Remediation Analysis of Lower Intramural Fields

BE 3220

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Abstract

This project focuses on the Lower Intramural Fields of Clemson University. These fields have a steep slope and are at a lower elevation than the surrounding land, and so are prone to water and sediment runoff during storm events. The Universal Soil Loss Equation was used to analyze the current conditions and compare 4 remediation possibilities. These possible solutions were analyzed environmentally, socially, and economically. Overall, the most viable and effective solution was to form a crown down the center of the field with a 1% slope to either side and sub-surface drainage.

Introduction

Erosion and flooding both weaken the integrity of playing fields. Erosion specifically is a factor of rainfall, vegetation, slope, and management practices; by changing some of these factors, soil loss can be reduced. Recreational activities effect field deterioration. On the LIM Fields, tailgating and sports have caused poor grass quality, greatly increasing erosion. The proposed solutions to these issues are to install subsurface drainage to prevent flooding, to change the field's slope grade and length, and to increase the vegetative cover. The main objective of this project is to determine which of these solutions is best, with budget and field usage in mind.

Existing Conditions

Soil Loss Calculation Results

Table 1. The chosen solutions and estimated soil loss for each

Proposed Solution	Soil Loss [tons/ac/yr]
No change (4.7% slope, 60% coverage)	2.72
Crown at 2.5% Slope	1.7
Crown at 1% Slope w/ sub-surface drainage	0.9
100% Turf grass coverage	0.194
80% Turf grass coverage	0.842

Model Development Results

The slope length shown is for one half of the field. The results shown are multiplied by 2 to account for the land to both sides of the crown.

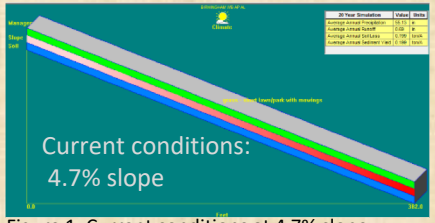

Figure 1: Current conditions at 4.7% slope

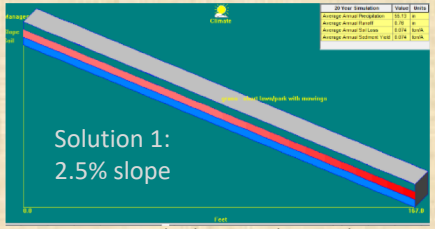

Figure 2: Proposed solution with 2.5% slope

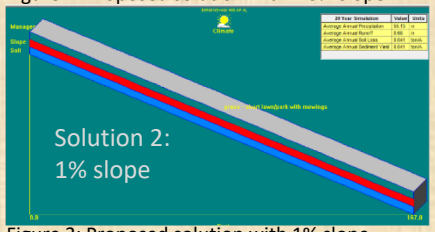

Figure 3: Proposed solution with 1% slope

Materials and Methods

1. The slope of the Intramural Fields was surveyed using a Level and Grade Rod, then calculated using geomatics principles.
2. The Universal Soil loss Equation, shown below, was used with both surveyed and observational values from Web Soil Survey to calculate soil loss for each scenario.

T = RKLSCP

3. WEPP software was used to model proposed slope solutions and estimate erosion and runoff.

Discussion

The 2 solutions selected for closer consideration were either to increase the grass coverage to 100%, or to give the field a crown at a slope of 1% with sub-surface drainage. Increasing grass coverage would achieve the lowest soil loss per year of the 4 options calculated (Table 1). To achieve this, tailgating would have to be stopped to allow for vegetative recovery and maintenance. This loss of revenue would quickly exceed the cost of construction for the slope & drainage solution. Also, it is unlikely tailgating would be limited, due to social and game-day parking considerations

Conclusion

The solution chosen was to give the field a crown with a 1% slope to either side of the crown, and sub-surface drainage around the edges of the field. The total cost of this construction would be about $85,000. The benefits would be that the soil loss would be limited to 0.9 tons/ac/year, and soil moisture would be efficiently removed. The field could continue to be used heavily for all its current purposes. This solution would be an effective option for any sports field that has the funding for initial construction.

References

1. Owino, Tom "BE 3220 Hydrology and Sedimentology of Small Watersheds." Clemson University. Unpublished course notes, 2018.
2. Web Soil Survey. United States Department of Agriculture. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Acknowledgements

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