The Role of Residential Roofs in Philadelphia's Stormwater Retention

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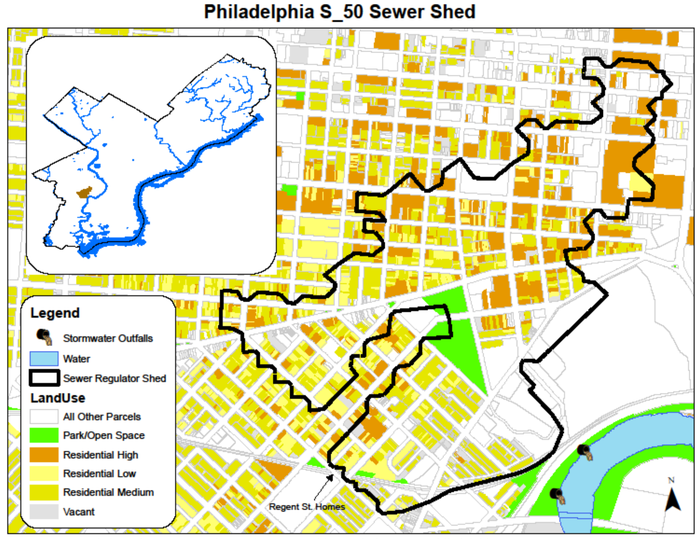
ABSTRACT: This study assesses the residential rain water harvesting efforts currently underway in Philadelphia and explores their possibilities and shortcomings. It examines which features and systems should be essential in all low/mid income residential Philadelphia homes in order to have real effects on stormwater runoff issues. Cost efficiency, benefits to home owner and impacts are the main consideration for judging applicability.
Besides obvious "low hanging fruit", the study examines relevance and design of other models and examples of roof water sequestration and on-site usage. Creative outdoor usage, interior domestic use and even potability are given cost benefit analysis. The final chapter offers a catchment design for an actual set of adjoining row homes. The design explores creative options that could elicit homeowner interest and involvement.

CONCLUSION: The Philadelphia Water Department's(PWD) holistic and progressive plan to reduce combined sewer overflow does not specify a specific mandate for the residential sector, despite homes accounting for roughly 20% of the city's impervious cover.[1] The low cost of municipally treated water and the absence of rebates or utility credits leaves little financial incentives for the residential sector to invest in stormwater harvesting. But surveys across the nation indicate that environmental consciousness remains a significant motivator. Pilot programs subsidizing cost effective catchment techniques (with admittedly small capacity) have been unable to fully meet enthusiastic public demand. Perhaps the added lifestyle benefits that creative designs can provide may give an added reason for homeowners to go further with their stormwater management than the classic rain barrel.

1. www.phillywatersheds.org : Long Term Control Plan Update for CSO Reduction (LTCPU) Section 10, p.16

Philadelphia S_50 Sewer Shed



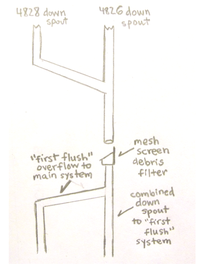
Map made by Ashton Jones and Antonio Larson with permission to use Philadelphia Water Department GIS data.

The S_50 Sewer Shed is a combined sewer that discharges into the Schuylkill River behind the Woodland Cemetery. The PWD has attributed it as one of the top outfalls for Combined Sewer Overflow, with 1 -1.8 billion gallons of volume per year. If every residence were to properly utilize 55 gallon rain barrels, a 5-6% projected CSO reduction could be realized.[1]

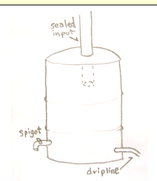
1 www.phillyriverinfo.org: CSOLTCPU: CSO Volume Map & Grid magazine: Water Pressure. Jacob Lambert. January 2011

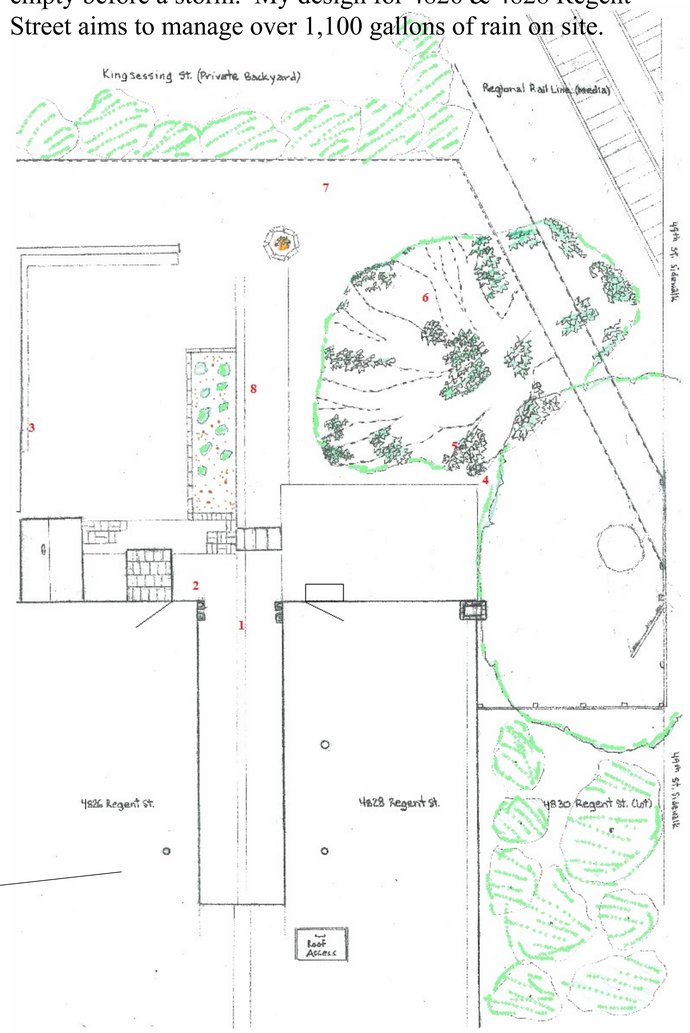
Going Further: About 85% of storms in the Philadelphia area result in 1" or less of rainfall, establishing a challenging sequestration benchmark for a residence. A typical rain barrel only holds the first 50 gallons, if they are empty before a storm. My design for 4826 & 4828 Regent Street aims to manage over 1,100 gallons of rain on site.

1. Downspout connection
Aluminum gutters cross the alley between houses, combining roof runoff. A debris screen filters large material before all water is routed to the *first flush* system. When full, water backs up the downspout and deviates toward 4828, where the gutter winds around the back face of the house and discharges into 4.

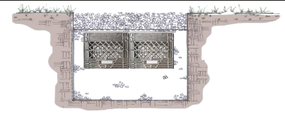


2. First Flush (60 gal)
The barrel fills with the dirtiest batch of roof-water. 40' of drip line slowly draws down the water around the east wall (3) where it drips into flower beds.

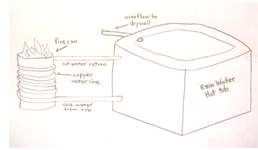




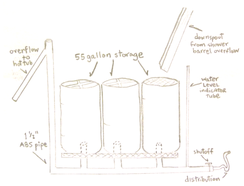
7. Dry Well (480 gal) 14' x 4' trench (2' deep) is filled with crushed rock, 24 overturned plastic milk crates, gravel, and soil. Landscape fabric allows water to pass into the milk crate "chamber". A rain garden will be planted on top. Overflow goes to 8, a 4" wide swale that returns toward 4828's sewer grate.



6. Hot Tub (400 gal)
The 6' diameter tub will function as a year round storage tank. A fire pit, located 5' away will serve to heat its water on special occasions. Conventional floating filters and an insulated cover will be used. A clean-out and overflow will both lead to 7.



5. Modular Barrels (150 gal)
Horizontal piping connected underneath barrels allows them to fill uniformly. Lines can be added for other uses, such as domestic flushing and laundry. Overflow goes to 6.



4. Shower Barrel (30 gal)
Downspout leader from back wall pours in post-*first flush* rain to elevated barrel. Nylon netting and settling provide added filtration. Shower usage spills gray water from walled stall into landscaped beds. Overflow goes to 5.

Panoramic view of 4826 & 4828 Regent Street, pre-design