CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Gajan R. Nagaraj

Project Number

36639

Project Title

Drought or Deluge: Creating a Novel Ground Water Basin for the Efficient, Economic, and Eco-friendly Capture of Runoff

Abstract

Objectives/Goals

With an increasing worldwide population, rapid industrial growth, and exponential commercial growth, water is becoming a scarce commodity. Climate change is causing unpredictable patterns of drought and deluge. A system which can effectively capture runoff is needed to preserve water for future use and to prevent excessive water during rains from causing floods. The goal of this work was to design and implement a novel water harvesting pond for the efficient, economic, and eco-friendly capture of runoff to enable water management through drought or deluge.

Methods/Materials

A novel design for a groundwater harvesting system which could outperform contemporary percolation ponds was created. Rocks in an inverted conical structure were positioned from top to bottom in the system to increase the surface area for water to diffuse and disperse. A carbon fiber filter was added to the surface of the pond, allowing for easier and more frequent desilting and to add to the efficiency. In order to collect data I created a novel soil/sand sampler which is positioned in the system at any point and can accurately collect a sample of any point. I created a parameter to normalize all data values, called effective dispersion factor, which is defined as the moisture content of a sample per unit distance away from the point water is poured and per unit volume of water poured.

Results

Overall the samples from the experimental percolation ponds had an average effective dispersion factor of 4.47, while the control ponds only had an average effective dispersion factor of 1.79. Desilting and redeploying the carbon filter for every trial also speeds the downward flow. Additionally, the experimental system had a greater effective dispersion factor everywhere, meaning it is able to spread water more effectively throughout the surrounding soil both horizontally and vertically.

Conclusions/Discussion

In conclusion, the experimental redeployable layered harvesting pond was more effective by allowing easier desilting, then allowing water to diffuse and disperse efficiently, and being a cost effective scalable solution to contemporary percolation ponds. The experimental harvesting pond has proven to be around 250% more effective in dispersing water. This redeployable harvesting pond is the most efficient method known now which can help communities survive during harsh droughts, deluges, or as a regular water supply.

Summary Statement

This project is about creating a novel ground water basin for the efficient, economic, and eco-friendly capture of runoff to enable water management through drought or deluge.

Help Received

No help asked for. I designed, built, and performed the experiments myself.