PART I

PREDICTING WATER EROSION LOSSES

SECTION C

THE FOLLOWING SECTION CONTAINS INFORMATION NEEDED TO CALCULATE GULLY EROSION AND FOR UTILIZING THE ALUTIN METHOD FOR CALCULATING RILL EROSION OUTSIDE OF THE RUSLE.

I. ESTIMATING OTHER EROSION

Annual soil loss predictions for planning purposes are made with RUSLE, the WEQ, or both. Erosion that is seasonal and caused by concentrated flow is not predicted by either of these methods. Detailed criteria for distinguishing rills, ephemeral gullies, and gullies are given below. Differentiating among them still may require careful judgment, and this is especially true where an ephemeral gully results from runoff that follows tillage marks rather than natural depressions.

Definitions

Rills: Rills may be any size, but are usually less than four inches deep. Rills have one or more of the following characteristics:

- generally parallel on a slope, but may converge downslope
- generally of uniform spacing and dimension
- generally appear at different locations on the landscape from year to year
- generally shorter than ephemeral cropland gullies
- usually end at a concentrated flow channel, terrace or an area where slope flattens
- are on the same portion of the slope that is used to determine the length of slope ("L") for the RUSLE
- rill erosion is considered in the RUSLE calculations

Ephemeral Gullies: Ephemeral gullies may be of any size, but usually larger than rills. They have one or more of the following characteristics:

- recur in the same area each time they form, rather than randomly
- frequently form in well-defined depressions in natural drainageways
- tend to occur in the upper reaches of a drainage
- are usually branching, but may have other patterns caused by row alignment
- generally wider, deeper, and longer than the rills on the field
- occur in depressions into which rows or tillage marks lead
- form along sloping rows or tillage marks
- partially or totally erased and filled by tillage operations
- occur on terraced fields where overtopping of the terraces occurs
- occur in the bottom of gradient terraces
- ephemeral gullies are not calculated by the RUSLE

Gullies: Permanent gullies are channels too deep for normal tillage operations to erase. Special operations are required to fill them. Gullies also have one or more of the following characteristics:

- may grow or enlarge from year to year by head-cutting and lateral enlargement
- may also occur in depressions or natural drainageways
- may begin as ephemeral gully that was left in the field and not erased by tillage
- may become partially stabilized by grass, weeds, or woody vegetation
- gully erosion is not calculated by the RUSLE

Soil losses from concentrated flow and gullies can be determined by calculating the volume of soil removed from the eroded area. The tons of soil loss can then be determined by multiplying the volume removed by the unit weight of the soil. If the time period of the erosion exceeds one year, the quantity should be divided by the number of years the gully has existed in order to determine an average annual rate.

TABLE 19

APPROXIMATE SOIL UNIT WEIGHTS 1/

Soil Textural Class	Dry Density (lb/ft^3)
Sands	95
Loamy sands	85
Sandy loam	85
Fine sandy loam	85
Loams	75
Sandy clay loams	75
Sandy clay	75
Silt loam	75
Silty clay loam	75
Silty clay	75
Clay loam	75
Clay	75

1/ The following table provides a guide for approximate unit weight of various soils that can be used in the absence of better data such as known bulk density values. Data and estimates from published soil surveys, laboratory data and soil interpretation records are to be used where available. If bulk density is known in g/cm^3, multiply by 62.4 = lb/ft^3

A. Ephemeral Gully Calculation

$$\frac{\text{Cross-sectional area x Length x Soil Weight}}{\text{2000 x number of years to form}} = \text{Tons of Soil Loss per Year}$$

Example: A gully is 3 feet wide at the top by 2 feet wide at the bottom, its average depth is 4 feet, its length is 1320 feet and it has taken 10 years for the gully to form. The texture of the soil is silt loam.

From Table 18, Page C-2, Erosion Prediction, Section I, Part C, and the above formula:

$$\frac{(3 \text{ ft} + 2 \text{ ft} \div 2) \times 4 \text{ ft} \times 1320 \text{ ft} \times 75 \text{ lbs/ft}^3}{2000 \text{ lbs/ton} \times 10 \text{ yrs}} = 49.5 \text{ Tons/Yr}$$

B. Alutin Rill Erosion Prediction Method

Calculating rill erosion outside of the RUSLE should be done using the Alutin Rill Erosion Prediction Method. This model measures rill erosion in tons per acre, but is fairly labor intensive, requiring significant field data collection.

The basic formula used in the calculation is:

T/Ac of soil loss = the sum of the cross sectional area of rills in square inches along a measured lineal distance of 13.7 feet across the slope. The procedure is as follows:

Step 1 - pace or measure a lineal distance of 42 or 84 feet perpendicular to the slope

Step 2 - measure in inches the width and depth of each rill along the chosen distance

Step 3 - multiply each width and depth reading to obtain a product in square inches

Step 4 - add all products of readings along the chosen distance

Step 5 - divide this sum by 3 if the 42 foot distance was chosen or by 6 if the 84 foot distance was chosen. The result is tons of soil loss per acre.

Example:

Width (in)	Depth (in)	Area (in)$^{2/}$
3	3	9
2	3	6
3	6	18
4	6	24
3	5	15
5	6	30
		102

For a chosen distance of 42 feet, the soil loss in ton/acre = 102/3 = 34 tons/acre