

# Thought Leadership

## Rain Gardens and Their Potential for Use in Urban Jamaica

Written by: Tariq King  
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### Setting the Stage

As the major Central Business District of Jamaica, the Kingston and St. Andrew (KSA) Region is covered by many impermeable surfaces that lead to significant surface runoff, often more than the capacity of the Storm Water Management Systems (SWMS) of the city. This leads to scenes of destructive flash floods seen in concerning frequency in the last few years becoming more common sights as urban flooding increases during periods of heavy rainfall. The breakdown of the average mean rainfall for the KSA (Figures 1-2) vs. the other parishes of Jamaica shows that on average, it receives a little less than the other parishes, especially during the summer months.

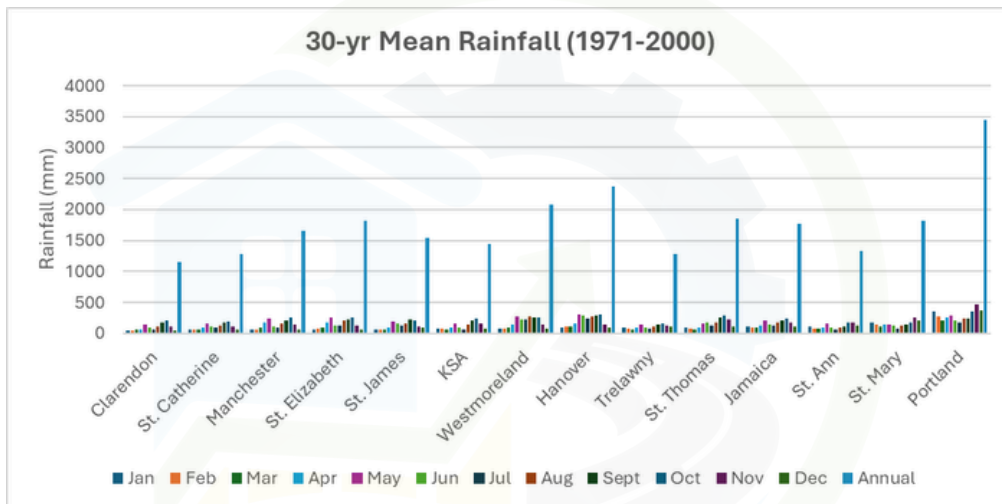


Figure 1: Jamaica's 30-year mean rainfall as compared by parish (Source: (Meteorological Service of Jamaica, 2015))

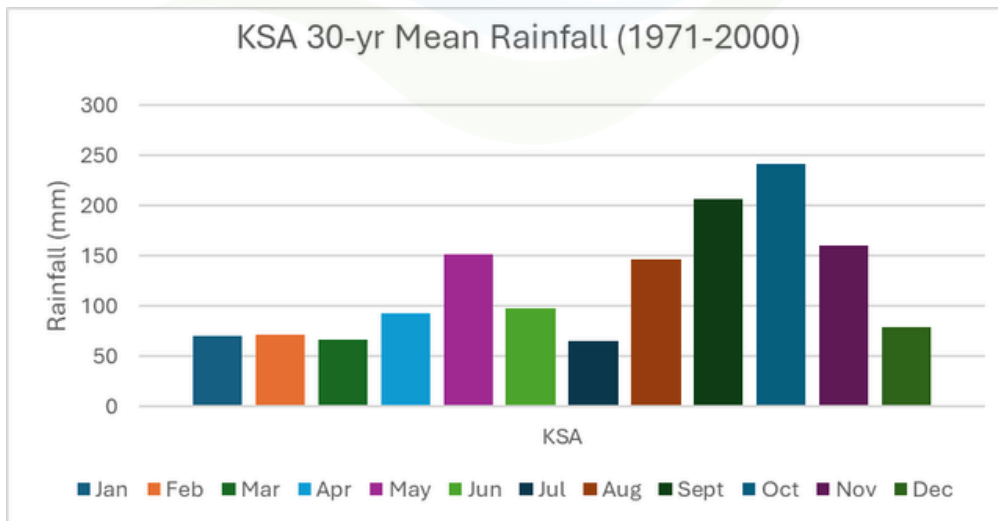


Figure 2: KSA 30-year average rainfall (1971-2000) by month (Source:(Meteorological Service of Jamaica, 2015))



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As Kingston continues to expand upward and outward, the city's drainage systems struggle to keep pace with the rapid development of the built environment. With increasing pavement area combined with more intense rainfall due to the Urban Heat Island (UHI) effect and climate change, what was once an occasional inconvenience has become a recurring public safety and infrastructure challenge: urban flooding. The ability of the ground to absorb rainwater into the soil has decreased and reduced water infiltration, due to more impermeable and low porosity surfaces. As such, urban areas have increased surface water runoff in comparison to other types of land use. When handled inefficiently, or if not adequately managed, surface runoff has the potential to overrun local sewage systems. Enter the Rain Garden—a sustainable nature-based solution that can effectively address the increasing volume of storm water, remediate against toxins present in urban storm water runoff, and looks good while doing it.

### What are Rain Gardens?

Rain gardens (Figure 3) aim to reduce and store surface water runoff, protecting ecosystems and water bodies from anthropogenic chemicals present in runoff. Rain gardens serve as an alternative and additive structure in the application of SWMS. They help to prevent flooding through several mechanisms; some systems allow water to drain into the ground naturally, thus reducing the volume of stormwater entering the sewage system, reducing sewer overflow. Others store water in underground tanks, reducing the size of the peak flow during a flood, which also helps to prevent flooding and sewer overflow (Ishimatsu et al., 2017). Other types marry multiple SWM principles with elegant design in a bespoke manner to tackle the needs of the area within which the rain garden is installed. These gardens also tackle issues such as the urban heat island effect as they serve as green infrastructure and, based on design, can incorporate different species of plants, shrubs and trees. Additionally, they promote increased groundwater recharge, improve aesthetics, and increase local biodiversity (Penniman et al., 2013).



Figure 3: Rain Gardens in action

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### How Do They Work?

Rain gardens serve as mechanisms that are aesthetically pleasing but are functionally sound. They act as storage spaces for excess water so as not to overload the sewage system, allowing for reduced runoff. The aim of a Rain Garden is the reduction of peak stormwater flow and as such are designed in a manner to control non-point sources of water runoff (Golden & Hoghooghi, 2018). Therefore, they take advantage of the natural topography of the area within which they are installed, utilising, or creating shallow depressions that follow the landscape's gradient. A typical rain garden consists of common factors that allow it to effectively conduct its function. These factors include: a ponding area, inflow structure, overflow structure and plants.

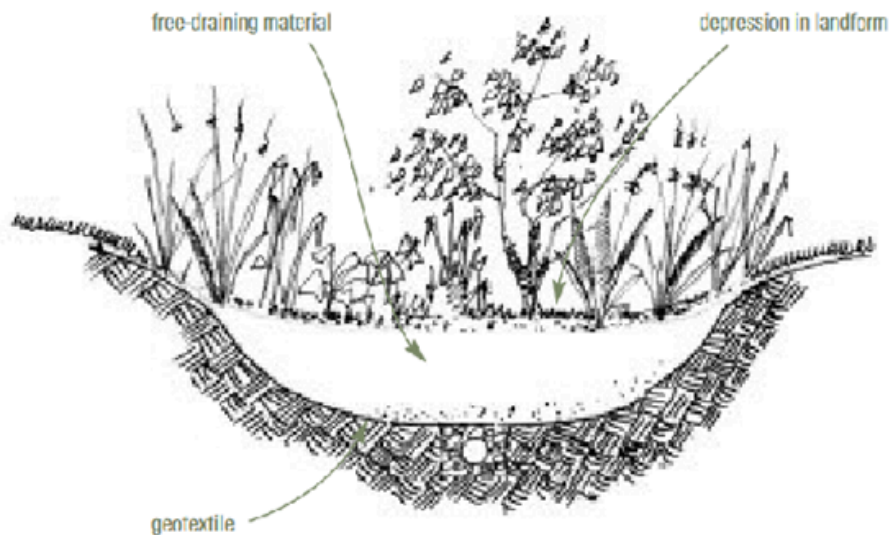


Figure 4: Fundamental rain garden design concept (Source: (Dunnnett and Clayden, no date))

Figure 4 highlights what a conceptual rain garden looks like in practice. Typically, plants would sit in the soiled area, which sits on top of a depressed geotextile. This geotextile allows for accumulated water to percolate into the ground over time. Some designs have pipes that redirect water to nearby rivers or sewers increasing its efficiency.

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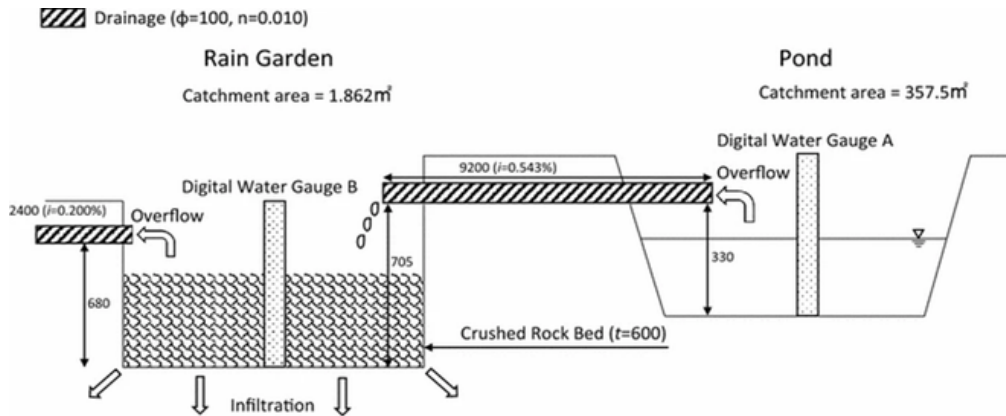


Figure 5: Rain Garden Schematic with Pond (Source:(Katsifarakis, Vafeiadis and Theodossiou, 2015))

Rain garden designs such as those in figure 5 can significantly reduce the lag time of a significant rainfall event. Catchment areas ponded or underground serve to hold large amounts of water that slowly release into the sewer or existing SWMS. This reduces the likelihood of extreme flooding events like the ones experienced in New Kingston in September 2025 (Figure 6). Increased time in storage also allows Phytoremediation, an important function of rain gardens, to be highlighted.



Figure 6: Flooding on Chelsea Avenue, September 19, 2025

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### What is Phytoremediation?

Phytoremediation is an emerging technology that uses plants to degrade, extract, contain, or immobilise contaminants such as metals, pesticides, explosives, oil, excess nutrients, and pathogens from soil. Bioretention systems are multi-factorial systems that utilise a combination of engineered and natural methods to maximise their effectiveness. Being an engineered system and using engineered soils, the lynchpin of these systems is often the dense vegetation planted on top. Plants play not just an important part in removing contaminants from the soil but add significant aesthetic benefit to areas within which rain gardens are placed. Plants help to contribute to urban greening which serves to increase the vegetation cover within urban areas (Bowler et al., 2010). Plant selection for a rain garden project in Jamaica would have to be primarily:

- Low maintenance
- Drought resistant
- Heat resistant
- Waterlogging Resistant
- Petroleum Resistant

Effective phytoremediation consideration allows for greater environmental control, preventing harmful toxins and pollutants from entering the sea and our rivers at the end of the sewer or drainage systems.

### From Global Practice to Local Promise

This exploration underscores the promising role of rain gardens in Jamaica's urban landscape. By considering factors like existing infrastructure and precipitation levels, rain gardens emerge as a viable solution for stormwater management. Deployment of nature-based solutions like raingardens or bioswales in areas like the KMA and have them integrated with the existing Stormwater Management Systems (SWMS), can effectively mitigate urban flooding by regulating peak runoff flow. Furthermore, the ancillary benefits offered include combating the urban heat island effect and facilitating phytoremediation.

Moving forward, it is imperative to conduct further research to identify additional locations within Kingston & St. Andrew where rain gardens can positively impact the urban environment. Additionally, by investigating local pollution levels in urban runoff there can be targeted remediation efforts. This follow-up research is crucial for advancing our understanding and implementation strategies for rain gardens in Kingston, fostering sustainable urban water management practices.

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