

2020 Proposal

Rainwater Harvesting

ENVL 4300

Mary MacDonald

Briana Nagengast

KC Hanscom

Table of Contents

I. Mission Statement.....	3
II. Abstract.....	3
III. Statement of Need.....	4
IV. Project Rationale Incorporating Literature Review.....	5
V. Project Narrative.....	6
1. Goals and Objectives.....	6
2. Proposed Activities.....	7
3. Facilities, Resources and Project Management.....	9
4. Evaluation.....	10
5. Outreach/Dissemination.....	12
6. Sustainability.....	13
VI. Resources.....	14

I. Mission Statement

Our mission is to establish a self-sustaining irrigation system for the Richard Stockton G. Larry James Stadium. By using a rainwater harvesting system, sprinklers used to water the athletic field would no longer have to draw up ground water which is a vital resource to our area. This would allow for the interception of storm water runoff, from the top of Stockton's Sports Center (Big Blue) to be stored and redistributed to the field for use of irrigation.

II. Abstract

Rainwater harvesting is a method of water collection that has been around for thousands of years, however it is starting to gain more popularity with the growing global freshwater crisis. Water conservation is becoming one of the main environmental focuses. Stockton University could benefit in a number of ways by implementing a rainwater harvesting system next to the Campus Sports Center (Big Blue). Rainwater runoff from the roof of this building can be stored and used for irrigation of the G. Larry James Stadium field. We have calculated that the Sports Center will be able to generate plenty of water monthly to keep the quality of the playing field in tiptop shape. In order to store enough water for this application we estimated that the storage tank would need to hold about 65,000 gallons of water. A tank this size would be able to hold more than enough water. The tank could be placed next to the Sports Center on the side of the building closest to the stadium field; it can either rest on top of the pavement or be dug underground. In regards to cost effectiveness and a reduction of environmental impact we believe it would be most beneficial to have it rest above ground on top of the pavement. Due to a unique design of the system it is hard to determine its initial cost without actually going through a consulting process with a company specializing in these systems. There is however some funding options available and multiple incentives associated with this system of water conservation. It would dramatically decrease the stress put on the groundwater, which is the current supplier for irrigation water used for the playing field. This system is very sustainable far into the future and is not associated with many drawbacks after the cost of the initial installment. It will also help Stockton gain more LEED credits and possibly

a higher certification. This system and its storage of high quality water will also have the ability to be used for a number of other applications on campus to add to additional benefits for Stockton's campus and community.

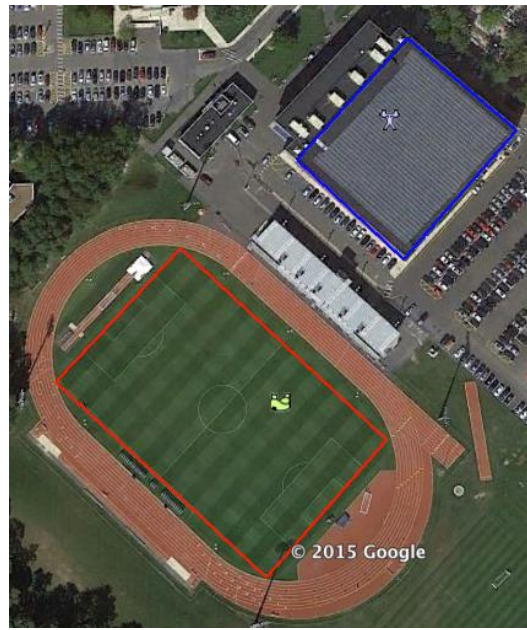


Fig 1. Aerial view of the Sports Center roof (outlined in blue) and the G. Larry James Stadium field (outlined in red) that will be affected by the rainwater harvesting system

III. Statement of Need

The implementation of a rainwater harvesting system for the G. Larry James Stadium field here at Stockton would help to conserve groundwater. Water conservation is becoming a popular practice and is needed to help protect this vital natural resource that humans, as well as everything else in the world, needs to survive. On average Americans use 100 gallons of water per day, with these values fluctuating in respect with the change of the seasons.¹ New Jersey has been experiencing an ever-increasing population which can lead to a number of problems, loss of open space, loss of wetlands and aquifer recharge areas, evaporative water loss due to inefficient irrigation, and increase in wastewater discharge to oceans and bays are some of the issues associated with.¹ With more people drawing from the groundwater table, water conservation is becoming more and more of a necessity. Stockton, being that it is located

relatively close to the shore means that depletion of the ground water table can also lead to salt water intrusion. This could make the slowly diminishing ground water table insufficient for use as well.

As much as fifty percent of the water we use outdoors is wasted from inefficient watering methods and systems.¹ The easiest and least expensive way to protect groundwater is to conserve it, meaning that we need to focus on drawing less water from the groundwater table. By using a rainwater harvesting system here at Stockton, storm water that would normally be diverted off of neighboring rooftops, could be stored and used for the athletic field irrigation. Rainwater harvesting also helps to mitigate local flooding.⁴

IV. Project Rationale Incorporating Literature Review

The University of Georgia has a number of rainwater harvesting systems currently installed on their campus. Kevin Kirsche serves as the Director of Sustainability at the University. He is a registered landscape architect as well as a LEED Accredited Professional with years of experience working for the University. When asked about the obstacles faced in construction of the rainwater harvesting systems, Kirche explained that the biggest challenge was “obtaining buy-in from all responsible stakeholders” and “getting commitment from all parties involved- from funding and design to construction and long-term maintenance.”⁶

The University of Georgia’s work with rainwater harvesting can foreshadow the challenges Stockton may run into when building their own system. In order to overcome such obstacles a strong organized plan needs to be set in place. This would ultimately include strong participation and backing from the Stockton University faculty and student body, familiarly seen on Georgia’s campus. Other issues the University of Georgia stumbled across when implementing their rainwater harvesting systems dealt with filtering and contamination. These will not be the biggest issue for us at Stockton because our goal for rainwater use is irrigation only, but there is maintenance needed regardless of water usage. In Kirche’s experience he found that the filters needed to be cleaned regularly in order to keep the system functioning correctly.

The University of Georgia is the leader in the region for water resource management and since 2007 has reduced their water use by 30%. Between 2005 and 2012 the University has constructed over 15 cisterns with more than 500,000 gallons of storage capacity.⁸ University of Georgia’s successful work with rainwater harvesting systems and their constant growth in the area proves that such a project can be achieved currently on the Stockton University campus.

V. Project Narrative

1. Goals and Objectives

The objective behind the installment of a rainwater harvesting system is to conserve water. By collecting and storing rainwater runoff from the rooftop of the Sports Center allows us to use that water whenever we need it to irrigate the playing field without having to draw from the ground water. The goal is to eliminate the need of drawing from or tapping into the groundwater for irrigation purposes of the stadium’s field. Some fields require as much as 63,000 gallons of water a month for irrigation.³ A rainwater harvesting system accommodates every gallon needed during this process, but from a conservative, collected, and stored source, that doesn’t rely on already stressed groundwater sources. This means that Stockton has the ability to potentially conserve up to 63,000 gallons of water per month during times of field use and irrigation.

General Assessment Plan

Goal	Outcome	Methods
Approval For Rainwater Harvesting Installation	This would allow Stockton to begin installation of the system and begin its focus on water conservation	Through this 2020 proposal as well as student and faculty support
Installation of Rainwater Harvesting System	1 year after approval the installation of the system should be complete	By working with a rainwater harvesting company to complete and insure proper installment of the system

Begin irrigation of stadium field at end of year 1	Focus on water conservation	By using the stored water that was collected in the harvesting system from the rooftop of the Sports Complex
With in 5 years, at least a 10% decrease in the stress applied by Stockton to the local groundwater table is desired	Water conservation is begin to play a large role on Stockton's Campus	The rainwater harvesting system is a visible way to show Stockton's efforts to protect to environment as well as contribute to water conservation

2. Proposed Activities

Stockton University takes pride in attempting to be an environmentally responsible learning community. The implementation of a rainwater harvesting system to water the stadium field is a way to enhance that environmental responsibility. We are proposing to install a rainwater harvesting system conveniently next to the Campus Sports Center (Big Blue), which effectively collects rainwater runoff from the roof of the building, and stores it for the use of irrigating the stadiums athletic field. A pressurized rainwater harvesting system is most effective for irrigation purposes in this case, rather than a non- pressurized rainwater-harvesting system. The pressurized system will allow the water to be pushed through hoses and dispersed through sprinkler heads to water the field. Storage tanks can be either placed underground or located off to the side of the building. The best location for water storage could be portrayed in Figure 2 and 3. Avoiding underground storage tanks, and strategically locating an above-ground tank next to the building, avoids having to tear up the ground. Another advantage to storing the rainwater above ground is that the system would benefit from both pressurized and gravity fed non-pressurized water distribution.⁴



Fig 2. Above ground rainwater harvesting system



Fig 3. Potential location for rainwater harvesting system (outline in green)

The stadium field is mostly used during three seasons, fall, spring, and summer. In order to ensure the tank stores enough water to irrigate the field, we estimate that the storage tanks needs to hold about 65,000 gallons of water. According to the University of Tennessee, they apply 63,000 gallons a month to their football field from May to November.³ This estimate is most likely higher than the amount of water used to irrigate the stadium field here at Stockton University considering differences in location and climatic patterns, but it is a good way to generate a logical estimate of how much stored water is needed per month to maintain the field's quality. We figured the tank should hold about 65,000 gallons of water, which would ideally support the field with plenty of irrigated water from month to month. Systems can also be equipped with an emergency valve having the ability to draw groundwater, ensuring the system doesn't run dry in times of consistently low-levels of rainfall. Also as rainwater harvesting system technology increasingly advances, upgrades become readily available to improve the systems efficiency. For example, water condensation dispersed indoors and outdoors can also be effectively captured and stored in the tank.

3. Facilities, Resources, and Project Management

The facility that will be used for the collection of storm water is the campus's Sports Center (Big Blue). The water storage system will be linked to the preexisting storm water management system that is used to divert water off Big Blue's roof and flow directly into the storage system. The installation of the rainwater harvesting system will benefit the local community and keep the athletic field in great working condition.

Equipment necessary for implementation:

- *Storage Tank*

This may be an underground single chamber tank or an above ground tank. Tanks typically come with a floating suction filter, inlet calmer, inlets and outlets located to suit local site drainage, a backpressure valve, rodent guard, and lockable cover.⁴

- *Control unit*

Self-contained unit incorporating a filtration and control system. These typically are pre-wired for ease of installation.⁴

- *Pumps*

Used to get the water from the storage tank to where ever it needs to be. Pumps can either be stand-by or duty assist systems.⁴

The Campus Sports Center (Big Blue) needs to be able to supply enough rainwater runoff to fill the storage tank and irrigate the field. To determine this we used Google Earth and calculated the area of Big Blue's roof to be about 41,360 square feet. Then we looked up the average amount of rainfall per month for the state of New Jersey. According to a study conducted by Rutgers University, the monthly average precipitation amount is 3.5 inches.⁵ After analyzing this data we calculated the average amount of water in gallons diverted off the roof to equal approximately 89,721 gallons per month. According to the system's containment solutions for every inch of rain, approximately 620 gallons of water can be collected per 1,000 square feet, which effectively correlates this calculations alignment with our original calculations and monthly average of rainwater being stored.⁷

Stockton LEGS initiative team, specifically the sustainability leaders, along with the University's environmental/sustainability student body, will responsibly lead this project. The costs associated with completion of the entire project will be outweighed by the long term water conservation benefits and expose other awaiting future benefits. Respectively though, funding options are available for this encouraging project. In addition, none of Stockton's faculty or students will be negatively affected by the implementation of this system. In fact, a rainwater harvesting system can help to establish LEED credits and inevitably other positives.

4. Evaluation

Due to its unique design it is hard to calculate the cost of installment of the rainwater harvesting system. There are a number of companies that specialize in production and installation of the system, but they require consulting before they will estimate pricing mostly because of the different circumstances involving unique storage systems and hired professionals. This is highly recommended because hiring professionals to properly install, design, and train self-maintenance of these systems, not only raises the efficiency and effectiveness required to reach desirable goals and objectives with minimal error, but also ensures included insurances and warranties if there is an error.

Unfortunately, currently the state of New Jersey doesn't provide any state or local funding for rainwater harvesting, but this fact doesn't necessarily mean future sustainable practices like is are not inching its way towards the near future. There are multiple options and incentives toward such a project to be enacted here at Stockton University. The insurance of a healthier future and quality of life begins with logical steps forward, such as rainwater harvesting system conservatively irrigating playing fields. Therefore installing this system we will dramatically lower the amount of stress put on our direct water source. Stockton University will also gain a competitive edge and recognition for using a water conservation system such as this. It is hoped that such

a move shall aid a chain reaction of more sustainable and environmentally conscious installments throughout Stockton and other Universities, especially when the outweighing benefits of such an effort can be exposed over time. Lake Fred will also benefit from lowered stress/load reduction imposed from built-up storm water discharge. The system will also reduce localized flooding and beautify the only “Campus of the Pine Barrens.”

There are multiple approaches towards funding this operation if one already doesn't have a convincing understanding of just how far this small step towards distinctiveness can transform Stockton University. Nationally small greenway grants can be obtained from The Conservation Fund, partners with the National Geographic Society, if applied and accepted in result of creative projects like this. Considering Stockton is already LEED Gold, an addition like rainwater harvesting will only add credits, save energy & maintenance costs, as well as competitively spark interests essential to New Jersey's journey forward. This will give Stockton deserving recognition in so many ways, and ultimately make it the first University here in NJ to harvest rainwater for irrigating recreational fields. Government grants are obtainable, but need to be sought after and approved properly. Considering rainwater harvesting can improve Lake Fred, qualification under the U.S. Fish and Wildlife Service or the NJ Fish and Game, can be argued strongly as a site in support of migratory bird habitat that has significantly diminished overtime here in NJ. Another source of funding can be acquired by the EPA under the Clean Water Act Section 319.² This of course needs to be decided by the State of New Jersey, which ultimately submits a proposed plan to and provides funding from the EPA. These are just a few possibilities for funding, but keep in mind the process necessary for moving forward may be overlooked and extremely timely after submission and awaiting a response.

Most importantly, such an addition needs to happen for New Jersey, not just Stockton University. Of all the states here in America, NJ being the most densely populated and coastally over-developed, sustainable additions like this one need to start somewhere and sooner than later. This addition is only the beginning of many

great things Stockton University can achieve in a world that desperately needs to evolve more efficient/greener practices today. In order to become more progressive in NJ on economic, social, and environmental issues; Universities need to set an example and change the playing field because they can afford it initially and beneficially thrive off it. What better way to put Stockton's name out there by raising the bar sustainably with initial funding responsibility towards rainwater harvested irrigation? Hands down, benefits from every spectrum of this project will expose themselves, and ultimately outweigh the initial associated costs for this additional stepping-stone necessary for the future prosperity of Stockton University.

5. Outreach/Dissemination

To inform others about our project we can first put it on the Stockton University website under the "Energy and Sustainability at Stockton" document. From this page we can add a link to a separate website describing the projects information including the goals, research, progress and future actions. We can also use email, the Stockton Facebook page, and the Universities newspaper 'The Argo' to showcase the project.

To inform the students and faculty we can host a lecture on campus explaining the benefits of using a rainwater storage irrigation system. In order to get a larger audience, we could aid and partner-up with other lectures or seminars happening on campus, such as the annual environmental forum and use incentives for attending such as ULTRA credit.

Stockton University has continued over the years to develop sustainable buildings and projects and has pride in being environmentally conscious. This project will aid in the Universities ideals and can be shown off on the green incentives page of our website, as well as other circumstances where Stockton presents its current initiatives on campus sustainable projects. Also, being located within the sensitive ecosystem of the Pine Barrens, this project has potential to gain interest from local/state groups. For example, groups like the Pinelands Nation Reserve, which can

further aid in public awareness on environmental/sustainable solutions toward the future.

6. Sustainability

The benefits of rainwater harvesting will be seen far into the future and the majority of the cost for the project lies within the initial installment. After the rainwater harvesting system is installed it will be able to continuously conserve water for years to come. This means that Stockton University will be able to continuously benefit from this project year after year with little drawbacks. Rainwater is a sustainable, renewable and a high quality water source. This water could be used for a number of other applications if the accumulation is high enough. We calculated that the roof of the Sports Center, Big Blue, could generate on average 89,721 gallons of water per month, which is more than enough water needed for the athletic field. Therefore, more sustainable possibilities can enhance use of this water in other beneficial ways. Futuristic advancements may include additional rainwater harvesting systems throughout campus, as well as other creative solutions toward sustainably conserving water here at Stockton University.

VI. Resources

- ¹Cape May Conserves - Cape May County. (n.d.). Retrieved March 16, 2015, from <http://www.capemaycountygov.net/Cit-e-Access/webpage.cfm?TID=5&TPID=13859>
- ²Financing Alternatives Comparison Tool (FACT). (n.d.). Retrieved March 16, 2015, from http://water.epa.gov/grants_funding/cwsrf/fact.cfm
- ³Hall, C., & Sorochan, J. (n.d.). Costs of Managing a Bermudagrass Football Field in Tennessee. Retrieved March 1, 2015, from <https://utextension.tennessee.edu/publications/Documents/SP651.pdf>
- ⁴Industrial Rainwater Harvesting. (n.d.). Retrieved March 16, 2015, from <http://www.stormsaver.com/Industrial-Rainwater-Harvesting>
- ⁵"New Jersey Monthly Precipitation." New Jersey Monthly Precipitation. Web. 16 Mar. 2015. <http://climate.rutgers.edu/stateclim_v1/data/njhistprecip.html>.
- ⁶Novak, Celeste Allen., Eddie Van Giesen, and Kathy M. DeBusk. Designing Rainwater Harvesting Systems: Integrating Rainwater into Building Systems. Print.
- ⁷Underground Rainwater Tanks - Containment Solutions, Inc. (n.d.). Retrieved March 17, 2015, from <http://www.containmentsolutions.com/flowtite-water-storage/rainwater-harvesting/underground-rainwater/>
- ⁸"Water." UGA Office of Sustainability. Web. 17 Mar. 2015. <<http://sustainability.uga.edu/what-were-doing/campus-operations/water/>>.