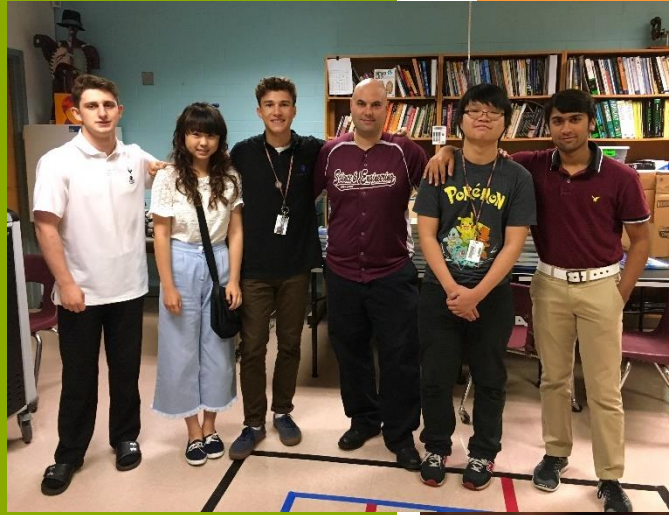


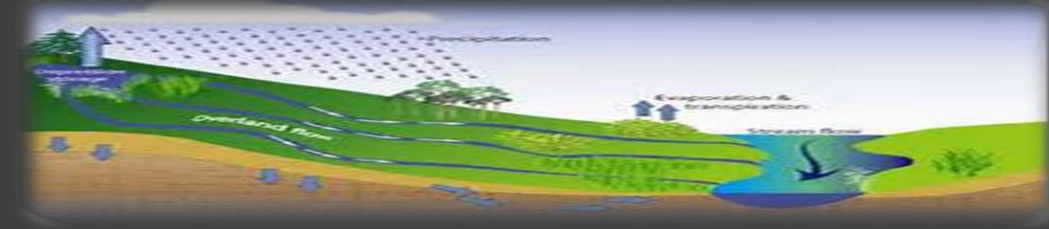
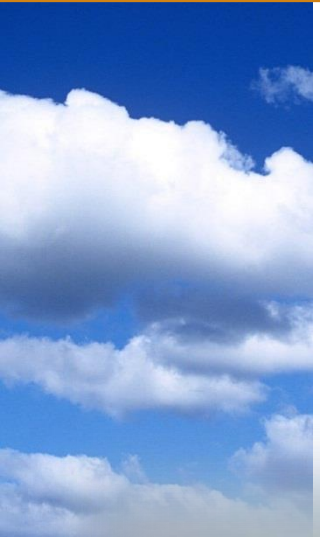
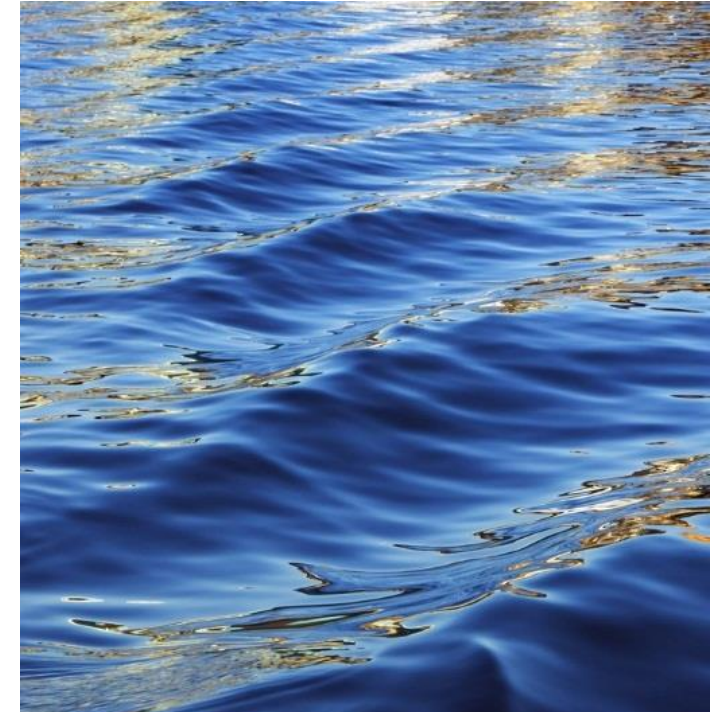


Land and Water Challenge



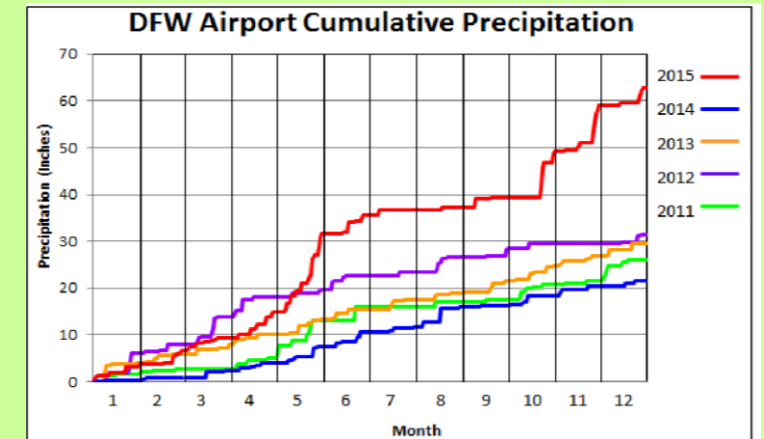
Runoff Resolvers

Teacher Advisor: David McLoda
Student Names: Hunter Adams, Kimmy Chang, Nolan Kuo,
Aadit Mehta, Leo Troik
School of Science and Engineering Magnet
Dallas, TX
Principal Name: Tiffany Huitt



What's the environmental issue?

- Based on the NOAA gage at the DFW airport, 2015 was the wettest year with 62.8 inches of precipitation. The graph on the side illustrates the cumulative total precipitation of the past five years. Cumulative wastewater discharges into the river in the DFW area averaged around 450 million gallons per day.
- The high volumes of wastewater discharges elevated nutrient concentrations and pollutant levels within the river including *E. coli* (20-30% above the state maximum), phosphate (8-75 ppm), and nitrate (10.3 ppm). These nitrogen and phosphorus concentrations put the river at risk for algae blooms and loss of biodiversity. In addition to this, high *E. coli* levels can lead to contamination of much of North Texas' drinking water source.
- Our team designed a bioswale and filtration device to counter these harmful pollutants.

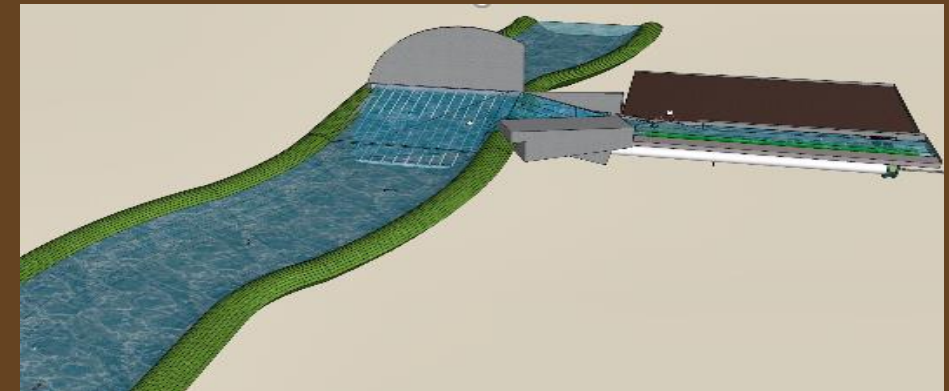
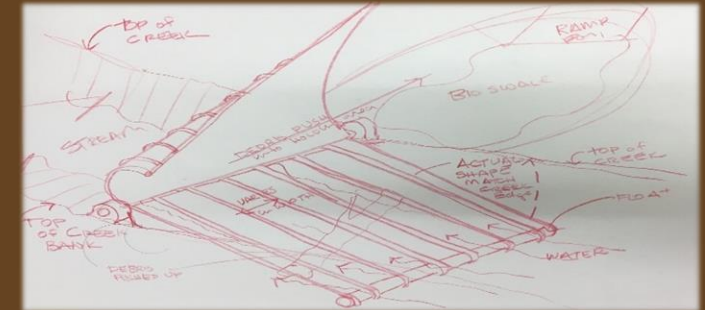
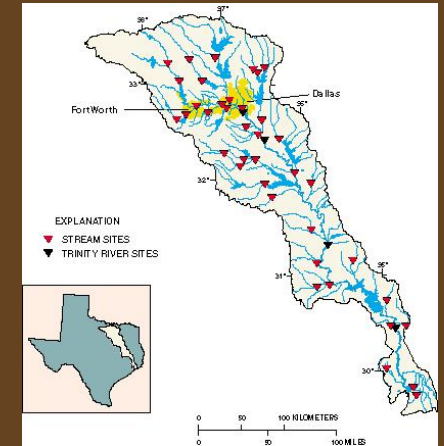


PARAMETER	AVERAGE CONCEN- TRATION	MINIMUM	MAXIMUM
Orthophosphate	2.6 (mg/L)	2.1	4.4
Nitrate/Nitrite	10.3 (mg/L)	9.0	11.8
TKN	1.0 (mg/L)	0.7	1.5
Chlorophyll a	30.6 (ug/L)	8.7	51.7
Dissolved Oxygen	10.2 (mg/L)	8.7	11.5
TSS	88.3 (mg/L)	65	103

Parameter	Screening Level
00630 NO ₃ /NO ₂ *	1.95 mg / liter
00665 TP	0.69 mg / liter
31699 <i>E. coli</i>	126 colonies / 100 ml
32211 Chl-a	14.1 µg / liter

Our Action Plan: Step-By-Step Actions

- I. Our team researched possible solutions and arrived at the conclusion to use bioswales. We then found native plants for the bioswales that could be used to target specific pollutants, and added a filtration device to improve on our design.
- II. Sampled the river's composition to validate statistics we found.
- III. Consulted our mentor to improve our design.
- IV. Found key points of application for our model.
- V. Drew blueprint and made a digital 3D model of bioswale and filtration device.
- VI. Created several stages of implementation.
- VII. Found sponsors and spread awareness in schools and the community.
- VIII. Got funding for the first stage (bioswales) and volunteers from the community.
- IX. Resampled the river's composition and monitored the bioswales' impact at the experimental site.
- X. Continued to expand our project to other sites of the Trinity.



Our Action Plan: Responsibilities

I. Hunter Adams

- Blueprint draft of bioswale and filtration device
- Set up appointments with sponsors

II. Kimmy Chang

- Design 3D Model of bioswale and filtration device
- Create PowerPoints (for awareness, sponsors, submission)

III. Nolan Kuo

- Create website
- Compiled initial contact list of sponsors, schools, and community groups

IV. Aadit Mehta

- Organize meetings and schedule
- Photographer

V. Leo Troik

- Coordinated school and community awareness events
- Followed up with sponsors

VI. David McLoda (Mentor)

- Review designs
- Advice on possible improvements

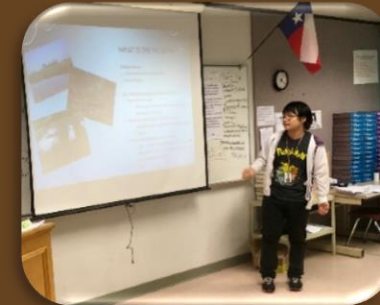
Each team member collected river samples, tested river's composition, presented to sponsors, spread awareness in the community and schools, installed bioswale, and researched background information on the topic.



Hunter Adams



Kimmy Chang



Nolan Kuo



Aadit Mehta



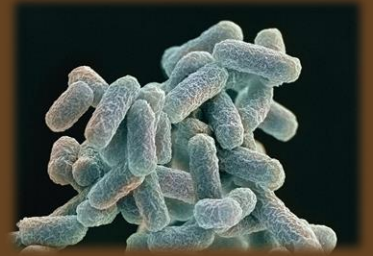
Leo Troik (with our principal)



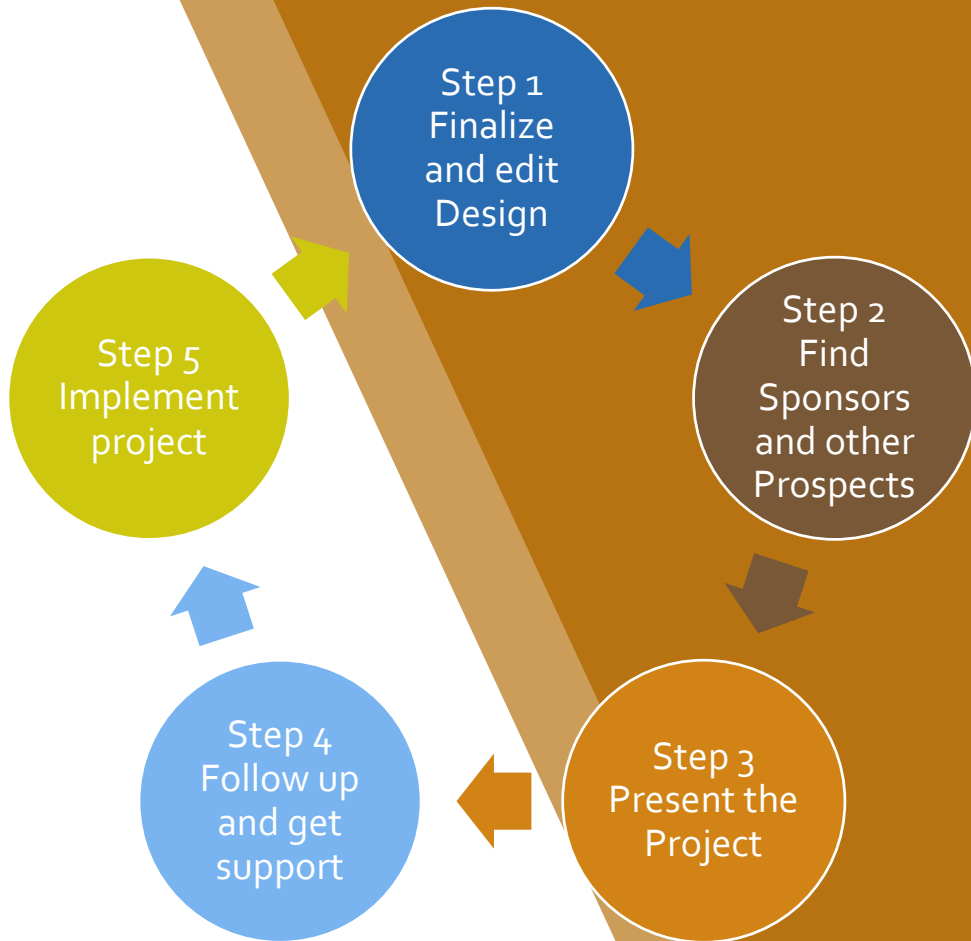
David McLoda

Our Action Plan: Success and Impact

- I. Our team has found sponsors and spread awareness in schools and the community in the DFW area. Through this, we've gotten the funding needed to implement stage 1 of our project (the bioswales) as well as volunteers to help install the plants. Following this, we retested contaminant levels in the implemented in order to quantify the impact of the experiment. The nitrogen, phosphorus, and E. coli levels decreased over time after the respective plants were introduced.
- II. We are continuing to get financial support from sponsors as our project expands to other sites. In a year, we hope to implement the filtration design to complete the model.
- III. The measure of our success involves lowering harmful pollutant levels closer to acceptable state maximums.

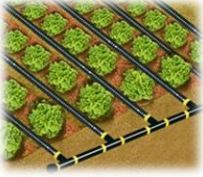


How did you implement your ideas?



- Our team found local environmental groups and sponsors that could help fund and provide labor for the bioswale implementation (stage 1).
- Our bioswale uses Yellow-flag/Blue-flag Irises (these remove carbon dioxide from water, make the water less acidic, and slow water flow so suspended particles can settle), Marsh Plants (reeds to remove oil and E. coli, bulrushes to eliminate heavy metals), Submerged Plants (which remove fertilizer chemicals such as nitrogen and phosphorus), and Spikerush (for the filtration of ammonium).
- After contacting possible sponsors, we set up appointments to present our project. Following our presentation, we successfully got the funding and support we needed to test out our design in the Trinity.
- We've currently made one bioswale with the help of our partners and conducted tests to confirm its effectiveness.
- Our team looks forward to spreading this project to other regions of the river and adding the filtration device.

How did you implement your ideas?



School Events

- Townview Magnet Center (School for the Talented and Gifted, School of Science and Engineering, School of Health Professions, School of Business and Management, ESSM, School of Law)
- McKinney ISD (Wolford Elementary School, Evans Middle School)

At each of these schools, our team gave lessons about the Trinity River and water pollutants in classes, after-school meetings, and extracurricular activities. In these lectures, we informed students of the importance of the Trinity River for the DFW area, how we planned to reduce harmful pollutants in the Trinity River, and ways that they could help with water pollution. Some of this advice included picking up grass clippings (grass clippings – high in nitrogen and phosphorus content – are often swept into storm drains which flow into rivers), hand water or using soaker hoses (reduces runoffs), picking up pet waste (fecal matter – high in nitrogen content – leads to algae blooms), using recyclable bags (plastic bags often end up in waterways and are a threat wildlife), and to not use excess fertilizer and pesticides (contamination of waterbodies).

Sponsors

- TODVT Inc. (Dallas, TX)

We met with the partner of this corporation and presented our work. The General Manager asked our team specific questions and embraced our ideas. Upon the close of the presentation, he agreed to sponsor our work and show our project to his employees at meetings. He was glad to support us since he values the Trinity River as a drinking water resource and recreational site.

Governmental Agency

- Dallas Park and Recreation

The School of Science and Engineering principal set our team up with the Head of the Dallas' Park and Recreation so that we could get more advice on how to improve our project. We met with the officer and gave a presentation of our model. Afterwards, we exchanged contacts and presented to other district officials. We drafted up an approximate cost and time plan and got permission to implement our project.

How did you implement your ideas?

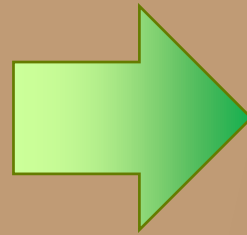


- We got our team's work out by creating a website, meeting with school principals, and creating a separate PowerPoint for presentations. In this, we promoted the advantages of our project (decreased contamination levels, low-cost, high efficiency, aesthetically pleasing, easy to maintain, and versatility).
- Website link: <http://runoffresolvers.wixsite.com/lexuseco>
- Website includes the 3D model, videos, a photo gallery, and PowerPoint presentation.

Evaluation of Our Plan & Results: Success and Challenges

Challenges

One of the main challenges our team faced in this project was time management. Researching ways to solve the Trinity pollutant level issue, creating a solution, finding sponsors and volunteers, and conducting experiments to test the bioswales' effectiveness; was nearly a mission impossible to complete in the Lexus Eco Challenge time span. Furthermore, organizing meetings and setting up presentations with associations was both new and difficult. Presenting in these real-world situations forced us to learn how to control our nerves so that we could convey our message proficiently.



Success

The Runoff Resolvers were able to get the funding and labor needed to implement Stage 1 of our plan (bioswales). The bioswale successfully decreased water contaminant levels in the section of the river. In addition to this, we also created a school and community movement towards reducing water pollution sources.

Evaluation of Our Plan & Results: Awareness and Quantifiable Results

Awareness

Our team spread awareness in our school and community. We did this by hosting events in our community and creating a website to spread our information and work to others. Through this medium, we've been able to see a myriad of perspectives and improve on our initial plan as people propose new ideas. As more people come to hear about our project, we hope to continue gaining enthusiastic support.

Quantifiable Results

Before implementing the bioswale in the Trinity River, the respective area had noticeably high E. coli levels (approximately 20% above state maximums). However, our tests after implementing the bioswale there indicate improvements in the contaminant level (15% above state maximums). We plan to continue reaffirming the progress of the project as well as taking into consideration factors that may skew our data.

Average Concentration of Substances

Substance	Concentration (mg/L) (Test 1)	Concentration (mg/L) (Test 2)	Concentration (mg/L) (Test 3)	Average Concentration (mg/L)
Nitrates	9.72	10.57	10.18	10.16
Phosphates	13.84	15.43	14.39	14.55
Heavy Metals (Aluminum, Copper, Lead)	16.24	17.31	16.70	16.75

Evaluation of Our Plan & Results: What Our Team Learned

- Initially, researching up possible solutions to the Trinity water pollution issue seemed simple. However, thanks to our mentor's advice, we were able to realize that some of our models wouldn't suit this particular circumstance. Thus we learned how to refine our research tactics and better understand factors that contribute to the composition of a project.
- Following this, our team drafted up a blueprint and made a 3D model. In this, we learned how to translate our ideas into scaled realities.
- In addition to this, our team worked on forming contacts and relations with prospect sponsors, district officials, community figures, and schools. Here we gained invaluable life skills such as contacting people, following up, forming professional statements, and creating informative presentations. When presenting in front of audiences, we understood the importance of anticipating questions, counterarguments, and criticism.
- We also learned how to make sacrifices such as using lunch time and coming to school early in order to work on the project since we all live around an hour away from each other.
- As a whole, this project not only gave us academic lessons; but of character, presentation, and organization.

Runoff Resolvers



The majority of our winnings will go towards funding other bioswale applications. However, we will also use some of the winnings to donate to other local environmental groups, spread awareness, save up for college, and fund further research.

What the Runoff Resolvers, School, and Teacher Advisor will do with the Winnings

Teacher Advisor

Funds will be used to purchase materials for an in-class bioremediation lab. We will research the use of plants, fungi, and bacteria in restoring soils contaminated with oil, heavy metals, and other toxins.

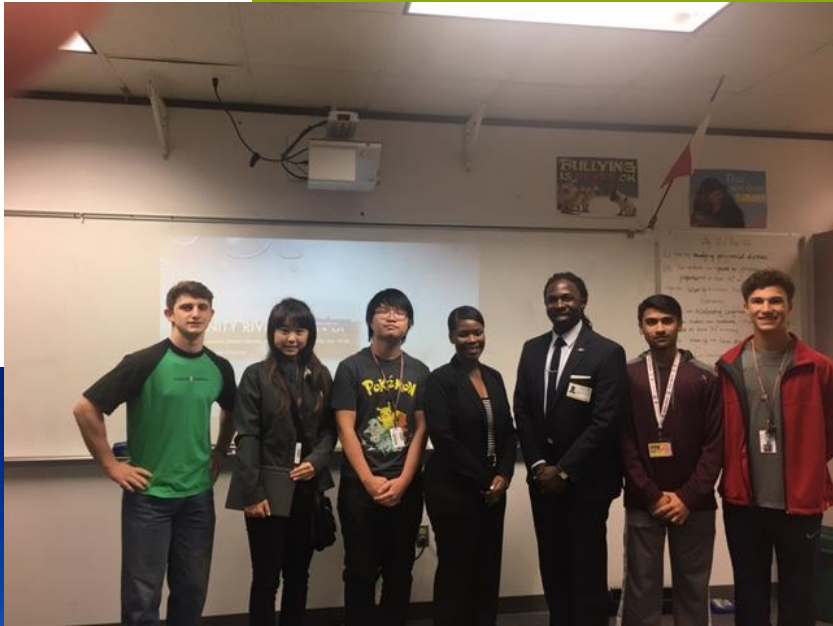
School

Ms. Huitt, our principal, will put most of the winnings toward later stages of our project. Additionally, she wants to initiate a recycling program in Townview as it currently lacks one.

Project Gallery

Our Team!





Project Gallery

Making Connections!

Trinity River Clean-Up

Aadit Mehta, Kimmy Chang, Leo Troik, Hunter Adams, Nolan Kuo

What is the Problem?

> The Trinity River is being polluted!

- Causes: Urban Runoffs and Sewage Plants
- High Concentration Levels of Hazardous Chemicals such as Nitrates and Phosphates
- Growth of Bacteria such as E. Coli

Our Solution

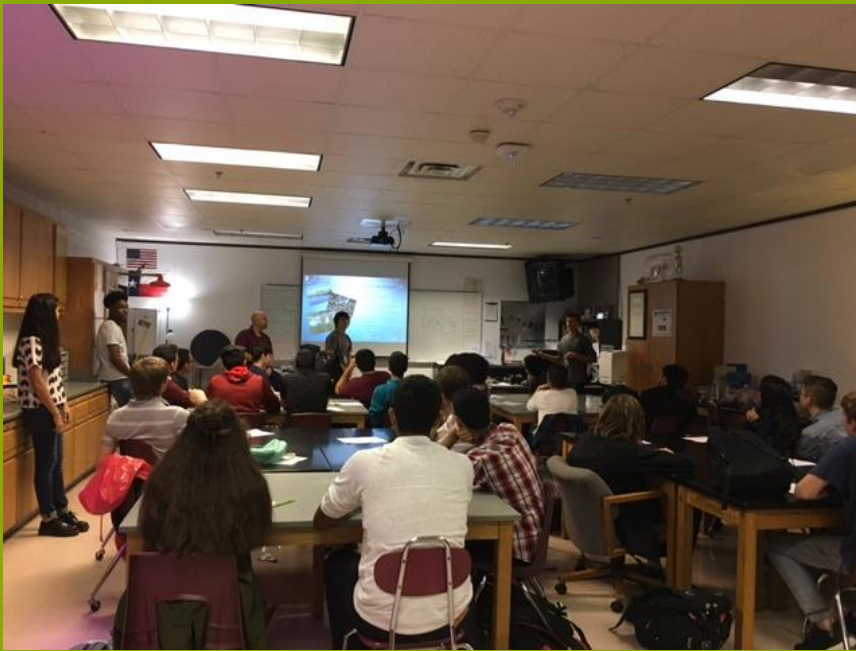
> Bioswales

- Advantages: Organic, Versatile, Efficient
- Plants Help Filter the Harmful Substances
- Ex: Submerged Plants Filter Chemicals found in Fertilizers

What Can You Do?

- Pick Up Pet Waste
- Pick Up Grass Clippings instead of Sweeping Them on Streets
- Don't Use Excess Fertilizer
- Use Hoses instead of Sprinklers

Project Gallery



Spreading Awareness in Schools

