Sarah Ramp: Independent Study CIT Honors Research

Implementing a Stormwater Sustainability Ratings System for Distressed and Vacant Urban Properties

Abstract: Permanent for Meeting of the Minds Conference, subject to change for other use of research

Sustainability ratings systems (SRS), such as LEED or Green Globes, incentivize individual, commercial, industrial, and institutional investment in sustainable building practices. Many SRS reward "green" stormwater management practices through accreditation for water efficiency or minimal hydrologic impact; however, the existing ratings systems are largely connected with buildings, and there is no ratings system that focuses solely on stormwater management investments. In cities with combined stormwater-sanitary sewer outflow, stormwater management is an important human safety, economic, and environmental health issue that warrants specific attention. The existing SRS ignore the stormwater management of vacant or distressed urban properties, such as brownfields, that will not be redeveloped with buildings. Therefore, this paper proposes a new stormwater SRS that can be applied to any property, synthesized from two prominent, national SRS and from several progressive municipal stormwater management programs. A site must satisfy a weighted combination of the following three objectives to qualify for stormwater SRS accreditation: (1) runoff quantity reduction, (2) runoff quality improvement, and (3) potable water consumption reduction. The weighted combinations of objectives necessary for accreditation vary depending upon each site's characteristics and major risks; for example, runoff quality is much more critical for a brownfield site than for a comparable greenfield site. Finally, this new stormwater SRS is applied to two sites in Pittsburgh, Pennsylvania: (1) a community farm located on 25 abandoned residential lots and (2) a new 12-acre residential/commercial development. *Economic impact analysis with respect to best management practices is performed for each case study.* This paper ultimately proposes a stormwater SRS that can be adapted and implemented by municipalities to reduce the costs of stormwater runoff from vacant and distressed properties by incentivizing localized sustainable stormwater infrastructure.

1. The Problem

Urban stormwater management is important for human health and safety, the economy, and the environment. Stormwater management is necessitated by the problems of combined sewer systems with insufficient capacity for high runoff volumes and flooding. Understanding the history of Pittsburgh's combined sewer system and the effects of combined sewer outflow are important toward understanding Pittsburgh's specific and unique stormwater management needs.

1.1 History of Pittsburgh Combined Sewer System

Pittsburgh, Pennsylvania is one of many cities suffering today for stormwater infrastructure investment decisions made in generations past, and it is the inspiration for this research. Pittsburgh's oldest combined stormwater-sanitary sewage pipe networks were designed based on late 19th-century technology, which originally routed streams of both domestic wastewater and stormwater through a single pipe network straight into the rivers. The original "combined" system incorporated no wastewater treatment (chemical or physical) based on the incorrect theory of "self purification of streams" through dilution of pollutants in moving water (Tarr, 1996). Because communities downstream used these flows as drinking water sources, this model of routing raw sewage into the rivers proved deadly; from about 1872 through 1907, Pittsburgh led the nation in typhoid death rates (Tarr, n.d.) In 1907, Pittsburgh began filtering its drinking water, and in 1911 chlorination was implemented to reduce water-born diseases. It wasn't until 1958, however, that the Allegheny County Sanitary Authority was created and Pittsburgh began treating its wastewater (Tarr, 2003). By 2008, over 50 years later, these wastewater treatment facilities could not accommodate modern sanitary sewage flow volumes or the increasing intensity of urban stormwater runoff due to the expansion of impervious surfaces. As a result, during high-intensity precipitation periods, combined sewer outflow is still routed into the region's rivers to relieve volume demands on treatment plants.

In 2008, the United States Environmental Protection Agency (US EPA), the Pennsylvania Department of Environmental Protection (PA DEP), the Allegheny County Health Department (ACHD) together ordered the Allegheny County Sanitary Authority (ALCOSAN) by consent decree to clean up the combined sewer outflow problem in compliance with the Clean Water Act. In July 2012, ALCOSAN submitted its plan for an unprecedented $2 billion investment in infrastructure capital improvements to underground CSO storage and conveyance tunnels along the rivers to be routed into a new treatment facility, to be installed and functional by 2026 (ALCOSAN, 2012). Public opinion did not favor this plan due to its cost and its lack of attention to "green" infrastructure solutions, so in early 2013 ALCOSAN requested more time from the federal government to consider alternative green, upstream solutions instead of an entirely-structural downstream solution (Willis, 2013).

1.2 Costs of Pittsburgh Combined Sewer Outflow

The costs of combined sewer overflow (CSO) are high in Pittsburgh, Pennsylvania. Costs of the problem include municipal expenditures for runoff treatment by the local sanitary authority, localized damage or injury in communities due to flooding and pipe or manhole ruptures caused by high pressures or clogs, and finally, environmental pollution.

Currently, municipal taxes and water-sewer bills are offsetting the costs of the CSO system. However, the costs due to stormwater runoff from vacant and abandoned urban properties are pure costs to the local environment and municipality that are not offset by tax revenues or utility fees generated from those vacant properties. Through deterministic evaluation of the sanitary authority budget, Blackhurst et al. (2009) estimated the annual cost due to stormwater runoff associated with "service demands of excess infrastructure" at $15 per city block of vacant property in Pittsburgh.

A pivotal moment that changed Pittsburgh public perception of the hazards of uncontrolled stormwater was the August 2011 flood that caused a 9'-deep flash flood on a low-lying stretch of Washington Boulevard, a four-lane road with high peak hour congestion. Four people, including two children, drowned and died in the flooding.

2. Possible Solutions

2.1 Sustainability Ratings Systems

Prominent, national sustainability ratings systems (SRS) such as Leadership in Energy and Environmental Design (LEED) or Green Globes, incentivize individual, commercial, industrial, and institutional investment in sustainable building practices. In general, these ratings systems inspire advancements in sustainability because they "raise the ceiling" on innovative sustainability practices through accreditation, unlike governmental regulations, which "raise the floor" through punishment of non-compliance. The existing ratings systems are largely connected with buildings, and there is no ratings system that focuses solely on stormwater management investments. Some SRS incorporate green design strategies that can help minimize stormwater runoff such as "protecting or restoring the natural habitat" and "maximizing open space" (LEED New Construction v2009 SSc5.1-2), but the emphasized benefits of these strategies are to "promote biodiversity," not explicitly to improve runoff characteristics (LEED, 2013a).

There is a growing demand for sustainability accreditation initiatives that are not associated with buildings. For example, the Institute for Sustainable Infrastructure (ISI) was established in early 2011 to promote smarter, sustainable public infrastructure design choices. The ISI was joint project founded by the American Society of Civil Engineers (ASCE), the American Council of Engineering Companies (ACEC), and the American Public Works Association (APWA), and one of its main goals is the establishment of the Envision ratings system for civil infrastructure in the United States (ISI, 2013). The ISI Envision ratings system is still under construction, and therefore was not included in the survey of existing SRS in Section 2.2.

Cities suffering from flooding due to combined stormwater-sanitary sewer systems like Pittsburgh, cities suffering from drought with climates like Phoenix, and cities with pollution-sensitive hydrologic environments could all be made "healthier" through the catalytic implementation of a stormwater SRS.

2.2 Survey of Existing Sustainability Ratings Systems that include Stormwater and Prevalent National or Municipal Guidelines

A survey of three well known SRS (LEED for New Construction v2009, LEED for Neighborhood Development v2009, and Green Globes: New Construction) plus stormwater management guidance documents from the City of Philadelphia was performed to understand how credits are typically awarded for objectives such as storm water run-off control, water conservation, off-site water treatment minimization, and adjacent waterway pollution control. Table A-1 in Appendix A presents the survey findings for LEED, Green Globes, and the Philadelphia stormwater credits program in tabular form. Of the three ratings systems evaluated, LEED for New Construction v2009 emphasized sustainable design for stormwater/ sanitary sewage runoff most with nearly 13% of 110 possible points related to sustainable stormwater/ sanitary sewage management practices.

Water-related criteria account for 12.7% of the possible credits for LEED for New Construction v2009 accreditation. LEED for New Construction v2009 awards credits for stormwater quantity control (SS Credit 6.1), water efficiency in landscaping (WE Credit 1), potable water use for sewage conveyance reduction (WE Credit 2), indoor potable water efficiency (WE Credit 3), and stormwater quality improvement (SS Credit 6.2). LEED v2009 allows for partial credit to be awarded for the threshold compliance levels in water efficient landscaping, innovative wastewater technologies, and water use reduction. As described by Lopez and Sanchez, the credits are based on discontinuous functions (2011). Therefore, above certain threshold compliance levels, LEED v2009 does not assign additional credit points for additional effort. LEED v2009 does, however, reward additional efforts in region-specific challenge areas through its "Regional Priority Credits" system. Up to two additional Regional Priority Credits can be earned in the Pittsburgh region for stormwater quantity control and stormwater quality improvement (LEED, 2013a).

Water-related criteria account for 8.5% of the possible credits for LEED for Neighborhood Development v2009 accreditation. LEED for Neighborhood v2009 awards credits for on-site rainwater management based on rainfall volume retained (GIB Credit 8), indoor water efficiency (GIB Credit 3), water efficiency in landscaping (GIB Credit 4), and wastewater management (GIB credit 14). There is also a pilot credit for sustainable wastewater management with respect to nutrient and organic carbon loading control in runoff (LEED, 2013b).

Water-related criteria account for 7.5% of the possible sustainability score for Green Globes: New Construction Final Assessment. Credits awarded by Green Globes for New Construction include runoff quantity control, water efficient landscaping and appliances, on-site wastewater treatment, graywater collection/distribution, and the containment or treatment of contaminated waters (GBI, 2013). Green Globes allows partial credit to be awarded for each criterion, and partial credit is determined both by threshold criteria being met and by subjective judgment by a third-party assessor. The Green Globes credits appear to be awarded on a more continuous scale than those of LEED, but the third-party assessor's precise scoring criteria are not clear from the website.

Since July 2010, the City of Philadelphia has incentivized stormwater runoff control through its stormwater billing program. The Philadelphia Water Department (PWD) places an additional fee on water utility customers as well as a tax on properties that are not currently water utility customers, based on the gross area of and percent imperviousness of the property. To decrease the property-based fees on each parcel of land, landowners are encouraged to take a number of actions to reduce percent imperviousness such as downspout disconnection, tree canopy covers, management of impervious areas through best management practices (BMPs), and surface water discharge routing (bypassing the PWD infrastructure) (PWD, n.d.). The fees paid by property owners vary based on a direct linear relationship with the percent impervious area of their properties.

2.3 Additional SRS Credits based on Brownfield or Infill Developments

LEED for New Construction v2009 and LEED for Neighborhood Development v2009 both award credits for brownfield redevelopment. The LEED for New Construction defines a brownfield site as one documented as contaminated by means of an ASTM E1903-97 Phase II Environmental Site Assessment or classified as a brownfield by a local cleanup program, municipal, state, or national governmental agency. The 1-point credit can be likewise earned if asbestos is found on site and remediated, in accordance with United States Environmental Protection Agency (US EPA) Reg. 40CFR part 763 (LEED 2013a). LEED for Neighborhood Development v2009 awards an additional point for brownfield redevelopment (SLLc2) if the project is located in a high-priority redevelopment area (such as those on the EPA National Priorities List, Federal Empowerment Zone, etc.) (LEED, 2013b).

2.4 Preliminary Stormwater Sustainability Ratings System

I propose a stormwater SRS that will inspire sustainable stormwater runoff management in urban areas. This new stormwater SRS will have the versatility to be applied to sites that include buildings and neighborhoods in addition to distressed or contaminated properties (such as brownfields) and vacant properties with no immediate redevelopment on site. Therefore, it is essential that the proposed stormwater SRS assess each site without regard to buildings on site or category of development, but instead by first properly characterizing the main sources of runoff flow and contamination for each site.

A site is defined as a “brownfield” by the US EPA if it is a “real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant” (US EPA 2013a). Under this new proposed stormwater SRS, contaminated sites categorized as brownfields will be required to demonstrate through hydrologic modeling and monitoring that 100% of hazardous contaminants are contained on site safely or removed for purification. Due to the myriad potential benefits of and the inherent challenges faced by brownfields redevelopment, this new proposed stormwater SRS awards “bonus” points for successful brownfield runoff quality control. Logically, if hydrologic monitoring of the brownfield site demonstrated that hazardous constituents were leaching off site or into the watershed, then the site would not get any accreditation under this new proposed stormwater SRS.

Figure 1 presents a flow chart that would guide users (developers, site inhabitants, municipal leaders, etc.) through the stormwater SRS assessment process.

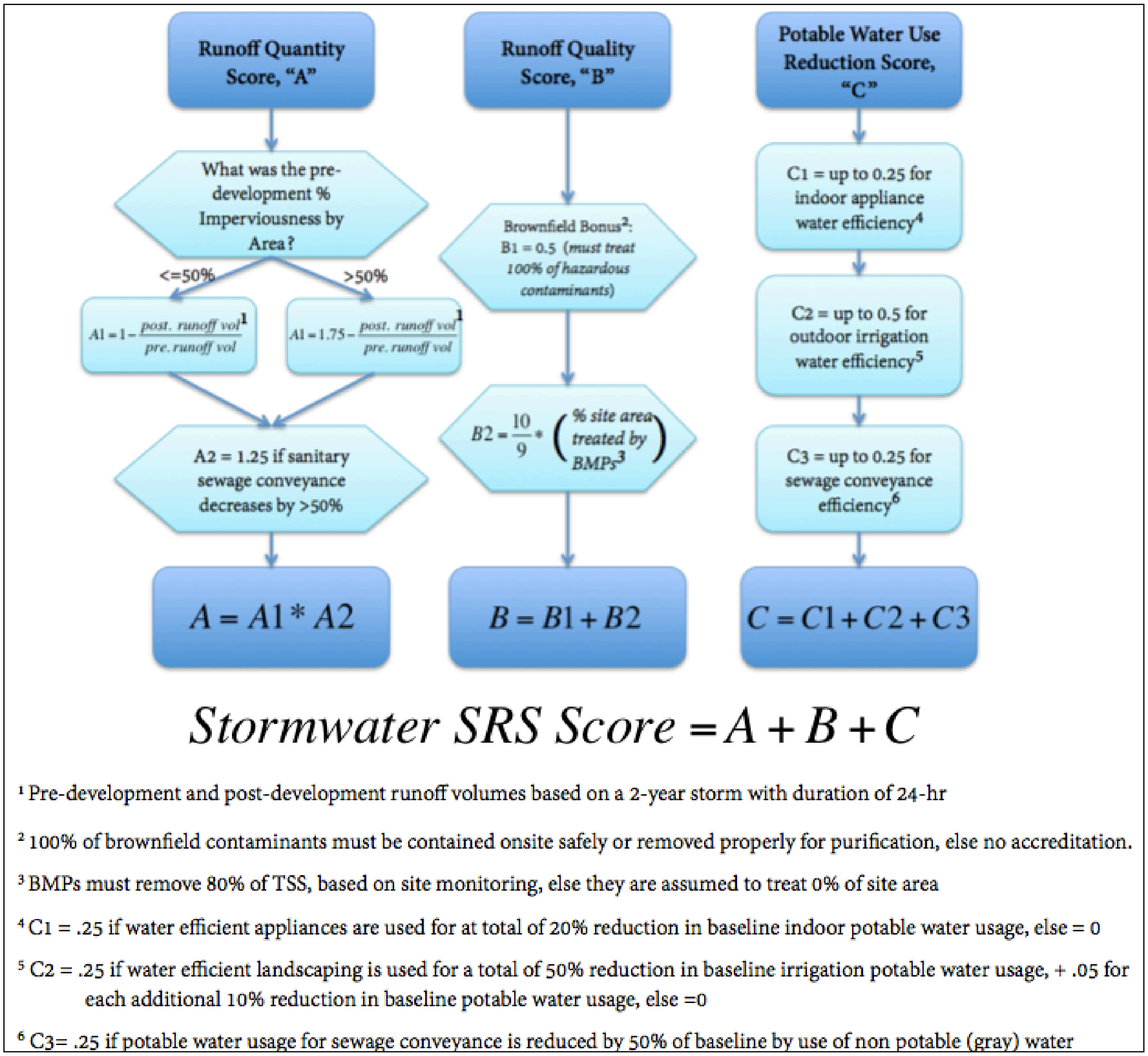

Figure 1: Preliminary Stormwater SRS Assessment Guidance Flow Chart

2.3.1 Objective Criteria

A site must satisfy a combination of the following three objectives to qualify for stormwater SRS accreditation: (1) runoff quantity reduction, (2) runoff quality improvement, and (3) potable water consumption reduction. These three objectives were chosen based on a synthesis of the existing SRS and because a combination of sanitary sewage and stormwater flow volumes contribute to the Pittsburgh CSO problem.

2.3.1.1 Runoff Quantity Reduction

This score is based on the LEED for New Development v2009 Sustainable Sites Credit 6.1, LEED for New Development v2009 Water Efficiency Credit 2, and the Philadelphia Stormwater Credits Program. (The LEED SSc6.1 erosion improvement exception was omitted because it does not directly relate to any of the three main objectives of the new proposed stormwater SRS; however, this should be considered in subsequent versions of the proposed SRS.) “A1” is based on LEED SSc6.1, but it allows for a more linear correlation between remediation input and credit output, like the Philadelphia Stormwater Credits Program. The stormwater discharge volumes needed for calculating “A1” should be estimated based on a two-year frequency design storm of 24-hour duration modeled on site. Factors that influence runoff peak discharge volumes include characteristics of the site such as % imperviousness, slope, and runoff reduction volumes due to BMPs. The proposed stormwater SRS does not specify which method should be used to determine the pre-development and post-development discharge volumes, but a suggested method is the SCS Curve Number method. BMP run-off reduction quantities can be estimated or predicted using engineering judgment or using design estimates. A sample of mean run-off reduction rates based on several years of research compiled by the US EPA is provided in Table XX later in Section 3, and this analysis is applied to the case studies.

2.3.1.2 Runoff Quality Improvement

This objective is based on the LEED for New Development v2009 Sustainable Sites Credit 6.2. Reduction in runoff total suspended solids “TSS” have been measured over the years and compiled by the EPA for various popular BMPs, and is provided in Table XX in section 3. Unlike the LEED SSc6.2, the proposed stormwater SRS allows for partial credit on a linear continuous scale for compliance. For example, a site where 70% of the surface area is directed to BMPs before running offsite is given less points than a site with 90% surface area treated by BMPs, and both of these sites are given less points than a site where 100% of the surface area is treated by BMPs.

2.3.1.3Potable Water Consumption Reduction

This objective is based on the LEED for New Development v2009 Water Efficiency Credits and prerequisites. Baseline flow volumes for total indoor potable water use, outdoor potable water use for irrigation, and potable water use for sewage conveyance can be sourced from EPA and LEED estimates.

2.3.2 Degrees of Accreditation based on % Compliance

The proposed stormwater SRS awards two levels of certification in sustainable stormwater management: “Gold” certification and “Green” certification, based on a total summation of the three objective scores: (1) runoff quantity reduction, (2) runoff quality improvement, and (3) potable water consumption reduction. The summation technique allows both for partial credit and also for a tradeoff between compliance levels for each of the three objectives. For example, the combination of a site’s runoff quantity reduction and its decrease in potable water together impact the total volume of water that enters the combined sewer system, and the scoring summation reflects that. The certification thresholds were assigned based on point values corresponding to “perfect” example sites. If a site had large imperviousness before development, was a brownfield, treated 100% of its area with BMPs capable of removing >80% of TSS, had no sanitary sewage conveyance after development, and met all LEED Water Efficiency criteria besides water efficient indoor appliances, the site would earn a maximum of approximately 4.55 points. If the site had an original percent imperviousness of <50%, saw no post-development increase in runoff volume, was not a brownfield, and earned maximum points for Water

Quality Score and Potable Water Use Reduction Scores, the development would receive 3.36 points. A score of 3.36 is much more feasible than a score of 4.55, although both are possible.

Under the new proposed stormwater SRS, "Green Certification" would be awarded for sites scoring >= 2.5, and "Gold Certification" would be awarded for sites scoring >= 3.0.

3.0 Introduction to Green Stormwater Infrastructure: Best Management Practices

There are several partial solutions toward improving the discharge from combined sewer overflows (CSOs) from urban watersheds into rivers, known as stormwater best management practices (BMPs). Many unique BMPs can be implemented on each site to improve the quantity and quality of stormwater runoff and to achieve sustainable stormwater management accreditation. These BMPs come in a variety of forms, with two main goals: (1) reducing the volume of stormwater runoff and (2) improving the quality of the runoff. Several methods are used to reduce the volume of stormwater runoff and include: (1) recharge of ground water, (2) reuse of captured rainwater, (3) interception of water flowing from impervious areas directly into storm sewers, and (4) the enhancement of natural processes such as evapotranspiration. Methods used to improve the quality of runoff include: (1) infiltration, (2) on-site wastewater treatment systems, and (3) natural pollution degradation. Many BMPs perform have both benefits of decreased runoff volume and increased runoff quality, including those which promote infiltration and recharge into groundwater.

Besides "green" stormwater infrastructure, existing sustainability ratings systems reward "green" practices taken to reduce the volume of potable water used on-site. Primary methods used to reduce potable water consumption include: (1) water-efficient appliances, (2) water-efficient agricultural or landscaping practices, and (3) use of recycled "graywater" or captured rainwater and direct runoff.

A comprehensive list of "green" stormwater BMPs used to improve the discharge from CSOs, including common methods and specific technologies, is provided in Table 1.

Table 1: Stormwater Best Management Practices categorized by Objectives and Methods

Objectives	Methods	Technologies
Reduce the Volume of Stormwater Runoff	Recharge into Groundwater	Engineered swales, Sand filters, Constructed wetlands, Mimicry of natural streams and channels, other Infiltration systems
	Reuse of Captured Stormwater	Irrigation
	Interception or Runoff from Impervious Areas or Elimination of Impervious Areas	Greenroofs (vegetated roofs), Pervious paving, Downspout disconnections, Detention systems, Retention systems, Tree Canopy Cover, Porous Pavement
	Enhancement of Natural Processes	"Daylighting" (excavation of culverts and creating natural open channels to restore historic streams), Plant trees and other "thirsty" yet hardy vegetation
Improve the Quality of Stormwater Runoff	Filtration	Proprietary media filtration, other Biofilters
	On-site Wastewater Treatment	Hydrodynamic separation, Catch basin inserts, Baffle Boxes, Oil/grit separators
	Enhancement of Natural Processes	Soil rehabilitation: aeration and additional organic matter
Reduce Consumption of Potable Water	Water-efficient Appliances	Use of recycled "graywater", Use of stormwater volumes for custodial uses
	Water-efficient Landscaping or Agriculture	Water-efficient irrigation, Vegetation with low-water requirements
	Use of Captured Rainwater	Reuse stormwater volumes for landscape irrigation

Sources: (GBI, 2013), (LEED, 2013a), (MARC and AWPA, 2012)

3.1 Quantifying the Costs of Implementation of Best Management Practices

According to a report on stormwater by the EPA in 2006, the base capital costs of construction for BMPs vary with respect to site conditions such as soil type and to drainage area. In cases of prospective project sites where the land has not been bought already, land acquisition fees are the highest factors that effect total cost of any given BMP (US EPA, 1999). Figure 2 represents the EPA's base capital cost estimates for various BMPs, and should be used for planning purposes only.

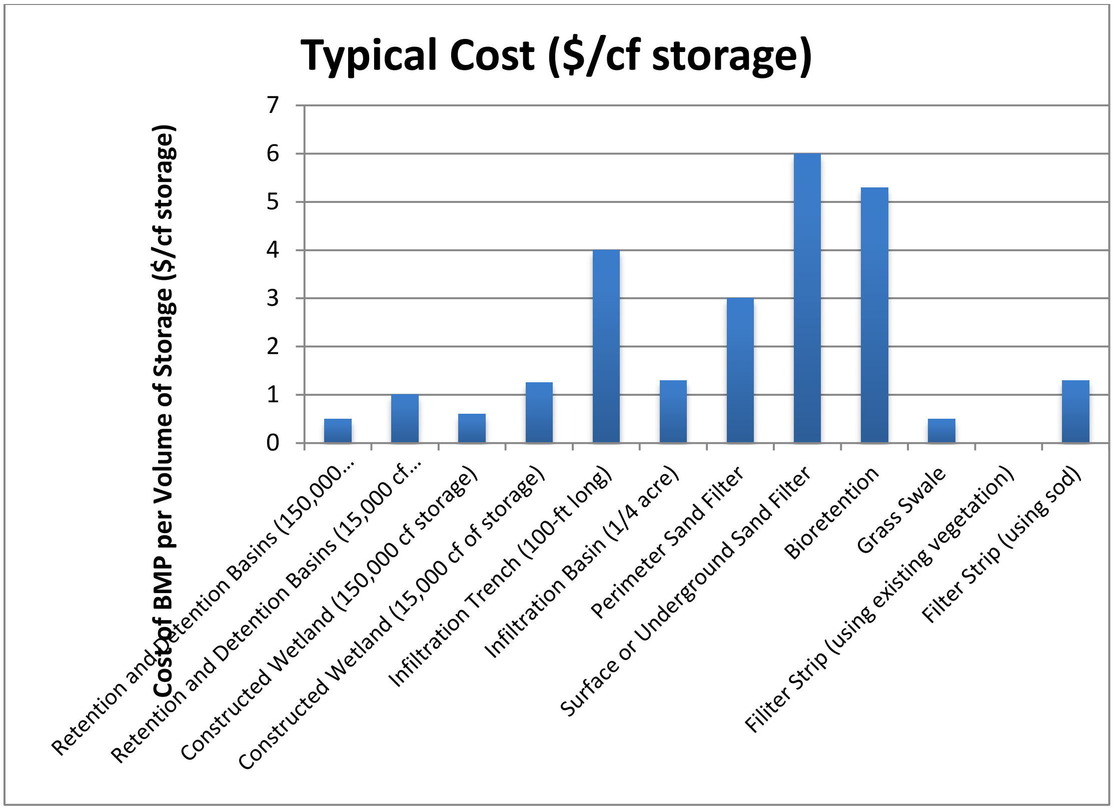

Figure 2: Average Cost of Each BMP in $/cubic foot Storage *Data:(US EPA, 1999)*

3.2 Quantifying the Benefits of Implementation of Best Management Practices

Runoff reduction rates, total phosphorus removal, and total nitrogen removal are estimated for fifteen BMPs in a 2008 technical report by the Center for Watershed Protection & Chesapeake Stormwater Network (CWP & CSN). These runoff reduction rates and pollutant removal rates were estimated by the CWP & CSN by a synthesis of over forty unique BMP runoff analysis data points gathered from existing research. According to the report, “the runoff reduction function of a BMP is seen as the ‘first line of defense,’ and the pollutant removal mechanisms help to treat the remaining runoff that ‘passes through’” (CWP & CSN, 2008). The runoff reduction rate and pollutant removal rates estimated by the CWP & CSN are given in Figure 3.

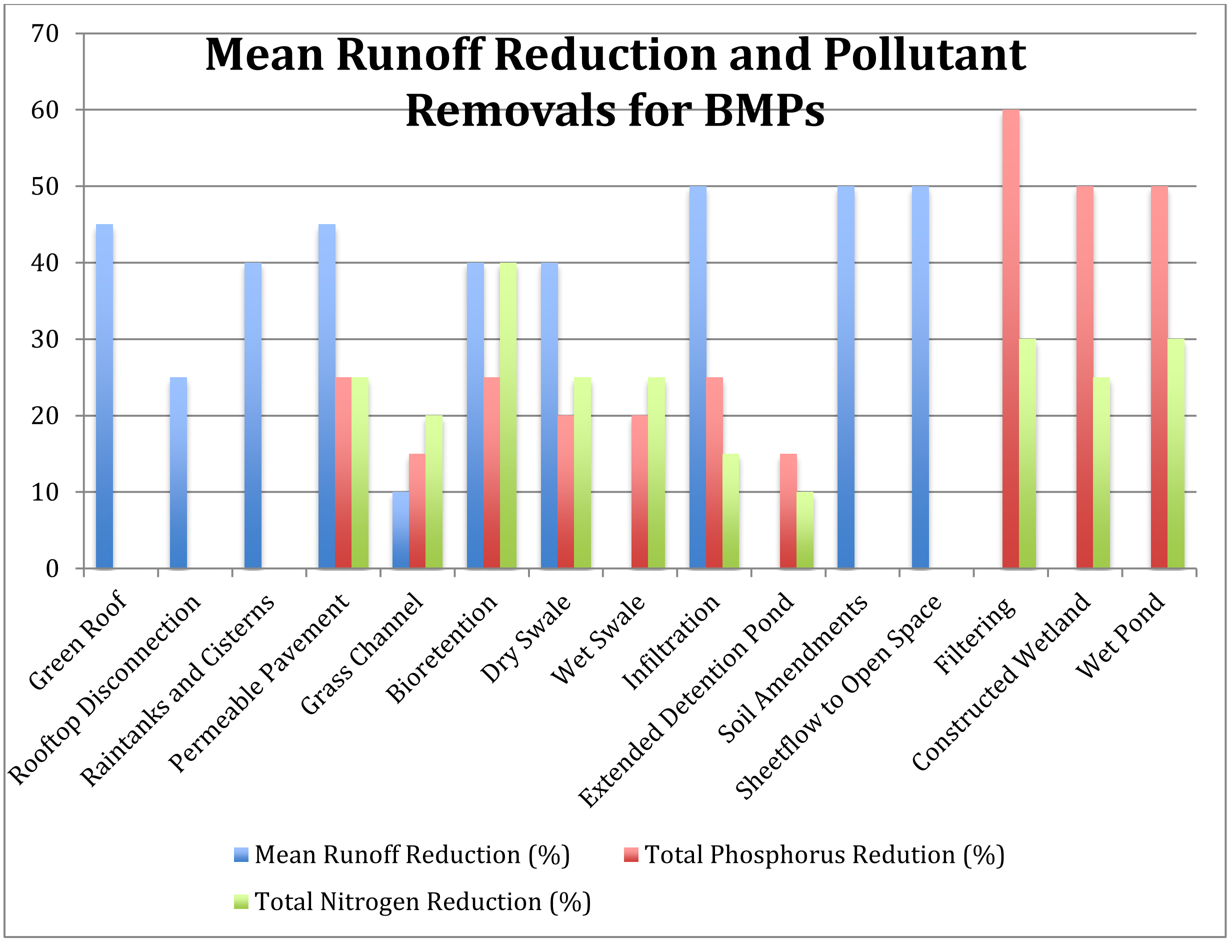

Figure 3: Runoff Volume Reduction rates for various BMPs *Data: (CWP & CSN, 2008)*

3.3 Relative Adsorption/ Runoff reduction effectiveness of various ground covers

Many, if not all of the existing SRS that include a stormwater section require compliance with respect to impermeable surface reduction, but none of the major SRS include an extensive definition of impermeable surfaces. According to the CWP & CSN 2008 technical report on runoff reduction, some ground covers traditionally considered "permeable" provide varying degrees of runoff reduction. For example, disturbed or compacted soils and managed, graded turf offer up to 20% less runoff reduction than forest cover (CWP & CSN, 2008). The new stormwater SRS I propose would take variable ground cover permeability into consideration through the use of the SCS Curve Number method for calculating runoff volumes, which takes soil properties and ground cover type into consideration.

4.0 Case Study [add intro here, brief description of how you selected and conducted the case studies. were you going to use the tool as well?]

Two case study sites were selected (1) to understand the history of actual brownfield and vacant properties being redeveloped in Pittsburgh, PA and (2) to apply the proposed stormwater SRS to these redevelopment projects to test the SRS in practice. The case study sites, a community farm located on 25 abandoned residential lots and a new 12-acre residential/commercial development, are both located within the watershed topographically "upstream" of the 2011 Washington Boulevard flooding site. The sites were chosen in particular because of the availability of contact persons at each site.

4.1 Garfield Farm

The first case study is a community farm, located in the Garfield neighborhood of Pittsburgh. The site lies on three consecutive residential city blocks and occupies a total of 25 lots. According to historic maps of the area, the site had up 15 houses and additional garages and sheds in the year 1923 (pittviewer). Sometime between 1995 and 2005, the City of Pittsburgh acquired all three blocks and proceeded to demolish the vacant buildings on site. The last of the houses was demolished in 2007 or 2008. Figure 5x is a map image of the site from 1923, and Figure 5x is a satellite image of the site from 2013.

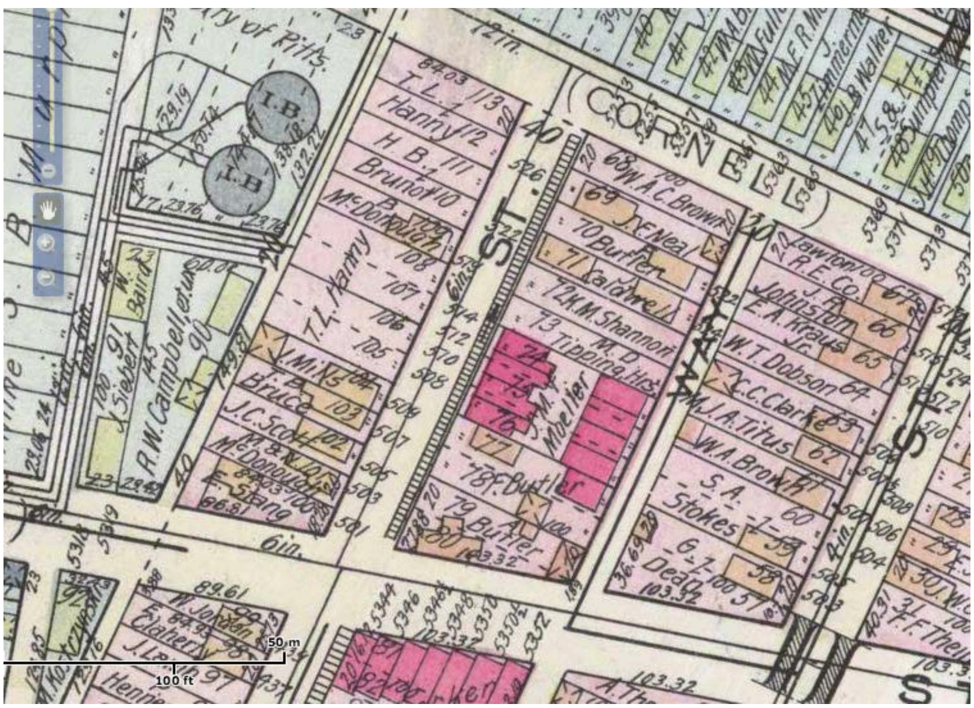

Figure 5X: Historic Map of GCF site from 1923 (http://peoplemaps.esri.com/pittviewer/)

Figure 5x: Satellite Image of GCF site from 2013 (https://maps.google.com/)

John Creasy, associate pastor of Open Door Ministries of Garfield, got permission from the City to farm on about ¼ block in 2008. The Garfield Community Farm (GCF) was established. Soon, the farm received several grants from 3-Rivers Community Foundation, Open Door Church, and the Snee-Rheinhart Foundation to purchase three ½-blocks of the land. At the time that GCF acquired the property, it was covered in an invasive species of Japanese knotweed, rubble, and various unsightly scrub trees with vines. There were also low-moderate levels of lead in the soil remaining from the buildings. GCF worked with Penn State Extension and other urban farmers for guidance for appropriate precautions to take to deal with this contamination; a solution involving the installation of a barrier between the rubble soil and new growth was used, and only compost and topsoil are used for growing produce.

Today, the site it nearly 100% permeable; rainwater runoff from a small equipment shed is diverted into rain barrels and all other surface area is permeable organics. The entire site has an average slope of at least 10%, and highly water absorbent fruit trees were planted at the lowest elevation portion of site. Hugelkultur swales were implemented to absorb rainwater and to provide nutrient-rich soils for growing, thus alleviating reliance on potable water usage for irrigation and providing natural fertilization. Most recently, a fish scale swale was installed in Fall 2012 for erosion control. This small swale diverts excess runoff into an aquifer for raspberry bushes and other perennials.

Future plans at the site include a bio shelter for year-round growing funded by grants through the Sprout Fund and the PNC Charitable Trust. This greenhouse will use water harvested from its roof for irrigation. Also, the GCF plans to alleviate a runoff and erosion problem adjacent to site by diverting heavy runoff flows from the street gutter off of Cornwall St. into a rain garden on the lower portion of the site.

Besides the stormwater management benefits from the Garfield Community Farm, social benefits to the community include community education events, a low-income food program, and a popular community supported agriculture (CSA) program to provide locally-grown produce to the community.

4.2 Bakery Square 2.0

The site is located on Penn Ave. near Fifth Ave. in Pittsburgh, PA, across Penn Ave from the original Bakery Square development on the site of the former National Biscuit Company factory. Historic maps of the site reveal that the parcel was home to a Baptist church circa 1882, Dollar Savings Bank in 1890, and Bauer Brothers & Co. Bakery as late as 1910 (CITE). The former Florence Reizenstein School was built by the City of Pittsburgh in 1975. The school was named after the late Florence Reizenstein of Pittsburgh, a beloved human rights activist. The school facilities were state-of-the-art and positioned at the border of Shadyside and East Liberty, poised to attract an integrated student body from a variety of neighborhoods and ethnicities.

By 1977, the Reizenstein School had become the largest middle school in the district. This overcrowding, coupled with rumors of discipline problems, deterred many white families from enrolling their children there. According to the Post-Gazette.com, by 1986, the school population was 75% black. Many parents and students reported getting a great education at Reizenstein, but its reputation of poor academics was hard to shake.

In 2002, Reizenstein Middle School was placed on a list of federal “improvement schools” under President Bush’s “No Child Left Behind Act,” based on its students’ low math and reading scores. Under the Act, parents were given the option to send their students to other schools showing adequate academic improvement in the District. By 2005, the school operated at 40% capacity and was ranked at the top of the District’s list of schools programs to close. In 2006, the City of Pittsburgh closed the Reizenstein Middle School and sent its remaining students elsewhere.

At the same time, the Pittsburgh Schenley (Grades 9-12) international baccalaureate (IB) studies magnet school also closed. Its sister school, the Pittsburgh Frick (Grades 6-8) school, was chosen for expansion to accommodate the remaining Schenley students. The two schools’ aging facilities faced expensive or impossible repair, and intentions were to relocate the students from both schools under one building. School officials decided to renovate the former Reizenstein School to host the Schenley/Frick students.

Renovations lasted one year. The new school opened in Fall 2008 as an international studies magnet school, offering advanced language courses. A coalition of community members, parents, and students chose to name the school after the current president; in December 2009, the school was named the Barack Obama Academy of International Studies. The facilities operated for two and a half school years under this name, but in 2012 the Barack Obama Academy moved from Penn Ave. to another facility on S. Highland Ave. for continued use.

The Pittsburgh Public Schools placed the property for the former Reizenstein School up for sale in Fall 2012. On January 22, 2013, Walnut Capital finalized a deal to purchase the property for $5.4M from Pittsburgh Public Schools. Demolition of the school building began the following day, led by contractor P.J. Dick. Ground was ceremonially broken for the new development on February 14, 2013. Figure 6X is a satellite image of the site taken in early 2013 prior to the start of demolition, and Figure 6X2 shows the new development according to the Bakery Square 2.0 Master Plan.

Figure 6X: Satellite Image of Site Prior to Demolition (https://maps.google.com/)

Figure 6X2: Post-Development Image of Site (Courtesy of BkSq 2.0 Master Plan)

Bakery Square 2.0 is expected to help satisfy future demand for additional office space in the East Liberty area, with 400,000 square feet of office space in three separate buildings. The development will offer up to 450 new units of studio apartments and townhouses. The apartments are expected to satisfy local demand in the vicinity for good quality one- and two-bedroom apartments. Strada, a company that self-identifies its niche as architecture, interiors, landscapes, and urban design, developed the Bakery Square 2.0 Master Plan. Strada's design for the Google office in Bakery Square 1.0 was awarded LEED Gold for Interior Design and Construction. Demolition of the Reizenstein school is expected to be completed by the end of April 2013. Two apartment buildings are scheduled to be erected by June 2014, and the office components of the project are expected to be complete by Summer 2016.

Because its predecessor, the original Bakery Square development, was awarded a LEED Platinum certification, it's no surprise that BkSq 2.0 is slated to feature green infrastructure. The development will preserve an existing bike path that cuts through Mellon Park, offer additional bike/pedestrian – only paths, and designate urban open spaces. Stormwater will be managed through the use of permeable pavement, bioretention, green alleys, and green roofs (CITE).

5.0 Results of the Case Study Analysis, Recommendations for Improvement of the Stormwater SRS, and Future Work

The Garfield Farm case study comparison assumed a pre-development year of 1995, before the City of Pittsburgh demolished the 15 houses with detached garages on the property. The post-development year is assumed to be 2013, just after the construction of the bio shelter was completed. These pre- and post-development time periods were chosen to quantify the benefits that resulted when the City decided to demolish the vacant buildings and to lease or sell the distressed properties to the GCF.

The Bakery Square 2.0 case study comparison assumed a pre-development year of 2012, right before the City of Pittsburgh Public Schools sold the Reizenstein property to Walnut Capital. The post-development year is assumed to be 2016, right after construction has been completed. These pre- and post-development time periods were chosen to quantify the benefits of the Bakery Square 2.0 development.

Due to time constraints and information constraints, the only assessment performed on the case studies was the "Runoff Quantity Score" of the proposed stormwater SRS. This assessment assigned score "A" from Figure 1 dependent on calculated pre-development runoff volumes and post-development runoff volumes for each case study site, in addition to assumptions made about comparative sanitary sewage conveyance volumes pre- and post-development. The results were as follows:

Out of a possible

Sample calculations and assumptions made for the Runoff Quantity Score are included in Appendix B.

Case study analysis should be performed using the "Runoff Quality Score" and "Potable Water Use Reduction Score," for redevelopment sites with rich data available on the total suspended solids removal capacity of on site BMPs (can be collected by on-site monitoring of the inflow and outflows from BMPs), the indoor appliance water efficiency, irrigation plans and landscape water schedules, and the use of either graywater or potable water for sewage conveyance. There is room for refinement of the proposed stormwater SRS, and this will be more evident after case study analysis.

The proposed stormwater SRS accreditation threshold score values should be re-evaluated after case study analyses are complete, to determine the optimal score criteria to encourage sustainability in stormwater runoff design. The thresholds should be attainable but require intentional effort for accreditation to be earned.

6.0 Conclusions

For many years, during the peak of the Steel City's industrialization, the region virtually ignored the health of its waterways and valued them only for cheap transportation of goods. Since the decline of industry along Pittsburgh's rivers, combined with the monumental Clean Water Act of 1972, the public perception of rivers has shifted to valuable drinking water sources, recreation, and as beautiful components of the natural ecosystem.

The successful implementation of a stormwater sustainability ratings system would encourage sustainable design decisions for …. Conclusion

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Appendix A – see other file (.xls) because of large size of table

Table A-1: Comparison of Existing SRS that have stormwater credits

Appendix B – see other file (.xls) for Runoff Quantity Score Calculation for case studies