

Hydro-Sustainable Cool Bus Stop for Ashburton

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Abstract

The Liberty Grace Church of God is a Baltimore City Community Resiliency Hub (CRH) that provides frontline resources for the Ashburton community. The hub program is a part of the city's Disaster Preparedness and Planning Project (DP3) serving as a mitigation strategy for extreme heat relief and local crisis management. To make use of a commonly traversed bus stop at the hub facility, Liberty Grace Church of God incorporated a pilot hydration station project to provide free water filtered through solar technology along with other mitigations that were identified in the city's green space plans, and extreme heat best practices. Extreme Heat mitigation strategies for the city of Baltimore include clean water, access to critical messaging, nature-based canopy and contingency canopy to mitigate the burdens of historical urban infrastructure and the social effects of heat stress in underserved communities (Cite). 11.5% of Baltimore residents use public transportation and the Ashburton community serves a population of 3,000, according to the U.S. Census Bureau, thus making those without direct transport and who depend on public transportation in need of infrastructure support for resident pedestrians. The community was presented with an opportunity by the Leon Lowenstein Foundation and the Urban Sustainability Directors Network (USDN) to provide a data analysis of perception for the public hydration station which was conducted by local youth participants. An additional water quality test was conducted to measure the technology's results and performance against a city requested method. The results from the water quality test and community perspective survey inform the confirmation of replicability of projects such as these in Baltimore. The CRH program supports community-based organizations address the acute needs of their communities with resources to produce innovative pilot projects and leverage the outreach and capacity of a localized approach. This Liberty Grace Church of God hydro-sustainable cool bus stop endeavor was uniquely designed by frontline leadership to address urban issues that are germane to the culture, composition, and future of the Ashburton neighborhood.

- **Summarize your entire proposal:** *What is the issue, why does it matter, what will you do, and what is the expected outcome?*
- **Include:**
 - *Problem overview*
 - *Goals/objectives*
 - *Summary of methods*
 - *Expected impact*
 - *Funding amount requested*

Student Response (150-200 Words):

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The issue our project addresses is the lack of community resilience in areas of Baltimore often described as “deserts,” where residents lack access to basic needs like water, shade, and safety—especially during emergencies and extreme heat events. Many elders and residents who rely on public transportation are exposed to dangerous conditions at uncovered bus stops. This project focuses on creating *Cool Bus Stops* that provide shaded seating, clean water access, and safer environments for waiting passengers.

Our primary goal is to use nearby church land, beginning with Liberty Grace Church of God in the Ashburton community, to design and install green infrastructure that supports both environmental and social resilience. Working in partnership with Temple X Schools, we aim to create spaces that combine function and beauty—adding trees for cooling, rainwater harvesting systems for hydration, and nature-based art installations to slow traffic and enhance neighborhood safety.

Our methods include community-based research, data collection on traffic flow and heat exposure, and collaboration with residents, faith institutions, and city partners.

The expected impact is a safer, greener corridor that promotes health, reduces heat risk, and strengthens community connections.

Introduction

- *State the problem clearly and why it's important.*
- *Mention the target population (e.g., rural students, underserved communities).*
- *Include a brief project overview (1–2 sentences on what the paper will discuss).*

Student Response (200-300 words)

The Liberty Grace Church of God is a Baltimore City Community Resiliency Hub (CRH) that activates during Code Red days to provide an air-conditioned environment for residents in need of managing their personal heat thresholds. The Baltimore City Office of Emergency Management provides Maryland Foodbank donated water bottles to the hubs which can only be distributed on Code Red Activated days that are declared by the Health Commissioner. As an active CRH, Liberty Grace Church of God recognized an immediate need of shade canopy at the bus stop in front view of the church grounds and imagined a more sustainable way to distribute water on non-Code Red days. With hotter days occurring in Baltimore City's Urban Heat Island (UHI), Liberty Grace Church of God developed a solution for the residents struggling at the exposed bus stop presenting in need of water, shade, and an open invitation for hub use. The city does not have the capacity to increase the water supply for excessively hot days and has experienced XX Code Red days in 2024 and XX Code Red days in 2025 (Baltimore City Health Department). This increase of Code Red days has stretched the water supply available for distribution to become an additional challenge. To solve this growing problem of water scarcity, water quality, shade deficiency, and limited communication, Liberty Grace proposed a hydro-panel to extract moisture from the air to be converted into drinkable water at the bus stop, which would accompany planted fruit tree canopy to improve air quality, shade, and food

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scarcity, as well as a misting station tent to bridge the gap of providing relief until a city developed cool bus stop is implemented. The additional feature of a digital sign capable of solar connectivity, allows for Code Red days to be announced and additional crisis messaging to be issued by a trusted resource in the community.

11.5% of Baltimore residents use public transportation. With the Ashburton community serving a population of 3,000, according to the U.S. Census Bureau, those who depend on public transportation are in need of extreme heat infrastructure support for residents without direct transport. Residents who walk long distances on Liberty Avenue experience little shade as both directions are central areas of conducting community affairs. Walking, using public transportation, recreational cycling, and other physical modes of transport require thoughtful infrastructure to alleviate the extreme heat burdens of the city's UHI.

Extreme Heat in the Ashburton community affects a wide range of vulnerable populations inclusive of able-bodied individuals with no adverse health conditions. Water consumption is critical to Baltimore's heat mitigation strategy as guidance from all City Hall issued notices include water consumption as a priority for extreme heat conditions and Code Red days. With water quality concerns in the community, the Liberty Grace Church of God hub addressed a cross section of community concerns into one solution-based effort. The first concern of an exposed bus stop, the second concern of water scarcity, the third concern of limited use of the hub space on Code Red days were applied through a lens of lived experience and a solution was provided.

This white paper discusses the process of building a hydro-sustainable cool bus stop, the community perspective of the endeavor, and best practice and guidance for replicability of hydro-sustainable cool bus stops.

Background / Literature Review

- *Describe the **current state of the issue** using recent research and data.*
- *Use **reliable sources**: USDA, CDC, WHO, peer-reviewed journals.*
- *Discuss:*
 - *Gaps in services or knowledge*
 - *Past efforts (if any) and why more work is needed*
- *Include **local relevance***

Student Response (500-700 words)

The Baltimore City DP3 outlines extreme heat as a rapidly intensifying climate hazard with broad implications for infrastructure, human health, and urban resilience. As outlined in Chapter 4 of the plan, extended periods of high temperatures especially those exceeding 90°F for several days are becoming more frequent due to climate change and are projected to dramatically increase by the end of the century. The report highlights a compounding risk for energy delivery systems, which are strained by increased demand for cooling. This can lead to blackouts, which

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are especially dangerous for vulnerable residents such as the elderly and individuals without access to air conditioning. The DP3 notes that neighborhoods with low tree canopy cover and high impervious surface area, typically low-income areas are at greater risk due to the Urban Heat Island effect. These inequities align closely with demographic disparities, meaning that the same communities already burdened by poverty are also more physically exposed and less able to adapt to extreme heat conditions. The City's vulnerability analysis also identifies gaps in adaptive capacity, including a lack of vegetation, outdated infrastructure, and inequitable access to cooling centers, especially for seniors living in isolated conditions or areas far from designated cooling zones.

The Baltimore City "Code Red" Extreme Heat Plan triggers when heat indices surpass 105°F or when high heat is paired with unhealthy air quality. Under Code Red conditions, city agencies coordinate to open cooling centers, issue public warnings, and increase outreach to unhoused populations and those without adequate home cooling systems. Yet, the DP3 reveals that this response is only as effective as the city's physical and social infrastructure allows. For example, essential facilities like hospitals and emergency shelters may lack backup power, posing operational risks during power outages. The plan emphasizes that increasing vegetative cover, retrofitting infrastructure, and expanding access to critical facilities, particularly in underserved neighborhoods, are necessary to build long-term resilience. The Code Red response may address immediate threats, but it must be supported by systemic investments in tree planting, affordable energy, and adaptive housing to reduce future risk.

In addition, the article "How Extreme Heat Affects America's Most Vulnerable" by Madrigano et al., published in the Journal of Health Politics, Policy and Law (Project MUSE), expands on the systemic nature of heat vulnerability through a case study of New Orleans. Researchers found that many low-income residents despite technically having access to air conditioning chose not to use it due to fears of high energy bills. As a result, indoor temperatures still reached dangerous levels. This reflects a broader reality: that extreme heat impacts are not simply a function of outdoor temperatures, but of social determinants like energy insecurity, poor-quality housing, and racialized patterns of disinvestment. The article emphasizes that the communities most affected by heat are often excluded from decision-making, reinforcing the importance of integrating equity into climate adaptation efforts. The article also praises New Orleans' "Healthy Homes" ordinance, which now requires landlords to keep indoor temperatures below 80°F, showcasing how research can drive tangible policy outcomes.

Methods / Project Description

Break this into the following subsections:

a. Objectives, Target Population, Activities / Procedures, Evaluation plan

- **List 3–5 SMART objectives** (Specific, Measurable, Achievable, Relevant, Time-bound)

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Student Response (500-700 words)

The objectives for this project was to develop a hydro-sustainable cool bus stop from inception to completion with community support of a high quality water source at no cost to anyone. To test the community's perception of the technology used in the solar filtration system and the associated Q-Code access capacity for the public facing benefits of a real-time water tested system at the hydration station. The hydration station consists of a water fountain that has two options for water dissemination. The system used is a CYCLEAU filtration unit that includes a water testing capacity which the public can see the water quality prior to their consumption. To test this perception, the Liberty Grace Church of God youth workers canvassed the area with a community survey collecting data on residents willingness to use and trust the water, as well as to collect data on residents ability to use Q-Codes.

Once the hydration station was fully installed, a city provided test was conducted on the water to determine if the unit's real time data is in alignment with city testing results. The method used was **XX** water testing. Once the two results were determined suitable for public use, and the stakeholders can track how many times the Q-Code was accessed to measure the full scope of public usage.

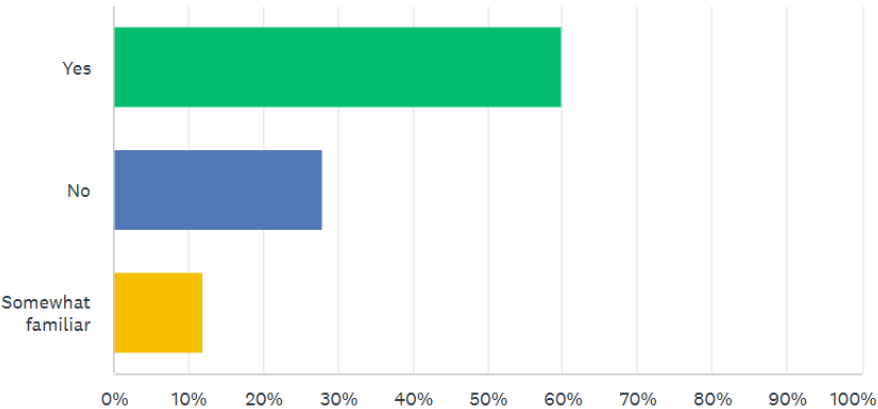
Data

Survey Data

The data recovered by the Liberty Grace Church of God youth workers include the responses to the following prompts:

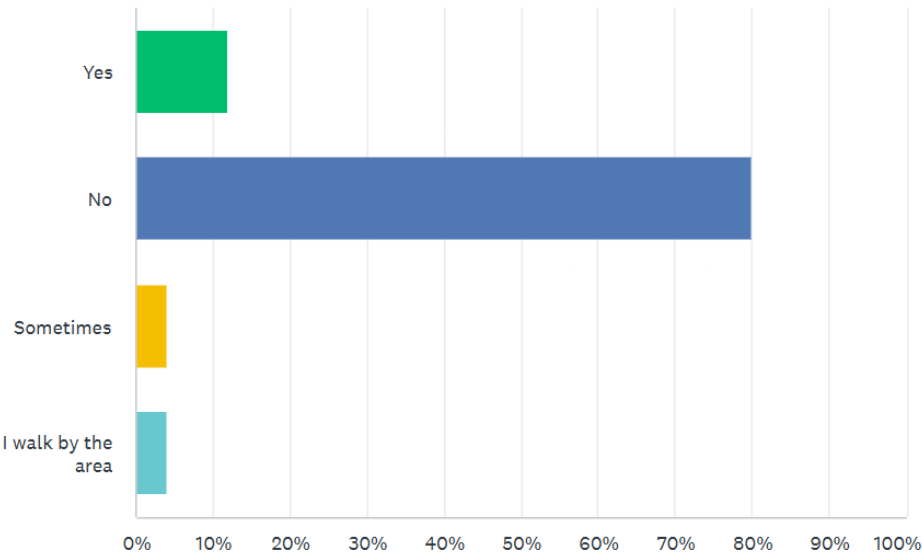
Do you know where Liberty Grace Church of God Resiliency Hub is located?

Answered: 25 Skipped: 0



Do you take the bus in the area of Liberty Avenue and Copley Rd

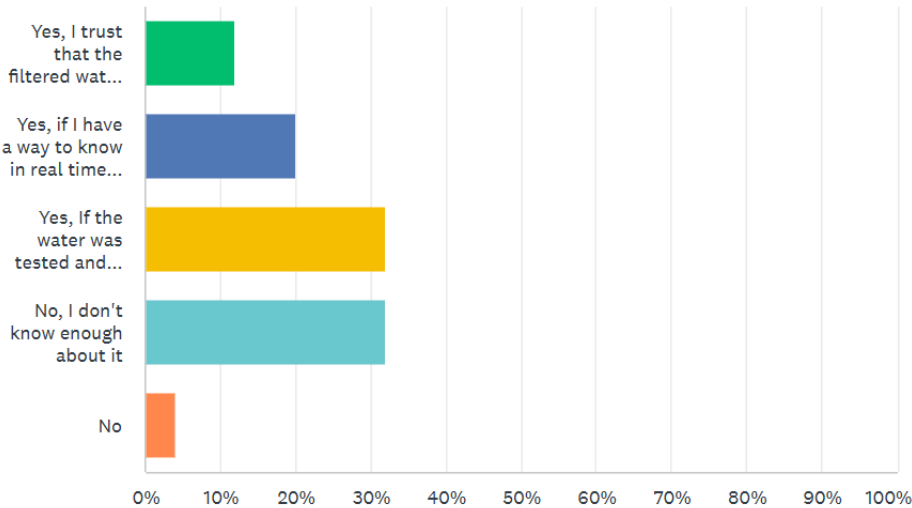
Answered: 25 Skipped: 0



| ANSWER CHOICES | RESPONSES | |
|--------------------|-----------|----|
| Yes | 12.00% | 3 |
| No | 80.00% | 20 |
| Sometimes | 4.00% | 1 |
| I walk by the area | 4.00% | 1 |
| TOTAL | 25 | |

There is a new water fountain generated by a solar powered rainwater filtration system. Would you use this water fountain station if you needed water?

Answered: 25 Skipped: 0

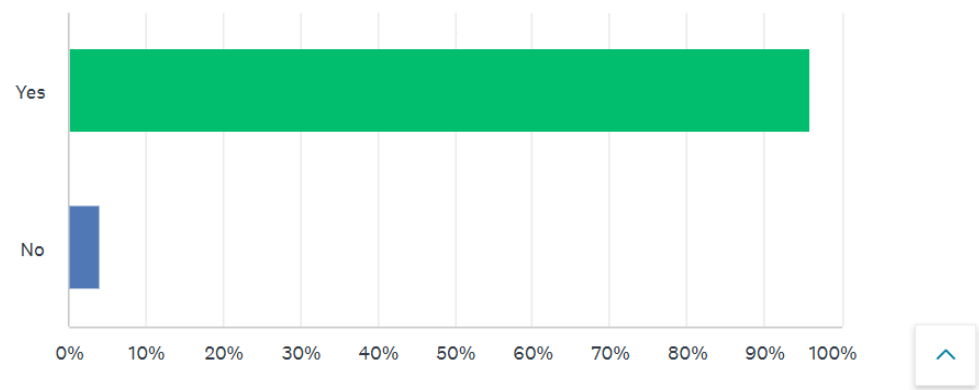


| ANSWER CHOICES | RESPONSES | |
|--|-----------|---|
| Yes, I trust that the filtered water will be good | 12.00% | 3 |
| Yes, if I have a way to know in real time that the water is ready to drink | 20.00% | 5 |
| Yes, If the water was tested and approved by an authorized agency | 32.00% | 8 |
| No, I don't know enough about it | 32.00% | 8 |
| No | 4.00% | 1 |
| TOTAL | 25 | |

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The water fountain will have a QR Code that can tell you the water quality in real time before you drink it. Do you know how to use a QR Code?

Answered: 25 Skipped: 0

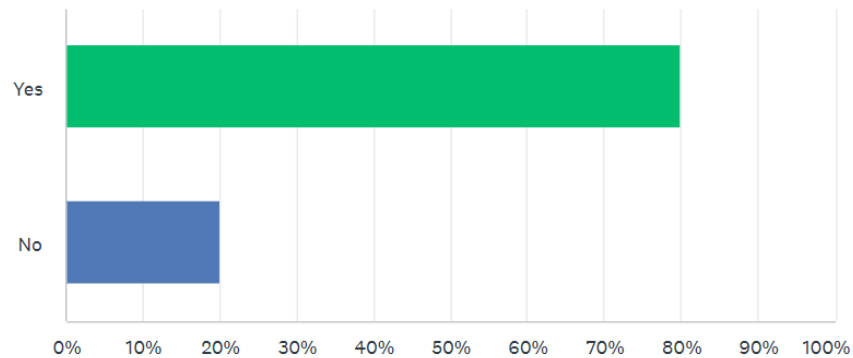


| ANSWER CHOICES | RESPONSES | |
|----------------|-----------|----|
| Yes | 96.00% | 24 |
| No | 4.00% | 1 |
| TOTAL | 25 | |

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The water will be tested by an authorized agency to certify the QR Code real time results. Would you accept the water as safe to drink if this is done?

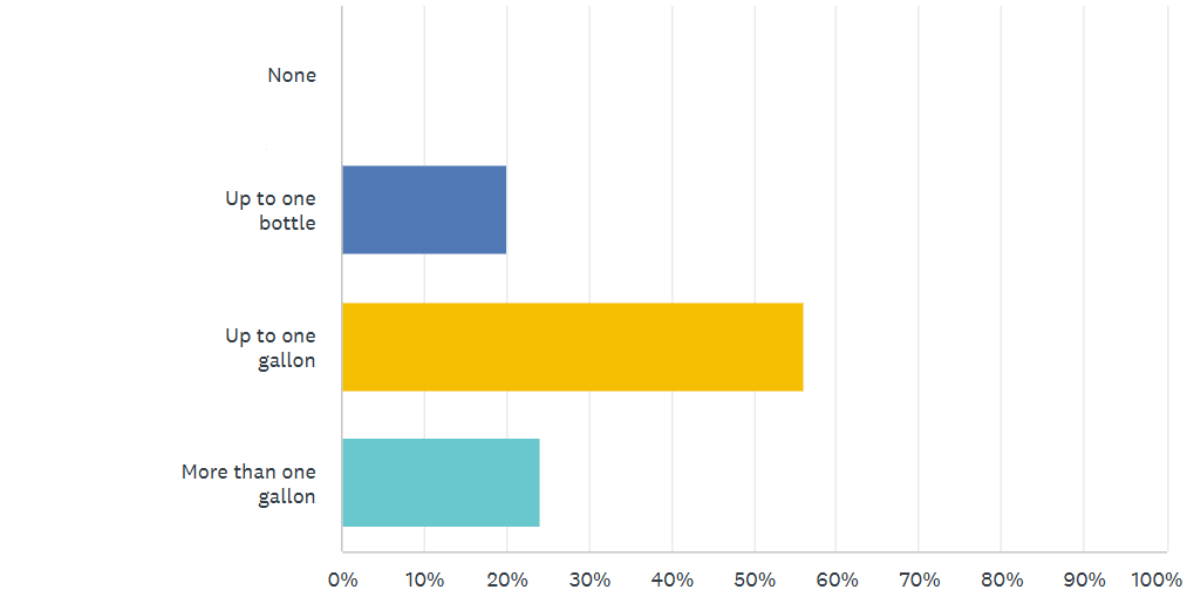
Answered: 25 Skipped: 0



| ANSWER CHOICES | RESPONSES | |
|----------------|-----------|----|
| Yes | 80.00% | 20 |
| No | 20.00% | 5 |
| TOTAL | | 25 |

How much water do you drink on a hot day?

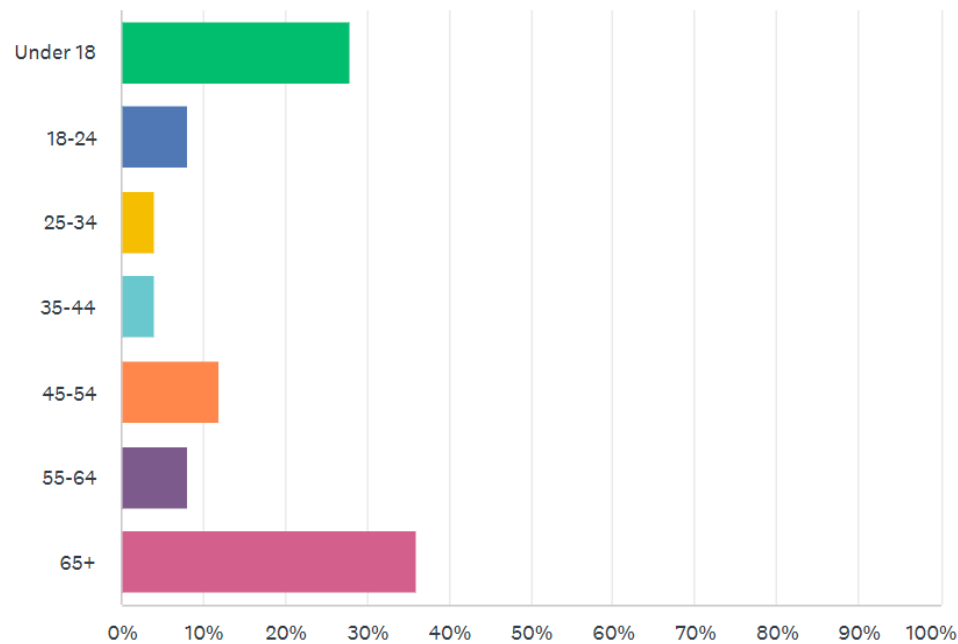
Answered: 25 Skipped: 0



| ANSWER CHOICES | RESPONSES | |
|----------------------|-----------|----|
| None | 0.00% | 0 |
| Up to one bottle | 20.00% | 5 |
| Up to one gallon | 56.00% | 14 |
| More than one gallon | 24.00% | 6 |
| TOTAL | 25 | |

What is your age range?

Answered: 25 Skipped: 0



| ANSWER CHOICES | RESPONSES | |
|----------------|-----------|---|
| Under 18 | 28.00% | 7 |
| 18-24 | 8.00% | 2 |
| 25-34 | 4.00% | 1 |
| 35-44 | 4.00% | 1 |
| 45-54 | 12.00% | 3 |
| 55-64 | 8.00% | 2 |
| 65+ | 36.00% | 9 |
| TOTAL | 25 | |

Discussion

- *What makes your project **innovative** or impactful? Include a sustainability plan,*

Student Response (300-400 words)

This project is innovative as it pioneered three major ingenuities. The first is implementing the CYCLEAU unit in Baltimore with a customized build to provide a public facing unit with the technology protected and embedded in the hub property. The solar panels, water collection tanks, and CYCLEAU filtration unit was positioned in the rear of the **XX,XXX** sq ft property, and pipe lines were installed to connect the filtered water source and the public facing hydration station. This partnership of private land use for a public good with no cost to any entity other than the initial investment award, has demonstrated the expediency of development when there is a no burden partnership.

The second cause for ingenuity explores deeper into the city partnership with community-based organizations to develop within capacity and utilize the best use of each entity to expedite project development. The partnership between the city and hub permitted for the opportunity from the Leon Lowenstein Foundation through the city's Office of Sustainability's membership with the USDN to directly impact the Ashburton community without the civic processes that can hinder time efficient expenditures. This project was given six months to complete and due to the hub receiving and expending independently, the project was made possible by direct payments from awardee to the vendors.

The third point of ingenuity is the customized technology used for the Ashburton community specifically. Initially, the project was intended to implement a hydro-panel which takes moisture from the air and converts into portable drinking water. The climate of Baltimore of harsh winters and insufficient dry air was not conducive to the needs for available technology now for hydro-panels. The next option was for rain collection water that uses the same CYCLEAU filtration capacity to purify gray water, hydro-panel water, or any water source in need of a process prior to consumption. The amount of water produced from hydro-panels is an insufficient amount of water for the population of the neighborhood. A goal was set to provide a gallon of water per day (rain permitting), per resident. For that, two 5,000 gallon tanks were secured. The CYCLEAU unit uses NSF-certified technology which ensures accuracy of assembly and processes which is shared in real-time with anyone with access to the QR-Code. This allows for a sustainable, no effort, and free water supply for a community with multiple lanes of vulnerability.

Planting fruit and shade trees through the Chesapeake Bay Trust Urban Tree Grant serves two objectives of the project which is shading at the public bus stop and nourishment. While the trees were planted on Liberty Grace Church of God property, their maturity is insufficient to offer the requisite shade for the many bus users at this location. To mitigate the lag in benefit, a purchase of a misting tent was secured to be managed on Code Red days by the activated hub.

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With the fruit tree canopy, misting tent, and hydration station sits the digital signs for community crisis messaging. This addition at a highly traversed area by motorists as well as pedestrians allows for the hub to announce activations and community support messaging through a direct partnership with the city and the Office of Emergency Management CRH lead.

The ability to address a community level need with a community based organization demonstrated a mutually beneficial relationship that required minimal exertion of resources, time, and stakeholder reluctance.

Lessons Learned and Best Practices

- *Reiterate:*
 - *The **problem***
 - *Your **solution***
 - *Why it's **timely and important***
- *Briefly summarize the **expected long-term benefits**.*

Student Response (150-200 words)

Lessons learned include the following takeaways:

1. Check availability of new technology at the time of development as new options became available and customization that were not available during the time of the proposal writing process of the grant award. The hydro-panel concept has been growing with interest and use of hydrogels have improved water extraction methodologies as cited by the MIT Review, *Bubbles' turn air into drinkable water* (Chu, 2025).
2. Utilize underground land use for water storage tanks. The water tanks could be efficiently stored beneath ground which frees up space that can be used for other above ground use.
3. Have a weatherization plan for the solar panels as they can be toxic to the environment if airborne during a storm or wind event.
4. When utilizing piping to transport water, ensure that there are flow and elevation considerations being made to avoid pressure and flow issues to the connected station.
5. Conceive of all potential uses for water connectivity in advance of the installation. With the misting tent and the digital signs, the solar panels could have been connected to the Digital Signs and the water lines could have been developed for irrigation of the canopy, the misting station as well as the fountain.
6. Consider an over supply of water. The pilot project planned for one gallon of water per resident a day. With larger investments in tanks, this could be increased substantially. If placing the water tanks below ground, this will support water sustainability at micro and hyper local levels in a no-cost, no burden endeavor.

Conclusion

In conclusion, the goal of addressing a multi-pronged challenge of extreme heat in an urban heat island, with an exposed bus stop with no shade, and community dealing with food and water scarcity, the Liberty Grace Church of God maximized their partnership with the city of Baltimore's Community Resiliency Hub program to implement a solution in a more efficient timeline. The community was provided with a two-way outreach opportunity conducted by the youth workers of the hub, and a data analysis report was developed. The data identified any hesitancy and overall public trust in the water issued from the CYCLEAU solar filtration system which yielded favorable responses across the age groups. The water was also tested by XXX to ensure that the results were in alignment with the real-time water quality analysis provided by the hydration station QR-Code technology. The results include that the community is prepared, willing, and ready for the hydration station and has already served as a benefit in the community. The digital signs permit the emergency response capacity to address offline communication scenarios and information sharing in an age of mis/disinformation. The reliability of digital crisis messaging assists forthcoming systems tests address communication opportunities through the CRH program.

The replicability of hydro-sustainable bus stops is encouraged based on the facilitated install capacity, the no-cost and no-burden to any entities involved other than the initial investment award, and the lessons learned support the next implementation process for a more hydro-sustainable Baltimore.

- *Reiterate:*
 - *The **problem***
 - *Your **solution***
 - *Why it's **timely and important***
- *Briefly summarize the **expected long-term benefits**.*

Student Response (150-200 words)

References

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- *Include at least 5–10 credible sources (USDA, peer-reviewed studies, policy reports).*

The Disaster Preparedness Planning Project. (2023). [Microsoft Word - 2024-01-30_Baltimore2023DP3.docx](#)

The Climate Action Plan Update. (2024). [2024-Climate-Action-Plan-Update.pdf](#)

Baltimore City Health Department Code Red Extreme Heat Guidance. (2025). [Code Red Extreme Heat | Baltimore City Health Department](#). Web

Chu, Jennifer (2025). Bubbles' turns Air into drinkable water. MIT Review. ['Bubbles' turn air into drinkable water](#). Web.