SUSTAINABLE PUBLIC PLACE DEVELOPMENT WITH COMMUNITY PARTICIPATION PROCESS: A CASE STUDY OF BELLE ISLE PARK, MI

Ву

Bridget Guminik

A THESIS

Submitted to Michigan State University in partial fulfillment of the requirements for the degree of

Environmental Design – Master of Arts

ABSTRACT

SUSTAINABLE PUBLIC PLACE DEVELOPMENT WITH COMMUNITY PARTICIPANT PROCESS: A CASE STUDY OF BELLE ISLE PARK, MI

By

Bridget Guminik

There are many positive influences from greenspaces which are even more crucial in large urban cities such as Detroit, Michigan. The abandoned area of the old Belle Isle Park Zoo has been the subject of numerous redevelopment proposals. However, there is a gap in what designers have done and what this research proposes, which is that previous designs lacked community engagement. The purpose of this study is to demonstrate the importance and value in including community engagement into design choices. With a series of public workshops with stakeholders, landscape performance research has been adopted to assess the impact of the final design proposal. The success of a final design after community engagement aims to promote the use of community engagement in design as a beneficial and necessary factor when installing public space developments. The study will utilize the abandoned zoo space in Belle Isle Park to demonstrate that the community spaces while still allowing the designers room to implement environmental and socioeconomic beneficial tactics.

ACKNOWLEDGEMENTS

I want to thank my team members in studio for their contribution to the output of the case study design of the master plan proposal, Holly Hennelly and TJ Lynch. I also want to thank my chair member and studio instructor, Dr. Jun-Hyun Kim, for his guidance throughout this entire process. Lastly, I want to thank my family and friends for their endless support.

TABLE OF CONTENTS

LIST OF TABLESv
LIST OF FIGURESvi
CHAPTER 1. INTRODUCTION1
CHAPTER 2. LITERATURE REVIEW
CHAPTER 3. METHODOLOGY
CHAPTER 4. RESULTS
CHAPTER 5. DISCUSSION AND CONCLUSIONS
REFERENCES

LIST OF TABLES

Table 1. Community Workshops	16
Table 2. Design Goals and Considerations from Community Workshops	17
Table 3. Environmental Landscape Performance Metrics	22
Table 4. Socioeconomic Landscape Performance Metrics	24
Table 5. Environmental Landscape Performance Metrics Findings	30
Table 6. Socioeconomic Landscape Performance Metrics Findings	35

LIST OF FIGURES

Figure 1. Belle Isle Old Zoo Project Area Boundary and Context14
Figure 2. Strengths, Weakness, Opportunity, Threat (SWOT) Analysis of the Site15
Figure 3. Design Goals and Objectives20
Figure 4. Master Plan of the Old Zoo Area in Belle Isle Park25
Figure 5. Design Program
Figure 6. Habitat Revitalization and Educational Designs28
Figure 7. Sheba's Entry29
Figure 8. Sustainable Parking Lot Redevelopment33
Figure 9. Treetop Walkway Over Stormwater Management Ecosystem
Figure 10. Mixed-Use Plaza

CHAPTER 1. INTRODUCTION

It is estimated that between 1950 and 2014, the urban population of the world increased by 423%. By 2025, roughly 90% of U.S. residents are expected to live in urban areas (Kim et al., 2017). Additionally, due to the increase of the human population on Earth, there is an increasing rate of global environmental changes being caused. This can include factors such as temperature increases induced by greenhouse gasses, desertification, deforestation, and loss of biodiversity. This is especially true for those who live in cities, as they are the major drivers of global environmental change, as resources are being disproportionately used by urban residents given the large and increasing fraction of population living in these condensed cities (Grimmond, 2007). Since these areas are further developing and building, it is essential to prioritize urban green spaces being preserved and implemented in the beginning of urban development. Urban green spaces have several benefits for humans, wildlife, and the environment. Having parks in cities will increase health and wellbeing for the people who live in the urban area. One factor to recognize is that parks can improve physical fitness and decrease mental depression (Bedimo-Rung et al., 2005). Green spaces are able to provide a place to perform physical activities and also encourages it to those living nearby (Kim et al, 2014). Physical activity can reduce mortality and decrease diabetes, heart disease, colon cancer, and blood pressure (Lee, C., & Moudon, A.V., 2004). It can also be very beneficial to decreasing levels of depression and anxiety, benefit healthy weight, and support healthy bones, joints, and muscles (Bedimo-Rung et al., 2005). In addition to these health benefits, air quality can be improved, and urban temperatures decreased, further improving citizens health (Kim et al., 2016; Park et al., 2017; Kim et al., 2018). Additional benefits for the residents residing near

green space include storing carbon and mitigating climate change, as well as decreasing the risk of flooding (Sohn et al., 2017; Kim et al., 2017).

Belle Isle Park, a state-managed park, in Detroit, Michigan, U.S.A. is located in the Detroit River which divides the United States from Canada. The park is located closely to the heart of the Detroit downtown district. The success of Belle Isle Park is extremely important as one of the most popular parks in the urban area of Detroit. According to a survey conducted by the Michigan Department of Natural Resources (DNR) in 2010, it was found that nearly 30% of visitors polled utilize the park every day, displaying that the park has a huge impact and importance to the immediate community who heavily rely on this opportunity to utilize green space daily. 35% of visitors go to the park weekly, and 28% visit monthly (DNR, 2011). The high percentage of people who attend the park recurrently shows how influential it is to the immediate community, in addition to the Metro Detroit communities who visit often, but not daily are also appreciative. Belle Isle Park is stated to be the most popular state park in the entire state of Michigan (Farrell, 2017), displaying how important the park is to not only the city of Detroit, but to the state as a whole. Belle Isle Park being a popular attraction to those outside the city is also important to bringing in business and socioeconomic benefits to the city of Detroit.

There are multiple groups who treasure Belle Isle Park. Between the on-site and remote surveys by the DNR in 2010, differences can be seen in the varying cultural groups that responded. The on-site results are mostly from people who belong to the immediate community. These people use Belle Isle Park as a place to gather with others and do family activities. From this, the survey found that picnic shelters (64.7%) are the most utilized feature,

followed by the playscape (50%), and the beach (46.6%) (DNR, 2011). These everyday public features are what are being appreciated by the people living in Detroit who have limited access to things such as greenspace picnics and outdoor recreational spaces.

Those who responded to the DNR survey remotely, mostly belong to the surrounding communities, value the island in a different way, further showing that Belle Isle Park having facilities provided for not only local residents but also the surrounding communities is important. The survey has found that the areas are frequently used and appreciated by those visitors, who are in turn bringing in financial and social benefits with them when they come to the city to see these public features. Those from outside of the city see Belle Isle Park as a destination and a place to go specifically to attend an event or visit a specific facility such as Scott Fountain (71%), Conservatory/Gardens (68.4%), Dossin Museum (49.9%), Picnic Shelters (47.3%), and Nature Center (45.2%) (DNR, 2011). This shows that they use community facilities less, but that the attractions are highly valued and appreciated.

Despite its popularity and attractions, Belle Isle Park has a number of challenges and obstacles. Several facilities in the park are outdated and unmaintained due to lack of funding over the years. Furthermore, some have gone as far as to be condemned due to safety concerns. The waterfront boathouse venue continues to be abandoned, as well as the old zoo area. Some of these facilities, such as the aquarium, have been reopened and renovated after the state government took over management of the land from the city. Some areas have remained closed and continue to deteriorate, including the old zoo area. A community engagement effort was implemented when the DNR branch of the state government first took

control of the city park, however with further research for more up to date and area specific data, a better result can come from redesigning those abandoned areas.

Additionally, Belle Isle faces the challenge of flooding during extreme rainfall events. This has been detrimental not only to the community who often cannot access the park when these events happen, but also the natural environment on the island. Belle Isle is home to the Wet-Mesic Flatwood forest type which is listed as imperiled in Michigan (Allnut, 2020). A wetmesic flatwood forest is a mixture of upland and lowland diverse hardwoods which are nearly exclusively found in southeastern lower Michigan due to thriving in poorly drained glacial lake planes (Michigan State University, 2022). Belle Isle is the largest remaining example of a Wet-Mesic Flatwood ecosystem and many of the species within it are of concern and threatened species (Allnutt, 2020). A study using drones found that the flooding on the isle is detrimental to this ecosystem and is resulting in mass canopy tree death (Allnutt, 2020). The flooding is a large concern and needs to be assessed.

Often, policymakers and designers install developments without a full understanding of the culture, including structure, relations, agents, practices, and processes (Maginn, 2007). Due to this, a community participation process can incorporate inclusionary argumentation to give designers the benefit of being more aware of the cultural relations and practices which will help be more effective in planning for the community (Maginn, 2007). The efforts of applying community engagement in a decision-making process has become more and more important over the recent years for proper implementation of new concepts and designs. The value can be found in decreasing the gap attributed a decline in good education, economic opportunities, health, and access to justice, while the resources which are available to combat

these problems have not been increasing at the same rate (Barnes & Schmitz, 2016). Due to this increasing gap, leaders are looking for the most beneficial way possible to invest the available resources. This includes using evidence-based programs which show a correlation between an intervention and an impact. Additionally, collective impact initiatives that use data to design and evaluate solutions are being utilized (Barnes & Schmitz, 2016). Community engagement activities can be performed to strengthen the social benefits in a community (Barnes & Schmitz, 2016). It also can help reduce socioeconomic health inequalities when involving the community in decision making as green spaces are public and used by everyone in the community. In the urban and diverse city of Detroit, these benefits and important aspects of community engagement will further enhance designs to better the day to day lives of people who live in the area. In addition to community participation helping to create a welcoming beneficial space for the citizens, it can also be used when designing for environmental sustainability (Frazer & McAlpine, 2006). The community can be involved in identifying environmental indicators and monitoring developments and sustainability management goals. Having stakeholders and environmental groups work together with policymakers will benefit the design, environment, and community in a sustainable way.

The purpose of this study is to utilize community participation in order to establish a robust decision-making process to develop a comprehensive master plan for public space, the old zoo area in Belle Isle Park. Community participation will allow designers to reflect what the community wants and needs in the design goals, spatial plan, and program elements of the public space. This will make the space more valuable and more appreciated to the people who use and need it the most. Once the design goals have been established, the next step will be to

incorporate these goals into the design of the space. A master plan will be developed which will display a spatial representation of what the study area could become and what it could include. This design will then be evaluated by applying quantitative assessments using landscape performance metrics. This will put a quantifiable number on how beneficial, sustainable, and improved the landscape will be from the current site to the study area. Quantifying these factors makes it easy and accessible to see how impactful the potential design would be on the existing land.

CHAPTER 2. LITERATURE REVIEW

2.1 Benefits of Public Green Space

Research over past years has sought to find a relationship between human health and green space through a variety of different variables. Public green space is especially important for urban communities and lower income neighborhoods as these populations tend to experience more health problems associated with pollution or lack of access to outdoor recreation opportunities. People who live in urban cities have a disproportionately high rate of obesity, Type 2 diabetes, cardio-metabolic conditions, and cancer (Pearson et al., 2020). Neighborhoods with more green spaces have lower rates of obesity (Kim et al., 2014; Pearson et al., 2020). Parks are a place where people have the opportunity to be physically active as well as be in direct contact with nature. One reason why lower income urban communities are more susceptible to these illnesses is that their neighborhoods can contain a risk of lower physical activity levels paired with higher levels of stress and lower quality of life (Kim et al. 2016; Pearson et al., 2020). In addition to physical activity, it has also been studied that green spaces such as visually seeing trees, plants, and hearing nature, can also lower stress levels (Shanahan et al., 2016). Researchers and city planners have come together to see if changing the built environment in which these communities live in, can offer help to promote a change in physical activity and stress levels, in turn promoting a healthier lifestyle (Pearson et al., 2020).

Along with being linked to human health, green spaces have also been researched to be associated with ecological benefits. A study in 2017 comparing multiple green spaces in Texas found that watersheds composed of healthier green spaces were more likely to have smaller amounts of stormwater runoff (Kim et al., 2017). Green spaces contribute to absorbing surface

water overflown from impervious pavements and structures in developed land, leading to mitigate flooding potentials and pollutant loads in waterways (Kim et al., 2017; Sohn et al., 2019; Sohn et al., 2020). This ultimately helps prevent the associated impacts on infrastructure and habitats. Additionally, urban heat islands have been shown to be able to be mitigated through small greenspaces (Kwon et al., 2021; Park et al., 2021).

Urban areas tend to be at a higher temperature than rural areas. A study done during a heat wave in 2003 found that this is due to the building structures absorbing more heat than natural surfaces do. It was found that 42% more people passed away due to a heat wave in the urban city of London versus those living outside the city (Johnson et al., 2005). Providing green spaces and shade trees helps mitigate these heat waves impacts. For example, a study showed that the impact of small green spaces was more beneficial than building shapes in spaces and found that areas with larger greenspaces had a greater effect at mitigating cooling impacts (Park et al., 2021).

Urban areas also are filled with tiny particles or air pollutants. This can cause serious health problems in humans and lead to a vast number of illnesses. The World Health Organization reported in 2012 that 3.7 million people died worldwide due to inadequate air quality (World Health Organization, 2014). Leaves on trees and shrubs can absorb these pollutants and remove them from the air through capturing the pollutant particles in their foliage (Rasanen et al., 2013). It can also be seen that since humans began to industrialize, the carbon dioxide in the atmosphere has increased by 40% (Ciais et al., 2013). This air component and detrimental particles can be mitigated through green space as well. Finally, green space is economically beneficial to the surrounding city. It has been seen that green spaces can increase

the sale price as well as overall value of residential properties that are nearby (Kim et al., 2018; Sohn et al., 2020).

2.2 Community Participation Process

Collaboration between the local government and the citizens is a key to improving mental and physical health as well as lessening the inequalities which are present in urban areas (Rock et al., 2016). Planners should ensure that urban parks have everything that the people in the city need. Public parks are important to promote physical activity, well-being, and positive social interactions to those in the community (Rock et al., 2016). Community participation is vital for these parks to meet all the needs and be a full benefit to the community. This can be achieved through public workshops, meetings, interviews, focus groups, and surveys to discover the viewpoints of those in the community (Shuib et al., 2014). These concepts will then help create a concrete vision of what would best benefit the community to improve quality of life.

A top-down approach can be defined as when elected officials, leaders of a large institute, and philanthropists, introduce programs and services without engaging with the community leaders and intended beneficiaries to seek their opinion (Barnes & Schmitz, 2016). This is shown to usually end very poorly and unsuccessfully. It has been seen that the community will immediately rebel and reject the implementation of these beneficial programs, if they were not consulted on their needs. Barnes and Schmitz states that it is how policymakers and leaders explore new initiatives which will determine if the implementation will be successful or not (Barnes & Schmitz, 2016).

The community participation processes aim to improve services where change is truly needed. The strategies aim to promote health as well as well-being mainly focusing on places with health inequalities in disadvantaged populations (Attree et al., 2010). A meta-analysis done on various community engagement interventions found that there was a positive impact on health in numerous ways from the participants who were involved (O'Mara-Eves, 2015). The strategy aiming to aid those less healthy populations would include redesign of a city space or community area. These methods invite a new way for councils, communities, and voluntary and statutory sectors to utilize engagement with the community to better their impact of services. The four main goals of the community planning system are community engagement, working together, outcomes approach, and achieving alignment (Community Places, 2012). This research focuses on community engagement through community participation processes. Community engagement is utilized to guide the user in terms of quality and effectiveness, and to process the planning and designing of the engagement to best fit a certain issue, the level of participation required, timeframe, and what stakeholders will be affected (Community Places, 2014). Stakeholders can include a variety of groups, some of which are local residents or groups based in the area, communities of interest, local community and volunteer groups, web and virtual groups. cultural, ethnic, and racial groups, and faith-based organizations (Community Places, 2014). While there are many different types of community participation processes, two that are widely utilized are workshops and focus groups. These methods allow for people to freely speak about their thoughts and ideas in an open and welcoming environment (Community Places, 2014). Workshops are beneficial because the aim can directly incorporate what is needed. What is discussed and what information is extracted can be chosen

by the facilitator and can include strengths, weaknesses, threats, and opportunities (Community Places, 2014). The ideas generated and thoughts exclaimed can be specifically targeted towards the priority and production of the action plan (Community Places, 2014). The pros of having a workshop is that they allow for active discussion in an accepting environment, they are efficient in identifying and clarifying key problems, conflict is more easily dissolved in smaller groups, they can have a specific target purpose, and they can specifically speak to members or certain groups (Community Places, 2014). The cons of this however are that in small groups not everyone is represented, the conversation can be taken over by the loudest person in the room, and it requires experienced facilitators (Community Places, 2014).

2.3 Landscape Performance Research

The Landscape Architecture Foundation (LAF) combined a range of resources and models to create one master set of landscape performance metrics. The metrics assess a range of measurable options which can fit a variety of project types (Yang et al., 2020). The goal of the landscape performance metrics is to be able to quantify, display, and communicate the benefits and contributions of landscape solutions (LAF, 2022). They can show a range of quantifiable solutions from environmental to social and economic while aiming to advocate for the use of landscape architecture developments being the solution for sustainable issues. The organization aims to demonstrate that there are sustainable benefits to certain features through case studies (Canfield et al., 2014). Numerous case studies have cited this method and explained the benefits that their designs have encouraged long-term sustainability through identifying and quantifying the benefits (LAF, 2022).

Opportunities for local and regional community engagement have been on the rise in Detroit in recent years. These have been seen to be successful, utilized, and necessary. This not only shows that development on Belle Isle Park would be beneficial, but also brings up that these other community engagement opportunities will bring people to the area and allow them to visit Belle Isle Park. Recent developments have included redeveloping William G. Milliken State Park, owned by the State of Michigan. A Landscape Performance Benefits Case Study states that the DNR's Explorer Program now attends William G. Milliken State Park, and that the attendance of this program has increased 300% since beginning in 2010 (LAF, 2022). This huge increase in community engagement to a state park in such close proximity to Belle Isle further shows how large of an impact revamping Belle Isle Park could have.

It was found through LAF that Willaim G. Milliken State Park collects 4.5 million gallons of water which mitigates the flooding problem in the urban city, and creates native habitats for a variety of species. Additionally, 3 tons of carbon is sequestered plus 99% of sediment removed (LAF, 2022). Socioeconomically, the park is estimated to raise almost \$6 million dollars per year from visitors.

CHAPTER 3. METHODOLOGY

3.1 Study Area

The study area for the final design is the old zoo area in Belle Isle Park, Detroit, Michigan, USA, as seen in Figure 1. The old zoo area is an enclosed space at Belle Isle Park which has been abandoned over the last decades. The Belle Isle Zoo was opened in 1895 and was well used and loved by the community, leading to its rapid growth in size, to 150 animals in 1909. The site featured many iconic features within and around the animal exhibits, including the introduction of its raised boardwalk design, in 1980, which allowed visitors to walk among the trees and view the animals from a different viewpoint. In 2002, the zoo was closed due to the City of Detroit's financial challenges (Abbey-Lambertz, 2017). The land has been abandoned ever since which led to a surplus of invasive species, degradation of infrastructure including the buildings and a treetop boardwalk, the introduction of graffiti and increased crime, and unmanaged stormwater flooding. The current conditions of the project area are not meeting the needs of the community. Therefore, the area should be reassessed and redeveloped in order to fit the demands of the urban community for green space as well as Belle Isle Park's future development plan.



Figure 1. Belle Isle Old Zoo Project Area Boundary and Context

The zoo area is located in the center of the island, by the public beach area, as seen in Figure 1. Belle Isle Park is just a couple miles from the heart of downtown Detroit, and close to many major attractions in the city such as Milliken State Park, the Dequindre Cut, Eastern Market, and the Detroit Riverfront. Both being close to these attractions as well as the popularity and attractions on Belle Isle itself will bring visitors from the community and state. This will be a major strength for the project area as seen in Figure 2. The degradation and missed opportunity of the zoo area will be ideal for redevelopment. As noted in Figure 2, a weakness and threat which will have to be assessed is the flooding and invasive species. With proper design methods as well as community input, the site will be designed to best fit the needs of the park and its attendees. Many of the opportunities will be coordinated with the

goals set by the public meetings.



Figure 2. Strength, Weakness, Opportunity, Threat (SWOT) Analysis of the Site

3.2 Community Workshops

For this study, two stakeholder workshops were conducted to collect public inputs for the future development of the project area, noted in Table 1. The workshops were organized by the National Charrette Institute (NCI) in Michigan State University (MSU). NCI is a program which is incorporated within MSU's School of Planning, Design, and Construction. The program aims to change the way people work together by increasing the availability of collaboration. This system is a process which is both collaborative and design based and aims to incorporate the skills of all individual stakeholders to come together to make one accessible plan.

Table 1. Community Workshops

Workshops	Date	Attendees	Goal of Meeting	Format
Vision	August	15 Stakeholders	Overall design goals	Breakout
Workshop	25 th , 2021			Discussion Groups
Design	September	20 Stakeholders	Design	Facilitated case
Workshop	22 nd , 2021		program/amenity	study discussion
			choices	

The first workshop was a public stakeholder meeting conducted as a vision workshop to gather information about what stakeholders would like to see in terms of design elements for the area of Belle Isle which was occupied by the zoo. This first workshop was held on August 25th, 2021. The meeting was organized by NCI along with MSU's School of Planning, Design and Construction (SPDC) and the State of Michigan DNR. The organizations and stakeholders were all facilitated in the meeting by the NCI. 15 stakeholders attended the meeting and were gathered into groups to discuss the questions: "What are your hopes for public outdoor recreation at the old zoo area in 10 years?" The groups then reconvened with the facilitators and expressed their thoughts. The ideas were all written down and then attempted to be categorized into umbrella categories, as shown in Table 2. The six design goals aimed to be created for the master plan based on the major findings from the first workshop, which can be seen in Figure 3.

Design Workshop Goals	Design Considerations
Honoring and Exploring Belle Isle's History	 Creating and keeping memories for generations
	• Save as much habitat as possible
	Keeping animal history alive
	Education
	 Passing along stories
	Preserve existing art
	Keep nature and relate to zoo animals
Showcasing the Island's Opportunities for	Sense of belonging
Sustainable Ecosystems	Education
	Transition zones
	Heavy vegetation is still welcoming to
	all
	Less development
	Kiosk
	Less is more
	 Information on species and wildlife in
	the site
	Awareness of invasive species
	 Leave wildlife to grow naturally
	 Outdoor adventure and education
	 Connectivity without disturbing
	habitats
	 Invasive species introduced from zoo
	Blend with Nature
	 Ecosystem respected and protected
	 Habitat for many rare species already
	on the site- birds, bald eagle, beaver,
	trogs
	Water connections
	 Keep water clean for fish and animals

Table 2. Design Goals and Considerations from Community Workshops

Table 2. (Cont'd)

Provide Ample Outdoor Education	Habitat discovery and development
Opportunities	Educational outdoor nature area
	• Educate on wildlife in the area
	Engagement with Educational
	components
	Field trip programs
	• Experience the boardwalk as a value
	to nature and education
	Opportunities for natural science
	learning and nature education
	• Facility
	All age ranges
	• Education about tree species, water,
	unique ponds, environmental science,
	diverse populations, wetlands
	Outdoor education
Creative and Performing Arts in Nature	Amphitheater and event space
	Highlight artists from Detroit
	Art in many forms
	Nature inspires art
	 Meaningful and Instagram worthy
	experiences
	Urban art
	 Student/rotating art
	Performance space
	Street art
	 Focusing participation on people of
	Detroit
	Interactive education

Table 2. (Cont'd)

Interactive Outdoor Adventures and	Camping
Concessions	Multiple seasons
	Hikes
	Ropes course
	Sky walks
	• Woods are the main attraction,
	educate and highlight.
	• Transition zone between natural and
	developed areas
	 Opportunity for something new
	Physically challenging
	Welcome people into wet flat woods
	Nature exploration opportunity for all
	Blend with environment
	• Kayak, water activities, BMX, fitness,
	yoga, adventure, zip line
	All ages activities
	Trail system
	Group meeting area
	Story walks
	Nature in Detroit for kids
	opportunities
Space to Retreat and Interact with Nature	Tree canopy walk
and Each Other	Green storm water management
	Cultural use of nature
	 Nature on display, walk through like
	zoo but different types of nature
	 Natural Playground
	Walking paths
	Camping
	Split space
	Keep natural
	 Linkage to other parts of the island
	 Events throughout year
	Creative reuse of existing structures





The second workshop was to collect detailed feedback in terms of design elements and amenities aligned with the six goals established from the first workshop. This was a design workshop to further explore what design elements the stakeholders would like to see at the old zoo area on Belle Isle within the pre-established goals from the previous meeting as displayed in Table 2. The meeting was held on September 22nd, 2021, by MSU's SPDC and the State of Michigan's DNR. The organizations and stakeholders were all facilitated in the meeting by NCI. The smaller group meeting was also run by MSU students who had undergone facilitator training with NCI prior to this event. Twenty stakeholders attended this meeting to discuss the six goals in rotating groups. The facilitators recorded design ideas from the participating stakeholders by drawing their ideas on the map and recording their reactions to several images representing the given theme through case studies.

The group of community members deeply thought about each goal individually and created some ideas of their own of how they would like these goals to be implemented. The findings of the second workshop were more detailed and extremely vast. Each design goal received on average around 20 amenities or suggestions. These design considerations have been condensed in Table 2. While it was impossible to implement every single comment, the majority of the considerations were incorporated into the final master design. It can be noted that the goal with the most ideas within it was "showcasing the island's opportunities for sustainable ecosystems", showing that this is the area which people felt passionate about and excited to talk about possible changes within.

3.3 Landscape Performance Metrics

Landscape Performance Metrics are a quantifiable method to discover the value of a landscape and design (LAF, 2022). They can assess a wide array of topics which aim to show environmental as well as socioeconomic benefits. These benefits and factors will be analyzed as the project area is current day, and what the design proposal would hypothesize. These will then be compared to see what impact each factor will have. For measuring environmental benefits, this study selected various variables including stormwater retention, habitat preservation, plantings, as well as CO₂ and pollutant sequestration. The landscape metrics being used to assess environmental benefits of the proposed plan can be seen in Table 3.

Environmental Metrics					
Measurements	Variables	Unit	Equation and Resources	Proposed Design Prediction	
Critical habitat or ecologically valuable land created	Additional area of critical habitat or preserved ecological land created	Acres	Site Map	+	
Wetlands created	Additional wetland area created	Acres	Site Map	+	
	Percent of wet days retained	Percent	National Stormwater Calculator (EPA)	+	
	Maximum amount of stormwater retained	Inches per year	National Stormwater Calculator (EPA)	+	
	Average annual runoff depth	Inches per year	National Stormwater Calculator (EPA)	_	
Stormwater retention	Stormwater retained through retention ponds	Gallons	National Stormwater Calculator (EPA)	+	

Table 3. Environmental Landscape Performance Metrics

Table 3. (Cont'd)

	Area greenspace for infiltration	Acres	National Stormwater Calculator (EPA)	+
	Amount of stormwater infiltrated from rain gardens	Inches	National Stormwater Calculator (EPA)	+
Stormwater infiltration	Amount of infiltration from permeable pavement	Inches	National Stormwater Calculator (EPA)	+
Pollutant reduction	Non-point source pollutants reduced from trees	Pounds per year	MyTree by i- Tree (USDA Forest Services)	+
CO ₂ sequestration	Amount of CO ₂ sequestered from trees	Pounds per year	MyTree by i- Tree (USDA Forest Services)	+
Runoff avoided	Amount of runoff avoided from trees	Gallons per year	MyTree by i- Tree (USDA Forest Services)	+
Native plantings	Areas where non-invasive native plantings are created or preserved	Acres	Site Map	+

In addition, gathering spaces, recreational spaces, and educational spaces are some variables that were selected to measure socioeconomic benefits of the proposed design elements (Table 4). These will also be analyzed in contraction to the existing site to form a comparison to the proposed master plan. Social and economic factors can be impacted by a redevelopment plan and this in turn will have a large impact on the community.

Socioeconomic Metrics					
Measurements	Variables	Unit	Equation and Resources	Design Proposal Prediction	
Capacity of gathering	Area of proposed gathering space	_	Heskey, E. (n.d.). EHow		
space	divided by the number of guests	People	Calculator	+	
Safety enhancement	Number of pedestrian crosswalks added	Each	Site Map	+	
Educational opportunities	Areas where educational opportunities can be utilized and signage/education areas present	Each	Site Map	+	
New sidewalks	Length of new sidewalks added	Linear Feet	Site Map	+	
Community gathering space	Area of community gathering spaces added	Acres	Site Map	+	
Trails and boardwalks add	Length of trails and boardwalks added	Linear Feet	Site Map	+	
Open space	Area of open space added	Acres	Site Map	+	
Recreational areas	Area of recreational space added	Acres	Site Map	+	
Increased parking opportunities	Amount of parking added	Spaces	Site Map	+	
Increased accessibility	Amount of ADA features added	Each	Site Map	+	
Increased scenic space and access to vegetated surroundings	Area of scenic and vegetative surroundings	Linear Feet	Site Map	+	
Job creation	Number of jobs created from businesses proposed in the design	Number of Jobs Created	United States Small Business Profiles	+	
Community engagement processes	Number of community participation workshops held	Each	Methodol ogy	+	

CHAPTER 4. RESULTS

4.1 Design Proposal

A design proposal, seen in Figure 4, was created by a MSU student design team led by the author of this study with the goals from the first community workshop aiming to be met. History, art, education, sustainability, retreat, and adventure are all met through various means. The graphic in Figure 4 shows amenities, different native and sustainable environments, and building or infrastructures to be utilized.



Figure 4. Master Plan of the Old Zoo Area in Belle Isle Park

The amenities suggested in the second community workshop were applied to achieve design goals. All six of the goals of history, education, adventure, sustainability, art and retreat were met throughout the use of various amenities on the site as suggested by the community in the second workshop with the proposed design program. Many of the amenities and considerations can be seen numerous locations in multiple ways throughout the project area.







History can be seen through the animal sculptures through the site as well as maintaining the architectural integrity of the iconic building style. *Educational* signage is posted throughout the site and in all the various garden styles and sustainable features. Additionally, an outdoor classroom as well as a team building activity low ropes course are proposed for potential school field trips. *Adventure* awaits at every turn from the grand entrance to the above ground treetop walk as well as ground level nature walk. Recreational rentals were also proposed in the buildings. *Sustainability* was met by placing many different garden styles and habitat restoration which are native and beneficial to a variety of creatures. Additionally, the parking lots near the old zoo area were completely redeveloped to offer help with flooding mitigation and stormwater management through geotextile permeable pavement, raingardens, and increased vegetation. Lastly, the important wet-mesic flatwood habitat will be maintained and expanded wherever possible. There are opportunities to display *art* in buildings and the placement of animal sculptures throughout. To preserve the street art history of the project area and to incorporate the community into the space, a public art wall is proposed to allow for anyone to come and create art on the wall. *Retreating* into nature can be achieved through the multiple types of pathways through the dense vegetation proposed as well as open green spaces to gather in.

To enhance the overall environmental quality of the project area, an array of design features was proposed. The design met the goals and amenities requested by the community while still meeting design standards which benefit landscape performance metrics such as a variety of native gardens and habitat creation, as seen in Figure 6. Additionally, a retention pond, wetland, geotextile permeable paving, open green space and stormwater control is proposed. These features can be seen in Figure 4 through the pink labels.



Figure 6. Habitat Revitalization and Educational Designs

For socioeconomic aspects, the final design proposal includes many beneficial amenities for the public. Referring to the master plan (Figure 4), the blue and purple labels display amenities for the community. These amenities include job opportunities at the buildings as well as attractions to bring tourism in, increasing economic revenues. Social benefits include gathering spaces, trails, educational opportunities, and interactive opportunities to improve community engagement. The design allows for educational, iconic features, and gathering spaces for the community, like Figure 7, being welcoming to all including ADA accessible treetop ramp in a large welcoming entrance. Additionally, incorporating historic significance through the tribute to Sheba the elephant as well as signage which will educate the visitors about the history of Sheba as well as the park area itself and both of their importance.



Figure 7. Sheba's Entry

4.2 Landscape Performance Findings

After investigating several landscape performance metrics, a number of variables were calculated and concluded, as seen in Tables 3 and 4. These show that the redevelopment will be beneficial to the project area environmentally and socioeconomically. These benefits will in turn benefit the community as well, in addition to meeting the goals and needs that the stakeholders brought up in the community workshops.

4.2.1 Environmental Benefits

Several environmental benefits can come from landscape design choices, eleven were assessed in this study as seen in Table 5. They range from subject matters including habitat preservation and CO_2 sequestration, to runoff and stormwater infiltration. These will aim to show a multitude of viewpoints on how the design proposal will benefit the project area more than the current conditions will.

Table 5.	Environmental	Landscape	Performance	Metrics Findings	

Measurements	Variables	Existing	Master Plan	Benefit
Critical habitat or ecologically valuable land created	Additional area of critical habitat or preserved ecological land created	0 Acres	4.2 Acres	+ 4.2 Acres
Wetlands created	Additional wetland area created	0 Acres	0.6 Acres	+ 0.6 Acres
	Percent of wet days retained	57 Days	72 Days	+ 15 Days
	Maximum amount of stormwater retained	2.28 in	2.56 in	+ 0.28 Inches Retained
	Average annual runoff depth	10 in	6.55 in	- 3.45 Inches
Stormwater retention	Stormwater Retained through retention ponds	0 Gallons	886,315 Gallons	+ 886,315 Gallons

Table 5. (Cont'd)

	Area of greenspace for infiltration	9.65 Acres	10.03 Acres	+ 0.38 Acres
	Amount of stormwater infiltrated from rain gardens	0 in	0.32 in	+ 0.32 Inches
Stormwater infiltration	Amount of infiltration from permeable pavement	0 in	0.78 in	+ 0.78 Inches
Pollutant reduction	Non-point source pollutants reduced from trees	10.4 lb	19.2 lb per Year	+8.8 Pounds
CO ₂ sequestration	Amount of CO ₂ sequestered from trees	2,608 lb	4,797 lb per Year	+ 2,189 Pounds
Runoff avoided	Amount of runoff avoided from trees	6,030 Gallons	11,090 Gallons per Year	+ 5,060 Gallons
Native plantings	Areas where non- invasive native plantings are created or preserved	0 Acres	4.2 Acres	+ 4.2 Acres

Through the analysis of landscape metrics for quantifying environmental benefits seen in Table 5, the design elements implemented were estimated to increase opportunities for environmental health. The benefits include an increase of 4.2 acres of newly developed native plantings to be created and preserved to create critical habitats and preserved ecological lands as compared to a baseline of zero acres on the current site which is infested with invasive species and failing infrastructure. This will allow for ecological benefits through creating a habitat for all forms of wildlife that are not able to thrive in such an urban environment and help keep native plantings and ecosystems thriving. One of these native environments being rejuvenated, is the rare and dwindling wet-mesic flatwoods which is currently on the project area. The new design plan aims to clear out invasive species, insufficient infrastructure, and deteriorated areas and replace them with expanding wet-mesic flatwoods, helping to maintain and regenerate the habitat naturally on the isle and increase native plantings at the same time.

The addition of these habitats, trees, and green spaces will do more than help wildlife and ecosystems. The proposed design solution could mitigate stormwater and help decrease the severe flooding crisis at the project area. The current 10 inches of runoff will be reduced annually to 6.55 inches comparatively with 0.28 more inches retained per rainfall, as well as an increase of 0.38 acres of area able to be infiltrated from greenspaces. This increase in infiltration and reduction in runoff will help to reduce flooding as well as decrease pollution in waterways.

Increasing the green environment area will furthermore help to mitigate pollution and air quality. This is something which is drastically important for urban areas as they continue to sprawl, grow in development, and populate. CO₂ levels are increasing as urbanization increases, adding greenspaces and trees is something which will mitigate this by sequestering CO₂. Major trees being added to the planting scheme will sequester an additional 2,189 pounds of CO₂ per year. As well as this, the trees in the area would reduce the pollutants in the air by 8.8 pounds and runoff by 5,060 gallons annually compared to the current area. Trees will be very beneficial to the project area and have multiple benefits to the environment, human health, and habitats generated.

The parking lot redevelopment, as seen in Figure 8, is essential to control the flooding occurring within the project area. Flooding is a major problem that would likely lead to

inhibiting the number of visitors who may experience the beneficial space. To assist in reducing the amount of impervious space within the project area, pervious geotextile pavement is proposed. This design approach will absorb about 0.78 inches of stormwater compared to the 0 inches that impervious pavement collects currently. In addition to the improvement in pavement type, the parking lot islands will be converted into raingardens. These raingardens will increase the amount of absorption by an added on 0.32 inches retained. This combination aims to capture and control as much flooding water as possible in these problem areas.



Figure 8. Sustainable Parking Lot Redevelopment

One of the design considerations of creating habitats is a retention pond, displayed in Figure 9. This pond will support wildlife habitats and educate the public about sustainability.

Despite being visually pleasing, it will mainly help to mitigate stormwater and reduce flooding by holding 886,315 gallons of water.



Figure 9. Treetop Walkway Over Stormwater Management Ecosystem

4.2.2 Socioeconomic Benefits

Twelve Socioeconomic benefits on the site were analyzed (Table 6). These aim to see if the proposed master plan has a larger benefit than the existing site in terms of socioeconomic statuses. Numerous factors benefit the society and community which will attend the park. Additionally, many will benefit the economy as well.

Measurements	Variables	Benefit
Capacity of gathering space	Area of proposed gathering space divided by space for each guest	+ 9,944 People Able to Gather
Safety enhancement	Number of pedestrian crosswalks added	+ 2 Crosswalks
Educational opportunities	Areas where educational opportunities can be utilized and signage/education areas present	+ 11 Educational Opportunities
New sidewalks	Length of new sidewalks added	+ 1,400 Linear Feet
Community gathering space	Area of community gathering spaces added	+ 2.5 Acres
Trails and boardwalks	Length of trails and boardwalks added	+ 4,285 Linear Feet
Open space	Area of open space added	+ 2.5 Acres
Recreational areas	Area of recreational space added	+ 0.5 Acres
Increased parking opportunities	Amount of added parking	+ 60 Spaces
Increases accessibility	Amount of added ADA features	+ 3 Main Features
Increased scenic space and access to vegetated surroundings	Area of scenic and vegetative surroundings	+ 1,400 Linear Feet
Job creation	Number of jobs created from businesses proposed in the design	+ 8 Jobs
Community engagement processes	Number of community participation workshops held	+ 2 Engagements

Table 6. Socioeconomic Landscape Performance Metrics Findings

All 12 benefits which were researched were seen to be more beneficial under the new design. The amount of open area was increased by 2.5 acres compared to the area currently, and this in turn would allow for 9,944 carrying capacity of people' space to gather. One of the main attractions for societal benefits is an increase in trails allowing for more recreational health benefits in the green space, with 4,285 linear feet of added trails, anyone in the community will be able to enjoy and benefit from the study area. There is not only increased parking allowing for a larger amount of people to attend the attraction and benefit Detroit

socially and economically, but also an increase in securing safety with new sidewalks and two additional cross walks, in contrast to the lack of any within the current system in place. The new design has a surplus of benefits for socioeconomic standards in the city of Detroit.

Open space plazas with local interactive areas, as seen in Figure 10, will give the community opportunities to gather while still having most of the site being dedicated to natural features. The area can be used as a gathering space, as a community area to express art, and opportunities for concessions, help desks, and economic benefits through the building availability. The plaza incorporated hardscape as well as green space to be the most beneficial possible for both human use and the environment.



Figure 10. Mixed-Use Plaza

CHAPTER 5. DISCUSSION AND CONCLUSION

Parks and open green space are vastly beneficial to humans mental and physical health (Bedimo-Rung et al., 2005). This is done by creating a space for recreation, social gathering, and clean air environments. In addition to this, their environmental impacts combat issues such as flooding, and associated water pollution (Sohn et al., 2017; Kim et al., 2017). Lastly, they are often beneficial to the economy through providing job opportunities and bringing people into the area as an attraction. With these many benefits, it is even more important to have green spaces in urban areas. This is due to the limit of accessibility and lack of opportunities for green areas (Grimmond, 2007).

Incorporating community engagement into the design process enhances and improves the design by making it what the community needs to better itself (Maginn, 2007). The community can engage with designers to express where they need to see improvements in their daily life. The citizens will benefit more from and find greater enjoyment from spaces in which they had a voice in creating, rather than being told by outsiders, which often leads to rejection (Barnes & Schmitz, 2016).

The results of this study came in multiple forms and were all found to be successful. Firstly, it was researched to find what the community wanted to see in their city to best serve them. This study used the community engagement as a key tool to discover what the community needed and wanted, and to envision what the future development of the study area could be. Throughout this study, two community engagement workshops were conducted to find out what the associated stakeholders goals for the development of the island were, as well as what amenities and considerations would help achieve those goals. These workshops

were successful in doing just that. The first public meeting encompassed a design workshop aimed to discover concise goals that the public had for the abandoned old zoo area on Belle Isle. Six goals were discovered through this open conversation. The second public meeting aimed to look deeper into each goal individually through the use of visualization, case studies, and mapping. Specific desires from an array of people were represented. Six goals and over a hundred design considerations were found from this research and gone on to be assessed.

Following the community engagement design workshops, a master plan for the study area was produced to adopt these goals and considerations with a wide spectrum of design features to improve upon the current problems on the site. The results produced a plan which incorporated all the goals onto the site successfully. The opportunities on Belle Isle in the old zoo area are abundant. Thus, every goal was met that the community requested. Each goal was achieved through the implementation of multiple amenities which the stakeholders suggested and encouraged. These were able to be displayed in a cohesive design which flows through the site filling it with education and appreciation of the land used.

Finally, the design proposal was assessed to find a quantitative value of its features using landscape performance metrics. The existing site was compared to the design proposal and assessed using landscape performance metrics. The metrics found that in numerous ways the design proposal would be beneficial to the environment and socioeconomic factors of the future development in comparison to the current site conditions. The metrics showed that the design proposal would be wildly successful, and each factor increased the benefit of the design features. It was concluded that stormwater runoff would be reduced, and a larger amount of CO₂ would be sequestered, while community gathering spaces, educational opportunities, and

native plantings would be increased. The study concludes that community engagement in design is incredibly important while still allowing for beneficial design features to be implemented by designers.

The limitation of this study is that only one site was analyzed. The data could be stronger if multiple sites and communities were evaluated. Another limitation is that this research was a simulation, meaning it was not actually implemented on the site to analyze the actual results. Despite these limitations, the results of this study will help future planners realize the importance of community engagement in design and be more open to using these techniques. If more future developments utilize community engagement, then communities themselves will continue to improve and benefit from it. The performance data shows that developments can support the community while still being cohesive designs which encompass sustainable practices. REFERENCES

REFERENCES

Abbey-Lambertz, K. (2017). Forgotten In Time: Detroit's Abandoned Belle Isle Zoo. HuffPost.

- Allnutt, B. (2020). How has flooding impacted Belle Isle's 'imperiled' Wet-Mesic Flatwoods forest? *Planet Detroit.*
- Attree, P., French, B., Milton, B., Povall, S., Whitehead, M., & Popay, J. (2011). The experience of community engagement for individuals: a rapid review of evidence. *Health & social care in the community*, *19*(3), 250-260.
- Barnes, M., & Schmitz, P. (2016). Community engagement matters (now more than ever). *Stanford Social Innovation Review*, *14*(2), 32-39.
- Bedimo-Rung, A. L., Mowen, A. J., & Cohen, D. A. (2005). The significance of parks to physical activity and public health: a conceptual model. *American journal of preventive medicine*, *28*(2), 159-168.
- Canfield, J., & Yang, B. (2014). Reflections on developing landscape performance case studies. *Landscape Research Record*, *1*, 310-317.
- Ciais, P., C. Sabine, G. Bala, L. Bopp, V. Brovkin, J. Canadell, A. Chhabra, R. DeFries, J. Galloway, M. Heimann, C. Jones, C. Le Quéré, R.B. Myneni, S. Piao and P. Thornton, 2013: Carbon and Other Biogeochemical Cycles. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Community Places (2012). Community Planning. Community Planning Toolkit.

Community Places (2014). Community Engagement. Community Planning Toolkit.

DNR. (2010). Belle Isle Park Survey Results.

EPA (2022). National Stormwater Calculator. Retrieved May 7, 2022, from https://swcweb.epa.gov/stormwatercalculator.

Farrell, P.A. (2017). Belle Isle is Michigan's Most Popular State Park. Detroit Free Press.

- Fraser, E. D., Dougill, A. J., Mabee, W. E., Reed, M., & McAlpine, P. (2006). Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. *Journal of environmental management*, 78(2), 114-127.
- Grimmond, S. U. E. (2007). Urbanization and global environmental change: local effects of urban warming. *The Geographical Journal*, *173*(1), 83-88.
- Heskey, E. (n.d.). How to Figure Out the Capacity for Events. EHow.
- Johnson, H., Kovats, S., McGregor, G., Stedman, J., Gibbs, M., & Walton, H. (2005). The impact of the 2003 heat wave on daily mortality in England and Wales and the use of rapid weekly mortality estimates. Eurosurveillance, 10(7), 15-16.
- Kim, J.-H., Gu, D., Sohn, W., Kil, S., Kim, H., and Lee, D. (2016). Neighborhood landscape spatial patterns and land surface temperature: An empirical study on single-family residential area in Austin, Texas. *International Journal of Environmental Research and Public Health*. 13(9), 880.
- Kim, H. W., Kim, J. H., Li, W., Yang, P., & Cao, Y. (2017). Exploring the impact of green space health on runoff reduction using NDVI. *Urban Forestry & Urban Greening*, *28*, 81-87.
- Kim, Y., Lee. C., and Kim, J.-H. (2018). Sidewalk vegetation and thermal conditions for child and adult pedestrians. *International Journal of Environmental Research and Public Health*. 15(1), 148.
- Kim, J.-H., Lee, C., Olvera, N., and Ellis, C.D. (2014). The role of landscape spatial patterns on obesity in Hispanic children residing inner-city neighborhoods. *Journal of Physical Activity and Health.* 11(8), 1449~1457.
- Kim, J. H., Li, W., Newman, G., Kil, S. H., & Park, S. Y. (2018). The influence of urban landscape spatial patterns on single-family housing prices. *Environment and Planning B: Urban Analytics and City Science*, 45(1), 26-43.
- Kim, J.-H., Newman, G., Feng, H., Merrill, J., Park, J., and Bian, J. (2017). Sustainable urbanism for a metropolitan corridor: An evidence-based urban design for Park 10 in Houston, Texas. Landscape Architecture Frontiers. 5(5), 96~109.
- Kwon, Y., Lee, D., Kim, J.-H., and Oh, K. (2021). Improving urban thermal environments by analyzing sensible heat flux patterns in zoning districts. *Cities*. 116, 103276.

Landscape Architecture Foundation. (2022). Landscape Performance Series.

- Lee, C., & Moudon, A. V. (2004). Physical activity and environment research in the health field: Implications for urban and transportation planning practice and research. *Journal of planning literature*, 19(2), 147-181.
- Maginn, P. J. (2007). Towards more effective community participation in urban regeneration: The potential of collaborative planning and applied ethnography. *Qualitative research*, 7(1), 25-43.

Michigan State University. (2022). Wet-mesic Flatwoods. Michigan Natural Features Inventory.

- O'Mara-Eves, A., Brunton, G., Oliver, S., Kavanagh, J., Jamal, F., & Thomas, J. (2015). The effectiveness of community engagement in public health interventions for disadvantaged groups: a meta-analysis. *BMC public health*, *15*(1), 1-23.
- Park, J., Kim, J.-H., Lee, D., Park, C*, and Jeong, S. (2017). The influence of small green space type and structure at the street level on urban heat island mitigation. *Urban Forestry and Urban Greening*. 21, 203~212.
- Park, J., Kim, J. H., Sohn, W., & Lee, D. K. (2021). Urban cooling factors: Do small greenspaces outperform building shade in mitigating urban heat island intensity?. *Urban Forestry & Urban Greening*, *64*, 127256.
- Pearson, A. L., Pfeiffer, K. A., Gardiner, J., Horton, T., Buxton, R. T., Hunter, R. F., ... & McDade, T. (2020). Study of active neighborhoods in Detroit (StAND): study protocol for a natural experiment evaluating the health benefits of ecological restoration of parks. *BMC public health*, 20(1), 1-14.
- Räsänen, J. V., Holopainen, T., Joutsensaari, J., Ndam, C., Pasanen, P., Rinnan, Å., & Kivimäenpää, M. (2013). Effects of species-specific leaf characteristics and reduced water availability on fine particle capture efficiency of trees. *Environmental pollution*, 183, 64-70.
- Rock, M. J., Degeling, C., Graham, T. M., Toohey, A. M., Rault, D., & McCormack, G. R. (2016).
 Public engagement and community participation in governing urban parks: A case study in changing and implementing a policy addressing off-leash dogs. *Critical Public Health*, 26(5), 588-601.
- Shanahan, D. F., Bush, R., Gaston, K. J., Lin, B. B., Dean, J., Barber, E., & Fuller, R. A. (2016). Health benefits from nature experiences depend on dose. *Scientific reports*, 6(1), 1-10.
- Shuib, K. B., Hashim, H., & Nasir, N. A. M. (2015). Community participation strategies in planning for urban parks. *Procedia-Social and Behavioral Sciences*, *168*, 311-320.

- Sohn, W., Kim, H., Kim, J.-H., and Li, M.-H. (2020). The capitalized amenity of green infrastructure in single-family housing values: An application of the Spatial Hedonic Pricing Method. *Urban Forestry and Urban Greening*. 49, 126643.
- Sohn, W., Kim, J.-H., and Li, M.-H. (2017). Low impact development for impervious surface connectivity mitigation: Assessment of directly connected impervious areas (DCIA). *Journal of Environmental Planning and Management*. 60(10), 1871~889.
- Sohn, W., Kim, J. H., Li, M. H., & Brown, R. (2019). The influence of climate on the effectiveness of low impact development: A systematic review. *Journal of Environmental Management*, *236*, 365-379.
- Sohn, W., Kim, J.-H., Li, M.-H., Brown, R., and Jaber, F. (2020). How does increasing impervious surfaces affect urban flooding in response to climate variability? *Ecological Indicators*. 118, 106774.
- USDA Forest Service. (2022). MyTree. *i-Tree.* Retrieved May 7, 2022, from https://mytree.itreetools.org.
- World Health Organization. (2014). Burden of Disease from Ambient Air Pollution. Glob. Health Obs. Data.
- Yang S., (2020). Optimizing Revitalization Planning and Design Guidelines for a Shrinking City, Flint, MI.
- Yang, S., Kim, J.-H., Sohn, W., and Kotval-Karamchandani, Z. (2020). Developing a revitalization planning and design guideline for enhancing land use performance of a shrinking city. *Journal of People, Plants, and Environment*. 23(4), 387~398.