



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Kai T. Narum</b>	<b>Project Number</b> <b>J1015</b>
<b>Project Title</b> <b>Pay More Attention to Bioretention: Effectiveness of Filtration Media for Removal of Pollutants from Stormwater</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Raingardens use bioretention to filter pollutants from stormwater using layers of media. The filtered water can then be returned to the environment without causing harm. The objective of my project was to determine the media most effective at filtering pollutants from stormwater. I tested four different media: 1) layered coarse gravel, pea gravel and sand(layers), 2) tire-derived aggregate(TDA), 3) a mix of sand, clay, and organic material(mix), and 4) crabshell below a mix layer(crab).</p> <p><b>Methods/Materials</b> I prepared four testing chambers with each of the different media and collected three samples of stormwater (2 L volumes). Before filtering, I tested the media for saturated hydraulic conductivity, and the stormwater for turbidity (suspended solids), pH, conductivity (dissolved solids), and total solids (suspended plus dissolved solids). I used water quality instruments to measure turbidity, pH and conductivity and a gravimetric analysis to measure total solids. I filtered 300 mL of each stormwater sample into a chamber and tested the filtered water for turbidity, pH, conductivity, and total solids. I repeated each measurement three times for the three stormwater samples resulting in 180 data points.</p> <p><b>Results</b> The average saturated hydraulic conductivity ranged from 91 ft/day for the mix media to 470 ft/day for the TDA media. I found that the mix was very effective at reducing turbidity (80-99%) but greatly increased total solids (546-869%) and conductivity (3743-5151%). Average pH increased from 5.9 to 11.2. My research suggests the increases were due to the presence of hydroxide salts in the clay. The crab media had similar results, (but not as drastic), because of the mix layer above the crab. The layers media and TDA media reduced total solids by 36-39% on average; however, the TDA was more effective at reducing conductivity (19% on average). The reductions in turbidity varied greatly (16-98%) and were dependent on the initial turbidity of the stormwater. Both the layers and the TDA kept the pH at about the same level.</p> <p><b>Conclusions/Discussion</b> The layers and TDA were equally effective at eliminating pollutants based on my testing, but the mix was the most effective at reducing turbidity. I plan to design a new media chamber that incorporates the turbidity-reducing properties of clay and the conductivity-reducing properties of TDA. The results of these experiments will be presented at the state science fair.</p>	
<b>Summary Statement</b> The goal of my project was to determine the effectiveness of different filtration media in bioretention areas at elimination pollutants from stormwater runoff.	
<b>Help Received</b> Lewis McCrigler and Marty Reed of HSU assisted in the construction of the sample cells; used lab equipment at HSU under supervision of Dr. Eileen Cashman; Colin Wingfield of HSU assisted in media preparation; Ms. Diana Skiles and David Narum (dad) helped with editing and suggestions for backboard.	