Classic Gully
Calculating Gully Erosion

The soil loss from concentrated flow, gullies, and other similar types of erosion will 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 to get an average annual rate.

Soil losses from some areas of concentrated flow are referred to as ephemeral cropland gully erosion (gullies which are plowed in or filled in by some tillage operation soon after forming). This type of gully erosion sometimes re-forms several times per year and sometimes does not form during a year. The voided volume which could be calculated after a runoff event would not necessarily be representative of the annual rate but would represent only the specific event. This erosion can be calculated for individual storms and can be summed for yearly amounts of measurements following each erosion occurrence.

The following table provides a guide for approximate unit weight of various soils that can be used in the absence of better data.

Approximate Unit Weight[1]

Soil Textural Class	Dry Density Lb/ft.^{3}
Sands	105
Sandy loam	
Loamy sands	
Fine sandy loam	
Loams	85
Sandy clay loams	
Sandy clay	
Silt loam	
Silty clay loam	
Silty clay	
Clay loam	
Clay	

[1]Data and estimates from published soil surveys, laboratory data, and soil interpretation records are to be used where available. Parent materials, soil consistency, soil structure, pore space, soil texture, and content of coarse fragments all have influence on unit weight.

(Example – Bulk density on the soil interpretation sheet multiplied by 62.4 = lb/ft^3

Gully erosion formulas:

Where -

A = top width
B = bottom width
C = depth
D = length
E = soil unit weight
F = headward advancement
G = average annual rate of sloughing or recession
H = number of years

Gully development and volume computations are as follows:

New gully or channel – Eroded silt loam soil; ten-foot top, two-foot bottom, one foot deep, and 600 feet in length. Gully was formed in 2 years.

$$\frac{(A+B) \times C \times D \times E}{2 \times 2000 \times y} = \frac{(10+2) \times 1 \times 600 \times 85}{2 \times 2000 \times 2} = 76.5 \text{ tons/yr}$$

Advancing gully head – six-foot deep, thirty-foot top, six-foot bottom, advancing five-foot/year. Silt loam soil.

$$\frac{(A+B) \times C \times F \times E}{2 \times 2000 \times y} = \frac{(30+6) \times 6 \times 5 \times 85}{2 \times 2000 \times 1} = 23 \text{ tons/yr}$$

Sides of gully sloughing – 2 sides sloughing, 60 feet long, 4 feet high, sloughing 1.0 ft/yr, clay loam soil.

$$\frac{2 \times C \times D \times G \times E}{2000} = \frac{2 \times 4 \times 60 \times 1.0 \times 85}{2000} = 20.4 \text{ tons/y}$$

This method, unlike the USLE, estimates past erosion and cannot predict future erosion. Where terraces, grassed waterways, etc., will be installed to control erosion in watercourses, we can estimate past erosion using this method and could assume future erosion to be zero.

Where small ephemeral watercourses are scoured by concentrated flow and grassed waterways are not appropriate, practices such as crop rotations, conservation tillage, or other cultural practices could be installed. Although these practices have the potential to reduce concentrated flow erosion, we do not have a way to predict it.