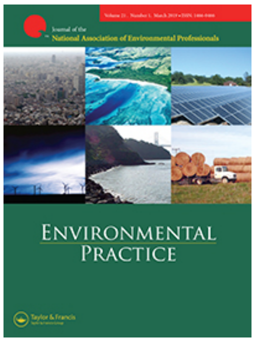

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RESEARCH ARTICLE

Integrating placemaking concepts into Green Stormwater Infrastructure design in the City of Philadelphia

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ABSTRACT
Green Stormwater Infrastructure (GSI) is a sustainable way to manage urban stormwater. GSI projects are usually designed with little or no community involvement and provide mostly environmental and some economic benefits—if designed effectively, constructed properly, and maintained regularly. GSIs in neighborhoods viewed as vulnerable or with a significant presence of disinvestment, however, rarely serve as placemaking projects offering social benefits such as recreational and community-building opportunities for residents. This article explains the process of planning and designing GSIs with a dual agenda: stormwater management and placemaking. The planning process used Geodesign and Community Design methods. This endeavor engaged community residents, stakeholders, and environmental professionals focusing on two vacant lots in a Latinx neighborhood of the City of Philadelphia, USA. The resulting site plans show that blending unique design elements derived from dual functionalities and multiple methods is possible through a collaborative design process. This article argues that integrating placemaking concepts into GSI design processes may have a broader appeal to communities viewed as vulnerable or with a significant presence of disinvestment.

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Community design; community design charrette; geodesign; Green Stormwater Infrastructure; participatory planning; placemaking

Introduction

Many urban areas face stormwater management issues due to buried streams or filled-out water bodies, excessive impervious surfaces, and poor drainage. Processes of urbanization may cause less on-site stormwater infiltration and greater runoff which impair adjacent water supplies, disrupt natural hydrologic processes through extensive channelization and piping, and result in flooding, aquatic ecosystem degradation, sewer overflow, riparian habitat loss, and water quality impairment (Cimorelli et al. 2016; Dhakal and Chevalier 2016; Dunn 2010; Jaffe 2010; Paul and Meyer 2001; Trihrintzis and Hamid 1997). Green stormwater infrastructure (GSI) is considered a sustainable alternative to conventionally engineered grey systems, and can capture stormwater allowing for infiltration, evaporation, and plant use, thereby reducing the burden on the sewer system (Carter and Fowler 2008; Keeley et al. 2013). GSIs, also known as "designer ecosystems," are becoming an important component of the urban landscape (Palmer et al. 2004). Examples of GSIs include rain gardens, green roofs, tree trenches, stormwater planters, rain barrels, detention basins, infiltration galleries, and riparian buffers. If appropriately designed, constructed, and maintained, GSIs can offer many environmental, economic, and social benefits to communities and improve the general quality of life by supporting broad planning goals related to clean water, neighborhood development, and community livability (Jaffe 2010; PWD 2009; EPA 2008; Wise 2008).

Typical GSI planning processes are similar to the traditional top-down planning approach, which relies heavily on expert knowledge rather than community knowledge (Corburn 2002). Designing GSIs is a process of domestication of the ecosystem (Kareiva et al. 2007) and requires complexity and multi-functional components (Carter and Fowler 2008).

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GSIs—commonly designed by professionals such as environmental engineers, landscape architects, and watershed planners (see Dunn 2010; Rouse and Bunster-Ossa 2013)—generally provide only stormwater management benefits and do not serve as placemaking projects that could offer recreational and community-building opportunities for residents. There is usually little or no direct community involvement, community investment, and community buy-in during the design phase, especially on public, vacant, and institutional properties. New York City, for example, has embarked on a 20-year, 2.4-billion-dollar project to install GSIs (including curbside rain gardens) but has attracted little fanfare, which leads to the question of whether there has been significant engagement with communities where these gardens are being installed (Flegenheimer 2014). Conversely, some recent practices have focused on dual functionalities—mixing stormwater management with other uses related to placemaking—in order to increase community involvement and community buy-in. Examples include Copenhagen's parks that turn into ponds (Cathcart-Keays 2016) and Philadelphia's Herron Park Playground which seamlessly incorporates GSI into the water-enhanced play area or sprayground, basketball court, and the overall landscape (ASLA 2016).

No systematic methodological framework, however, is available to plan and design GSIs with a placemaking agenda. This study attempts to bridge this methodological gap by combining two methods—Geodesign and Community Design—and applying this framework in an ultra-urban watershed of the City of Philadelphia, USA. Geodesign follows the concept of "science-based design," which involves not only the disciplines that traditionally have concerned themselves with design (e.g., planning and landscape architecture), but also disciplines that are interested in environmental and social systems (e.g., earth science, engineering, geography, and sociology), as well as disciplines of information technology (e.g., geographic information science or GIScience) (Goodchild 2010, 8). It integrates the techniques, concepts, and approaches in design and planning with geospatial technologies, in order to create comprehensive solutions for the processes and forms of both built and natural environments (Vargas-Moreno 2010). Community Design, in contrast, promotes the participatory decision-making process, in which planners work with stakeholders to discuss prevalent issues affecting their future, and to make culturally appropriate decisions (Toker 2012).

Many Community Design processes include design charrettes, which use mapping and visualization tools (e.g., GIS maps, photo-realistic renderings, photographs, and multimedia) because such tools provide a common language through which diverse participants can understand the process, broaden perspectives, and participate without hesitation (Al-Kodmany 1999; Sutton and Kemp 2002; Tanaka et al. 2009). This article explores whether and how combining Geodesign and Community Design methods to develop proposals for new GSIs and community recreational spaces can become beneficial in a Latinx neighborhood in North Philadelphia.

Background

Planning for placemaking

The concept of placemaking, although relatively new to the general public, emerged as a response to the systematic destruction of human-friendly and community-centric spaces of the early 20th century (Silberberg et al. 2013). The idea that public places should be inviting, inclusive, and meaningful to all has been discussed since Jane Jacobs wrote *The Death and Life of Great American Cities* in the 1960s (Jacobs [1961] 1992). In recent times, the discussion and practice of placemaking has evolved considerably, as planners, designers, and community residents have learned what they should strive for during the process. No longer does placemaking rely heavily on the physical design of the space; rather the participation and process of reaching whatever "end state" is valued, building community cohesion, strengthening ties, and empowering residents (Silberberg et al. 2013). Community-driven placemaking projects treat spaces as both physical space and an expression of relationships between varying stakeholders and organizations (Hou and Rios 2003).

Following the work of sociologist William Whyte (1980) on New York City's street life and city dynamics, the nonprofit organization Project for Public Spaces (PPS) is engaged in a holistic approach to placemaking that describes the following benefits of place: building and supporting the local economy, nurturing and defining community identity, fostering frequent and meaningful contact, creating improved accessibility, promoting a sense of comfort, and drawing a diverse population (PPS 2016). Placemaking is considered a multidimensional concept that cannot be addressed by urban design and capital investment alone (Knox 2005; Whyte 1980).

Community-driven design and planning for placemaking is not uncommon, although there are professional placemakers such as architects, landscape architects, facility managers, interior designers, and engineers (Schneekloth and Shibley 1995). Researchers have connected placemaking ideas or practices with diverse groups such as immigrant populations and children, and wide-ranging topics such as sustainability and gentrification. A case study by Arreola (2012) highlights an example of immigrant-driven placemaking, countering an idea in Arizona that immigrants do not care about their spaces. Sutton and Kemp (2002) theorized children's participation in neighborhood placemaking and discussed the potential benefits of such initiatives. Karacor (2014) reviewed how placemaking can be used to achieve social sustainability, as opposed to causing gentrification and/or increased development (Zukin et al. 2009).

Placemaking is not about only improving the environment, but also improving the quality of the relationships between people and places; therefore, good design has to be sensitive about human relationships for placemaking to be successful (Shibley 2003). The term placemaking is often used in planning literature to describe a physical planning process, where professionals draw on local history and culture, sense of place, architectural norms, and community needs in order to create public spaces that encourage mixed uses and social interaction (Paulsen 2010). This paper focuses on a community-based planning process of a placemaking project, not the project itself.

Stormwater management in Philadelphia

Philadelphia—a consolidated United States city-county in the State of Pennsylvania of 142 square miles with more than 1.5 million people—was chosen as the broader study area for this project due to three primary reasons: the co-existence of stormwater management issues, Philadelphia Water Department's (PWD's) nationally known GSI program, and the availability of 40,000 plus vacant land parcels, located mostly in neighborhoods viewed as vulnerable or with a significant presence of disinvestment. Two-thirds of Philadelphia is served by a combined sewer system (CSS) and this is most prevalent in the older, denser parts of the city (PWD 2016). CSS collects both wastewater and stormwater runoff for treatment before the water is returned to local water bodies. Runoff is increased in areas where it cannot penetrate the surface. Philadelphia has an impervious cover rate of approximately 54%, which means water cannot soak naturally into the earth in more than half of the city. During heavy rainfall, the CSS system often exceeds its capacity, leading to untreated water being discharged directly into water bodies in what is known as a Combined Sewer Overflow (CSO).

To address this issue, PWD is managing stormwater under a "land-water-infrastructure" hierarchy that focuses on land-based GSI projects and restoring waterways, while judiciously implementing appropriate infrastructure upgrades. Philadelphia's *Green City, Clean Waters* program was adopted in 2011 to implement these approaches. The program intends to use GSIs to reduce the amount of stormwater pollution entering Philadelphia's waterways by 85% over a 25-year period.

While Philadelphia's GSI initiative has received national acclaim, it may need to address the critique that its GSI projects may not be equitably distributed throughout the city, especially in some disadvantaged neighborhoods with low community capacity (e.g., neighborhoods with lower median income, lower rate of educational attainment, lower number of community-based organizations, or lower percentage of green spaces, among other factors) (Mandarano and Meenar 2017). In addition, prioritizing new GSI locations based on social and equity factors (e.g., presence of neighborhood advisory committees, proximity to transit stops, schools, universities, and community recreation centers), in addition to typical physical factors, is slowly becoming a point of discussion (Christman et al. 2018).

This study was designed on a premise that GSI projects can help bring a greater sense of community to vulnerable populations.

Methodology

The Project Team conceptually followed the essence of Steinitz's Geodesign framework (2012), but developed a modified version in order to make a direct connection with Community Design processes and make the framework applicable to the planning for stormwater management and placemaking. As seen in Figure 1, the methodological framework consists of two concurrent, interdependent branches—a two-phase Geodesign branch and a Community Design branch. Geodesign phase 1 has four steps: (i) Watershed Selection—determine which watershed is most suited to project goals using qualitative and quantitative data; (ii) GIS-based Watershed Inventory—analyze and visualize the watershed's physical, social, and environmental characteristics; (iii) GIS-based Suitability Analysis for GSI Locations—identify areas best suited for future GSIs; and (iv) Site Analysis—analyze the site selected for the project using primary and secondary data. Community Design process has five steps: (i) Community Partner Selection—choose a nonprofit organization whose service area overlaps the selected watershed; (ii) Project Site and Site Partner Selection—choose the project site and site partner from a list of priority sites provided by the community partner, as well as suitability analysis; (iii) Stakeholder Identification—identify community members and professional experts who are interested in the project; (iv) Design Charrette—organize participatory planning and design event in the community; and (v) Scenario Development and Design Element Selection—develop scenarios based on charrette outputs. Geodesign phase 2 has two steps: (i) Analysis of Potential Benefits of Scenarios—determine environmental and economic benefits of proposed scenarios; and (ii) Site Plan Finalization and Visualization— develop a final site plan and artistic rendering. In the figure, the arrows represent the flow or order from one step to another, leading to the final step: Implementation Strategies.

The Project Team consisted of two groups of researchers, one focusing on Geodesign and the other on Community Design. The Geodesign group included 16 people including researchers, professional experts, and graduate students from City Planning, Environmental Engineering, and Landscape Architecture disciplines who focused on stormwater management issues. The Community Design group included 21 people including researchers, community residents, and professional experts who participated in a community design charrette focusing primarily on placemaking concepts. Finally, representatives from both groups worked together to develop scenarios and site plans combining GSI projects and community recreational amenities.

Two brief online surveys were conducted upon the completion of the project—one for Geodesign participants (number of responses = 15 out of 16) and the other for Community Design participants (number of responses = 15 out of 21). The survey purpose was to identify the key outcomes from the process and the project. A Likert scale was used for answers (from strongly agree to strongly disagree – 5 to 1). In addition, participants offered open-ended comments on the planning process and methods.

The planning process and results

This section explains the overall planning process and presents results related to each step tied to Geodesign and Community Design methods—as illustrated in the methodological framework (Figure 1)—followed by the survey results.

Watershed selection

Based on factors such as the CSS boundary, percentage of impervious surfaces, presence of vacant lands, socioeconomic and physical characteristics, and environmental challenges, the Project Team selected the Delaware Direct Watershed, which contains approximately 40 of the city's 142 square miles, draining directly to the Delaware River (see Figure 2). Water quality is one of the major issues in this watershed, where

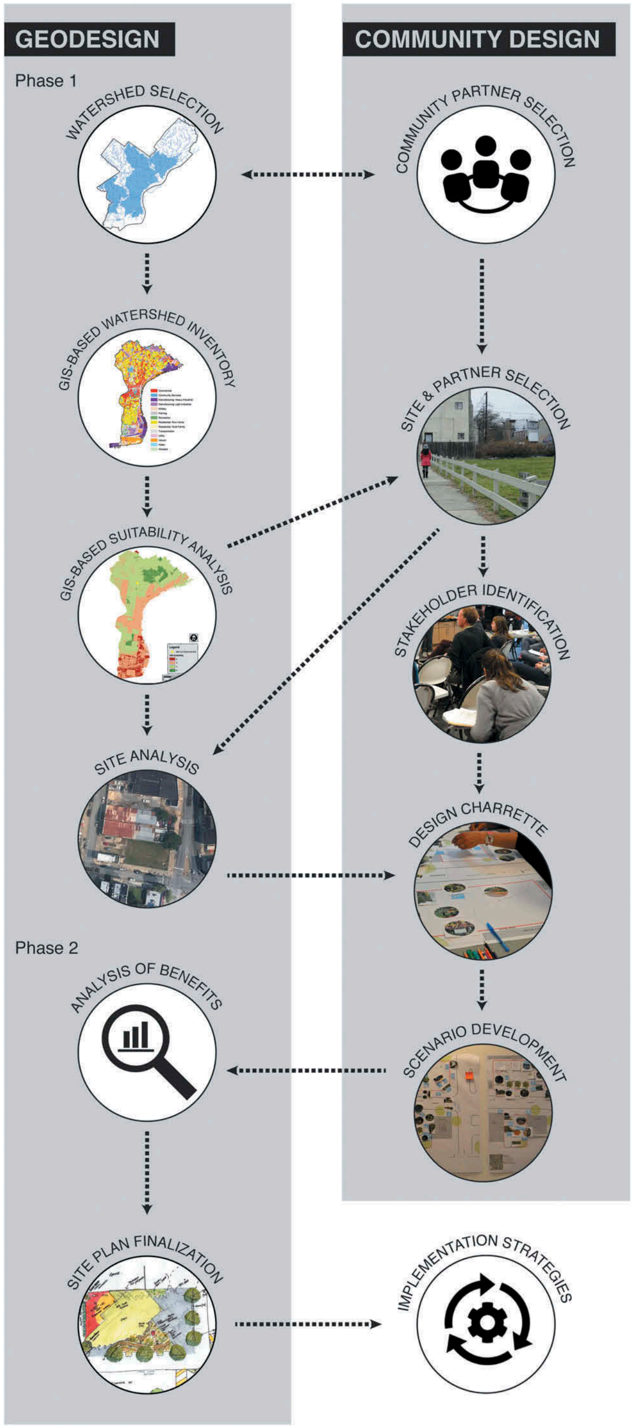

Figure 1. Conceptual methodological framework used in this study.

all the steams were buried due to development (PWD and DDWP 2011). Many neighborhoods in this watershed face socioeconomic issues including poverty, crime, land vacancy, and unemployment. The implementation of GSI in this watershed presents an opportunity to not only address issues associated with poor water quality, but also to spur additional investments and recreational opportunities in communities viewed as vulnerable or with a significant presence of disinvestment.

Community partner selection

The Asociación Puertorriqueños en Marcha for Everyone (APM)—a Community Development Corporation in North Philadelphia—was selected as the community partner based on its location, mission, capacity, and relationship with the surrounding community. This organization has the capacity to perform the necessary outreach to ensure community input and participation for the Community Design process in minority and disadvantaged neighborhoods.

GIS-based watershed inventory

According to a GIS-based inventory and assessment, the Delaware Direct watershed is densely developed (14,764 persons/square mile) and estimated to have 72% impervious surface, covering residential housing, industrial, large-scale commercial, and transportation land uses. About 95% of the watershed is comprised of soils classified as Urban Land because they have been highly modified through development. The slope of the watershed is primarily flat, and more than 80% of the land in the watershed drains to a CSS. There are 54 stormwater outfalls where CSOs can occur during storm events (PWD and DDWP 2011). Extensive impermeable surfaces within the watershed have amplified the volume, frequency, and velocity of runoff and led to a number of problems, including increased incidence of flooding, impaired water quality, and ecological degradation.

GIS-based suitability analysis for GSI locations

A GIS-based site suitability model was created for the study area to identify suitable locations for future GSIs using a weighted overlay analysis. The model was based on two sub-models: the first model evaluated the natural and built environment criteria (e.g., soil, elevation, impervious surface), while the second looked at the social environment criteria (e.g., areas

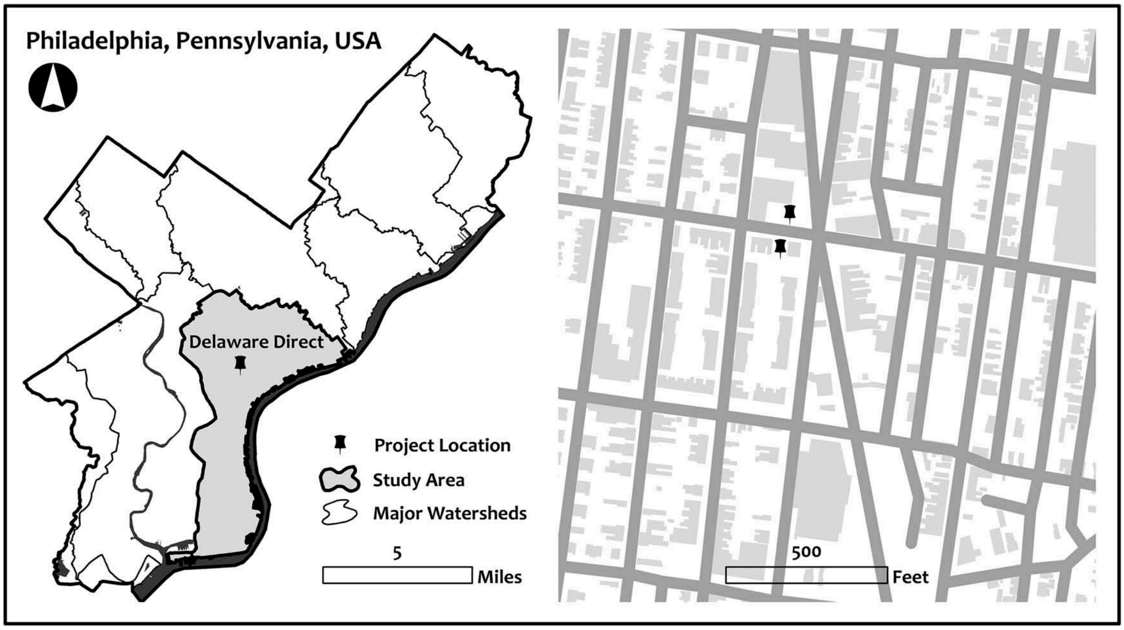

Figure 2. Study context.

with a significant presence of disinvestment, youth population). Table 1 presents all the layers used for both sub-models and their weight factors. Polygon-based data were converted into raster format and then each layer was reclassified according to natural break classification, to a scale of 1–5, with 5 being the highest score, meaning the most suitable location. A point density analysis was used to calculate the density of the CSO inlets. Analysis of existing GSI projects and historic streams were proximity based. The final step combined the two sub-models giving them equal weight.

Project site and site partner selection

Community partner APM identified seven potential project sites and the Project Team analyzed the GSI and placemaking potential of each site. Based on the suitability analysis, current land use and character, land ownership, and community interest or preference, a pair of vacant lots in North Philadelphia were chosen as the project site. The larger lot (see Figure 3) was owned by an absentee landlord, but maintained by APM and the Pennsylvania Horticultural Society, and was serving as an informal community space; the other lot was owned by APM. The neighborhood surrounding the project site was in need of a designated community recreational space for families. The pervious areas made it a compelling case for easier and cheaper construction of GSI projects.

Site analysis

At the time of this study, the site was zoned vacant residential and the surrounding area had a high level of vacancy. The land use around the site was a mix of both residential and commercial. The slope of the site and surrounding parcels was mostly flat. There were several bus stops within blocks of the site. The population density of the site's census tract was roughly 18,100 people per square mile, placing the area toward the middle of the spectrum compared to the citywide average. The population in the site's immediate area was predominantly Latinx, mostly those of Puerto Rican descent. The youth population (under 18) in the area was considerably higher (about 22%) compared to older population. The median household income of the tract was approximately $16,800 only. Educational attainment was low in the area as well, with only 5.8% of residents over 25 having a Bachelor's degree.

Stakeholder identification

Following the finalization of the site, the Project Team began outreach activities for the design

Table 1. Criteria for suitability models.

Model Criteria	Data Source	Analysis	Weight
Built and Natural Environment Model			
Away from existing GSI	Philadelphia Water Department	Euclidean distance	28%
On impervious surface	Philadelphia Water Department	Rasterize then reclassify (yes/no)	16%
Density of CSO Inlets	Philadelphia Water Department	Point density	18%
Soil type-runoff intensity	U.S. Department of Agriculture	Rasterize then reclassify	18%
Closer to historic streams	Philadelphia Water Department	Euclidean distance	10%
On low elevation	Philadelphia Water Department	Rasterize then reclassify	10%
Total			100%
Social Environment Model			
Within areas designated as socio-economically disadvantaged*	Delaware Valley Regional Planning Commission analysis based on American Community Survey 2012–2016 five-year estimates data	Rasterize then reclassify	70%
Within areas with high percentage of youth population (up to 17)	American Community Survey 2012–2016 five-year estimates data	Rasterize then reclassify	30%
Total			100%

Note: The following population groups were used an indicator in the analysis: female, racial minority, ethnic minority, foreign-born, youth, older adults, limited English proficiency, disabled, and low-income.

charrette. APM was responsible for the promotional and logistical elements of the charrette. Digital and hard-copy flyers were created in Spanish and English, distributed to community residents and businesses, and also posted on the project website. In addition, professional experts representing government agencies and Philadelphia-wide environmental nonprofit organizations were invited to the charrette.

Design charrette

A three-hour long design charrette was held on a Saturday morning within a few blocks of the project site. The total number of participants (n = 21) was consistent with the usual number for such events (Van der Heijden 1996). The event began with an informational presentation by the Project Team. Participants were then split into four smaller groups named A, B, C, and D—with five to six participants each—to develop visions and design scenarios by using various tools such as maps, blank papers, free-hand drawing materials (e.g., pencils, colored pencils, markers, crayons), and lots of icons showing potential design elements (see Figure 4). The Project Team created those icons based on a review of hundreds

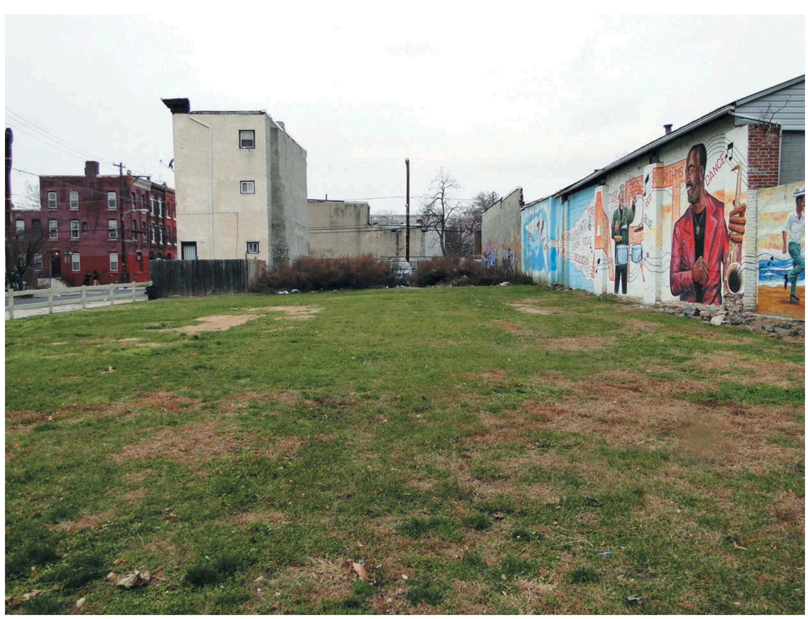

Figure 3. A partial view of the project site.

Figure 4. Photos from the community design charrette.

of GSI and placemaking projects. Following the design activity, a representative from each group presented their conceptual design. Finally, each participant was given a ballot asking to identify their favorite overall design and favorite individual design elements from each group.

Scenario development and design element selection

Four future scenarios were developed based on ideas generated at the charrette (see Figure 5). Each group had both similar and unique ideas for the two lots. Group A envisioned the smaller lot as a social gathering space, while they thought the larger lot would work best as a more formal community park/space with a historical plaques/walkway showcasing Puerto Rican history. Group B thought the smaller lot would be best used as a community garden, while the larger lot could serve as a park with areas for barbecuing, sitting, and playing. Group C also proposed a community garden and roof deck in the smaller lot, with a plaza with seating and a movie screen in the larger lot. Group D suggested several food-related activities in the smaller lot (community garden, market, etc.) and an active space for the larger lot (turtle play area, sprayground, handball court, etc.).

Several common themes emerged, both from the initial visioning questions and the small group activities. Through the visioning exercises, participants identified several potential uses/visions for the two lots. Overall, there was a strong desire for an informal community/park space that was safe, green, and attractive. Residents noted that the smaller lot could be used by APM for community events and activities such as community gardening, while the larger lot could be used for less formal activities, such as barbecuing and family gatherings.

Analysis of potential benefits of scenarios

The Project Team digitized the four scenarios in GIS and then calculated the benefits of design items proposed in each scenario. The following cost-benefit analyses were done for the proposed GSIs, based on their suggested area in each plan: (i) calculation of storage capacity and estimated costs of potential GSIs (e.g., rain garden, bioswale, planting bed, planter boxes, cisterns, stormwater bumpout), based on design and construction of similar completed projects; (ii) water quality benefits (e.g., removal efficiency of pollutants such as nitrogen, phosphorus, sediment, biochemical oxygen demand, and total suspended solids), based on Pennsylvania Stormwater Best Management Practice Manual (PA BMP Manual) and U.S. Environmental Protection Agency's (EPA) Spreadsheet Tool for the Estimation of Pollutant Loads (STEPL); and (iii) Stormwater functions (e.g., velocity reduction, volume reduction, water quality benefits), based on the PA BMP Manual. No specific GSI scenario stood out as the highest benefit, so the Project Team focused on community priorities.

Site plan finalization and visualization

Following the voting, the Project Team reviewed each ballot and tallied the votes. There was no clear favorite overall design; each of the four scenarios received between 1 and 3 votes. However, several individual design features emerged as favorites, including the historical plaques/walkway (Group A), a formalized

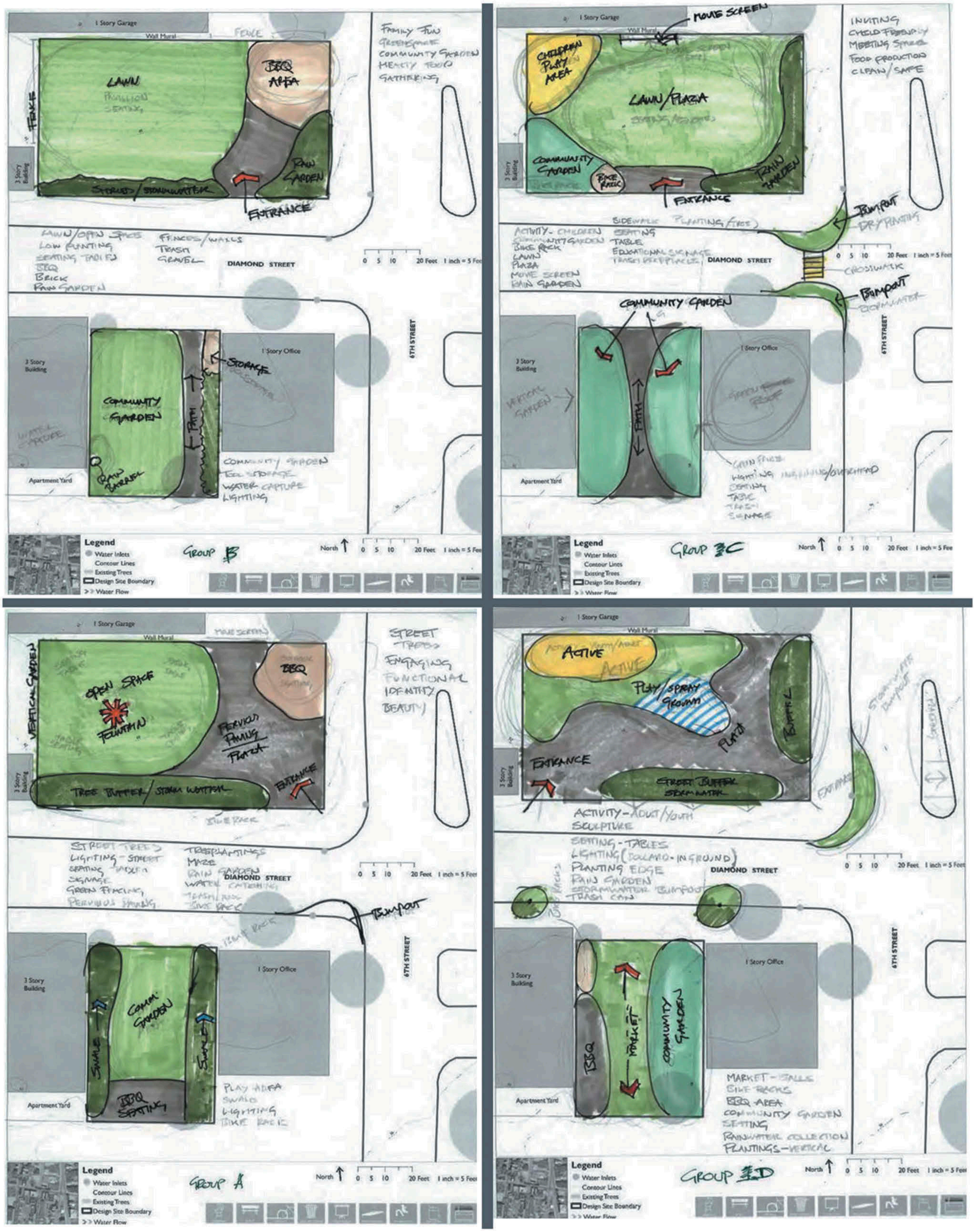

Figure 5. Alternative design scenarios.

barbecue space (Group B), a membership-based community garden (Group B), a roof deck on the APM building (Group C), the turtle play area (Group D), and the handball court/sprayground area (Group D). Overall, participants identified several important ideas for the Project Team to consider: a community garden (particularly in the smaller lot); a space for residents to gather (both formal and informal); a place that is safe and deters crime; something that incorporates the community's history; a park that is green and clean; and a place that has activities for the whole family/all ages.

The final conceptual site plans are shown in Figure 6. The handball court was placed in the northwest corner of the larger lot in order to provide an opportunity for active recreation without interfering with the more passive activities suggested for the site. The central lawn space allowed for a variety of activities for both children and adults, and was included as a buffer between the more active parts of the site. Additionally, the open lawn allowed residents to bring seating for movies and concerts. The stage space and movie screen space provided the neighborhood with opportunities to host community movie and concert nights. The children's play area was designed to be in between the plaza/barbecue area and the lawn space, to provide a safe place for children to play with supervision located nearby. The boulder seating provided alternative seating arrangements for those supervising the children's play area. The plaza/barbecue area was kept in the same area, but a more formal arrangement was suggested.

Improved crosswalks were identified as a way to improve the safety of those crossing between the two lots, as a result of the fairly heavy traffic on the streets. The community garden on the smaller lot arose from the idea of a fee-based community garden. The raised plaza was designed because of the topography of the lot, with the slope rising in the southwest corner of the lot. Additionally, this lot had a maintenance area with the necessary tools and equipment for the community garden.

In terms of stormwater management, the rain garden was located in an area that the site analysis process identified as an ideal place for GSI, based on the topography and runoff flows of the site. The bioswale was identified as a GSI and also a potential buffer between the street and the site, as there is currently only an unattractive fence. The stormwater bumpouts, located on the corners of the two lots, would serve as both traffic-calming measures as well

Figure 6. Final site plan.

as stormwater management tools. Residents identified the streets as fairly busy, so this proved an ideal situation for the suggestion of combining traffic calming with stormwater management.

Implementation strategies

Following the final conceptual site plan, the Project Team outlined implementation strategies. In terms of stormwater management, the team prioritized the rain garden and bioswale based on a cost-benefit analysis. The overall estimated cost of all proposed GSIs was low and could be considered in a single grant proposal. This site would provide high visibility and serve as a good demonstration of implementing multiple stormwater control practices by transforming the vacant space from existing turf condition to a naturalized community space. In terms of placemaking elements, most design items could be completed by community residents and volunteers, with the remainder being grant funded, and implemented by APM.

Post-charrette survey results

Table 2 summarizes the central outcomes from the process and the project. The open-ended comments suggest that none of the Community Design participants appeared to have felt any intimidation to speak up or were hampered by a language barrier. The small-group discussion format and the use of icons and drawing tools, which were provided by the Project Team, were helpful. The participants commented on how learning from the Project Team and invited experts helped them understand the science behind any planning, design, and decision-making process. Scenario planning allowed participants to understand each other's perspectives on the future use of the vacant lots.

The Geodesign group members commented on the ways their work was influenced by Community Design. Their exposure to culturally appropriate participatory planning and facilitation methods led to an improved level of cultural competency in work advocating for marginalized populations. According to participants, Geodesign contributed to the project in several ways: (i) it supported information sharing and consensus-making; (ii) it effectively provided basic geographic information; (iii) it provided expert information; and (iv) it integrated Community Design outputs in the Geodesign process. Overall, student participants learned culturally appropriate participatory planning methods, which are considered a critical lesson for university students in planning and related design disciplines (Cushing et al. 2012, 183).

Discussion

A major strength of this project was its multidisciplinary methodology: using Geodesign and Community Design tools in participatory environmental planning and design. The blending of two methods added new dimensions and viewpoints to a project with a dual purpose: stormwater management and placemaking. Table 3 shows the major design elements used in the final site plan and their connection to stormwater management/placemaking and Geodesign/Community Design methods. As seen in the table, there were design elements generated from only Geodesign process (e.g., stormwater bumpouts) or Community Design process (e.g., handball court), and serving only stormwater management (e.g., cisterns) or placemaking (e.g., barbecue area) purposes. A few design elements, on the other hand, were derived from both methods (e.g., rain gardens suggested by both Geodesign and Community Design teams) or addressed both purposes (e.g., community gardens serving both stormwater management and community placemaking).

Geodesign and GSI

This project differs from many Geodesign projects due to its geographic scale, research design, selection of participants, and community engagement process. Most Geodesign projects focus on large landscapes of ecological and cultural significance (see examples in Steinitz 2012). This project started with an initial analysis at a watershed level (regional scale), but then focused on a neighborhood level (local scale). For any Geodesign process, smaller projects with simpler methods may encourage more direct stakeholder participation, compared to larger studies, which require more complex methods and significant contribution by design professionals and scientists

Table 2. Outcomes from the project and planning process.

	Community Design Participants (n = 19)	Geodesign Participants (n = 15)
Outcomes from the Process		
The process built community consensus	63% "strongly agree"; 26% "agree"	80% "strongly agree"
The process helped understand people's needs	89% "strongly agree"	100% "agree"
The blend of Geodesign and Community Design helped practicing good design	NA	60% "strongly agree"; 33% "agree"
The process helped capture the essence of community awareness, knowledge, and vision	32% "strongly agreed"; 58% "agreed"	NA
The process helped participants building trust with the community	NA	53% "strongly agree"; 40% "agree"
Participants gained environmental education	100% "strongly agree"	100% "strongly agree"
Participants learned culturally appropriate participatory planning and facilitation methods	NA	87% "agree"
Participants learned from each other and understood each other's perspectives	79% "strongly agree"	87% "strongly agree"
Community participants felt empowered	32% "strongly agree"; 63% "agree"	NA
Participants enhanced the capacity to cultivate a stronger sense of commitment	63% "agree"; 26% "neutral"	NA
Participants had realistic expectations of outcomes	NA	47% "agree"; 20% "neutral"; 27% "disagree"
Community design methods (e.g., design charrette) were effective additions to the geodesign process	NA	95% "strongly agree"
Expected Outcomes from the Project		
Preserves Puerto Rican heritage	32% "strongly agree"; 63% "agree"	NA
Enhances community social life	95% "strongly agree"	NA
Enhances community health	84% "agree"	NA
Increases social inclusion and equity	84% "neutral"	NA
Prevents crime	84% "neutral"	NA
Encourages engaged stewardship	89% "strongly agree"	NA
Brings design and planning expertise to everyday environments	NA	40% "strongly agree"; 53% "agree"

Note: NA denotes questions were not asked to that group.

(Steinitz 2012). This project was small enough or methods used here were simple enough to engage stakeholders more effectively and was not more expensive or time-consuming than typical GSI design methods.

Geodesign—while encourages participatory planning—does not clearly lay out the details on how planners can learn about people and the issues they raise, which participatory planning scholars such as Forester (1999) have strongly argued is needed. Stakeholder input is an essential component of any Geodesign process, but their role is typically limited to two actions: Initiating the project based on the needs in their community and reviewing and making final decisions that Geodesign team proposes (Steinitz 2012). This project has expanded the role of stakeholders by involving them directly in the design process. Many Geodesign projects consider only government officials and nonprofit organizations as stakeholders, but this project has prioritized neighborhood residents as the key stakeholders representing minority and underprivileged populations. Community residents or organizations can initiate and build many of the design elements proposed in this project with a minimum budget—by organizing volunteer days or community days—and may gain a better sense of ownership of the project and responsibility for site maintenance, once the project is completed.

The Project Team found the blending of Community Design methods directly in a Geodesign process beneficial in three ways.

(i) **Community knowledge and awareness.** While community participants learned about stormwater management issues and site-specific challenges from the Geodesign team, the Geodesign team also gained in-depth

Table 3. Comparing design elements from Geodesign and community design exercises.

Topic	Elements from Geodesign Exercises	Elements from Community Design Exercises
Overall vision	A maintained community pocket green space with stormwater management features	Informal community/park space that was safe, green, and attractive
Stormwater management	Rain gardens Bio-swale Stormwater bumpouts Cisterns Naturalized filter areas	Rain gardens
	Planter boxes	Community garden raised beds Planting beds
Placemaking	Raised plaza (Lot B) Bike parking	Seating area/Plaza Bike parking Community gardens Greening sidewalks/trees Improved fencing Stage/movie screen space Handball court Central lawn space Barbecue area Shade Historical plaques/ walkway Children's play area Safety crossing surface Market space Maintenance area

community knowledge about the site and the neighborhood, which would not have been possible without direct resident participation. Without community input, many important considerations about the project site would have been missed, as demonstrated in the following three examples. First, residents were concerned with security if too many trees were added, reducing the visibility of the larger lot. Second, residents mentioned a failing community garden in the neighborhood that did not work because people did not take ownership of individual lots, so they suggested charging a small membership fee and assigning participants to individual plots. Finally, stakeholders identified the current informal uses of the lots, including grilling/barbecuing and parties, which were typical informal summertime activities not visible to the Geodesign team who worked on the project in late fall.

(ii) **Community vision and interests**. While the Geodesign process suggested common activity spaces such as community gardens or a neighborhood pocket park, participation of residents in the Community Design offered a better idea about community vision and their interests. Each Community Design group identified unique elements for potential desired uses and how the community viewed the future of the site—either as active or passive recreational space or food production space. The fact that each group identified unique elements for the potential desired uses was a key outcome from the process. The design elements were a direct reflection of both current needs and future vision for the vacant lots, as known best by neighbors of these lots.

(iii) **Partnership**. Through Community Design activities, the Geodesign team became aware of the strength of forming a strong partnership with community-based organizations and the development of more partnerships throughout the process.

Community design and placemaking

The use of the design charrette and scenario development was an effective way to build community consensus and therefore the methods contributed greatly to the Geodesign process. Traditional community consensus building processes need rational arguments to articulate participants' viewpoints, requiring well-developed argumentative skills (Dryzek 2000; Gutmann and Thompson 2004), the reliance on which often confer an advantage to communities of greater means (Young 2001). Alternatively, the scenario planning process may create a space where participants can discuss openly and thoroughly, engage each other's perspectives and experiences, and listen empathetically without going through a rational debate (Young 2001; Zapata 2012).

Besides contributing to Geodesign methods, this project has demonstrated how planning for placemaking can become an integral part of the process of planning for GSIs at a neighborhood scale, and on a vacant urban land. "Design and planning processes for placemaking must be context specific in order to be effective and meaningful." (Cushing et al. 2012, 182) The project followed three key dimensions of the placemaking process, as described in Rios et al. (2012): Use of public and private spaces (e.g., a public community pocket park, a private community gardens), creation of a sense of belonging in those places, and the way participants made claims in relation to the built environment.

Stormwater management was the initial primary goal of this project, but blending it with placemaking concepts became equally important after the design charrette. The idea of a neighborhood social space followed the triangulation of use so that people of all age groups can enjoy the space at all times and turn it into a vibrant place. According to the concept "The Power of 10+", places thrive when users have a range of reasons (10 plus) to be there, acting as layers to create synergy (Project for Public Spaces (PPS) 2016). Activities may include those reflecting the culture and history of the surrounding community. This project offers 10+ reasons: music event, movie event, sculptures, a community garden, a flower garden, a marketplace, a barbecue area, bike parking, hangout spaces, a basketball court, a kids play area, seating (grass, boulders, and benches), environmental education, and heritage education. Considering the context, all the design components appeared to work well for Latinx populations. Plazas, gazebos, local stone ground covering, benches, and pathways are typical design features of Latinx social life (Main 2012). Community gardens can re-imagine Caribbean culture in the urban landscape, and many times the establishment of gardens demonstrate the power of local residents to control community lands that are vacant or have abandoned buildings (Angotti 2012).

Concluding remarks

The main argument of this article is two-fold. First, blending Geodesign and Community Design in the participatory planning process can increase community involvement and community buy-in. Second, planning for stormwater management, if co-existing with planning for placemaking, may have a broader appeal to residents in neighborhoods viewed as vulnerable or with a significant presence of disinvestment, who are generally not too enthusiastic about GSI projects. The bottom-up planning approach applied in this project was supported by an objective understanding of the community needs, the quality of life of residents, and the long-term sustainability of the proposed projects. If implemented, the proposed GSI site plan and its design elements are expected to improve community ownership, empowerment, and environmental stewardship.

The methodological framework and planning process presented in this article can be easily transferred—with minor modifications—to similar projects in other communities, specifically those viewed as vulnerable or with a significant presence of disinvestment and ones with similar environmental, economic, and social conditions. Many cities across the U.S. are becoming interested in lower-cost GSI projects in order to address water quality, stormwater management, and flash-flooding issues. At the same time, placemaking projects are becoming an urban design trend, reviving unused or underused public spaces and revitalizing vacant lands. Other communities can modify the proposed methodology by contextualizing data layers and their weights used in the suitability study and addressing the following three limitations. First, site identification was primarily done by a community-based organization, not the community as a whole, which may have skewed the perspective. Second, site analysis could have used direct community input through focus groups, surveys, or interviews. Third, the Saturday morning charrette may have limited the participation of residents with weekend jobs or no child care options. Arranging multiple charrettes at different days/times would maximize the diversity of participation.

In addition to addressing these limitations, future projects may engage stakeholders into the Geodesign process more directly by using tools such as online mapping and GIS-based sketching. Stakeholders may also be engaged in local data collection and site analysis by using apps such as ArcGIS Collector and tools such as photovoice. A future study may also focus on constructed projects and analyze the ways people are actually using, experiencing, and maintaining the spaces designed for a dual purpose: stormwater management and placemaking.

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