

City of Baltimore **Rainwater Harvesting and Urban Agriculture: Context and Potential**



CONTENTS

Ι.	BACKGRO	UND		3	
	A. INTR	ODUCTION		3	
	B. URBA	AN AGRICULTURE		3	
	C. RAIN	WATER HARVESTING		4	
	D. PURF	POSE		4	
	E. METH	HODOLOGY		5	
II.	BENEFITS AND RISKS				
	A. BENE	FITS TO CITY		6	
	B. BENE	FITS TO GARDENS		6	
	C. RISK	S		7	
III.	MODELS			9	
	A. CASE	E STUDY: DETROIT, MICHIGAN		9	
	B. CASE	E STUDY: OAKLAND, CALIFORNIA		9	
	C. CASE	E STUDY: MILWAUKEE, WISCONSIN		10	
	D. CASE	E STUDY: PHILADELPHIA, PENNSYLVANIA		10	
	E. CASE	E STUDY: NEW YORK CITY, NEW YORK		.11	
	F. SUMI	MARY		12	
IV.	RESOURC	ES AND LIMITATIONS		13	
	A. BLUE	WATER BALTIMORE		13	
	B. PAR	KS AND PEOPLE'S COMMUNITY GREENING RESOURC	E NETWORK	(14	
	C. CON	STRUCTIO COMPANIES		.14	
	D. GRAI	NTS FOR GARDENERS		14	
	E. EXIS	TING SYSTEMS		15	
	F. LIMIT	ATIONS		19	
۷.	POLICY OF	PTIONS		21	
	A. FUNE	DING SOURCES		21	
	B. STAT	US QUO		23	
	C. SPRE	EAD INFORMATION ABOUT RWH		24	
	D. CREA	ATE RWH INSTALLATION OR TRAINING PROGRAM		24	
	E. EXPA	AND EXISTING RWH INSTALLATION OR TRAINING	PROGRAMS	25	
	F. CONI	NECT GROWERS USING RWH TO OTHER GROWERS.		26	
	G. REQI	JIRE RWH FOR STORMWATER MANAGEMENT		27	
	H. CREA	ATE STORMWATER MANAGEMENT CREDIT TRADING	PROGRAI	М	
				27	
	I. STUE	DY RAINWTAER HARVESTING FURTHER		28	
VI.	APPENDIX	A: ACKNOWLEDGEMENTS		28	
VII.	APPEND B	: COPY OF SURVEY		30	
VIII.	APPENDIX	C: SURVEY RESULTS		35	
IX.	REFERENC	ES		??	

BACKGROUND

INTRODUCTION

Baltimore created a Sustainability Plan in 2009 to address local issues of air, water, and land pollution, transportation, environmental education, the green economy, and urban greening. As part of this plan, several goals were created for the city including Greening Goal #2, which aims to "Establish Baltimore as a leader in sustainable, local food systems" through a variety of strategies. Strategy D was to create an urban agriculture plan, which was completed with the creation and adoption of the Homegrown Baltimore report in November 2013. As part of this report, several recommendations were made with respect to land, soil, capital, agency support, and water. Recommendation "2e. Support the **Development of Rainwater Capture** Systems" was suggested as a potential way to assist Baltimore farms and gardens in getting a reliable source of water, in addition to reducing pollution from run-off into the Bay.

This document outlines existing projects and programs related to urban agriculture and rainwater harvesting in Baltimore City, as well as some models from other cities that demonstrate how local governments can encourage the use of harvested rainwater for urban agriculture. From this information, a list of potential policies for Baltimore are described.

URBAN AGRICULTURE

Baltimore has a rich history of urban agriculture over the past century and a half beginning as a more independent form of charity for the unemployed in 1890's, through the era of victory gardens in WWI and WWII, and into the explosion of the grassroots environmental movement in the 70's. A recent resurgence of interest in urban gardening within the city and around the country has caused an outburst of farms and gardens to sprout throughout the city and inspired non-profits, businesses, and the city government to work together to make urban gardening more viable as a means of community renovation, financial compensation, and environmental restoration.

This work has included the formation of several organizations to support farms and gardens and modifications in city policy to make urban gardening more accessible. These modifications include providing city residents agreements that give them the right to garden on vacant city-owned land, modifications to the zoning code that allow for urban agriculture, exempting hoophouses from building permit requirements, updating regulations related to the keeping of wild, exotic, and hybrid animals to allow for some animal husbandry, and providing affordable access to city water mainlines to any garden or farm located adjacent to water meters.

As a result of this work and the work of city residents, Baltimore now home to at least 13 farms, 70 community gardens, and 70 youth gardens and farms. While this shows the urban agriculture can be successful, there are still barriers to urban agriculture that are not fully addressed by the city government. Since water is essential to the operation of any farm or garden, the success of urban agriculture in the future is very much intertwined with the accessibility of clean and healthy water for growers.

RAINWATER HARVESTING

Rainwater harvesting (also known as rainwater capture) is the practice of collecting runoff from roofs or other ground surfaces before it can join tributaries, rivers, or lakes. Typically, rainwater harvesting systems operate by diverting water from a downspout to an apparatus that stores the water for future use. This storage apparatus can range from a rain barrel that holds a few gallons of water to a larger underground cistern that can hold several thousand.

Standard uses of small-scale rainwater harvesting systems range between gardening, cleaning, toilet water, indoor heating, showering, and garden irrigation; however, in some cases complex filter systems are capable of making harvested rainwater the primary source of drinking water for some low-impact homes. The amount of water that can be collected by systems are limited by the efficiency of rainwater filters, the amount of available roof space to collect from, and the type of surface the roof is made of. While individual rainwater harvesting systems may not hold a significant portion of the total rainfall of a city, studies of Salt Lake City have shown that they have the potential to collect enough water to accommodate for 50% of the city's nonpotable water needs.ⁱ

PURPOSE

Considering the potential that harvested rainwater has to supplementing water needs of urban farms and reducing stormwater run-off to the Chesapeake Bay, identifying policies to encourage the use of harvested rainwater on urban agriculture sites can fulfill multiple goals of the Sustainability Plan. While there may be many benefits to rainwater harvesting, it is important to understand the risks associated with investing in a punctuated source of water collected from potentially unclean surfaces. By looking at other city's models, evaluating current research, and considering a variety of policy options, this paper hopes to give a strong overview of

Sustainability Plan Goals Addressed

- Transform vacant lots from liabilities to assets that provide social and environmental benefits
- Ensure that Baltimore water bodies are fishable and swimmable
- Reduce Baltimore's water use while supporting system maintenance
- Establish Baltimore as a leader in sustainable, local food systems
- Raise environmental awareness of the Baltimore community

whether Baltimore city government should work to encourage the use of harvested rainwater on urban farms and gardens and, if so, how can it best do so.

METHODOLOGY

A significant amount of research was conducted in order to construct this report. In order to understand the current resources available to urban farms, the following steps were taken:

- Baltimore Office of Sustainability Staff provided insight into the structure of the plan, key stakeholders, background on current rainwater harvesting work, and relevant documentation.
- Existing documents related to rainwater harvesting and urban agriculture were reviewed to provide background for the report.
- Information on five other city's urban agriculture and rainwater harvesting programs were gathered through phone interviews and email correspondence.
- In-person and phone interviews (listed in Appendix A) were conducted to understand current programs and regulations related to rainwater harvesting and urban agriculture in Baltimore City.
- Site visits to eight different urban farms (listed in Apendix A), school gardens, and community gardens were conducted to

discuss current barriers and potential solutions.

- Based on site visits, an online survey (copy in Appendix B) was created and sent out to several listservs to gauge interest in rainwater harvesting and opinions on potential policy solutions. Information from the survey was compiled and summarized (listed in Appendix C).
- A tool was constructed using historic NOAA weather data and statistics on crop water needs and soil attributes from FAO to estimate the water usage of urban farms and the collection potential of rain barrel systems.



A rain barrel from Whitelock Community Farm in Resevoir Hill

BENEFITS AND RISKS BENEFITS TO CITY

As previously mentioned, encouraging the use of harvested rainwater or urban ag sites aligns with many of the city's sustainability goals, whether related to encouraging urban agriculture, reducing stormwater run-off, revitalizing vacant land, educating local communities, or reducing mainline water consumption.

To get a better understanding of what impact this can make, an estimate of the water needs of the average urban farm (see Appendix D for more details) suggests that a farm will use an average of about 9.3 gallons of water per square foot of uncovered growing space per growing season. This means that a 1 acre of farmland will use about 405,000 gallons of water a season in Baltimore City. Collecting this water on urban agriculture sites reduces stormwater run-off that enters the bay and the cost of maintaining Baltimore's stormwater drainage system.

In addition, by supporting rainwater harvesting, the city is supporting urban agriculture and the use of low-impact design features. This could in turn increase the market for harvested rainwater, which expands the green jobs industry concomitantly, as well as increase environmental awareness of water conservation throughout the city.

BENEFITS TO GARDENS

Since rainwater harvesting provides people with a source of water, which usually ends up flowing back into the bay before it can be used, the most obvious benefit of rainwater harvesting is reducing water consumption from public and private water systems. In the event that a farmer or gardener does not have a direct water line with the city and pays per gallon, this can save the garden some money; however, savings may not be as large as anticipated in this case. For example, a 55 gallon rain barrel hooked up to a 1,000 ft roof on an acre farm is expected to save 533 gallons per growing season, which costs about \$2.62 based on 2014 Baltimore water rates. For small gardens, rainwater harvesting may be capable of replacing a city water line hook-up. This could save significant amounts of money if the \$120 annual mainline fee costs more than a rain barrel or cistern hook-up; however, without financial assistance it will likely still be cheaper to use a metered hose to water crops instead of installing a rainwater harvesting system. There may be cases where the cost of installing a water line to a mainline is prohibitive and the most convenient sources of water nearby is harvested rainwater, but this depends on the growing space. Ultimately, the financial benefits of harvesting rainwater will likely need to be analyzed on a garden to garden basis before it can be considered a cost-saving tool.

Specifically for urban agriculture, rainwater harvesting provides many other benefits. In the event that a water source is not easily accessible, it can supplement an expensive irrigation hook-up with the city's water services. Since rainwater is typically more acidic

than drinking water, some growers suggest that harvested rainwater better assists plants in absorbing nutrients from soil; however, harvested rainwater may increase in basicity after running down a roof,

especially on concrete tile roofs. In addition, for growers that rely on small spaces, any land that becomes flooded by the outflow of water from impervious surfaces is land that could be under cultivation. Being able to capture water to prevent localized flooding is an ideal way to optimize space on an urban agriculture site. In some cases, gardeners have also suggested that disconnecting downspouts removes space for mice to live and breed. Finally, for individuals who decide to take control of their own food production, rainwater harvesting provides a further means of independence and community resilience.

RISKS

While the benefits of rainwater harvesting are substantial, there are plenty of risks involved in the development of rainwater harvesting systems, which need to be addressed before encouraging the use of harvested rainwater on urban agriculture sites.

As someone working actively to be more self-reliant, water conservation and rainwater catchment are top on my list of priorities.

-Sheila Cassaní, Kansas Street Farm

The clearest limitations to rainwater harvesting systems is their cost and utility. In order to be useful, rain water harvesting systems need some type of surface to collect run-off from, a good supply of rain, and a relatively convenient way of getting

water from the collection system to the soil.

In terms of cost, a 55 gallon rain barrel with an overflow tube and holes valve can be purchased for \$89 from Blue Water Baltimore.ⁱⁱ Based on

historical weather data from, a rain barrel of this size will likely collect and distribute an average of 591 gallons of water in Baltimore. If a farm is paying directly for water, this means that they would save at best about \$2.91 per year giving this system a minimum of a 31 year pay-back period. This shows that without financial assistance or other extenuating circumstances, rainwater harvesting doesn't pay for itself quickly.

Low water pressure from simple rainwater harvesting systems can also make implementing rainwater harvesting systems difficult for large farms that are better watered with a high-pressure hose or drip irrigation system. Sometimes, solar pumps are used to mitigate this issue; however, these systems can be very cost-prohibitive on top of expensive rainwater harvesting systems.

In addition to these barriers, studies of the use of residential and commercial rain water harvesting systems in the UK show that other barriers include a lack of qualified businesses to install more complex rainwater harvesting systems, consumer knowledge about rainwater harvesting, and low consumer confidence in the viability of rainwater harvesting. Since many rainwater harvesting systems are unique to their specific buildings, it is likely difficult for those interested in urban agriculture to construct a rainwater harvesting system for custom accessory structures like hoop houses and tool sheds.

Finally, one of the largest concerns with harvested rainwater is contamination. Before constructing a rainwater harvesting system, it is important to consider the potential for contamination beyond the recommended limits for irrigated water. In some cases, contamination on the run-off surface, either from the specific roofing material or from hazardous material deposited on the roof, can enter harvested rainwater. In the event of this contamination, it may be best to use water from the mainline for watering purposes or to only use harvested rainwater for non-edibles.

Some concerns about microbial contamination of gardeners using harvested rainwater have also arisen. A study that looked into the risk associated with using contaminated harvested rainwater suggests that there is not a significant risk of sickness when using harvested rainwater to water nonedibles.ⁱⁱⁱ Additionally, since harvested rainwater spends most of its time still in a barrel, there are also concerns about providing space for mosquitoes to breed. It is recommended that any rainwater harvesting system include a mesh filter at any opening to prevent mosquito entry.

Some rainwater harvesting systems have "first flush" filters specifically built in, which can isolate and remove the first few gallons of runoff from the pipe flow before it reaches the collection systems. To reduce the risk of contamination, installing this to a rainwater harvesting system may be a wise choice. In fact, based on available FAO standards for irrigation water and a study from the Texas Water Board^{iv} on the impact of different roofing materials on the quality of harvested water, a first flush is necessary to ensure that levels of copper, chromium, and aluminum are not harmful to human or plant health. Even with a first flush, the data suggests that rain barrels should not be hooked up to thin hoses, like those for drip irrigation, or else they risk clogging lines with their high suspended solids content. The study did not measure every contaminant the FAO has set standards for, so some caution must still be taken when using harvested rainwater on edibles.

MODELS

The role that city governments have to play in encouraging rainwater harvesting can vary significantly between cities. More frequently than not, cities do not provide direct services to farms and gardens in creating rainwater harvesting systems, but have programs that these operations can take advantage of. Some of these programs require the city to have a direct hand in the design and implementation of rainwater capture systems. Others give farms and gardens agency to decide for themselves what their capture systems will be. Considering concerns for run-off pollution from nutrient-containing imported soil, many cities require stormwater management features to be implemented on some urban agriculture sites.

DETROIT, MICHIGAN

Presently, Detroit Water and Sewage Department (DWSD) operates under the International Plumbing Code of 2009. According to this code, water collected in a cistern cannot be used as "sources of individual water supply unless properly treated by approved means to prevent contamination." While this statement does not directly imply that harvested rainwater cannot be used to water plants, Detroit follows the state's lead in interpreting this clause with caution. While they do allow individual households to install rain barrels and cisterns for stormwater capture, Detroit's government does not do any direct work in encouraging rainwater harvesting in their city.

Presently, the DWSD will appeal to the state to get a more clear interpretation of this clause, so that they can better understand what role they can play in encouraging harvested rainwater in the city.

OAKLAND, CALIFORNIA

In 2010, Oakland started the <u>Rain</u> <u>Barrel Program</u> with funding from the American Reinvestment and Recovery Act and California State Water Resources Control Board. Over three years, they installed 400,000 gallons of rainwater harvesting systems through subsidized rain barrel giveaways to residential, school, church, and nonprofit facilities and the construction of several cistern demonstration projects. In addition, they provided links on their website with information and resources for design and construction of rain barrels collection systems.

In addition to this program, Oakland has several regulations in place that require stormwater management practices on some urban farms and gardens. In the event that an urban agriculture project is located within close proximity to one of Oakland's creeks, the managers of the project would be required to receive a Creek Protection Permit from the Community and Economic Development Agency to ensure significant run-off will not makes its way into local waterways. In some cases, rainwater harvesting systems may assist in the approval of an urban agriculture project's Creek

Protection Permit Application. In addition, a <u>regulation under the San</u> <u>Francisco Bay Region Regional Water</u> <u>Quality Control Board</u> exists when any project that increases the impermeable land area of an area by 10,000 square feet must implement a stormwater management plan. This is unlikely for most urban agriculture operations, but it could require one that constructs a large area of hoop houses to construct a rainwater harvesting system or otherwise treat the stormwater that comes from their site.

MILWAUKEE, WISCONSIN

As part of their mandated green infrastructure goal of collecting up to 740 million gallons of rainwater by 2035 in a heavy downpour to prevent overflows in their combined stormwater and wastewater sewer, the Milwaukee Metropolitan Sewerage District have several plans in operation to reduce stormwater run-off. They created a website to teach residents about stormwater management practices, including rainwater harvesting. The Milwaukee Department of Public Works also holds a half-priced rain barrel sale one day each year, where each residence is allowed to purchase one rain barrel.

In terms of agriculture, a recent <u>Urban Agriculture Code Audit</u> allows for rain barrels and cisterns on vacant land. This audit also helped to further define requirements for the construction of urban farms in residential areas, including a planning review. This review considers the impact of run-off on local waterways, which means that the result of a review may include recommendations to install a rainwater harvesting system, before an agriculture project can be built. Typically, a stormwater management feature is integrated into every urban agriculture and orchard project, since <u>1 foot of new</u> <u>soil</u> must be added to the land used for any urban farm or garden on vacant land.

PHILADELPHIA, PENNSYLVANIA

Three programs exist in Philadelphia to focus on reducing stormwater run-off: RainCheck, Stormwater, Stormwater Management Incentive Program, and Green Vacant Land Program. <u>Rain Check</u> is a program of the Philadelphia Water Department (PWD) that works to educate homeowners about stormwater management practices and subsidize the cost of materials to do so. In terms of rainwater harvesting, the program provides free 55 gallon rain barrels with installation to any household in Philadelphia willing to attend a rain



One of Whitelock Community Farm's rainwater harvesting systems collects rain water from half of the greenhouse roof to water seedling inside it

barrel workshop. In addition, the PWD also maintains a <u>map</u> of rain barrels in the city. Theoretically, this program could cover the cost of a rain barrel used for urban agriculture, as long as it is collecting from residential space.

The Stormwater Management

Incentives Program is a collaboration of the PWD and the Philadelphia Industrial Development Corporation that provides financial assistance to nonresidential PWD customers, including schools and businesses. in the form of grants of up to \$100,000 per acre of impervious surface with the first 1" of runoff managed. In order to apply the owner of the land must create an Economic Opportunity Plan and only apply for funding for work that exceeds the current requirements for stormwater



This Pagoda from Mt Clare Street Community Garden houses a Vietnam War exhibit and the garden's rat-control system, Charmer the cat.

management on the site. Additional benefits include credits against the stormwater charge. Theoretically, this system could be used to install a rainwater system that collects water for a local greening project. One example is from Walnut Hill Community Farm in Philadelphia, which harvests from a local septic station roof.

Finally, the <u>Green Vacant Land Program</u> provides assistance for communities to collaborate with the PWD to install green infrastructure on vacant land. The PWD is primarily in charge of planning

> and implementing projects, which need to have an expected lifespan of 45 years. As a result, it is unlikely that an urban agriculture project would be implemented with this program; however, there are some scenarios where this may occur. For example, if a community collaborated with the **Department of Parks** and Recreation to maintain a site with some urban agriculture purposes, a rain barrel may be an important stormwater mitigation and water attainment tool.

NEW YORK CITY, NEW YORK

As part of New York's Department of Parks and Recreation, <u>GreenThumbNYC</u> provides resources and information to New York City community gardens. They work in collaboration with <u>GrowNYC</u>, a local environmental programming non-profit, to increase the viability of urban agriculture in New York and reduce the stormwater impact of these projects. As part of this work, GrowNYC has several programs to encourage the use of harvested rainwater on urban agriculture sites that have allowed them to construct 80 rainwater harvesting systems in community gardens throughout New York.

Like other city programs, GrowNYC provides information on their website about rainwater harvesting, including an extensive how-to guide. They also maintain a map that shows the location of rainwater harvesting projects throughout the city. As part of their work, they have also assisted gardens in the construction of several systems. In some cases, they were contracted by GreenThumbNYC to build systems for urban agriculture projects on city land. Finally, to inform the public more about rainwater harvesting, GrowNYC have contributed to rainwater harvesting exhibits at three local museums.

In addition to GrowNYC, several programs in New York provide funding for the construction of rainwater harvesting systems. For example, <u>The</u> <u>Green Infrastructure Grant Program</u> provides money for projects that reduce at least the first 1 inch of stormwater from a contributing impervious area, which can include a rainwater harvesting system. Also, GreenThumb has sponsored the #ConserveH2O <u>Contest</u>, which gives away \$5,000 for innovative stormwater management projects, which could include rainwater harvesting systems for urban agriculture.

SUMMARY

Most cities do not have specific programs that integrate rainwater harvesting with urban agriculture, but instead have programs that cover a wide array of stakeholders or projects, which can be used to build rainwater harvesting system. This does not mean that these programs are unsuccessful, but that comparing work being done by GreenThumbNYC and Oakland's Rain Barrel Program in terms of how well they encouraged urban agriculture sites to adopt rainwater harvesting practices, would not accurately reflect the intentions of those programs.

Ultimately, New York City was the only place interviewed that had programs specifically designed to integrate rainwater harvesting into urban agriculture. The result was that 80 gardens in their city had a harvesting system, while most cities could only point to a few demonstration project at best. Clearly, a program that specifically targets urban farms and gardens is going to be most successful at benefitting urban farms and gardens. Most other programs specifically targeted reducing stormwater at the residential level. Programs like those in Philadelphia that gave money to businesses and homeowners to reduce stormwater run-off appeared to be successful at doing so.

RESOURCES AND LIMITATIONS

While Baltimore currently has no program that specifically targets implementing rainwater harvesting systems for urban agriculture, it does contain many programs that urban growers can take advantage of. In some cases, these programs have limitations set by who they can serve, what resources they can provide, and how much of those resources they have.

BLUE WATER BALTIMORE



Blue Water Baltimore (BWB) is an organization dedicated to "restor[ing] the quality of Baltimore's rivers, streams, and harbor to foster a healthy environment, a strong economy, and thriving communities." This means that they implement several stormwater management and pollution reduction programs including water audits and subsidized rain barrel sales. BWBs Water Audit Program provides free assessments of businesses, schools, homes, and churches water use and provides recommendations and rebates on stormwater reduction services like rain garden construction, tree planting, pavement removal, and rain barrel or cistern installation.

BWB currently provides some information about rainwater harvesting on their website, in addition to selling rain barrels of different sizes and capabilities at subsidized values. In addition, BWB holds Rain Barrel Workshops, where residents of the Baltimore can construct and paint a rain barrel for about \$69. In both cases, a professional is available to install the rain barrel to a roof downspout at no cost. Finally, BWB provides \$0.50 per gallon rebates for cistern installation up to a value of \$2,000 per household or \$6,000 per institution.

While these services are incredibly useful to urban agriculture project, BWB typically limits its operations to privately owned land or schools. This means that projects where water is harvested from a private residence, organization, or school can receive assistance from Blue Water



One of Lakeland School's Visionary Garden's 1250 gallon cisterns

Baltimore; however, many of the urban agriculture projects that are constructed on vacant city-owned land or abandoned privately owned land, are unable to take advantage of these services to harvest water from their farm or garden's lot.

PARKS AND PEOPLE COMMUNITY GREENING RESOURCE NETWORK

Parks and People Community Greening Resource Network (CGRN) is a centralized resource for community gardens to access resources, connections, and knowledge necessary to grow in the city. Their work includes seedling and soil giveaways, providing tool libraries, managing a central listserv and calendar, and conducting informational workshops for their network of over 200 school, family, individual, and community gardens.

One of their workshops is about the stormwater remediation fee credit. This credit is available for privatelyowned landowners as a way to reduce the stormwater management fee owned from their house or building project. Since this credit includes a \$24 annual reduction for the construction of a rainwater harvesting system that is a minimum of 400 gallons collecting from a 800 square foot roof, these workshops also identify resources for creating these systems.

Most importantly, CGRN currently advises its membership to not use harvested rainwater on edibles, due to concerns about contamination from rooftops. Since 90% of them grow edible crops, an accurate understanding of how many of their gardens harvest rainwater is not available.

CONSTRUCTION COMPANIES

There are at least two companies that construct rainwater harvesting systems: <u>Conservation Technology</u> and Symbiosis Design/Build. <u>Symbiosis</u> <u>Design/Build</u> recently constructed a hoophouse rainwater collection system for Real Food Farm.

GRANTS FOR GARDENERS

Several grant programs exist to assist smaller community gardeners and urban farms in funding the installation of a rainwater harvesting project. Below is a list of organizations, relevant grants, and links to their websites.

BGE Green Grants

Baltimore Gas and Electric provides from \$500 to \$10,000 for projects that impact one of 5 "environmental focus areas" that include conservation and community engagement. This grant is available for any 501c(3) non-profit with a Board of Directors.

<u>Chesapeake Bay Trust Community</u> <u>Engagement and Restoration Mini Grant</u> <u>Program</u>

Chesapeake Bay Trust will donate up to \$5,000 for the construction of bay restoration projects including rain barrels. This grant is available to any 501(c)3 nonprofit, community associations, faith-based organizations, service and civic groups, government agencies, and educational institutions.

Parks and People Neighborhood Green Grant and Clean Water Mini Grants

Parks and People provides grants of up to \$1,000 for "vacant lot clean–up and restoration projects, community gardens, rain gardens, tree plantings, alley gating, neighborhood clean-ups, schoolyard greening, water quality improvement and environmental education activities." In addition to this grant, a supplemental \$250 can be provided for small water cleaning projects including rain barrel installation. This grant is available for any community-based group.

EXISTING SYSTEMS

There are several urban farms and community gardens, which have already implemented or are implementing rainwater harvesting systems. These range between collecting from a few square feet greenhouse roof to collecting from a several thousand square feet school roof.

Baltimore Montessori School Garden

The Baltimore Montessori School Garden is a 10,000 square foot vegetable, herb, and native plant garden that serves as an educational space for students at its namesake school. The program is currently run in collaboration with the school's kitchen and includes a beehive, chicken coup, and a large rain barrel that can hold an estimated 7600 gallons of water, collecting from an approximately 1960 square foot area. The system was installed six years ago with some of the funding the school received in a grant from the Chesapeake Bay Trust that involved removing some impervious surface from the schools' playground to install the garden. The system was not operational for several years, after changes in garden management and tampering with the rain barrel's spigot left it inoperable without the expertise to fix it. A few months ago, a school child's parent finally fixed the spigot, which has allowed the system to start collecting water.

The system does not have a first flush nor a visible overflow valve, which may lead to some issues in the future; however, it will not be put into full use until the school year begins again, because the garden is not maintained during the summer.

Boone Street Farm

Boone Street Farm began in 2010 as an initiative to revitalized twelve vacant lots in the Baltimore East Midway neighborhood. Presently, the farm operates off of a quarter acre area and manages a community garden and gathering space across the street. In addition to selling produce, it also hosts community events, school field-trips, and gardening workshops.

Since Boone Street is not located adjacent to a water meter, attaining water access is an incredibly important and costly task for them. In fact, while Boone Street qualified for a Water Irrigation Fund Grant, the grant covered less than half the cost of the mainline hook-up, preventing them from getting easy access to water. Consequently, Boone Street has built a rainwater harvesting system to collect from their small toolshed.

Unfortunately, this system cannot harvest all the needs of the farm without a direct line hook-up and is currently inoperable, because of wear and tear from use.

FAST I Wonder Garden

In 2013, a garden was constructed next to the Friendship Academy of Science and Technology (FAST) with a \$30,000 grant from the Chesapeake Bay Trust to remove impervious surface from a school parking lot and replace it with flowers, edibles, and native plants. This garden was designed by students and run in collaboration with the local Canton Community Association. It currently houses two aboveground cisterns built by Blue Water Baltimore that collectively hold about 2,500 gallons of water. These tanks collects from about a quarter acre area of the FAST roof and contain a filter for large particulate matter. Theoretically, this roof could fill both cisterns about 70 times during the growing season, assisting greatly with the growing needs of the 7,000 square foot farm.

Lakeland School's Visionary Garden

First constructed on Earth Day 2014 by students and staff at the Lakeland Elementary and Middle School, Lakeland School's Visionary Garden currently houses a native plant action research project for 6th graders, a 5 Senses Garden that explores the taste, smell, and feeling of nature for 2nd graders, and a Kitchen Garden for the school's staff. The garden will also be used as an outdoor education space for summer programs at Lakeview Elementary and Middle School.

This garden currently houses two 1250-gallon cisterns that collect directly



The FAST I Wonder Garden's recycle glass bottle fence. Behind is a mural that contains important quotes submitted by the Canton and Highlandtown community members

from the school's roof. These were funded from the Chesapeake Bay Trust Community Engagement and Restoration Mini Grants and constructed by Blue Water Baltimore. These cisterns were constructed concomitantly with the garden in the hopes of teaching students about water conservation and as a convenient source of water. especially for summer-time use when the school is closed. The hope is that these cisterns will provide 100% of the water needs for the three garden projects, especially since the native plant garden should be more selfsufficient in the Maryland climate.

Currently, spigot adaptors are used to empty out the cisterns into buckets for watering; however in the future, Rennie Watson, the garden coordinator, hopes to install a solar powered irrigation pump to water the native plant and kitchen garden.

<u>Mt Clare Street Community Garden</u> and Lombard Street Garden and Art Space

Located in the Hollins-Market neighborhood of Baltimore, Mt Clare Street Community Garden began in 1999, when Civic Works assisted in depaving a neglected basketball court. Currently, it houses 35 community plots, a chicken coup, a pagoda, a pond with a solar powered fountain, four rain barrels, and several raised beds.

Purchased from one of the head gardeners' construction and landscaping company, the four rain barrels are hooked up to two community members' houses in pairs. Altogether, they collect from about 1,300 square feet of roof space and have the potential to collect almost 5,000 gallons of water annually. They are the primary source of water for the garden throughout the early months of spring and summer; however, a city water hook-up supplants these uses during the hottest summer months. The garden managers are also installing another rain barrel to collect from one side of their two-story pagoda (pictured in previous page).

In addition, the Mt Clare Community Garden has inspired the formation of another garden across the street called the Lombard Street Garden and Art Space. This garden provides opportunities for local children and those from the St. Peter's Adult Learning Center to grow plants and produce in



Lombard Street Garden and Art Space homemade rainwater collection system.

one of its 10 plots and 9 tire planters. This garden has also constructed its own rainwater harvesting system that serves as the only source of water for this space. This system collects from a local neighbors' roof through a window mesh filter into two repurposed trashcans.

Real Food Farm

Built in 2009 as a project of Civic Works, Real Food Farm functions as a farming demonstration project, fresh mobile food market, compost drop-off, training space, and education center.

The farm currently operates over a half a dozen hoophouses on their Clifton High School site, which act as impermeable surface. Since the produce and herbs in these hoophouses need water, the farm decided to construct a system to collect rainfall from about 0.16 acres of hoophouse and land into two 1,000 gallon underground cisterns five years ago. Using a \$50,000 grant from the Chesapeake Bay Trust, Real Food Farm paid Conservation Technologies to construct their system, which was completed in May 2014.

The system collects water from

the hoophouses and through a gravel bed, before a coarse filter removes large particulate matter. An electric pump takes water from the cisterns and sends it

to a hydrant, where a hose can be attached for watering within the hoophouses. The water will be used only for irrigation purposes, because harvested rainwater does not qualify for other uses under Maryland's Good Agricultural Practices (GAP) standards, which the farm has adopted.

Based on historical NOAA weather data for Baltimore, calculations suggest that this site will be able to harvest about 41,300 gallons of water annually, saving about \$195 on water every year. In addition, the water that is harvested would traditionally flow into the farms existing bioswale system. By diverting this, the farm is reducing the wear and tear of the bioswale and the costs associated with that.

Whitelock Community Farm

Whitelock Community Farm is a community-based urban farm on less than a half-acre lot that has been operating since 2010. In addition to a toolshed, fence, and flower garden, Whitelock houses two rainwater harvesting projects. The first currently harvests from a half the roof of a small greenhouse and the second will harvest from half the roof of a 20 by 30 foot hoophouse. Currently, Whitelock uses water collected from the greenhouse roof to water the plants within the green

> house all year and in the hoop house during spring.

> Since Whitelock has already constructed an automated drip irrigation system that

hooks up to the city's mainline, rainwater harvesting is not a necessity for their operations; however, the environmental benefits have inspired their creation.

While the farm has dabbled in rainwater harvesting, it currently owns 2 rain barrels that are not slated for use for a specific project yet. One major barrier to implementing a rainwater harvesting system is the knowledge needed to install the system on their unique buildings. The Assistant Farm Manager of Whitelock suggested that for many, the cost of constructing a rainwater harvesting system like the one

"Nature's always better." -Rennie Watson, Lakeland School's Visionary Garden Coordinator in response to a question about the benefits

of rainwater over tap water

on their greenhouse would be very costprohibitive for many farmers.

LIMITATIONS

Even with a rainwater harvesting system built, there are still limitations to the uses, locations, and capabilities of these systems that need to be noted.

Most importantly, harvested rainwater is not a potable source of water, even with a first flush. It requires intense filtration in order for it to be used to clean vegetables or hydrate animals. In fact, the <u>Baltimore City Health</u> <u>Department: Regulations for Wild,</u> <u>Exotic, and Hybrid Animals</u> specifies that either a "clean sanitary environment" is maintained or that "fresh" or "potable" water is accessible for all farm animals. This means that, unless it is significantly filtered, harvested rainwater is not a legal source of drinking water for farm animals.

In terms of locations where harvesting can occur, there are no permit requirements to building an above ground rainwater harvesting system or disconnecting a downspout on ones' own land. For underground systems, more advanced permitting is required in order to not interfere with electric or water lines.

Some interest has existed for constructing rainwater harvesting systems on vacant houses in the city. Depending on the ownership of the property, the legal right to do so is very similar to getting the legal rights to farm on vacant land in the city with one difference:

- Mayor and City Council (MCC) owned vacant houses: Any individual interested in installing an above ground rainwater harvesting system must get a Right of Entry permit from the Department of Public Works and ensure that the system does not cause any damage to adjacent private owned property. Like Adopt-a-lot, the city would reserve the right to sell the land or require the removal of the system at any time with little notice.
- Property owned by other city departments: specific agreements must be made with that department.
- **Privately-owned vacant land:** An agreement can be made between the landowner and the interested party that would legally allow for the installation of a rainwater harvesting system of any form; however, the land owner has the right to sell that land at any time or require the removal of the system, unless a contract explicitly states otherwise. If the landowner does not respond to an inquiry to install a system on their site, rainwater harvesting systems cannot be considered legal under nuisance abatement laws, since stormwater is not typically considered a nuisance. The exception is if there is a legal claim from a neighbor that the stormwater is somehow causing damage to their property, which

Baltimore Office of Sustainability | Rainwater Harvesting | 20

can be stopped with the installation of a rainwater harvesting system. If the vacant house's owner is notified with a return-receipt letter, a neighbor affected by the stormwater can provide testimony about the negative impact of the stormwater, photos of the negative impacts are taken, and a notice is posted on the land with a description of the rainwater harvesting system and what it is abating, then it would be legal to do so, as long as the owner has not rejected the construction of the system; however, this is a hard case to make and it may be best to not install a system to avoid being charged with trespassing.

Similar to concerns with collecting water from vacant houses, the limitation of land tenure for many farms makes investing in infrastructure like rainwater harvesting system a risky choice. These systems often take many years to pay for themselves and many farms that rely on the Adopt-a-Lot program for land would be uncertain whether their farm or garden would be around long enough to benefit from it.

Finally, Baltimore's urban agriculture movement has relied on a variety of resources from different nonprofits, businesses, and the city government; however, there is a clear entrepreneurial do-it-yourself spirit to the movement that been encouraged by the nature of the activity and the financial limitations of many of those involved. As a result, it is not unexpected for many



Baltimore Mountessouri School Garden rainwater harvesting system stands approximately 11 feet tall and collects from a portion of the school roof.

farms and gardens to want to install systems on their own. While the mechanics may appear easy, there are many places where a rainwater harvesting system can malfunction, making significant knowledge about how to install and maintain systems necessary to their success. There are plenty of great resources to learn about rainwater harvesting in the city as described previously; however, more work can be done to ensure farms and gardens have the knowledge to install rainwater harvesting systems properly and use them safely.

POLICY OPTIONS

Within the cities analyzed, there are a diverse array of policy options available to Baltimore to encourage the use of harvested rainwater on urban agriculture sites. These policies are not always mutually exclusive and the particulars of them can be modified to fit the current condition of Baltimore's urban agriculture movement. A brief overview of some policy options available is supplied below.

FUNDING SOURCES

Several different sources could fund city programs and policies to incentivize the use of harvested rainwater for urban agriculture. Many of them can only fund specific initiatives, but a full list is given below and those that qualify for each recommended policy option will be identified in the policy section.

Chesapeake Bay Trust Agriculture Grant

This grant is used for farm-led partnership projects that involved strong evaluation and communication of successful models for agriculture. This can include funding a rainwater harvesting demonstration project with a program that teaches other urban farms how to implement rainwater harvesting projects.

<u>Chesapeake Bay Trust Green Streets,</u> <u>Green Jobs, Green Towns Grant</u>

This grant funds programs that implement urban green stormwater practices, which could include rainwater harvesting. The program puts a stress on the installation of "green streets," which may make urban agriculture projects less competitive; however, the program provides up to \$250,000 for implementation projects, which is significantly more than what would be needed to install a significant amount of rainwater harvesting features throughout the city.

Chesapeake Bay Trust Pioneer Grant

The Pioneer Grant, which ranges between \$5,000 and \$100,000, focuses on increasing water quality through the reduction of nutrient, sediment, and toxic loads from multiple sources. This program can include the creation of new programs that bring "new, creative ideas to the implementation of financing of nutrient, sediment, and or toxic load reductions." As a result, this project could be used for the installation of filtered rainwater harvesting on urban farms, either from farm run-off or from local rooftops that may be contaminated. The grant is closed for this year's funding cycle, but will likely reopen next year.

EPA Community Action for a Renewed Environment (CARE)

While it has existed in the past, funding has not been reallocated to CARE by Congress, so it may not be a possible source for funding rainwater harvest projects; however, if it does receive funding it could be a viable option. The program focus on reducing human risk to toxic pollutants through collaborate local level action. In the event that stormwater run-off caries toxic pollutants nearby an urban agriculture site, this funding (at the \$90,000 or \$275,000 levels) can be used to implement filtered stormwater harvesting projects to remediate the situation.

<u>EPA Nonpoint Source Program (319)</u> <u>Management and Financial Assistance</u>

A stipulation for the Clean Water Act Section 319(h), some revenue from national and state taxes are distributed to states each year for the purpose of managing stormwater for nonpoint sources in specific watersheds. These grants amounted to about \$3,300,000 in FY2013. Since urban agriculture sites typically use large amounts of fertilizers and impermeable surfaces in urban areas can collect large amounts of oil, grease, and chemicals, a system could be used to manage and collect run-off from urban agriculture sites for future watering. Since this program stresses reducing run-off from highly polluted areas, the only areas in Baltimore that were eligible for funding were the Lower Jones Falls Watershed and the Back River Watershed, which cover a significant portion of Baltimore, but exclude some areas. In addition, it may be necessary to significantly filter all pollutants from any collection area covered in this program before watering plants, since it stresses highly polluted areas.

Northeast Sustainable Agriculture Research and Education (SARE) Partnership Grants

While it may require a partnership with an environment non-profit or an

extension office, the Northeast SARE Partnership Grant could be used for a research project related to rainwater harvesting for urban agriculture. For example, it could be used to test the contamination levels of harvested rainwater from different properties or be used to show how much rainwater can be harvested from Baltimore City per unit area of collection area. It may only provide funding for a few projects, but those projects may benefit the farms or gardens involved, while providing insight into the viability of rainwater harvesting.

Northeast SARE Research and Education Grant

Any applicant is eligible to apply for a Northeast SARE Research and Education grant, but the purpose of the application must be either conducting on-site farm research or farm education to teach others about sustainable practices in farming. Theoretically, this grant could be used at a farm to conduct research around rainwater harvesting. like the types of water contamination found from collecting off of hoophouses, and also used to host workshops to teach others about the operation and installation of rainwater harvesting systems on urban agriculture sites. Typically projects are funded from \$30,000 to \$250,000 with a four year maximum for projects to be completed.

US Economic Development Administration Economic Development Assistance Program

With the goal of promoting the development of economically distressed areas by assisting in job creation and attracting private investment, the

Economic Development Assistance Program could be a potential source of funding for a rainwater harvesting system construction training program, since it supports the development of two industries, construction and urban agriculture. It could also be used to add a new position to an existing organization that do work with sustainability, stormwater management, or urban agriculture, but focusing primarily on custom low-cost rainwater harvesting systems for urban agriculture, for example, the Baltimore Center for Green Careers.

USDA NRCS Regional Conservation Partnership Program

The USDA Natural Resource Conservation received \$400,000,000 for innovative projects that focus on conservation for producers on private land. With a funding cap of \$20,000,000 for each project, this program would provide enough funds for the construction of rainwater harvesting systems on all privately owned urban agriculture growing space. Unfortunately, it would not cover any growing space on city-owned land or land owned by someone other than the grower; however, local governments are still eligible to apply. In addition, the requirement for keeping metrics of savings can help city growers better understand how much rainwater can be effectively harvested and used for urban agriculture. The program just recently closed for this year, but may reopen in future years.

STATUS QUO

Estimated Cost: \$0

Estimated Impact: None

Potential Partners:

Major involvement: None

Minor involvement: None

Potential Funding Sources: N/A

While rainwater harvesting is not a regular part of every urban agriculture project in the city, a variety of projects have had success in the city thus far, without any new policy. Rain barrels are fairly accessible for city residents thanks to Blue Water Baltimore and there are plenty of workshops that give an understanding of the hazards and benefits of rainwater harvesting. In terms of getting access to funding for projects, the Chesapeake Bay Trust has paid for the cost of several systems in the city and could continue to do so into the future.

Ultimately, the economics of rainwater harvesting does not make it a very desirable choice for the average urban farm or garden's budget, since it can take several decades for some systems to pay for themselves and few projects likely plan for that far in the future. If the city decided to keep things as is, rainwater harvesting would likely be accessible to those who care about the environmental benefits of harvested rainwater over any financial benefit.

There likely will be a few cases, where farms or gardens could benefit from rainwater harvesting as a more convenient means of getting water, but these projects must be fairly small to depend on harvested rainwater to supply their needs. As a result, it may not be a priority for the city to implement any new programs to encourage the use of harvested rainwater for urban agriculture.

SPREAD INFORMATION ABOUT RWH

Estimated Cost: \$0-\$50

- Cost of staff time to update website.
- Can include cost to create and print pamphlet.

Estimated Impact: Minimal. Serves those already interested in rainwater harvesting.

Potential Partners:

Major involvement: None

Minor involvement: Blue Water Baltimore, Farm Alliance of Baltimore City, Parks and People Community Greening Resource Network, University of Maryland Extension Office

Potential Funding Sources: None

Presently, there are a significant amount of resources available to farms and gardens already that can allow them to implement rainwater harvesting projects on their land. Unfortunately, centralized information about these resources is not readily available. In addition to a lack of information about the safety and yield of harvested rainwater, with many organizations having different views on what harvested rainwater can and cannot be used for. By serving as a central conduit to this information, the Baltimore Office of Sustainability may make accessing the financial and educational resources needed to install a safe rainwater harvesting system available to farms and gardens in the city.

Since this information is already available in this report, the simplest thing that can be done is to create a page on the Office of Sustainability website with the grants, organizations, and safety information already described. Similar pages could also be posted on the Parks and People: CGRN, Blue Water Baltimore, University of Maryland Extension Office, and Farm Alliance of Baltimore City's websites as well.

Informational pamphlets could be created and distributed at events attended by the Baltimore Office of Sustainability and its partners, but they would add printing costs to the total costs.

CREATE RWH INSTALLATION OR TRAINING PROGRAM

Estimated Cost: Moderate – Significant

- Cost of staff time/positions to design and install systems

Estimated Impact: Fairly Significant

Potential Partners:

Major involvement: A farm or garden to host demonstration project

Minor involvement: Blue Water Baltimore, Farm Alliance of Baltimore City, Parks and People Community Greening Resource Network, University of Maryland Extension Office

Potential Funding Sources:

Chesapeake Bay Trust Agriculture Grant, Chesapeake Bay Trust Green Streets, Green Jobs Green Towns Grant, Chesapeake Bat Trust Pioneer Grant, EPA Community Action for a Renewed Environment Grant, EPA Nonpoint Source Program (319) Management and Financial Assistance, Northeast SARE Research and Education Grant, USDA NRCS Regional Conservation Partnership Program

Since one of the largest barriers to the installation of rainwater harvesting systems on urban agriculture sites is knowledge, the city could potentially set up a program that can either train farmers how to install rainwater harvesting systems or even create a program where city workers install the systems themselves.

In order to be accessible to lowincome communities, this program would have to provide systems at subsidized prices. The prices would ultimately depend on the system installed. The largest caveat is that this program cannot be used by urban agriculture sites that are operating on privately-owned vacant land that is being gardened as a nuisance abatement.

In Columbia Ohio, an informal program exists that has the city install terraces, rainwater harvesting systems, and solar-powered pumps for local gardens at low costs. A program like this helps to eliminate many of the hindrances to rainwater harvesting, while being accessible to more farms and gardens. While it relies mostly on the expertise of an individual and an ordering error from the Transportation Department that made batteries very cheap, there is a possibility from a program of this nature to be replicated.

EXPAND EXISTING RWH INSTALLATION AND TRAINING PROGRAMS

Estimated Cost: Moderate - Significant

- Pay for staff time/additional positions at non-profit partners
- Resources to construct systems

Estimated Impact: Fairly Significant

Potential Partners:

Major involvement: Blue Water Baltimore, Civic Works Baltimore Center for Green Careers, Conservation Technologies, Community Greening Resource Network, Farm Alliance of Baltimore City, University of Maryland Extension Office, A farm or garden to host demonstration project, Symbiosis Design/Build

Minor involvement: None

Potential Funding Sources:

Chesapeake Bay Trust Agriculture Grant, Chesapeake Bay Trust Green Streets, Green Jobs Green Towns Grant, Chesapeake Bat Trust Pioneer Grant, EPA Community Action for a Renewed Environment Grant, Northeast SARE Research and Education Grant, US Economic Development Administration Economic Development Assistance Program, USDA NRCS Regional Conservation Partnership Program

Since several organizations are already doing work to make urban agriculture or rainwater harvesting more viable in Baltimore, it may make sense to tap into these existing resources to host trainings and complete installations of rainwater harvesting systems on urban agriculture sites. The benefit of a program like this is that expertise already exists within these organizations that have a large body of farms and gardens that work with them presently.

Considering urban farming and gardening in Baltimore has traditionally relied on a very entrepreneurial DIY character of the city, a training program may be the best use of resources that identifies with the Baltimore urban agriculture community.

The most likely partner to conduct installations would be Blue Water Baltimore, since they have expertise with rainwater harvesting already. This would require expanding the scope of their work to city-owned vacant land, since they only work on privately-owned land, churches, and schoolyards. Like any program, this program could not extend to privatelyowned vacant land where the owner has not given explicit permission for the growers to use it.

Trainings could be conducted on a farm or garden that has an existing rainwater harvesting demonstration project onsite. They could be administered by Blue Water Baltimore, the Farm Alliance of Baltimore City, Parks and People's Community Greening Resource Network, or the University of Maryland Extension Office.

The program could also involve the city providing subsidies for gardens to use existing rainwater harvesting system installation contractors, like Symbiosis **Design/Build and Conservation** Technologies, to build custom systems for them. This would like be more costly than the non-profit route, but the installed systems would be better. This could dovetail into Blue Water Baltimore's cistern rebate program that gives rebates for the installation of cistern installed on private land at 50 cents per gallon of storage. Blue Water Baltimore's estimations put cisterns at a cost of \$2 per gallon.v

CONNECT GROWERS USING RWH SYSTEMS TO OTHER GROWERS

Estimated Cost: Minimal

Staff time to implement

Estimated Impact: Minor

Potential Partners:

Major involvement: None

Minor involvement: Community Greening Resource Network, Farm Alliance of Baltimore City, University of Maryland Extension Office

Potential Funding Sources: None

For many growers, major concerns about rainwater harvesting is whether it is worth the investment, who to get to install a system, and how to construct their own system if interested. Almost a dozen projects have been described in this report already and there are likely many more that currently exist in the city. By using this shared experience, gardeners can be more informed about the benefits, hazards, and how-to's of rainwater harvesting. As a result, they can make more informed decisions on how to do so.

Like many other cities already have, a map could be created that documents places where existing rainwater harvesting systems on farms and gardens exist and provides contact information of those willing to share their experiences with others. Theoretically, existing Baltimore farm and garden listservs could be leveraged to compile a list of gardens and farms that implement rainwater harvesting in the city, which can be posted publicly for others to access if they wish. Since these listservs already exist, there may not need be significant work to make connections possible.

REQUIRE RWH FOR STORMWATER MANAGEMENT

Estimated Cost: Minimal

- Staff time to create and implement policy

Estimated Impact: Significant to increasing number of RWH systems, but detrimental to urban agriculture

Potential Partners:

Major involvement: None

Minor involvement: None

Potential Funding Sources: None

Considering urban agriculture requires the introduction of high nutrient fertilizers to previously low-nutrient land, it does have an impact on nutrient loads that enter local bodies of water. As a result, in many cities, stormwater management features are a necessary part of any new urban agriculture site. In some cases, these features are installed with the assistance of local governments to reduce the cost; however, these requirements still add additional costs to urban growers that often don't have significant amounts of money to spend. Due to these costs, a program of this type would likely increase the number of rainwater harvesting in the city, but at the cost of making urban agriculture less accessible to low-income populations.

Since these policies are not mutually exclusive, this could dovetail into other policies that include the creation of programs that install rainwater harvesting systems at low and no cost. This would make this implementing this policy less detrimental to low-income communities.

Finally, in the event that rainwater harvesting is not an option for the site, other stormwater management features like bioswales and rain gardens may occupy space that would have previously been used for sale crops or community garden plots.

CREATE STORMWATER MANAGEMENT CREDIT TRADING PROGRAM

Estimated Cost: Minimal

- Staff time to create and implement policy

Estimated Impact: Moderate - Significant

Potential Partners:

Major involvement: None

Minor involvement: None

Potential Funding Sources: None

Although not previously described, Washington DC current operates a program known as the Stormwater Retention Credit Training Program. Through this program, development projects that are required to implement stormwater management features may choose to purchase credits, which are used to pay for stormwater management offsite. In the event that the installation of a specific stormwater management feature is cost prohibitive, a cheaper feature can be constructed on a different site that prevents an equivalent toxic and nutrient load of run-off from entering the bay.

Typically, individuals, businesses, or non-profits can apply to participate in the program by describing stormwater management features that can be implemented on their residence or site and the money for the features is covered by the funders for new development projects in the city. The advantage of this project is that it can make development more affordable, while potentially investing money in areas that typically don't receive investment.

As part of this program, urban farms and gardens can apply for credits to cover the cost of rainwater harvesting systems. Presently, Baltimore's <u>Stormwater Management Ordinance</u> allows for offset fees to be used as a last resort for projects; however, by replacing fees with specific projects, the city can better understand what the real cost of stormwater management features may be. Currently, the ordinance only applies to projects that cause the redevelopment of a 5,000 square foot of non-agricultural plots with 40% impervious area.^{vi}

STUDY RAINWATER HARVESTING FURTHER

Estimated Cost: Moderate

- Staff time to conduct research
- Materials for model systems and testing equipment

Estimated Impact: Minimal - Moderate

Potential Partners:

Major involvement: A farm or garden for a demonstration project, Johns Hopkins University Bloomberg School of Public Health Center for a Livable Future, University of Maryland Extension

Minor involvement: None

Potential Funding Sources: Chesapeake Bay Turst Agriculture Grant, Northeast SARE Education and Research Grant, Northeast SARE Partnership Grant,

While there is plenty of research available about rainwater harvesting, there is a surprisingly small amount of information that identifies what steps need to be taken to ensure that harvested rainwater can be used for growing edibles, how much water do urban agriculture projects use, and how much water can rain barrels effectively provide for specific projects. The result of this is that many organizations are uncertain about what role harvested rainwater can play in agriculture. For example, Blue Water Baltimore openly admits that it does not have a stance on whether harvested rainwater can be used for edibles and the Parks and People Community Greening Resource Network openly recommend against using harvested rainwater for edibles.

Since there are a lot of varying viewpoints on harvested rainwater throughout the city and a large amount of uncertainty about their effectiveness, it may make sense for the city to conduct more research about rainwater harvesting. For example, research could be used to identify the quality of what can be collected from vacant houses, industrial buildings, school roofs, and private residences, so that growers can make more informed decisions about whether to harvest rainwater. In addition, this could better position important stakeholders in the city to align their opinions on harvested rainwater, so that future policy and programs regarding rainwater harvesting can be implemented with full support.

APPENDIX A: ACKNOWLEDGEMENTS

This report would not have been possible without the assistance of a variety of experts, stakeholders, gardens, and city government officials. As a result, special thanks are given to the following people for providing insight into urban agriculture and rainwater harvesting:

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- Christopher Lent, National Center for Appropriate Technology- ATTRA
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- Sarah Wu, Philadelphia Mayor's Office of Sustainability
- Sheila Cassani, Kansas Street Farm
- Tim McCollow, Home GR/OWN Milwaukee
- Tyler Brown, Real Food Farm

APPENDIX B: COPY OF SURVEY

RAINWATER HARVESTING SURVEY

This is a survey for urban farms and gardeners in Baltimore City to provide information to the Baltimore Office of Sustainability about rainwater harvesting and your current needs. The survey should take between 5 and 15 minutes.

Please answer all questions to the best of your ability, so that we can construct the best policy possible to make rainwater harvesting accessible and successful for urban agriculture. If possible, please forward this survey to anyone else who is gardening or farming in the city.

If you have any questions about the survey, please email Abby.Cocke@baltimorecity.gov. Thank you for your time and the work that you do to make Baltimore life greener, cleaner, richer, and healthier.

- 1. How long have you been growing on your garden/farm space?
- 2. Do you grow food for human consumption at your garden/farm space?
- 3. Do you have any issues accessing or paying for all the water that your space uses? If so, please elaborate.
- 4. What kind of urban agriculture project are you currently working on and referring to in this survey (check all that apply):
 - □ For-profit urban farm
 - 🗆 Non-profit urban farm
 - □ Community Garden
 - □ School or Educational Garden
 - □ Home/Personal Garden
- 5. What permissions do you have to the land that you are currently growing on? (check all the apply)
 - \Box I own the land
 - □ I have an Adopt-A-Lot license

 \Box Someone else owns the land and has given me permission to use it, other than an Adopt-A-Lot license.

Type of landowner (e.g. private individual, school, city park, etc.):

Length of time for which permission to use the site has been granted (if a term has not been discussed, put n/a):

 \Box Someone else owns the land and has not given me explicit permission to use it

6. Do you currently have or are you constructing a rainwater harvesting (RWH) system on your garden or farm? (check all that apply) If "No", skip to question 15.

□ Yes, I have a rainwater harvesting system

□ Yes, I am constructing a rainwater harvesting system

🗆 No

[If "Yes, I have a rainwater harvesting system" from question 6, questions 7 – 13 are prompted. If no, skip straight to question 14.]

- 7. Describe your system(s). How many containers do you use? What surface does it collect from? How big is that surface? Approximately how much water can it hold at once? What do you use that water for?
- 8. Why did you decide to construct a rainwater harvesting system(s) on your garden or farm?
- 9. What inputs were needed to construct it in terms of time, knowledge, and money? Who built the structure?
- 10. What difficulties, if any, did you have in constructing your rainwater harvesting system(s)?
- 11. What resources did you use to design and construct your rainwater harvesting system(s)? Please identify any organizations or companies that assisted you.
- 12. Is your RWH working? If so, how big of a benefit has it been to your site?
- 13. Have you considered constructing a rainwater harvesting system (or additional systems, if you already have one) on your garden or farm? If so, why? If not, why not?
- 14. What limitations do you have to constructing a new rainwater harvesting system on your farm or garden? If you already have a rainwater harvesting system, describe limitations to adding new systems or expanding current system. (check all that apply)
 - □ Already have a more convenient source of water
 - □ No physically accessible roof surface to collect from
 - \Box Lack of knowledge of the benefits of rainwater harvesting
 - \Box Lack of knowledge of how to design the system
 - \Box Lack of knowledge of how to build the system
 - Concern that harvested rainwater could be contaminated
 - \Box Concern about low water pressure from rain barrel or cisterns
 - □ Concern about attracting mosquitoes

□ Concern that materials making up the system will be stolen

- □ Uncertainty about regulations for rainwater harvesting systems
- □ Opposition from neighbors to constructing a system
- Not interested in making long-term investments in garden due to temporary land tenure
- \Box Trouble finding a reliable contractor to construct the system
- □ Design limitations specific to your growing site (i.e. no space for a barrel, interference with hoop-house maintenance, etc.)

□ Money

Desire/Motivation	n
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🗌 Time

Current rainwater harvesting system covers all water need	st
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- 🗆 Other:
- Of the following, how helpful from a scale to (1-5) would the following resources be or have been to constructing a rainwater harvesting (RWH) system? (1 – not helpful, 5 – very helpful, write N/A if the option is not applicable to your system)

	Not Helpful	A Little Helpful	Fairly Helpful	Very Helpful	N/A
Free or subsidized materials					
Information on the safety and benefits of RWH					
An estimate of expected water yield of your RWH system					
An estimate of financial savings of your RWH system					
A how-to guide to creating and maintaining a RWH system					
A list of companies that construct RWH systems					
Assistance in the design of the RWH system					
Assistance in the installation of the RWH system					
Community support for your RWH system					
A list of other gardens/farms with RWH in the city					

- 16. Are there any other resources that would be or would have been helpful in constructing a rainwater harvesting system?
- 17. Is there anything else you would like to share about your knowledge, experience, or opinions of rainwater harvesting systems?
- 18. Name:
- 19. Name of your current urban agriculture project:
- 20. What is the address of your current urban agriculture project?
- 21. Would you mind us following up with you on your survey? If so, what is the best email or phone number for us to use to get in touch with you?

⊠ Yes:_____

🗆 No

APPENDIX C: SURVEY RESULTS

References

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