Erosion Control Through the Application of Gypsum

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Executive Summary

In eastern Tulare County soils are primarily composed of high levels of clay creating an impermeable soil layer. We focus our study on the effects that clay soils combined with steep gradients have in creating undesirable conditions in agricultural farming. Through proper surveying and calculations, a model was created to assess specific areas which are in need of erosion control. A particular farm meeting conditions requiring immediate attention served as an ideal region where data could be collected, analyzed and interpreted.

This study focuses on issues with erosion in concerns to agricultural production. Depending on soil type and gradient this can be a major factor affecting crop yields for farmers. Erosion is defined as the gradual destruction of something by natural forces (such as water, wind, or ice) : the process by which something is worn away.

Project Objectives

The Natural Resource Conservation Resources(NRCS) originally named Soil Conservation Services (SCS) has been helping farmers with their land for over 80 years. (nrcs.usda.gov). The Program was originally set out to help farmers minimize erosion on land since it had such a great impact with agriculture productivity. Working for the NRCS engineers can help design projects that would not only minimize erosion from rain water but possibly collect and store water for future use. High levels of clay soil cause rain water to run off especially on properties on sides of hills. The use of gypsum is widely used by farmers to help break down soil and increase percolation rates. By surveying a piece of land and plotting the data using Auto-Cad engineers can model water flow and design a drainage system to redirect water to a desired area.

Project Approach

To analyze the type of soil conditions we were facing, websoilsurvey.nrcs.usda.gov was utilized to determine the soil composition in the specific region we were working in. This database was also used to determine water percolation rates for the area. Using Trimble surveying equipment GPS based points were taken intermittently along the perimeter and roadways to create a map of the subject farm. With the same equipment further points were taken continuously every 10 feet within the inner rows of citrus trees to generate a detailed topographical map with Auto-Cad. Four maps were constructed; an area plot plan, topographical, 3-D rendered, and a proposed developmental map. Using these designs, we were able to derive the area and slope of the land. With this information, calculations were used to formulate how much water flow was occurring during a given period including average rainfall. These results were used to determine what size irrigation system should be implemented as well as how much gypsum should be applied.

Project Outcome

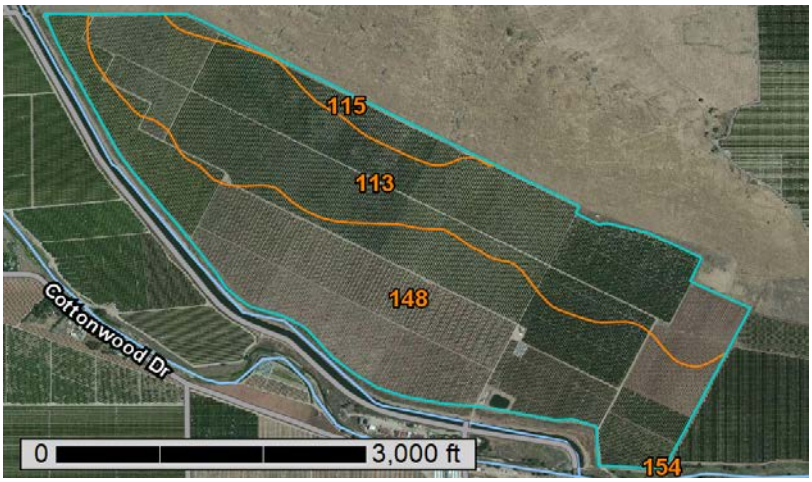
Once the data was collected we began to analyze each factor we focused on. Using the area determined from the survey and a 25-year design storm of 0.75”/day, we were able to determine what size drainage pipe would be necessary for proper flow as well as how much water could be stored annually. This data was also used to calculate the amount of gypsum to be applied and how often, about 1 to 2 tons per acre every one to two years. The amount of gypsum to be used was taken from the Journal of NACAA, “Results indicate that gypsum treatments had significant effect on select soil biological, physical and chemical properties. The concentration of Soil Microbial Biomass, the SMB:TOC (Total Organic Carbon) ratio, and the absorption rate were found significantly influenced by gypsum treatment, especially at the 2 ton per acre treatment level”. Once we established the highest precipitation rate we then analyzed the amount of time that rate occurred versus soil percolation ranging from .04 to .20 inches per hour. This data represented what size system would be needed to collect and store runoff water throughout the year.

Conclusion

Upon completing our research and performing the proper calculations our design recommendations are that gypsum should be used on the top portion of the land where we see the greatest slopes. Research shows that gypsum does in fact alter the chemical composition of the soil allowing greater water absorption particularly when working with clay soils. An initial saturated application of gypsum should be applied to allow for greater absorption followed with a dry application every 1 to 2 years. Areas to be initially treated should include greater elevation angles (roughly 204 acres) requiring about 408 tons of gypsum at a cost of $25-$45 per ton totaling $10,000 - $18,000. We also recommend that a drainage be installed to collect the remaining water runoff that is not absorbed by the ground. Based on our calculations the peak amount of runoff which can occur on a single day would produce 6434 gallons per minute. This amount would require a drainage pipe no less than 8 inches in diameter. The potential volume of runoff water conserved could reach amounts in excess of 19 million gallons per year.

Appendices

SOIL TYPES

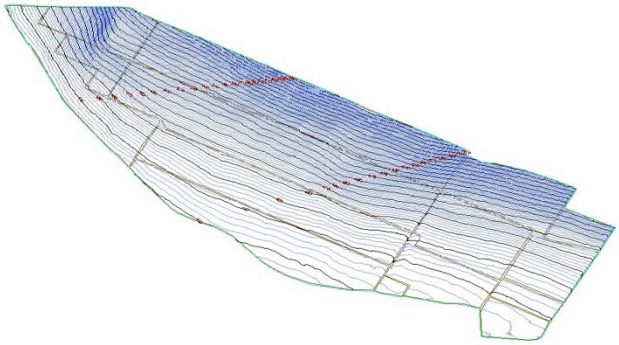


113 – Cibo clay **115 – Clibo-Rock outcrop complex**

148 – Porterville clay **154 – San Joaquin loam**

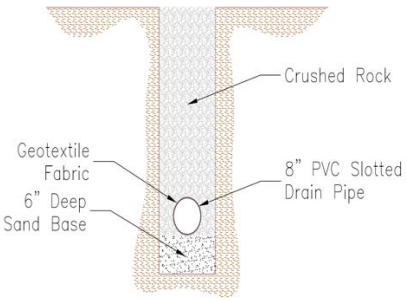
ROAD MAP

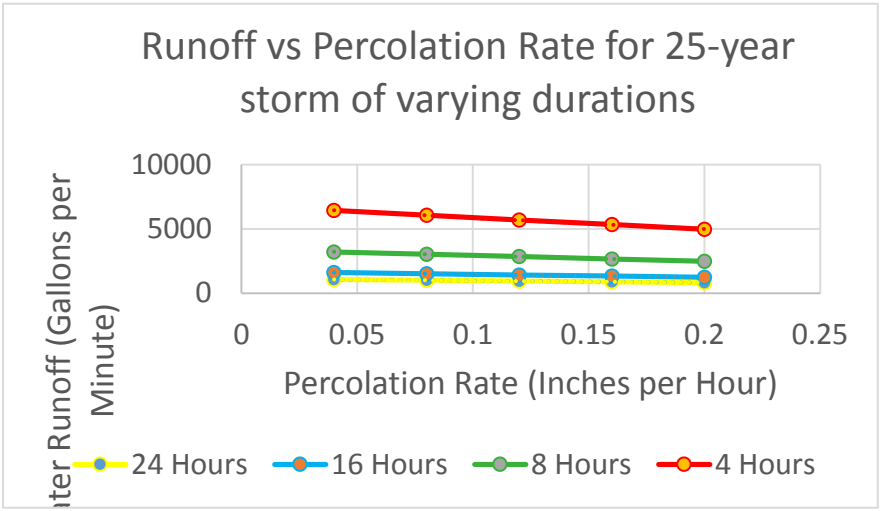
Topographical Map



Drainage design

Cross Section of Drainline





REFRENCES

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- **"80 years helping people help the land" http://www.nrcs.usda.gov/ Web. 11Sept 2016**