OPTIMIZING REVITALIZATION PLANNING AND DESIGN GUIDELINES FOR A SHRINKING CITY, FLINT, MI

By

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ABSTRACT

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Land vacancy is a persistent issue in most urban places in the United States, yet few case studies show how vacant lots are used in practice and the functions they serve in local communities. The purpose of this study is to optimize revitalization planning through an analysis of vacant land redevelopment alternatives and provide a design guideline for the Durant-Tuuri-Mott (DTM) Target Area in the shrinking city of Flint, MI. This study develops design modules in three development scenarios based on their implementation level: 100%, 75%, and 50% development scenarios, which fit different budgets and considers the local context to adopt different design modules. To generate a comprehensive master plan with a balanced distribution of modules, the study also analyzes the surrounding cultural, natural, and built environments and conducts community participant process by collecting residents and stakeholders' opinions. By utilizing landscape performance metrics to quantify the environmental, social, and economic benefits, this study identifies an ideal optimized development scenario with a comprehensive master plan for the reuse and redevelopment of vacant lots across DTM neighborhoods and analyzes the benefits of each redevelopment scenario. Furthermore, this study provides a flexible design method for balancing objectives in vacant land redevelopment, which can be applied in other shrinking cities as well.

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CHAPTER 1. INTRODUCTION

Vacant lots are an issue of concern as a city develops. As a result of urban expansion, an abundance of vacant lots in a city are generated with negative impacts, such as illegal dumping and violent crime, on remaining residents. Consequently, a future revitalization plan for vacant properties is required for neighborhoods (Gu et al., 2019; Newman et al., 2016). The City of Flint has been struggling with several environmental, social and economic challenges over the past decades. It once thrived as the home of the nation's largest General Motors (GM) plant. However, since the 1980s, due to the shrinkage of GM, the city's economy has started to sharply decline from a 1980 high of 159,611 to under 96,000 by 2018 (Scorsone, 2011). Due to the economic downturn, the unemployment rate in Flint has been approximately twice as high as the statewide rate since 2005 (Palmer, n.d.). Recently, the Flint water crisis, tainted drinking water, caused more problems for the city to accelerate population decline (Flint Water Crisis Fast Facts, 2019). One of the most severe issues in Flint today is lot vacancy. With more than 16,000 vacant parcels, 42% of the total parcels in the city are vacant (Worth-Nelson, 2018). Vacant lots would often create places with unwanted vegetation and trash, where activities like hiding illegal guns, inviting illegal activities and violent crime (Garvin et al., 2013). In the process of city expansion, vacant lots cause remaining residents to disconnect from others in the neighborhoods and other thriving areas of the city. Maintenance costs of vacant lots within the area substantially increase when illegal dumping makes the area unsafe. Furthermore, vacant lot redevelopment is a contested issue in many US cities; while residents expect more green space or parks, municipal governments prefer to utilize these lots to generate tax revenue (Pearsall et al., 2014).

With efforts from multiple organizations including the Genesee County Land Bank Authority (GCLBA), the demolitions of abandoned houses in the city have increased from 238 to

6,599 between 2005-2018 (Genesee County Land Bank Authority). After demolishing abandoned structures, there is still work to be done with clean up and maintenance; the clean and green program through the GCLBA exists to keep these properties groomed and kept. It is made up of 63 community groups that maintain 4,100 of these lots every three weeks (Genesee County Land Bank Authority). Illegal dumping, blocked sightlines, and limited access from overgrown vegetation are the biggest threats to safety on-site (2017 Vacant Property Maintenance Plan, n.d.). Existing buildings falling into disrepair, as well as deteriorating sidewalks and roads, are also dangerous.

Current efforts to mitigate vacancy issues have been documented to respond to this challenge by increasing economic, environmental, and social benefits. For example, Clean+Green lot design recommends the least expensive lot design approaches to the existing vacant lots. The design guideline includes improving soil quality and water conservation, discouraging illegal dumping, and creating a kid-friendly, pet-friendly social space through remediation of the lot (*Clean+Green*, n.d.). Placemaking is another way to revive public spaces and create an emotional connection with community members. Outcomes of successful placemaking include enriching quality of life, increasing community sustainability, fostering more excellent connectivity, increasing social capital, and so on (*What Is Placemaking?*, 2017).

The city with the most significant population in Michigan is Detroit. Detroit also faces the same vacancy problems as Flint. According to U.S. Postal Service data, the peak vacancy rate in Detroit once reached 22.8%, while the highest residential vacancy rate was 23.6% in March of 2015 (Mondry, 2019). In recent years, Detroit's market vacancy rate has shown a positive turn with the resurgence of downtown areas. With more companies locating in Detroit, the office vacancy rate continues to decrease, reaching 13.1% in the first quarter of 2019, a drop

of 0.8% (Mondry, 2019), while the residential vacancy rates dropped to 21.34% in 2019. Although the residential vacancy rate from 2018 to September 2019 decreased less than 1 percent, the total number of vacant residential addresses decreased by 2,239 (*Detroit Vacancies Decline Over Long-Term, Slow Uptick Recently in Numbers*, 2019). In order to keep decreasing the number of vacant, abandoned, and deteriorated properties, current strategies include strengthening residential neighborhoods and developing the public space inventory, which supports the city's land-use vision.

To redevelop vacant lots in Detroit, the Detroit Future City (DFC) Field Guide has been applied to encourage residents to improve their community along with partnerships with the city. The guidelines aim to benefit the residents by improving the aesthetic quality of the community as well as providing opportunities for residents to share learning and experiences that empower the community. Moreover, the guideline emphasizes the importance of green infrastructures to create more spaces for people of all ages to play and interact with friends and neighbors. On the aspects of ecology, green stormwater infrastructure such as bioswale, rain gardens, and permeable paving help reduce runoff, lower sewerage system costs, and improve the health of the Great Lakes ecosystem (DFC Field Guide, 2019).

While vacant lots bring negative influence for cities, they also work as opportunities for people to pause, look around, and invest in the environmental characteristics. In Flint, the GCLBA adopted three stages of management plan – maintenance, ripening amenity options, and ecological land use design – to plan the future of vacant lots. During the process, mow-to-own and transfer of occupancy rights programs were applied to enhance a sense of ownership and extend opportunities for legal ownership of property (2017 Vacnt Property Maintenance Plan, 2018).

The primary aims of this research are 1) to create and develop a design guideline to revitalize a declined community by applying a series of design modules for placemaking, and 2) to quantitatively assess design performance with different development scenarios.

This study reviews several successful vacant lot revitalization case studies, as well as reflects future development ideas and demands through community participation processes. This study proposes several design modules concerning the maintenance cost, purpose, and benefits for planners to choose from. The implementation of a successful placemaking plan from the design proposal also provides potential profits and opportunities to future neighborhood development ("Evaluating Landscape Performance: A Guidebook for Metrics and Methods Selection 2018," 2018).

CHAPTER 2. LITERATURE REVIEW

2.1 Declined cities and green space

Vacant urban areas have become a significant and ubiquitous phenomenon in the United States, especially in the Rust Belt region including Illinois, Indiana, Michigan, New Jersey, New York, Ohio, Pennsylvania, and West Virginia (Gu et al., 2019; Park et al., 2017). They are often associated with unmaintained space, filled with trash, and are known as locations where people engage in violent crime and conduct illegal activities. Vacant areas represent a security risk to cities (Garvin et al., 2013). Many cities located in the U.S. Rust Belt are severely impacted by this problem (Gu et al., 2019). Due to reasons like workforce relocation, deindustrialization, and suburban expansion, the number of vacant lots continues to increase between city blocks. Detroit, MI, Cleveland, OH, and Philadelphia, PA, are examples of cities that have experienced a decline of population in the United States. Numerous studies have been conducted on trend of declining city and how to revitalize them, and it has been proven that regional planning can be one of most effective solutions to address the issue of vacant lots in urban areas (Newman et al., 2016).

Since urban vacancy has become a typical problem in recent years, a number of researchers have found several social issues associated with these shrinking cities. One study determined whether urban elasticity has a significant impact on increased urban vacancy by using an exploratory, quasi-experimental longitudinal analysis (Newman et al., 2016). The research compared 40 U.S. cities of over 100,000 persons (top 20 elastic and inelastic based on expansion in size) from 2000 to 2010 and found that a higher rate of urban expansion causes increased urban vacancy, especially in residential land uses. Along with the land-use change in declined cities, population dynamics, household dynamics, and dynamics of residential land use

are also changing. Young singles are more likely to concentrate in the inner part of the city with well-connected public transportation. Elderly couples and families tend to move toward the outer parts or peri-urban parts of the town (Haase et al., 2010). Communities with higher unemployment rates, a higher ratio of owner-occupied housing stock, and higher non-minority populations are likely more vulnerable to increased vacancy (Newman et al., 2016).

Based on these social phenomena, making an efficient plan to revitalize declined cities is an urgent task (Gu et al., 2019). Creating a well-designed built environment is an effective way to mitigate the safety problems from vacant lots (J.-H. Kim et al., 2015, 2017). One study in Philadelphia tested whether greening can reduce violent crime (Garvin et al., 2013). Researchers performed greening, including cleaning the lots, planting grass and trees, and building a wooden fence around the perimeter in a randomized controlled trial of vacant lots. Based on the crime data from the Philadelphia Police Department and perception from neighborhood participants, their results indicated that greening could reduce violent crime and increase perceptions of safety.

A number of previous studies have documented the positive impact of green space to the environmental (Park et al., 2017; Sohn et al., 2019), socio-economic (J. H. Kim et al., 2018), and public health (J. H. Kim et al., 2014, 2016) benefits in communities. One study estimating whether greening interventions have an impact on the mental health of community-dwelling adults in Philadelphia demonstrated that for residents living in neighborhoods below the poverty line, the greening intervention led to a significant decrease in feeling depressed (South et al., 2018). Also, Pearsall, Lucas and Lenhardt (2014) highlighted the importance of green space for future community development, using vacant lots and a spatial analytical model to document the conversion of existing vacant lots to green space. For their final model, they applied percent

green cover, percent impervious cover, population density, median household income, percent minority population, proximity to industrial zones, number of brownfields, and crime rate as variables to balance three competing objectives: residential, commercial, and green space. Depending on this social phenomenon and previous management strategies, we can roughly predict the potential trend of city development and adopt strategies from previous studies.

2.2 Current revitalization planning efforts & design guidelines

As the largest and most populous city in the state of Michigan, Detroit also faces severe decline problems. The Detroit Future City, a nonprofit organization, serves as an independent think tank, policy advocate, and innovation engine. It provides policy implementation strategies in the DFC Strategic Framework, which is a 50-year guide for decision-making by all Detroit stakeholders (DFC Field Guide, 2019). For vacant lots in Detroit, DFC proposes the Field Guide to Working with Lots, which includes 38 landscape designs with step-by-step instructions. These lot designs aim to create profit for the community through stormwater management, mitigating illegal dumping, improving soil quality, and transforming vacant lots into community property. Also, residents can find the design that best fits their budget, maintenance level, and experience by sorting through the designs.

In Flint, MI, the GCLBA takes charge of vacant lots revitalization through transferring the vacant lots to community settings. With the City of Flint, community groups, and residents' support, the development of the city is following the Imagine Flint Master Plan and the Beyond Blight Framework (Genesee County Land Bank Authority, 2019). In order to strengthen the sense of community, eliminate blight, provide assistance to revitalize residential neighborhoods, and maintain green spaces in neighborhoods, 10 programs in Flint were proposed by GCLBA:

Planning and Outreach, Brownfield Redevelopment, Development, Adopt-a-Lot, Clean & Green, Demolition, Housing Renovation, Sales, Side Lot Transfers and Foreclosure Prevention (Jessics O'Neal Hill, 2009). The Planning and Outreach program allows key members of the public to be involved in the redevelopment plans. The Adopt-a-Lot and Clean & Green program seeks to involve communities and encourage residents to upkeep Land Bank owned land. The Side Lot Transfer program encourages people to buy and maintain the land as their yard with a small fee. Brownfield Redevelopment and Development program aims to develop the city with Smart Growth Principles and increase tax roll from the property. Then, the demolition program helps clean up decayed structures, increase visibility and safety, and decrease the crime rate. Housing renovation aims to speed up the demolition process and build affordable housing for cities, while sales programs propose affordable options for people to purchase housing. Finally, Foreclosure Prevention is set up to postpone foreclosure for one or two years for homeowners with significant financial hardship.

The efforts to revitalize the community are implemented in not only Michigan but in several communities in the Midwest. For example, Youngstown, in OH, is a typical shrinking city in the United States. Its primary industry was steel, with Youngstown housing the third-largest steel producer in the 19th century. Regrettably, the city was blinded by the success of the steel industry and neglected to diversify its economy. With the economic changes in the 1970s, the local industry shut down sequentially, homes and properties became abandoned, and the crime rate reached its peak, so a new revitalization plan was an urgent task for the city. It is worth mentioning that there is only one city publicly proposing the notion of planning for shrinking, and it is Youngstown. The Youngstown 2010 Citywide Plan has been well known nationally and internationally due to its straightforward method which looks to make

Youngstown a better, smaller city and defines its role in the new regional economy. The plan was applied by consolidating and reducing residential land uses, separating land uses, and increasing parks an open space. As a result, in 2017, the vacancy rate for Youngstown Ohio was 4.13%, which is 2.05% lower than the U.S average (*Youngstown Ohio Residential Rent and Rental Statistics*, n.d.). Besides the Youngstown 2010 planning, there was a new vision for land use strengthening institutional, residential, industrial and business uses while simultaneously growing green space, agriculture, and open space use within the city. Comparing the vacant land map and the future land use map, numerous vacant lots have been transferred to green space, agriculture, and open space uses or held for Industrial "Green" uses (Jessics O'Neal Hill, 2009). Now, due to the success of revitalizing plans in Youngstown, Ohio, it has become a model for other declined cities.

2.3 Landscape performance research

Landscape performance research has been widely applied to quantify the performance of built landscape projects. It is a method to offer evidence for the success of landscape solutions. In the past ten years, the Landscape Architecture Foundation (LAF) has produced over 150 case studies with faculty-student research teams, designers, and clients. They normally focus on documenting the environmental, social, and economic benefits of high-performing landscape projects. Based on these performance measures and evaluation of built projects, designers can increase their knowledge, innovate, and elevate the quality of designed landscapes. Also, validating and utilizing landscape solutions leads to more effective management, better future designs and helps fill the knowledge gap about the value of landscape solutions in the fields of policy design and development (Evaluating Landscape Performance: A Guidebook for Metrics

and Methods Selection 2018, 2018). Within landscape research, measurements, such as water conservation, air quality and carbon sequestration can be directly relevant to vacant lot revitalization.

CHAPTER 3. METHODOLOGY

3.1 Study area

Located at the edge of downtown, the DTM Target Area is a 161.4-acre neighborhood with over 30% vacant lots in Flint, MI (See Figure1 and Figure 2). Flint's rapid early expansion benefited from its water proximity and highway network, making it easy to get to and from the area by car. In the surrounding neighborhoods including Kettering University and Hurley hospital as major stakeholders within DTM who own some of vacant parcels and land on site, the current site condition represents severe issues related to neighborhood vacancy. However, the target area has some potential to be redeveloped with large amounts of existing open space, a good location and accessibility, passionate residents and local organization groups who are willing to participate in the community revitalization plan in the future.

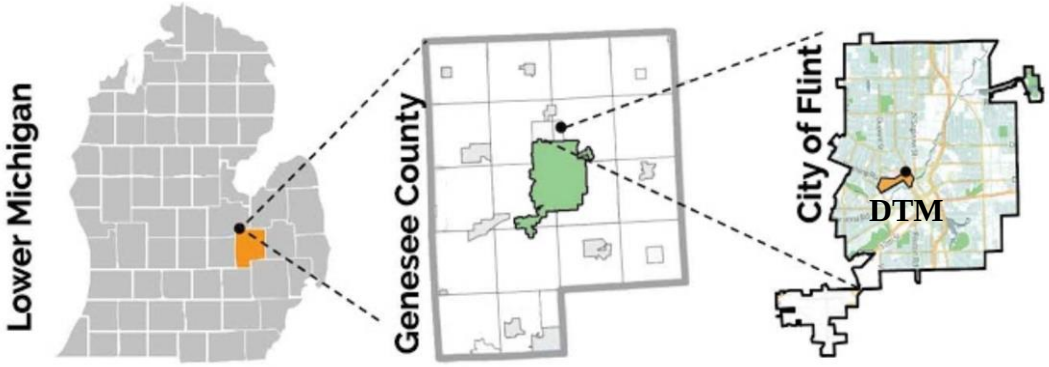

Figure 1 Location of Study Area

Figure 2 Existing Site Condition (a. open green space in neighborhood; b. dilapidated structure in a vacant lot) Copyright © Jun-Hyun Kim

3.1.1. Flint History

In the 20thcentury, the median income in Flint had once achieved the rank of best in the state due to General Motors (GM). However, today, according to new U.S. Census data, there are about 43,000 people living in poverty, representing almost half of the population in the city of Flint. Demolition of the factories as well as the moving of employees to other factories and plants around the state and country were the main reasons of population decrease from the 1980s. In 1950, nearly 90 percent of Flint's earnings were from local GM products. Based on the data from MLive-The Flint Journal archives, the population in Flint boomed from 13,000 to over 156,000 between 1900 and 1930, and in the 1960s the population kept increasing and peaked at approximately 200,000 which led to issues of overcrowding of land and housing. Nevertheless, in the 1970s, the city started spending federal and local funds buying property and moving people and businesses from the St. John Street neighborhood to build an industrial park and Interstate 475. This strategy is one of the facts leading to residents' decrease in Flint.

3.1.2. Vacancy Trends in Flint, MI

Increasing vacancy is currently one of the biggest challenges in Flint, MI. According to the statistics from the GCLBA, the completed demolition from 2001 to 2018 totaled 6,599 properties. By 2017, there were approximately 24,000 vacant properties in Flint which is 42% of the city's property. Meanwhile, demolition also consumes a vast chunk of resources. From 2015-2020, the demolition cost was estimated to be 71.88 million dollars in Flint, MI (2017 Vacant Property Maintenance Plan, n.d.). Since most vacant lots are private property and property owners are accustomed to abandoning property maintenance, residents, institutions, and the local government have to bear the burden of responsibility to mitigate vacancy in Flint.

3.1.3. Social Demographic Status

According to the report provided by the GCLBA, the current population in the DTM neighborhood is 938. The median age in the DTM neighborhood is 28.3, much younger compared to Flint's median age 39.8. However, the median household income in the DTM neighborhood is $25,000 which is a little lower than the city level of $26,901, and the unemployment rate reaches up to 19%, which is nearly four times higher than Michigan's. Only 14% of DTM residents have obtained Bachelor's, Graduate or Professor degrees, with 24% of residents without a high school diploma.

3.2 Existing context of the study area

Vacant lots take up over 30% of land in the study area. The rest of the site is mainly multi-family (25%), education (16%) and single family (11.82%) (Genesee County Land Bank Authority). The large vacancy rate disconnects the neighborhood causing the neighborhood to

lose a sense of community. A large number of vacant lots also lead to problems which increases the risk of the neighborhood's exposure to crime and other illegal activities.

The DTM neighborhood is surrounded by three main streets: Flushing Rd, W 5thAve on the north, University Ave on the south, N Chevrolet Ave on the West and Martin Luther King Avenue on the East. Among them, Martin Luther King Avenue is one of the main arterial roads connecting to the hub of the city. The University Ave features good maintenance and aesthetics, connecting Kettering University and the University of Michigan. Based on the data from the traffic count map, Flushing Rd has the most vehicles passing per day (approximately 15,000-20900), since it goes through several residential communities on the Northwest part of the city. On the east margin of the site, Interstate 475 (I-475) is another main access road for our site. I-475 goes through cities including Detroit, Ann Arbor, and Lansing. It has been proposed to have an extension to US23 in the southern part of Genesee County, in the future (Fonger, 2009).

In site, an existing bike trail and bus routes mostly provide access into the surrounding universities, neighborhood and downtown. A connected sidewalk network and different street hierarchies exists. Overall, sidewalks are in decent conditions with the linear squared off and traditional city planned look. However, no pruning plants and lack of maintenance make the sidewalks in the neighborhood unwalkable, especially for the elderly and disabled (See Figure 3).

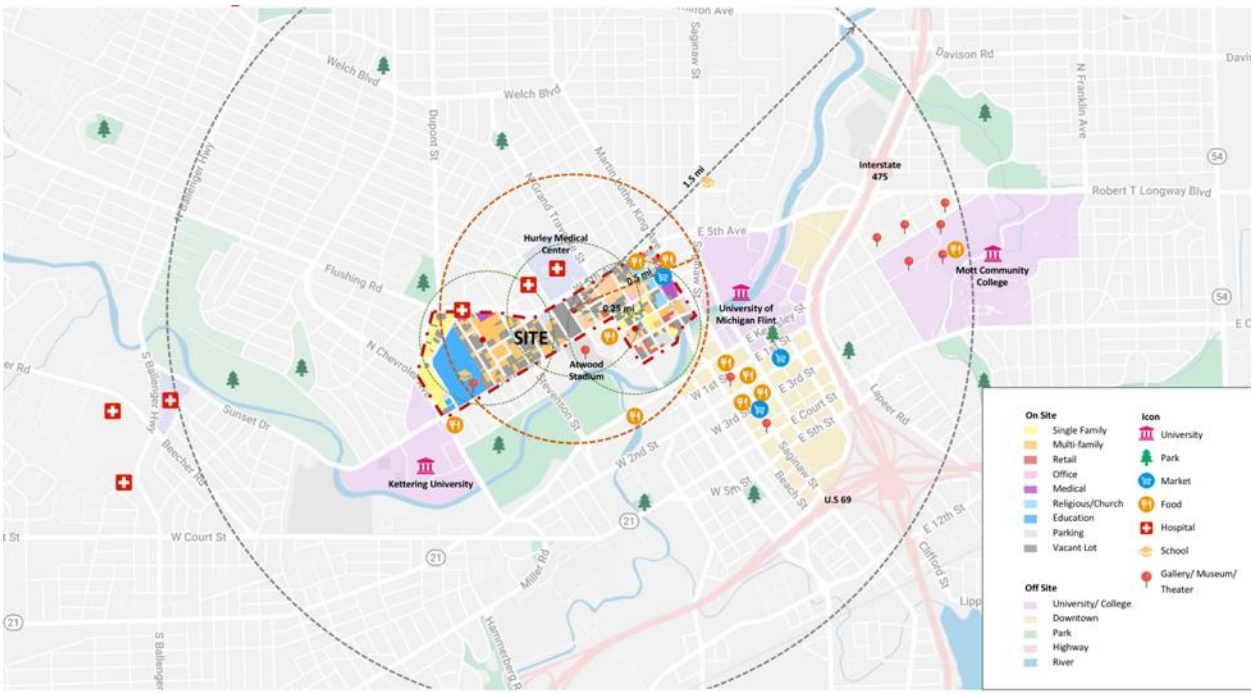

Figure 3 Proximity Map Copyright © Shu Yang

3.3 Design guideline development process

3.3.1. Conceptual Framework

To conduct this study, seven steps have been involved in the decision-making process to develop the final master plan. Then several landscape metrics have been applied to quantify benefits of the design proposal focusing on environmental, social, and economic.

3.3.2. Site inventory and initial meeting

To learn more about local culture and site details, an initial meeting with officers in the GCLBA was held in September 2019. After giving a brief introduction about the site context, the officers identified 6 major concentration areas, and the current demands and initial ideas for future development based on the surrounding land use (See Figure 4). Generally, the concentration areas were usable green space located in the place with potential opportunities to

develop. Since the neighborhood is closed to downtown, street amenities and infrastructure are well completed in main streets. However, illegal dumping, unmaintained plants and limited walkability are found as major issues across the neighborhood. Large amount of undeveloped open space disconnects the residents with each other. Overall, the city road system and amenities are relatively comprehensive. Undeveloped open space offers a significant opportunity to revitalize in the future.

Figure 4 SWOT Analysis Copyright © Shu Yang

3.3.3. Design Goals and Objectives

Based on the first community meeting and site analysis, this project has set four major goals (See Figure 5):

1. Revitalization – identify site positioning and optimize the potential value of vacant lots to improve surrounding residents' life quality. To achieve this goal, the final design is developed by reviewing Flint's social context and analyzing the existing land use. With developing more commercial space and points of interest, customers and visitors can stimulate local economic

development. For residents, diverse amenities will be provided in the public space to encourage outdoor activities. Affordable housing will be considered in the development process to attract a variety of demographics, especially young people who can make efforts for promoting social progress.

2. Placemaking – explore the features of existing conditions, try to maximize its function for surrounding residents with promoting social engagement, health, safety, and enhancing a sense of the site. The existing architecture features in the Carriage Town District can be applied in the development to emphasize the local community feature. Public space at different scales will fit multigenerational population groups. To ensure community members' well-being, the design aims to enhance safety and health of public space by increasing safety features, strengthening safety partnerships and improving accessibility of activated green space.

3. Connectivity – fill the gap caused by vacant parcels, increase the connectivity of space at both the site and city level. Due to the vacant lots, remaining residents are disconnected with others remaining in the neighborhoods and in other thriving areas in Flint. Providing diverse transit modes for citizens will help to mitigate the disconnection. Walking, as a common transit mode, should be promoted by providing diverse neighborhood context, improving sidewalk safety and visual accessibility, consequently maintaining existing sidewalks and proposing new sidewalks. Also, to increase the social connection between residents, various design modules including community garden, playground, plaza, event space, healing garden, sitting area and pollinator garden can be applied in creating new public open spaces.

4. Sustainability – promote sustainable development including ecological, social and economic perspectives. To achieve the sustainability goal, the final design considers environmentally

responsible design and provides a livable environment for the next generations by applying environmentally responsive design practices such as rain gardens, bioswale and permeable paving. Also, diverse native plants proposed in the final design will not only help improve the sense of place but also enhance aesthetic quality.

Figure 5 Design Goals and Objectives Copyright © Shu Yang

3.3.4. Proposed Design Elements

Specific design elements have been proposed to achieve each goal (See Figure 6). Seating, public space, street trees, shade structure, art, and attracting retailers to stimulate the economy were implemented to revitalize the community. Elements of placemaking include a community garden, playground, games, pet amenities, food truck, plaza, event space, and an outdoor gym. The communities' connectivity will be significantly increased with more lighting, added signage, sidewalk, traffic calming, and increased bike use. Also, to promote sustainability,

native plants, rain garden, waste management, permeable paving, bioswale, and bee boxes will be applied.

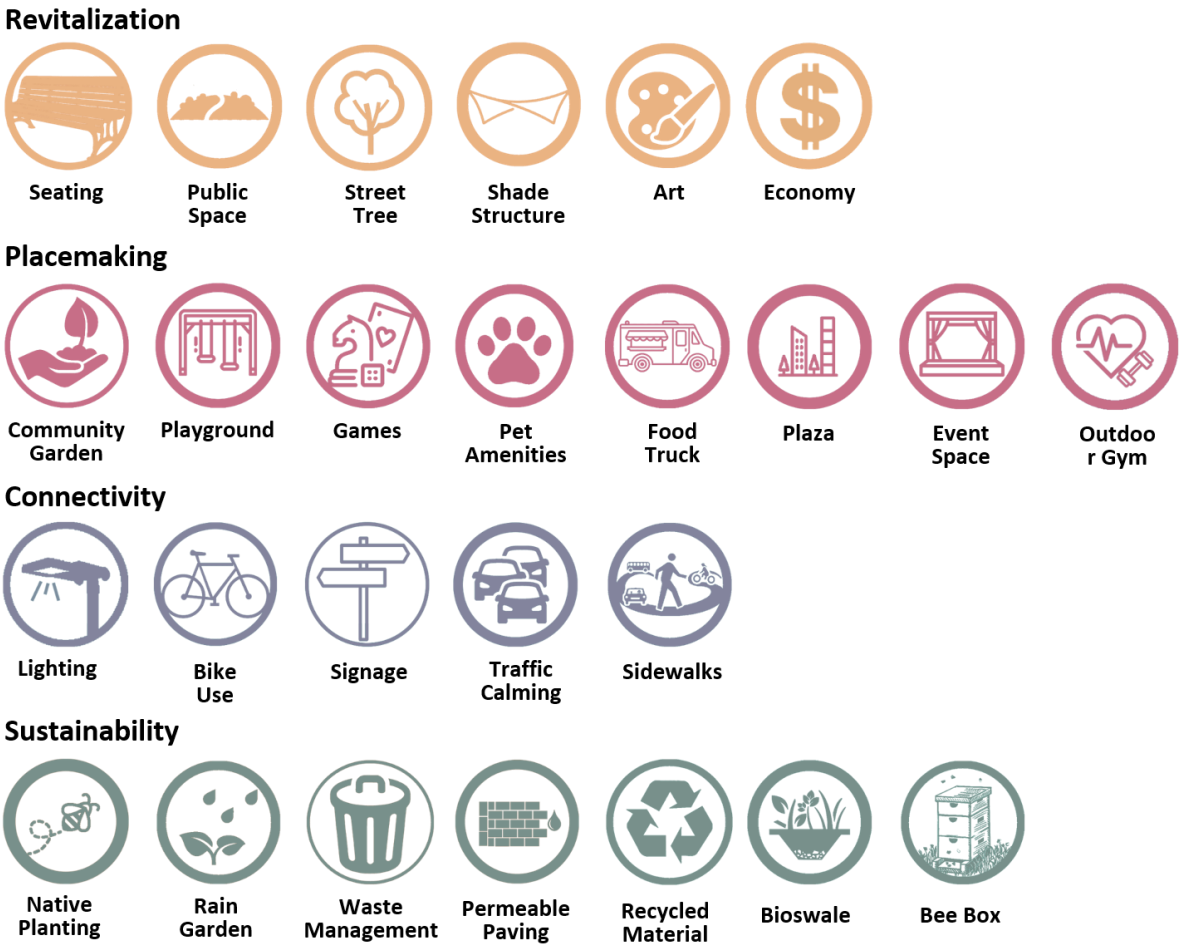

Figure 6 Design Elements Copyright © Shu Yang

3.3.5. Design Guideline

This project develops a series of design modules for three themes referred to vacant lot revitalization (Tables 1 and Table 2). Since the site has a large number of vacant lots (40 acres), it is almost impossible to design each parcel. To improve design efficiency, the site is divided into three themes based on land use: single-family residential areas, public open spaces, and

mixed-use developments. For each module, there are two phases showing the site status in different periods. The first phase focuses on applying the cost-effect or tactical urbanism approach, which includes site cleaning and affordable fundamental amenities. The purpose of the first phase is to test if the module functions fit the site. Once the proposed idea for each site in phase one gathers community consensus to develop the site permanently, the site enters the second phase. In this phase, the design looks to enhance the sense of place and ownership to manage the site by promoting social interaction through community gatherings or events. More amenities will be added, such as shade structure and permeable pavement. However, if the site does not pass the first phase of the module, new ideas must be explored.

Table 1 Design modules for Theme #1 Enhancing Vacant Lots in Residential Areas

Design Module	Description	Design Module Proposal	
		Phase 1	Phase 2
Healing Garden	Healing garden functions as a place for people to reduce stress levels with live plants and a maze path. With native plantings to enhance health and recovery, the garden also provides community members with easy access to live plants and nature (Figure 11).		
Pollinator Garden	Pollinator garden features a native plant display with habitats for endangered species-pollinators. Stamp Stools are all recycled from the demolition wastes. In order to give community members an educational opportunity, signage, including knowledge about both pollinators and native plants, are applied in the garden (Figure 8).		
Sitting Area	The sitting area with an outdoor library provides people a stopping point to have a rest, especially for the elderly. The outdoor library also offers community members a free educational chance to enhance personal quality and share their ideas and books.		

Table 1 (cont'd)

Community Garden	Community garden in the residential area provides fresh food for community members. Raised planters are ideal for people of all ages, especially for the elderly. Shed and pavilions are also applied for convenience. People can make friends and communicate with each other while they are working outside together. Other than a public community garden, the residential community garden is for residents only, which is more private and safer (Figures 9 and 10).		
Playground	Playground in residential area give an activity space for children at all ages, especially for young children. Diverse amenities in playground can not only enhance parent-child relationship, but also increase the interactive between children. Compared to the public playground, it's safer and closer to home for children.		

Table 2 Design modules for Theme #2 Public Open Space Development

Design Modules	Description	Design Module Proposal	
		Phase 1	**Phase 2**
Community Garden	Public community gardens are designed to beautify cities' environments, provide fresh produce for families, and strengthen the connection between neighbors. With plenty of tools and amenities, children gain an educational opportunity while citizens obtain a chance to enjoy healthy outdoor exercise. Compared to the residential community garden, it has more infrastructures, and more people are welcomed.		
Dog Park	The dog park design serves as a gathering spot for pet owners. While the pets are playing, community members can exchange community information and form relationships. The dog park allows pets to play in a safe and comfortable area, which mitigates the damage to private property and the risk of dogs walking on busy streets. Seats in dog parks are all made of materials from demolition, and the pawn pattern hardcovers in dog parks are all permeable pavement. (Figure 12).		
Playground	The playgrounds in the public open space can offer children the opportunity to raise skills, including social, cognitive, emotional, and physical. While children are playing, they interact and share with other children, and during this, they are forming new essential relationships. Public playground fits more children and equips more facilities than the playground in a residential area.		
Sitting Area	The sitting area with an outdoor library provides people a stopping point to have a rest, especially for the elderly. The outdoor library also offers community members a free educational chance to enhance personal quality and share their ideas and books.		

Table 2 (cont'd)

Event Space	Event space is prepared for holidays and events. Paver stone grids along the sidewalk are implemented for food trucks providing food. Game amenities, balloons, and shade structures are also applied for people to have an excellent outdoor experience (Figure 12).		
Pollinator Garden	Pollinator garden features a native plant display with habitats for endangered species-pollinators. Stamp Stools are all recycled from the demolition wastes. In order to give community members an educational opportunity, signage, including knowledge about both pollinators and native plants, are applied in the garden.		

3.3.6. Design Modules

As shown Tables 1 and 2 in the above section, based on site context and ideas from the community, we proposed three design themes: 1) enhancing vacant lots in residential areas, 2) public open space development, and 3) mixed-use development for the community design (see Figure 7). The design for vacant lots in residential areas aims to repair broken connections from the vacant lots, proposing abundant options at different budgets that can fit throughout the residential area. Each of the modules considered residents' demand and its feasibility with detailed design feature (Table 3). Eventually, a healing garden, pollinator garden, sitting area, community garden, and playground modules will be developed in a residential area.

While theme 1 (enhancing vacant lots in a residential area) focuses on small scale vacant lots, theme 2 (public open space development) begins to develop larger-scale vacant lots with more comprehensive amenities for surrounding residents. All modules look to provide services for the community to interact with each other as well as with the environment. Furthermore,

public open space can also create a sense of place and provide education opportunities for residents. Consequently, modules, including a community garden, dog park, playground, sitting area, and event space, are recommended for use in public open space development.

According to the feedback from the community, this study identified three potential mixed-use development sites. This design aims to provide affordable housing options for young families with ample amenities, including plaza, seating, and fitness amenities (Figure 13). In order to improve surrounding residents' life quality and convenience, nearby restaurants and the commercial business, such as grocery stores on the first floor, will provide various commodities (Figures 14 and 15). Moreover, walkability and visibility are also improved by effective maintenance, including pruning plants, cleaning trash, and increasing sidewalk accessibility. Abundant public space, such as plaza and green space, supply residents with the opportunity to have social interactive or enjoy outdoor activities (Figures 16 and 17). After completing all module designs, a master plan with balanced design module distribution is generated (Figure 7).

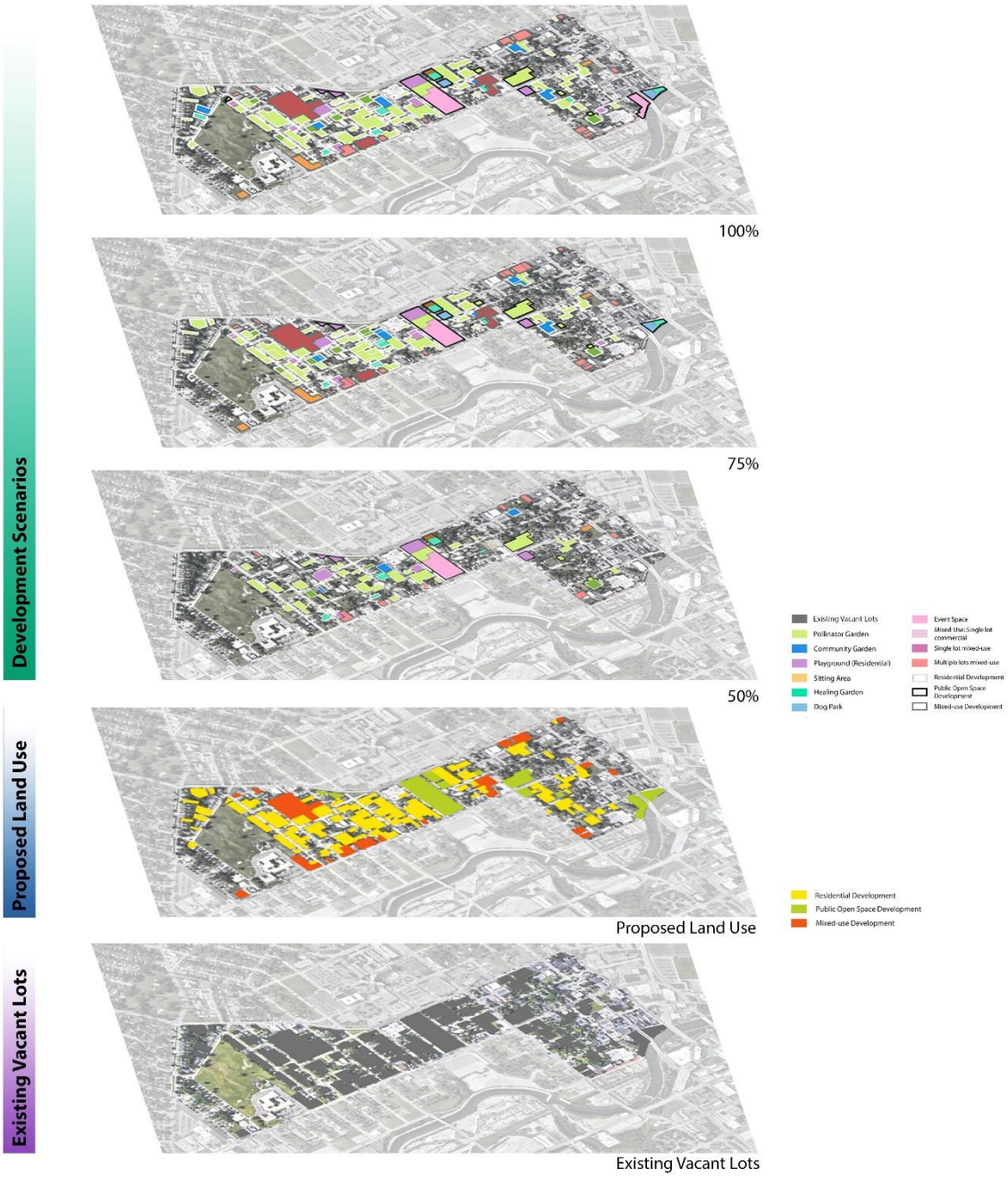

Figure 7 Master Plan and Development Scenarios Copyright © Shu Yang

Table 3 Detailed Design Features in Design Modules

	Size (sq. ft)	Grass (sq. ft)	Bioswale (sq. ft)	Shrub (sq. ft)	Permeable Paving (sq. ft)	Canopy Size (sq. ft)
Community Garden (Public)	10,000 (100%)	2,650 (26.50%)	195 (1.95%)	510 (5.10%)	4,455 (44.55%)	2430 (24.30%)
Community Garden (Residential)	10,000 (100%)	2,345 (23.45%)	300 (3.00%)	4,305 (43.05%)	3,050 (30.50%)	3070 (30.70%)
Dog Park	10,000 (100%)	1,915 (19.15%)	0 (0.00%)	200 (2.00%)	7,000 (70.00%)	0 (0.00%)
Event Space	10,000 (100%)	6,950 (69.5%)	0 (0.00%)	0 (0.00%)	3,050 (30.50%)	3,125 (31.25%)
Healing Garden	10,000 (100%)	5,195 (51.95%)	500 (5.00%)	1,150 (11.50%)	3,900 (39.00%)	3,760 (37.60)
Playground (Public)	10000 (100%)	3,640 (36.40%)	715 (7.15%)	1,960 (19.60%)	2,450 (24.50%)	5,345 (53.45%)
Playground (Residential)	10000 (100%)	2,315 (23.14%)	320 (3.20%)	4,305 (43.05%)	2,960 (29.60%)	3,800 (38.00%)
Pollinator Garden	10,000 (100%)	3,700 (37.00%)	270 (2.70%)	4,875 (48.75%)	1,160 (11.60%)	3,500 (35.00%)
Sitting Area	10,000 (100%)	3,810 (38.10%)	270 (2.70%)	4,566 (45.66%)	1,360 (13.60%)	3,816 (38.16%)

3.3.7. Development Scenarios

To quantify landscape performance benefits, this study projects three development scenarios: 100%, 75%, and 50% site development in regarding to the community's future financial social status and existing site conditions (see Tables 5 and Table 6). In 100% development scenarios the design will develop all the existing vacant lots, while 75% and 50% development scenarios will revitalize sites with priority. 75% development is based on the prediction of the 73.4% of the existing vacant lots will be developed, and the threshold of 50% development scenario is based on the existing vacancy conditions which approximately 46.7% of the existing vacant lots are ready to redevelopment by no abandoned structure on each lot (See Table 4). For example, the vacant lots with green space and without pre-existing structures will be the first priority. However, the lots with abandoned structures, may be revitalized later, as it may cost money to demolish the structure and clean the site. They will be developed, however, once stakeholders are fully funded. Additionally, each theme emphasizes specific functions

serving the local community. For residential themes, 19.5% of the area is devoted to low impact development (LID) practices, including bioswale and permeable paving. For social gatherings, in a 100% development scenario, 80% of the area in the public open space theme is identified as an activity area (space that invites activities such as seating, walking and exercising, including permeable pavement and grass area), while 20% of the area is preserved as scenery areas (a space aesthetics with no access for activities) to improve the aesthetic quality in the community. To accommodate multigenerational population groups, the mixed-use development theme also applies diverse housing types based on affordability.17% of the area is proposed to be filled with duplexes (Figure 17), apartments (Figure 16), and townhouses to support low-income, disabled, and elderly groups in the 100% development scenario.

Table 4 Proposed Developing Area per Development Scenarios

Development Scenarios	**Existing vacant area (sq. ft)**	**Proxy number**	**Theme 1 (sq. ft)**	**Theme 2 (sq. ft)**	**Theme 3 (sq. ft)**
100%	1,932,245	100.0%	1,089,801	420,832	421,612
75%		73.4%	799,913.9	308,890.7	309,463.4
50%		46.7%	508,937.1	196,528.5	196,892.9

Table 5 Development Scenarios for Theme #1 and Theme #2

Theme	Module Applied	Total Area (sq. ft)	Grass (sq. ft)	Bioswale (sq. ft)	Shrub (sq. ft)	Permeable Paving (sq. ft)	Canopy Size (sq. ft)
100%							
Theme #1 Residential	Community Garden	107,951	25,315	3,239	46,473	32,925	33,141
	Healing Garden	71,288	37,034	3,564	8,198	27,802	26,804
	Playground	61,852	14,319	1,979	26,627	18,308	23,504
	Pollinator Garden	761,178	281,636	20,552	371,074	88,297	266,412
	Sitting Area	87,532	33,350	2,363	39,967	11,904	33,402
Theme #2 Public Open Space	Community Garden	9,386	2,487	183	479	4,181	2,281
	Dog Park	34,000	6,511	0	680	23,800	0
	Event Space	158,741	110,325	0	0	48,416	49,607
	Playground	26,977	9,820	1,929	5,287	6,609	14,419
	Pollinator Garden	117,277	43,392	3,166	57,173	13,604	41,047
	Sitting Area	74,451	28,366	2,010	33,994	10,125	28,411
75%							
Theme #1 Residential	Community Garden	80,963	18,986	2,429	34,855	24,694	24,856
	Healing Garden	53,466	27,776	2,673	6,149	20,852	20,103
	Playground	46,389	10,739	1,484	19,970	13,731	17,628
	Pollinator Garden	570,884	211,227	15,414	278,306	66,222	199,809
	Sitting Area	65,649	25,012	1,773	29,975	8,928	25,052
Theme #2 Public Open Space	Community Garden	7,040	1,865	137	359	3,136	1,711
	Dog Park	25,500	4,883	0	510	17,850	0
	Event Space	119,056	82,744	0	0	36,312	37,205
	Playground	20,233	7,365	1,447	3,966	4,957	10,814
	Pollinator Garden	87,958	32,544	2,375	42,879	10,203	30,785
	Sitting Area	55,838	21,274	1,508	25,496	7,594	21,308
50%							
Theme #1 Residential	Community Garden	53,976	12,657	1,619	23,236	16,463	16,570
	Healing Garden	35,644	18,517	1,782	4,099	13,901	13,402
	Playground	30,926	7,159	990	13,314	9,154	11,752
	Pollinator Garden	380,589	140,818	10,276	185,537	44,148	133,206
	Sitting Area	43,766	16,675	1,182	19,984	5,952	16,701
Theme #2 Public Open Space	Community Garden	4,693	1,244	92	239	2,091	1,140
	Dog Park	17,000	3,256	0	340	11,900	0
	Event Space	79,371	55,162	0	0	24,208	24,803
	Playground	13,489	4,910	964	2,644	3,305	7,210
	Pollinator Garden	58,639	21,696	1,583	28,586	6,802	20,523
	Sitting Area	37,226	14,183	1,005	16,997	5,063	14,205

Table 6 Development Scenarios for Theme #3

Theme	Module Applied	Size (sq. ft)	Grass (sq. ft)	Bioswale (sq. ft)	Shrub (sq. ft)	Permeable Paving (sq. ft)		Canopy Size (sq. ft)	Building Area (sq. ft)	
Theme #3 Mixed-use Development	**100%**									
	Single lot mixed-use	61,050	25,056	890	3,816	Asphalt	17,389	8,700	Retail	8,293
						Brick	4,833		Apartment	16,585
	Single lot commercial	118,872	51,511	0	3,962	Wood	3,715	6,191	Retail	17,336
						Concrete	248			
						Asphalt	42,101			
	Multiple lots mixed-use	241,690	72,096	4,700	8,104	Wood	7,857	72,610	Retail	55,414
						Concrete	18,811		Apartment	86,021
						Asphalt	3,332		Garage	136,231
	75%									
	Single lot mixed-use	61,050	27,765	890	2,289	asphalt	17,590	6,639	Retail	8,293
						brick	4,986		Apartment	16,585
	Single lot commercial	118,872	51,511	0	3,962	wood	3,715	4,128	Retail	17,336
						concrete	248			
						asphalt	42,101			
	Multiple lots mixed-use	241,690	109,347	6,255	11,221	brick	6,911	65,246	Retail	34,947
						concrete	432		Apartment	56,525
						asphalt	42,332		garage	99,967
	50%									
	Single lot mixed-use	61,050	27,536	890	2,239	asphalt	17,387	6,639	Retail	8,013
						brick	4,083		apartment	8,013
	Single lot commercial	118,872	51,511	0	3,962	wood	3,715	4,128	Retail	17,336
						concrete	248			
						asphalt	42,101			
	Multiple lots mixed-use	241,690	137,459	4,258	7,857	brick	6,922	48,338	Retail	6,685
						concrete	1,152		Duplex	39,493
						asphalt	6,922			

3.4 Landscape performance measurement

The proposed functional green space analyzed in this section includes all new proposed green space, such as rain gardens, bioswales, tree canopy, grass, and shrubs. I-tree Eco Version 6 (I-tree) was used to calculate the benefits of CO_2 sequestration and air pollution removal (iTree Eco, n.d.). The process of I-tree Eco is designed to quantify urban forest structure and environmental effects, and value to communities using detailed field data from complete inventories or randomly sampled plots. The benefits of stormwater runoff reduction and groundwater recharge were calculated using the National Stormwater Calculator (EPA National Stormwater Calculator, 2019). The gathering space's capacity was determined using personal space design guideline for hosting events (Heskey, n.d.) and the total area of the proposed plaza space in mixed-use modules and the event space area in the public open space theme. The proposed green spaces consist of two main categories including activity and scenery areas. The proposed activity area is defined as the space for inviting activities such as seating, walking and exercising, including permeable pavement and grass areas. The scenery area defines a space purely for offering aesthetics with no access for activities. It is designed with shrubs and bioswale, making the area inaccessible. For social benefits, safety enhancement is based on the spots of the sidewalk proposed to maintain, proposed new sidewalk, and crosswalk. For quantifying economic benefit, community garden profits are calculated by multiplying the production value per the square footage of the planting area by the planting area proposed. In addition, the study measures rental income, increased tax revenue, water conservation, and maintenance reduction. Calculating the income from rental and tax uses the property size multiply rent or tax revenue for each property type. The benefits of water conservation are quantified by the reduced stormwater volume multiplied by the water cost based on the Flint city

water bill. Maintenance reduction is calculated by comparing the maintenance costs between using grass and native plants and multiplying this by the planting area (Table 7).

Table 7 Landscape Performance Metrics

Benefits	Metrics	Needed Data for Measurement	Units	Resources
Environmental				
CO2 sequestration	Reduced amount of CO2	Tree species DBH (in) Land use Height (ft)	lb/year	(USDA Forset Service, 2018)
Air pollution Removal	Cost savings of removing air pollution	Tree species DBH (in) Land use Height (ft)	$/ year	
Stormwater runoff reduction and groundwater recharge increase	Groundwater recharge (infiltration)	Soil type/drainage Topography (slope) Precipitation/ Evaporation Land cover LID controls	in/ year	(EPA, 2019)
	Percent of wet days retained		%	
	Smallest rainfall w/o runoff		in	
	Largest rainfall w/o runoff		in	
	Max rainfall retained		in	
Social				
Gathering space increase	Capacity of gathering space	Area of gathering space (sq.ft) Space for each guest (sq.ft/person)	person	(Heskey, 2020)
	Increased scenery area	Area of scenery area	sq.ft	n/a
	Increased activity area	Area of activity area	sq.ft	n/a
Safety enhancement	Sidewalk maintenance	Length of sidewalk maintained	ft	n/a
	New sidewalk	Length of new sidewalk added	ft	n/a
	Amount of crosswalk added	Amount of pedestrian crossing added	EA	n/a
Economic				
Rental Income	Increased apartment rent income	Apartment area (sf) Apartment rent ($/sf/month)	$/month	(RentCafe, 2020)
	Increased office rent income	Office area (sf) Office rent ($/sf/year)	$/ year	(LoopNet, 2020)
	Increased retail rent income	Retail area (sf) Retail rent ($/sf/year)	$/ year	(LoopNet, 2020)
Community garden profit	Increased profit from community garden	Planting Area (sf) Profit ($/sf)	$	(Landscape Performance Series, 2013)
Increased tax revenue	Tax appraisal value	Retail area (sf) Retail tax revenue ($/sf/year)	$/ year	(Bridge, 2015)
Water conservation	Supply water saving cost	Water saved (gal/year) Water cost ($/gal)	$	(MLive, 2019) (Wisely, 2016)
Maintenance reduction	Maintenance cost savings	Cost maintenance for natural plants ($/ac) Cost maintenance for native plants($/ac) Planting area (ac)	$	(Hahn, 2016)

CHAPTER 4. RESULTS

4.1. Environmental benefits

To estimate environmental benefits, this study quantified stormwater runoff reduction and groundwater recharge increase, CO_2 sequestration, and air pollution removal as categories (see Table 8). The annual CO^2 sequestration showed 25,538.2 lb in 100% development scenario, while it is reduced to 19,153.65 lb and 12,769.1 lb in the 75% and 50% development scenarios respectively. The benefits of annual air pollution removal in 100%, 75% and 50% development scenarios are $3,136.77, $2,352.58 and $1,568.39 respectively. The design proposal represents a significant increase in annual groundwater recharge (3,481 inches in 100% development scenario, 2,610.75 in 75% development scenario, and 1,740.5 in 50% development scenario). The percent of wet days retained are 85%, 63.75%, 42.5% in 100%, 75% and 50% development scenarios, respectively. The maximum rainfall retained in the 100%, 75%, and 50% development scenarios showed 213 in, 159.75 inches, and 106.5 inches.

Table 8 Environmental Benefits

Environmental				
Benefits	**Variables**	**100% Scenario Results**	**75% Scenario Results**	**50% Scenario Results**
CO_2 sequestration	Reduced amount of CO_2	25,538.2 lb/year	19,153.65 lb/year	12,769.1 lb/year
Air pollution Removal	Cost savings of removing air pollution	$3136.77 /year	$2,352.58 /year	$1,568.39/year
Stormwater runoff reduction and groundwater recharge increase	Groundwater recharge (infiltration)	3481 in/year	2610.75 in/year	1740.5 in/year
	Percent of wet days retained	85%	63.75%	42.50%
	Smallest rainfall w/ runoff	29 in	21.75 in	14.5 in
	Largest rainfall w/o runoff	200 in	150 in	100 in
	Max rainfall retained	213 in	159.75 in	106.5 in

Figure 8 Pollinator Garden Copyright © Shu Yang

Figure 9 Community Garden & Sitting Area in Fall Copyright © Shu Yang


Figure 10 Community Garden & Sitting Area in Winter Copyright © Shu Yang

4.2. Social benefits

The social benefits include 6 variables of the benefits (see Table 9). In 100% development scenario, the new gathering space can accommodate 9,356 people in the 100% development scenario and could accommodate 6,704 and 4,635 people in the 75% and 50% scenarios. The proposed scenery area (524,219 sq.ft. in the 100% development scenario, 417,783 in 75% development scenario and 281,317 in 50% development scenario) and activity area (986,414 sq.ft in 100% development scenario, 944,045 sq.ft. in 75% development scenario and 724,432 in 50% development scenario) are both expanded. Based on the existing sidewalk conditions, there are 11,875 ft of existing sidewalks needing maintenance, and 85 crosswalks are added in all three scenarios. The proposed new and existing sidewalks could be expected to bring benefits of enhancing safety and preventing traffic accidents. According to the Measuring the Street report, by increasing traffic calming in East 180th street in New York, there is a 67%

decrease in pedestrian crashes ("Measuring the Street: New Metrics for 21st Century Streets," 2013).

Table 9 Social Benefits

Social				
Benefits	**Variables**	**100% Scenario Results**	**75% Scenario Results**	**50% Scenario Results**
Capacity of gathering space	Capacity of gathering space	9,358 people	6,704 people	4635 people
	Increased scenery area	524,219 sq. ft	417,783 sq. ft	281,317 sq. ft
	Increased activity area	986,414 sq. ft	944,045 sq. ft	724,432 sq. ft
Safety enhancement	Sidewalk maintenance	11,875 ft	11,875 ft	11,875 ft
	New sidewalk	3,250 ft	3,250 ft	3,250 ft
	Amount of crosswalk added	85 EA	85 EA	85 EA

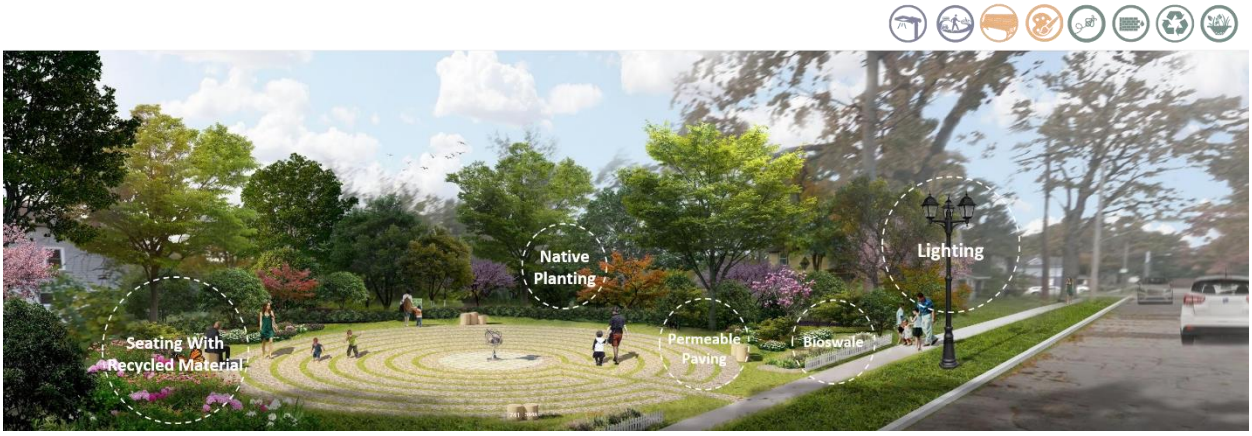

Figure 11 Healing Garden Copyright © Shu Yang

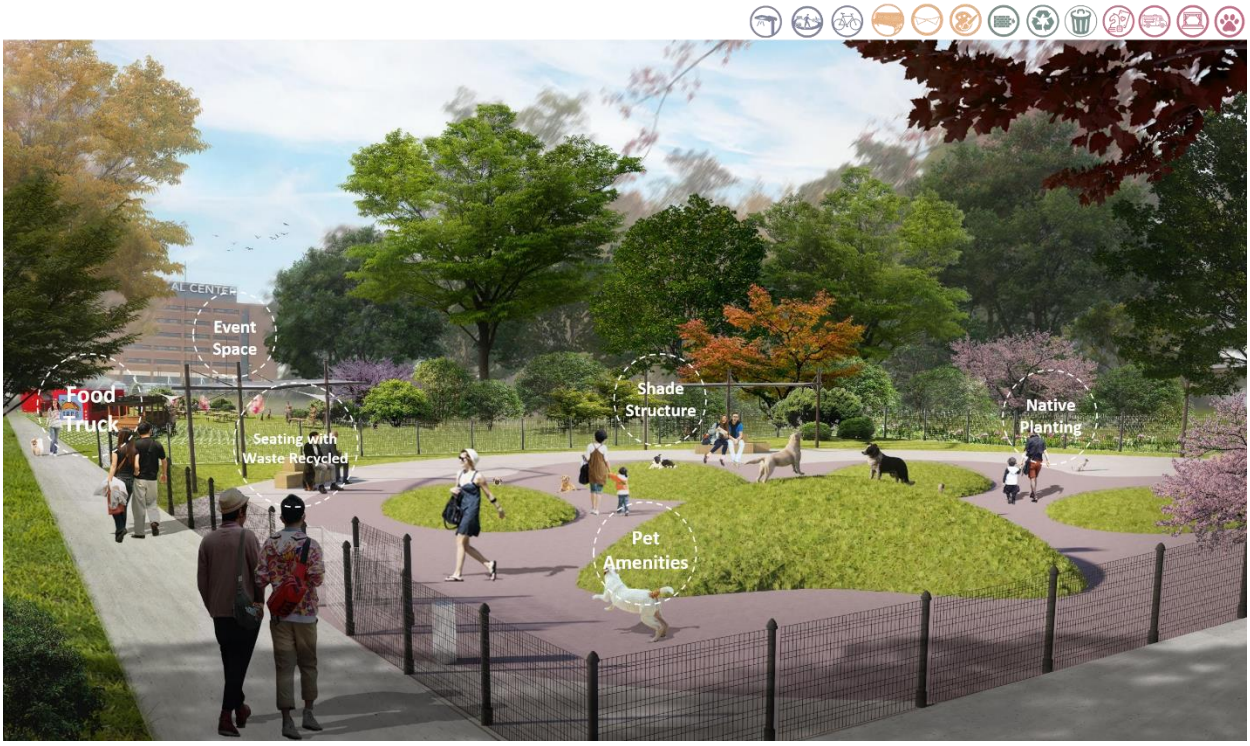

Figure 12 Food Truck & Dog Park Copyright © Shu Yang

4.3. Economic benefits

Calculating the benefits of economic aspects includes rental income, tax revenue increase, water conservation, and maintenance reduction (See Table 10). The result also showed that the design proposal could bring economic benefits from community gardens ($68,038 in 100% development scenario, $51,028 in 75% development scenario, and $34,018 in 50% development scenario). The total income of rents is the sum of apartment rent income, office rental income, and retail rent income. In the 100% development scenario, the apartment rent income reaches $73,223/month, while it reaches $53,370.3/month and $24,679.4/ month in the 75% development scenario and 50% development scenario (Figures 13, 14, 15,16 and 17). Office space is not proposed in the design proposal considering the existing site context and future demands, but the office rent income in the DTM neighborhood is approximately $9.5/sq. ft. /year, which can be used in the future design benefit calculation. Tax revenue from retail

reaches $2,026,050/year in the 100% development scenario, while it reaches $111,054/year and $58,727/year in the 75% and 50% development scenarios. Water conservation helps save $23,536,589/year in the 100% development scenario and can save $19,100,856/year and $14,316,750/year in the 75% and 50% development scenarios. The design proposal indicates that even the 50% development scenario can contribute to saving $35,024 per year in maintenance costs. If the project adopts the 100% development scenario, it can save up to $40,970 per year. Besides, the maintained sidewalks and new proposed crosswalks can save vehicle gas costs and bring health benefits. According to the Economic Value of Walkability report, shifting from driving to walking can save gas costs of 25 cents per vehicle-mile. Under urban-peak conditions, 50 cents per vehicle mile can be saved. In the health aspects, walking can bring $0.48 per mile benefits by reducing hospital costs (Litman, 2008).

Table 10 Economic Benefits

Economic				
Benefits	**Variables**	**100% Scenario Results**	**75% Scenario Results**	**50% Scenario Results**
Rental income	Increased apartment rent income	$73,223/month	$53,370.3/month	$34,679.38/month
	Increased office rent income	N/A	N/A	N/A
	Increased retail rent income	$148,577/month	$111,054/month	$58,727/month
Community garden profit	Increased profit from community garden	$68,038	$51,028	$34,019
Increased tax revenue	Tax appraisal value	$2,026,050/year	$1,514,375/year	$800,825/year
Water conservation	Supply water saving cost	$23,536,589/year	$ 19,100,856 /year	$14,316,750/year
Maintenance reduction	Maintenance cost savings	$40,970	$35,024	$28,370

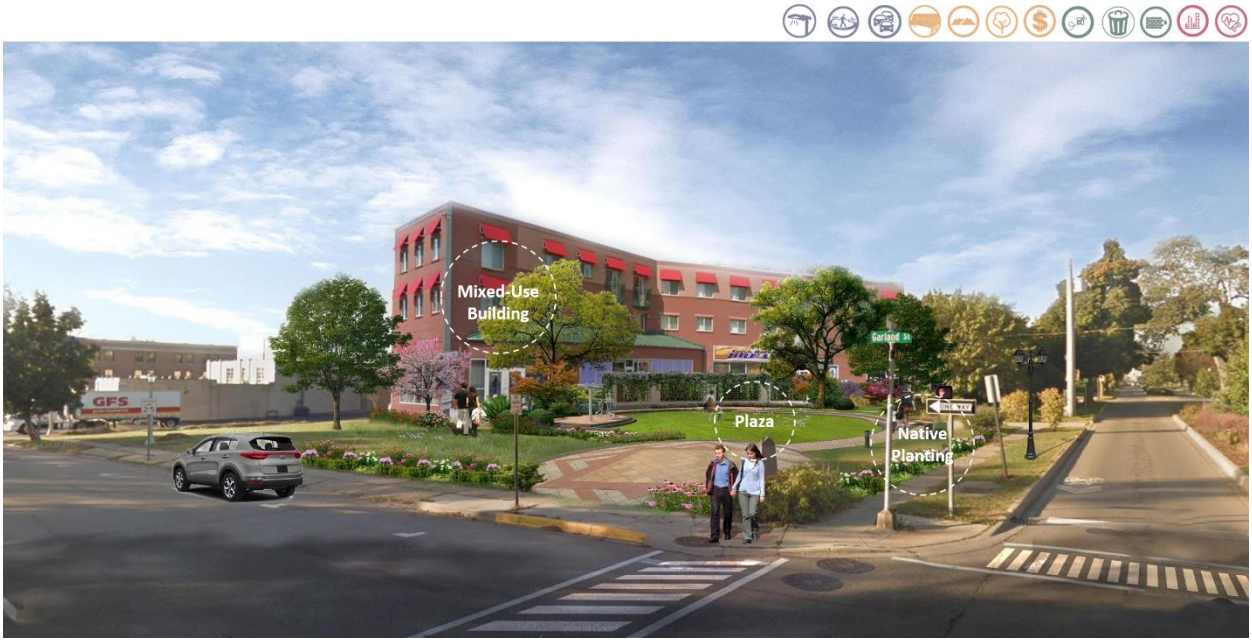

Figure 13 Single Lot Mixed-use in 100% Development Scenario Copyright © Shu Yang

Figure 14 Single Lot Mixed-use in 50% Development Scenarios Copyright © Shu Yang

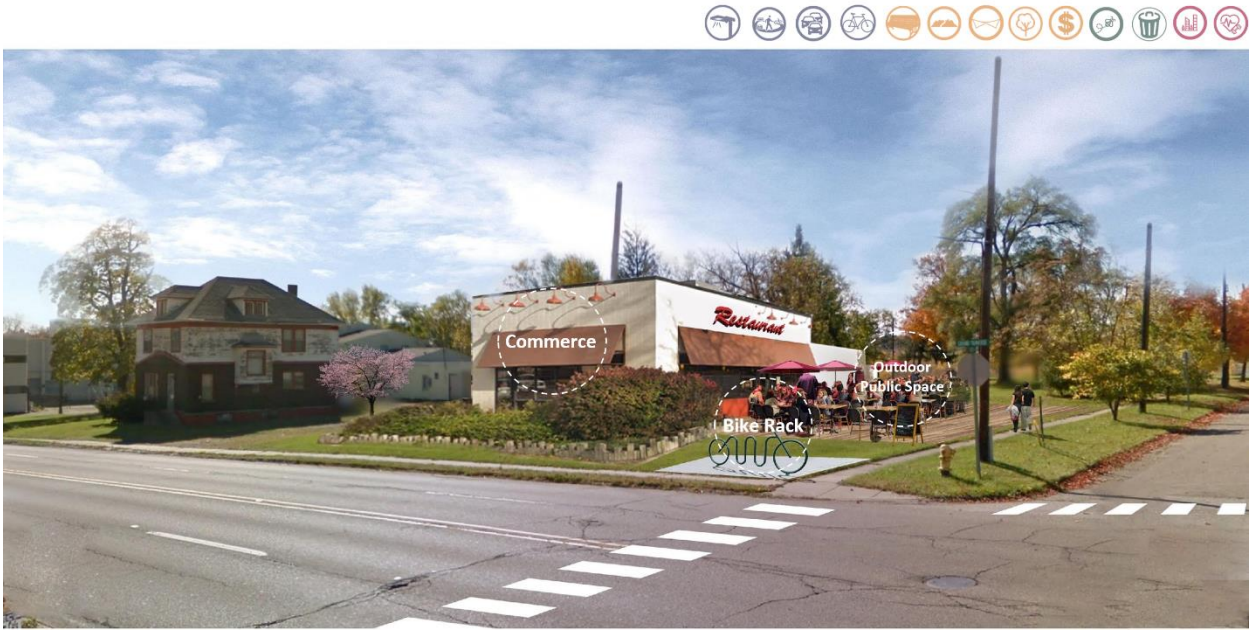

Figure 15 Single Lot Commercial Copyright © Shu Yang

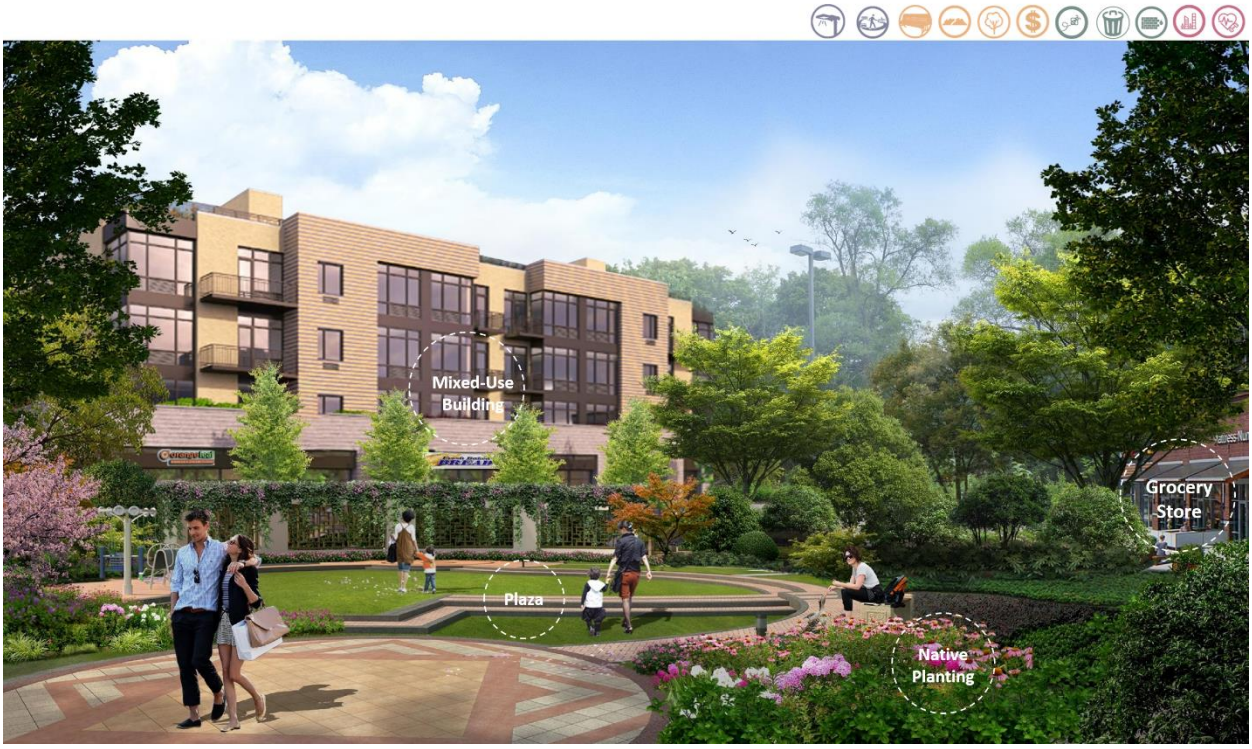

Figure 16 Multiple Lots Mixed-use in 100% Development Scenario Copyright © Shu Yang

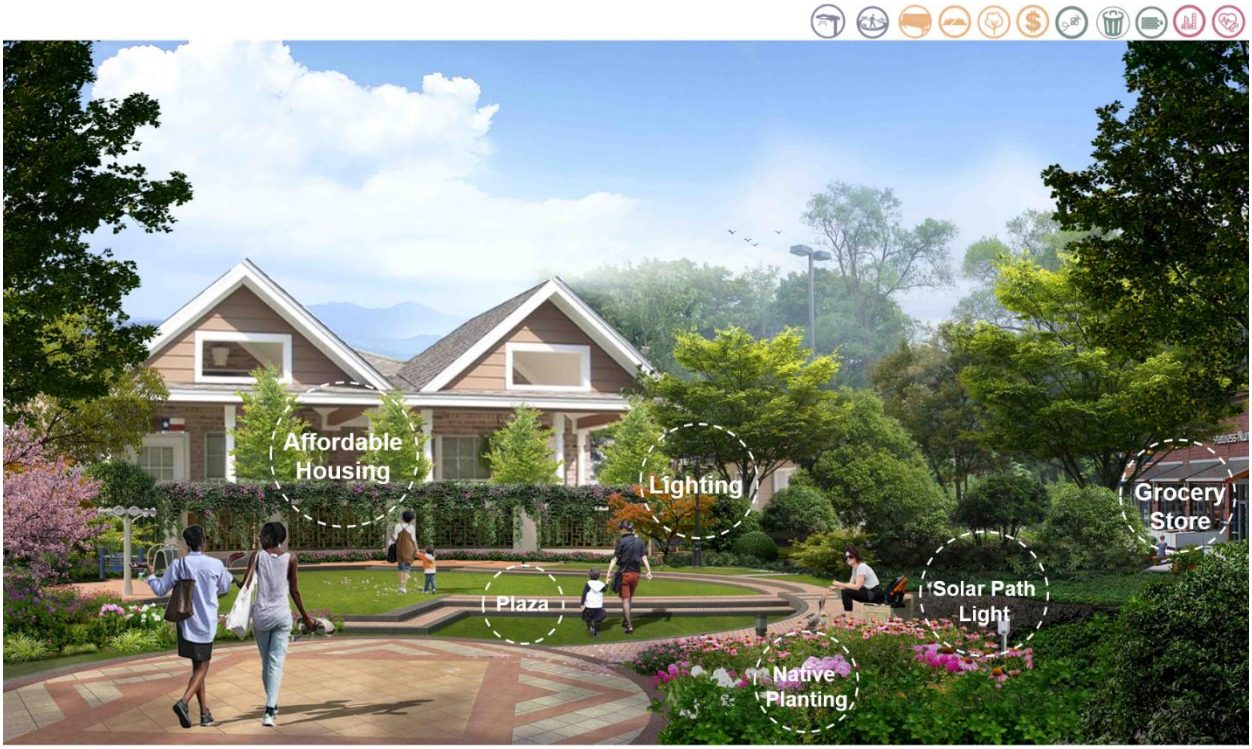

Figure 17 Multiple Lots Mixed-use in 50% Development Scenario Copyright © Shu Yang

CHAPTER 5. DISCUSSION AND CONCLUSIONS

Urban vacancy has become a typical problem in city development processes in recent years. It is often the result of deindustrialization, workforce relocation, and suburban expansion (Kremer et al., 2013). In addition, over-expansion of cities is more likely to cause decline in the urban core (Newman et al., 2016). Urban designers have access to studies on typical declined cities in the United States which elucidate social phenomenon and regular patterns of declined cities, while case studies within sustainable practices applied in the vacant lots also serve as valuable reference materials. The study site, the DTM Target Area in the city of Flint, MI, can benefit from previous models as it confronts land vacancy problems. As job opportunities declining property conditions worsened over time. By 2017, there were approximately 24,000 vacant properties in Flint - 42% of the total city's property - and the demolition costs became a huge encumbrance for the city budget (2017 Vacant Property Maintenance Plan, 2017).

The purpose of this study is to propose a master plan which aims to optimize revitalization planning and provide a design guideline for future DTM neighborhoods developments. The master plan conducts a balanced distribution of several design modules by analyzing surrounding land use in addition to residents' feedback from the community participatory decision-making process; feedback obtained through a series of design charrettes and community engagement activities. The final design proposal includes three development scenarios following the projected development density (100%, 75%, and 50% scenarios). For each scenario, the master plan presents three main themes: residential, public open space and mixed-use development. For each theme, 12 design modules in total have been identified based on on-site analysis and research. Relying on landscape performance research to quantify benefits of the final design proposal, this study documents several benefits in three major dimensions:

environmental, social, and economical benefits. With an increase in functional green space, the environment will be improved through stormwater runoff reduction (3,481 in/year), CO_2 sequestration (25,538.2 lb/year), and pollution removal ($3,631.77/year) in the 100% development scenario. To enhance the sense of community, the design proposal offers several social benefits by providing more gathering space and community gardens (2.69 acres), which offer residents more opportunities to interact with community members. To address safety concerns, proposed traffic calming devices, new sidewalks, and enhanced sidewalk maintenance would encourage people to be engaged in outdoor activities safely and comfortably. In terms of economics, rental income, tax revenue, and maintenance reduction would be expected to significantly increase the economic income. In the meantime, water conservation and vehicle gas cost reduction also help decrease future expenses. However, the study still has some limitations: first, landscape performance research is always conducted on built projects, but this project is a projected project; second, the project does not draw comparisons with baseline scenarios, since the baseline scenario's data is not comprehensively provided; third, the decision process will be very long, since there are multiple stakeholders in the site.

Overall, the proposed design guideline will allow the neighborhood to maintain its place in the community and become a safe, healthy, and welcoming space in the future. Furthermore, future studies could actively engage with more design module options and draw greater connections between modules while considering site context of development pace and economic growth. Developing design modules with various scenarios allows planning to be more flexible for residents; these modules can then be used as a reference for the design of large-scale vacant lots in the future. The impact of the project will contribute not only to neighborhood's future

development but will expand outward into the whole city of Flint and to other struggling areas that face similar vacant lots problems.

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