RUSLE2 MODEL BACKGROUND

The Revised Universal Soil Loss Equation (RUSLE) was developed by soil scientists over decades of empirical research in order to predict soil loss from water erosion.

Revised Universal Soil Loss Equation (RUSLE)

RUSLE computes average annual erosion from field slopes in tons/acre/year (Renard, 1997)

$$A = R*K*(LS)*C*P$$

A = Computed Average Annual Soil Loss
R = Rainfall-Runoff Erosivity factor
K = Soil Erodibility Factor
L = Slope Length Factor
S = Slope Steepness Factor
C = Land Cover-Management Factor
P = Conservation Practice

The USDA and NRCS have developed the Revised Universal Soil Loss Equation version 2 (RUSLE2) program primarily for soil conservation planning, estimating sediment delivery, and predicting erosion rates based upon the fundamental variables in the original Revised Universal Soil Loss Equation (RUSLE). RUSLE2 improves upon its predecessor by employing a variety of subfactor cover management techniques in a standardized database. It also implements additional sediment-based deposition equations and daily interval determinations that give a more dynamic scenario for soil loss and sediment delivery calculations.

For modeling the potential changes in sediment runoff from the construction of the proposed target range, a series of slope segments representing varying surface coverage were constructed for the entire length of the site slope profile. Rainfall and Soil Erodibility parameters (“R” and “K” respectively) are automatically calculated based upon historical climate and soil data within the RUSLE2 MOSES 2016 database for Union County, GA. Slope lengths and average steepness (“L” and “S”) were derived from the USGS National Elevation Dataset 2010 (1/9 arc-second resolution) as well as proposed construction plans for the project site. With these factors and the “P” value held constant, the surface coverage values were changed to best represent a series of before and after scenarios for different sectors of the site.

As with any erosion prediction model, topographic generalizations and coverage determinations were made to try and best reflect real-world conditions. The sediment loss rates should not be taken as an absolute numerical estimate of actual sediment delivery to the bottom of the slope. Rather, a comparative analysis between the rates gives a much better assessment of potential increases or decreases in soil loss when changes to land cover occur.

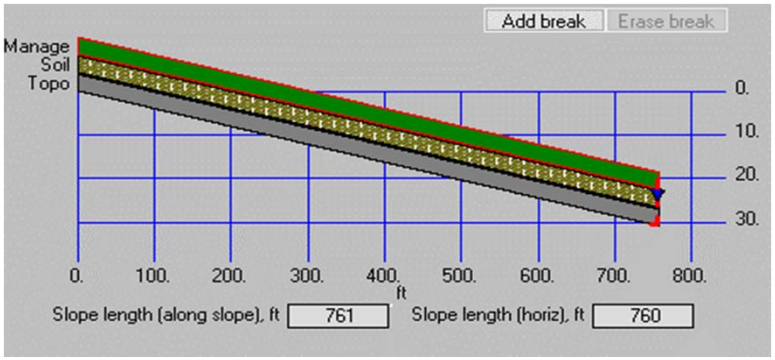
Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agricultural Handbook 703, 404 pp.

Sediment runoff estimates for Firing Range construction
Model: RUSLE2 v2.6.8.4
Erosivity (R) and Erodability (K) values provided by USDA MOSES2016 Database for Union County, GA
Slope values derived from USGS National Elevation Dataset (1/9 arc second) 2010

ADJACENT FOREST SLOPE

	sed delivery (ton/acre/yr)	soil loss (ton/acre)
STATIC	0.13	0.13

Segment #	Segment Horizontal Length (ft)	Average Slope (%)	Soil Type	Coverage
1	760	4.1	Thurmont fine sandy loam (2-6% slope)	vegetative barrier (excellent condition)

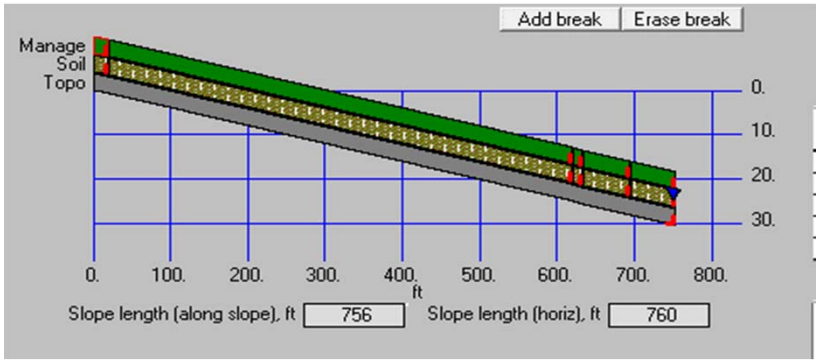


Example of generalized profile for adjacent forest slope in RUSLE2

RIFLE RANGE

	sed delivery (ton/acre/yr)	soil loss (ton/acre)
BEFORE	0.047	0.15
AFTER	0.055	3.9

Segment #	Segment Horizontal Length (ft)	Average Slope (%)	Soil Type	Coverage BEFORE	Coverage AFTER
1	20	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
2	600	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	cool season grass
3	15	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
4	60	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	rock coverage (93%)
5	60	4.1	Thurmont fine sandy loam (2-6% slope)	vegetative barrier	vegetative barrier

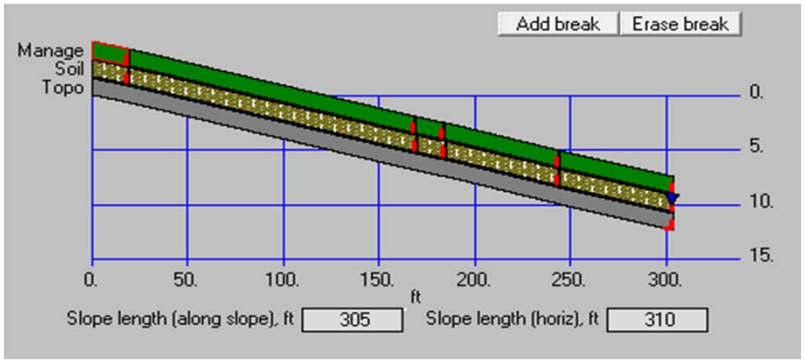


Example of generalized profile for rifle range in RUSLE2

PISTOL RANGE

	sed delivery (ton/acre/yr)	soil loss (ton/acre)
BEFORE	0.046	0.15
AFTER	0.0571	3.9

Segment #	Segment Horizontal Length (ft)	Average Slope (%)	Soil Type	Coverage BEFORE	Coverage AFTER
1	20	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
2	150	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	cool season grass
3	15	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
4	60	4.1	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	rock coverage (93%)
5	60	4.1	Thurmont fine sandy loam (2-6% slope)	vegetative barrier	vegetative barrier



Example of generalized profile for pistol range in RUSLE2