to the construction of the terrace so that the terrace will have a stable outlet when it is constructed. The capacity of the vegetated outlet must be large enough so that the water surface in the outlet is at or below the water surface in the terrace at the design flow.

Underground outlets are suitable for use on all terrace types. The outlet consists of an intake and an underground conduit. If underground outlets are required, use Conservation Practice Standard, 620, Underground Outlet.

Underground outlets may be designed for either pressure or gravity flow. If a pressure system is designed, all pipes and joints must be adequate to withstand the design pressure, including surges and vacuum. For gravity flow systems, use a flow-restricting device such as an orifice or weir to limit flow into the conduit or choose conduit sizes that are large enough to prevent pressure flow.

Design the outlet so that the flow release time does not exceed the inundation tolerance of the planned crop. If sediment retention is a primary design goal, adjust the release rate according to

sediment particle size. Locate the intake structure for the underground outlet to accommodate farming operations and to allow for sediment accumulation.

Combinations of different outlet types may be used on the same terrace system to optimize water conservation, improve water quality, and to accommodate farming operations or to provide for economical installation.

**Vegetation.** Stabilize all areas planned for vegetation as soon as possible after construction. Refer to Conservation Practice Standard, 342, Critical Area Planting or state planting guide for seeding criteria and as needed, use the criteria in Conservation Practice Standard, 484, Mulching.

An erosion and sediment control plan shall be developed for all disturbed areas. For disturbed areas greater than one acre, the erosion and sediment control plan shall meet the planning, installation, and maintenance requirements of NYSDEC state pollutant discharge elimination system (SPDES) General Permit for Stormwater Discharges. All erosion and sediment structures and measures shall be installed prior to earth disturbing activities unless otherwise directed in the construction drawings.

### **SAFETY**

Where slopes will be farmed, make sure they can be safely negotiated with the operator's equipment. Where steep slopes are unavoidable make sure the operator is aware of the location and potential danger of the slopes.

### **CONSIDERATIONS**

Consider including making curves long and gentle and spacing terraces so that the operator can make an even number of trips between terraces in order to end up on the same side of the field they started on.

Consider planting native species that provide food and cover for wildlife and pollen and nectar for pollinators. Do not mow these areas until after the nesting season to improve wildlife production.

Consider aligning terraces and/or installing subsurface drainage to intercept and correct seepage problems. Install the drainage prior to terrace construction by using Conservation Practice Standard 606, Subsurface Drain.

Consider the impacts of other activities such as nutrient management and pest management when planning and installing terraces.

### **PLANS AND SPECIFICATIONS**

Prepare plans and specifications for terraces that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications must include:

- A plan view of the layout of the terrace system.
- Typical cross sections of the terrace(s).
- Profile(s) or planned grade of the terrace(s).
- Details of the outlet system
- If underground outlets are used, details of the inlet and profile(s) of the underground outlet.
- Seeding requirements if needed.
- Bill of materials needed for the construction.
- Site specific construction specifications that describe in writing the installation of the terrace system.

## **OPERATION AND MAINTENANCE**

Prepare an operation and maintenance plan for the operator to follow for the design life of the terrace system. The minimum requirements to be addressed in the written operation and maintenance plan are:

- Periodic inspections, especially immediately following significant runoff events.
- Prompt repair or replacement of damaged components.
- Maintenance of terrace ridge height, channel profile, terrace cross-sections and outlet elevations.
- Removal of sediment that has accumulated in the terrace channel to maintain capacity and grade.
- Regular cleaning of inlets for underground outlets. Repair or replacement of inlets damaged by farm equipment. Removal of sediment around inlets to ensure that the inlet remains the lowest spot in the terrace channel.
- Where vegetation is specified, complete seasonal mowing, control of trees and brush, reseeding and fertilizing as needed.
- Notification of hazards about steep slopes on the terrace.

## **REFERENCES**

USDA, NRCS. 2004. Revised Universal Soil Loss Equation, Ver. 2 (RUSLE2).

USDA, NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 7, Grassed Waterways

USDA, NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 8, Terraces