GREENING THE COMMON GROUND
MAPPING EQUITABLE ACCESS TO
Detroit's 32 miles Joe Louis Greenway

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ABSTRACT

Public investment in green space should be nondiscriminatory. Studies have examined that green space is unevenly distributed in American cities. In this project, we analyze neighborhoods surrounding the proposed Joe Louis Greenway, one of the largest public projects in Detroit, Michigan. We collect environmental, demographic, and socioeconomic data that intersect the greenway project to find neighborhoods confronting severe environmental injustice issues and urgently need access to green space.

On a finer scale, we develop a landscape plan in Highland Park as an extension of the proposed greenway to emphasize accessibility for people of all abilities and multifunctionality. Drawing on previous literature, the city's framework plan, and feedback from public meetings, we provide measurable metrics to assess and monitor the outcomes of greenway constructions. Finally, we discuss how to achieve equitable development by actively engaging the community in a long-haul process using novel tools such as mobile apps. Achieving a more sustainable city includes distributing opportunities and risks equitably and our project aims to provide environmental, fiscal and economic, and social benefits to people of all races, economics, and social status.

Key Words:
Equitable Development, Urban Greenway, Public Infrastructure, Performance Metrics, Environmental Gentrification, Detroit, GIS analysis, Data visualization, Environmental justice, Euqitable access, Community engagement

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1

Introduction

"To bring new possibilities of empowerment and equity-driven by you -- to the neighborhoods that intersect with and surround it" --- city's goal for the Joe Louis Greenway

1.1 Joe Louis Greenway

The Joe Louis Greenway (Figure 1), named after a legendary boxer and Detroiter who lived in Detroit during the era of legal segregation, is a proposed 32-mile biking and walking trail that extends from the Detroit Riverfront to Highland Park, Dearborn, and Hamtramck (Figure 1). It also includes connectors along an existing urban trail Dequindre Cut and portions of the Detroit RiverWalk, as well as portions of the planned Iron Belle Trail and May Creek greenway (Joe Louis Greenway, 2020). As one of the largest public projects in the City of Detroit, the Joe Louis Greenway aims to "provide a fun, safe, and inspiring space for people of all abilities to walk, bike, run and connect upon completion" (Detroit Greenway Coalition. Joe Louis Greenway., 2020). The city recognizes this project as an opportunity to encourage economic growth by promoting local business (Motorless in the Motor City: The Inner Circle Greenway, 2016). Following guidelines of the upper-level planning, the Detroit Future City (DFC) Strategic Framework, Joe Louis Greenway also envisions that the greenway will bridge community divides, strengthen the surrounding neighborhoods, and provide beautiful, restorative spaces for the residents of Detroit.

The Detroit Future City (DFC) Strategic Framework establishes a set of policy directions and actions designed to transform Detroit into a more desirable, equitable, and sustainable city in 2050. In DFC, "Landscape as Infrastructure" is a prioritized principle, which guides all DFC's planning Elements including Land Use, Neighborhoods, Economic Growth, City Systems, and Environment.

"Landscape as Infrastructure" reconceptualized notions of infrastructure. Instead of traditional engineered infrastructure (e.g roads, bridges, sewer), infrastructure is seen as part of the larger landscape, where nature-based solutions (e.g. multifunctional urban trail and bike paths, rain garden and bioswales, community gardens), and non-structured alternatives (e.g. a sense of community and belonging; programming that activates public places) might better serve urban residents (Bélanger, 2009; SWA Group, 2020).

Much of Detroit's infrastructure adopted in the 19th and 20th century is close to the end of its productive life and requires replacing.

This presents an opportunity to implement practices of landscape infrastructure and transform Detroit into a more comfortable environment that responds to the needs of residents. Bélanger (2009) drew a picture of a systematic and large-scale landscape that could serve the city, carry resource and energy flows, and show the dynamic changes in the development of the city. Compared to traditional Infrastructure, well-designed landscapes can also function in ways that are less expensive due to the reduced cost of maintenance, and do serve to function in multiple infrastructural capacities. For example, a combined blue (water-based landscape) and green (trees) corridor might capture stormwater along drainage swales alongside a major road; while integrating a greenway for bicycling and walking, it supports connections among home, works, and services and provides ecosystem services.

The greenway, as a multifunctional landscape system, carries benefits far beyond the inherent function it serves including environmental, fiscal and economic, and social benefits. It also helps ensure that environmental burdens are not born disproportionately by Detroit's lower-income families and children (2012 Detroit Strategic Framework Plan, 2013). Joe Louis Greenway, as an enhanced and multi-functional open space system in Detroit, could provide a new and strong identity for the city.

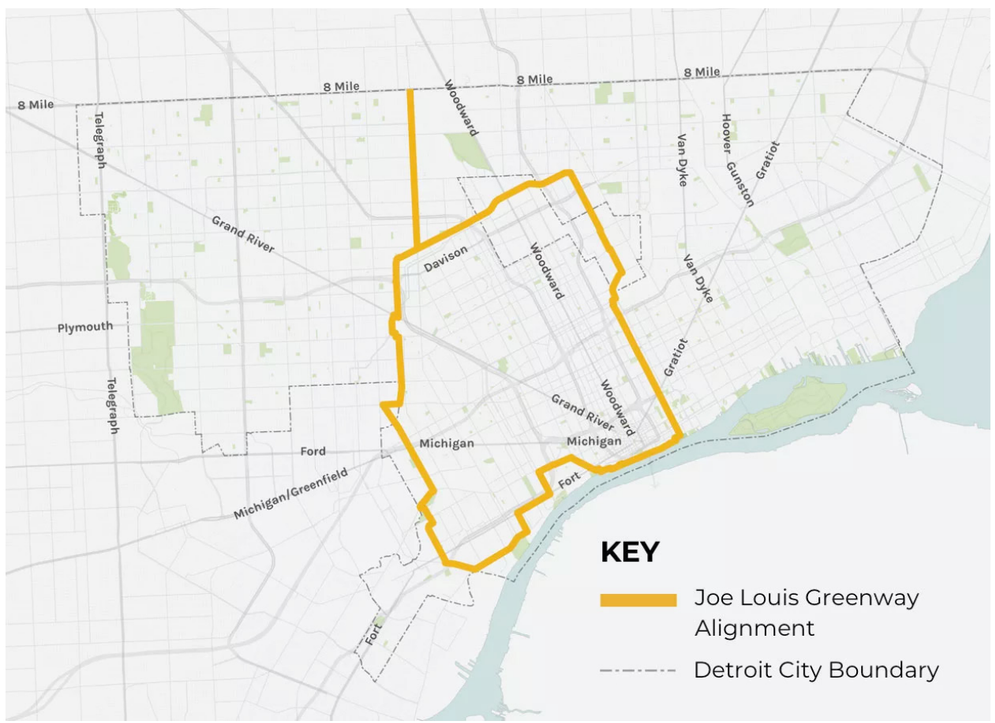

Figure 1. Joe Louis Greenway Route Map (Joe Louis Greenway Framework Plan, 2021)

1.2 The Potential Trajectories: Inequitable Access And Green Gentrification

At the turn of the century, a booming auto industry made Detroit the 4th-largest city in the nation, resulting in a bustling metropolis with numerous architecture projects and development to match. However, economic restructuring starting in the 1970s resulted in major economic upheaval and demographic decline. Recent financial fallout partially attributed to economic restructuring has contributed to the largest municipal bankruptcy case in U.S. history (Davey & Walsh, 2013; Hinkley, 2015), resulting in poverty, unemployment, and inequity.

While Detroit has recently had a modest economic rebound, the COVID-19 pandemic has shed new light on existing vulnerabilities – amplifying risks that have threatened community members in Detroit plagued by low mobility, lack of canopy, food insecurity, and unserved by healthcare opportunities. Moreover, the new round of declining population caused by COVID is expected to worsen the fiscal conditions many Detroit residents are facing, and widen basic service inequalities due to cutbacks, plummeting tax revenue, anemic economic development.

To avoid Detroit falling into a more serious vicious circle, the circumstances call for fresh, even radical thinking. Such an approach might adopt multifunctional landscape systems and equity lenses that initially require a greater investment, but may be socially and economically sustainable long term. In the context of the Joe Louis greenway planning, this requires critically reflecting on two questions:

Are greenways for everyone? Who has access to them? Access to physical activity resources is usually defined based on proximity, and while proximity to physical activity resources can increase levels of physical activity, emerging research is providing evidence that social and physical characteristics of the built environment are also important(Leslie et al., 2005; Saelen et al., 2003). Studies are investigating the use of greenways, which suggest that users tend to be members of the middle and upper-middle classes – wealthier, well-educated people with preferences for active, trail-related recreation (Mowen et al.,1998). Thus, access to greenways depends not only on the distance or time to reach the destination but also on the social and environmental characteristics of the surroundings, and the perceived safety and access due to issues of criminality (Crewe, 2001; Luymes & Tamminga, 1995). The "frontline communities" along the Joe Louis Greenway are communities that have suffered historic injustice and trauma including racial segregation, economic disinvestment, and institutional abandonment (Draus et al., 2019). Ensuring that the construction of Joe Louis Greenway does not contribute to additional structural inequities is a key concern, which requires a critical assessment of community access, preferences, and needs.

The construction of greenways may likewise contribute to the displacement of poor and aging residents through gentrification processes. The term "gentrification" was first used to describe the influx of a "gentry" to lower-income neighborhoods in London

during the 1950s and 1960s (Zuk et al., 2018). After that, a rich emerging literature on green gentrification(Gould & Lewis, 2016), ecological gentrification (Sarah, 2009), and environmental gentrification (Curran & Hamilton, 2012) examine the interconnection between well-intentioned efforts to produce environmental benefits and unintended outcomes such as increased land values, displacement of poor, disabled elderly or otherwise vulnerable populations.

While Detroit has one of the lowest gentrification rates of major U.S. cities (Brooker, 2020), the city has many pockets where residents are getting pushed out due to rising rents. Rigolon and Németh (2020) found that neighborhoods located within a half-mile of a new greenway park increase the odds that a neighborhood will gentrify by more than 200 percent. The development of other greenways also suggests that gentrification is a risk in Detroit. For example, the BeltLine project in Atlanta, a 33-mile trail, triggered sharp increases (as much as 80 percent in some neighborhoods) in home values in low-income and largely African-American communities in the southwest segment (Powers, 2017). This also occurred in Chicago in the vicinity of the 303, the Bloomingdale Trail which connected working-class communities on the northwest side of the city (Rigolon & Németh, 2018). Therefore, it is quite fitting to learn from the mistakes and successes of the cases to identify equity and avoid potential gentrification along Joe Louis Greenway.

An equitable development plan that connects adjacent communities has the potential to deliver numerous benefits to the communities along the Joe Louis Greenway. However, project success will likely be judged through the lens of historical inequities in green space delivery and the potential for gentrification that exasperated displacement and marginalization. Preventing past mistakes of combating these forces likely requires broad participation. Incorporating community input for collaborative engagement and consider who gets control of adjacent properties. Also, as the city is taking over the project currently and expands the scope of the project to address the desires and needs of neighborhood residents, their increased capacity, access to resources, and ability to collaborate with other entities could somehow avoid potential gentrification.

1.3 A Call For Data-Driven Equitable Development Plan

For designers, planners, or engineers, adequately measuring equitable access and outcomes resultant from planning or implementation of public infrastructure projects is often a vague or tertiary consideration. As new investments are made in urban transportation networks, housing stock, and employment centers, the current opportunity to reconceptualize infrastructure as public space that provides multifaceted benefits for all must not be squandered.

Nationally increasing disparities in income and access to housing or public resources have demonstrated that the capacity for cities to achieve equity in development is one of the foremost challenges concerning urban revitalization projects across the United States. Specifically in Detroit, two potential trajectories -- gentrification and inequitable access, all call for theoretical and practical methods and strategies to mitigate potential risks.

Cities are increasingly incorporating data and technology into infrastructure and the planning processes (Homstad, 2019). The potential to offer true data-driven assessments and monitoring of resulting equity outcomes of greenway constructions has become a reality given the wide availability of data and new transparent methods (Miller, 2012; Stessens et al., 2017). Measuring equity is challenging due to complex interaction between society, environment, policy, and economy, requiring techniques that capture its multifaceted nature. Geographic information systems (GIS) enable a better understanding of spatial inequities and can aid in assessing the vulnerability of communities based on the precise data. Moreover, it can aid in identifying sites suitable for development based on the spatial structure and physical characteristics (e.g. convertible land) and need (lack of green space) of communities along the greenway (Hwang et al., 2020). In the context of greenways, this spatial analysis can be applied to identifying the optimizing location for project development based on site characteristics and need (Chen et al., 2019.).

Geographic information systems (GIS) have been a driving force for advancing environmental understanding and promoting better planning and decision-making processes (Lee & Gamez, 2017). Geodesign brings GIS into the process of designing or planning human-built environments and brings complex data sets into the overall design process by extension. Such a data-driven process integrates geographic information with design thinking which could result in a systematic method for spatial planning and place-making (Albert & Vargas-Moreno, 2012; Miller, 2012). By applying a data-driven and geodesign approach, planners and designers can analyze, interpret and visualize geographic and spatial data, for consultation with residents then make decision-support tools (DST) to manage and assess complex data sets that represent interrelated urban/society systems (Aspinall et al., 1993).

For this project, our team will use a mixed-methods approach driven by geographical, demographic, and socioeconomic data to characterize neighborhoods along the proposed Joe Louis Greenway. This analysis will help in identifying needs and priorities related to equitable access to transportation, recreation, adaptive reuse, ecosystem services, and public engagement in urban greenway planning. Meanwhile, an equitable development plan will be developed to address and introduce strategies to support or mitigate potential outcomes related to equity issues as the Joe Louis Greenway moves from the initial planning phases to implementation and future use by the Detroit community.

2

LITERATURE REVIEW

2.1 Urban Green Space as an Indicator of Environmental Justice and Equity

Green space provides a suite of benefits and services to city residents through creating opportunities for physical exercise, regulating local climates and pollutants, increasing a sense of belonging by providing places for social cohesion and interaction, serving as corridor magnets that facilitate cross-community interaction and contributing to climate resilience (Detroit Greenway Coalition. Joe Louis Greenway., 2020; Livesley et al, 2016; Rugel et al., 2019). The distribution of urban green space is rarely evenly allocated in US urban centers (Wolch et al., 2005). Estabrooks et al. (2003) concluded that minority racial and ethnic communities generally have less access to green space in the US. Critical analysis of this distribution is important for the amelioration of these green inequities. In the following, we proposed several measures to understand green space access and need.

First, the size and proportion of urban green space is an important measurement for environmental justice and equity. Relatively large-scale size urban green space would ensure people have sufficient space for a variety of outdoor activities and would enrich different kinds of human activities. More canopy cover, on the other hand, would better moderate urban temperatures (Oke, 1989), reduces heating and air-conditioning requirements (McPherson, 1994), and mitigates particulate air pollution (Nowak et al., 1994). Landry and Chakraborty (2009) used a case study in Tampa, Florida to show that the percentage of street tree cover increases significantly with median household income and the proportion of owner-occupied housing and declines significantly with the proportion of African-American and Hispanic residents.

Second, the quality of green space is also important. One commonly used indicator of green space quality is the Normalized Difference Vegetation Index (NDVI). NDVI can provide estimates of vegetation density and health. A dense planting area with multiple layers of canopies often has a higher NDVI. In the research from Casey et al. (2017) across metropolitan areas in the contiguous U.S., Greenspace often has higher NDVI in urban neighborhoods with higher socioeconomic

status or with higher percentages of White residents. The quality of green spaces is often related to a sense of place and intimacy with the environment, which supports a healthy and resilient living environment for humans (Barron et al., 2019).

Last, previous research has found that accessibility is a highly important factor for evaluating urban green space usage (Rahman & Zhang, 2018). For residents, a travel time of between three and eight minutes is viewed as being comparatively ideal, while optimal accessibility is less than a 3-minute-walk assuming between 1.1 and 1.3 m/s speed (Yuan et al., 2017) which leads to 200- to 230- meter walking radius. Higher-level accessibility to public green space would provide more opportunities for community members to communicate with each other and enhance health and well-being, therefore improve social equity (Maas et al., 2009; Ward Thompson et al., 2012).

2.2 Infrastructure and Public Facilities as Indicators of Justice and Equity

According to the U.S. Census Bureau (2011), 91.2% of Michigan workers commute by car. However, more than 3000 Detroit residents conveyed that a lack of sidewalks and bike paths is preventing them from walking and biking to work (VanRenterghem, Detroit Free Press, 2019). Disparities in transportation infrastructure often come with social inequality. Other than a sustainable mobility strategy, biking has health benefits related to physical activity, obesity, diabetes, and cardiovascular disease (Hamer & Chida, 2008; Pucher et al., 2010; Wanner et al., 2012). Braun et al. (2019) used quantitative research methods to test 22 large U.S. cities' bike lane distribution and found out that block groups with higher proportions of minority residents and lower socioeconomic status had significantly lower access to biking facilities. From the planning perspective, Flanagan et al. (2016) examined trends in cycling infrastructure investment in Chicago and Portland and then found bike lanes and bike-share stations were more likely to be built in communities with higher educational attainment and higher homeownership rates, and often in areas experiencing gentrification.

Inadequate food access is another indicator of environmental injustice. A previous study found that black and Hispanic predominant neighborhoods are likely to have less access to supermarkets and large-chain grocery stores than predominantly white areas (Walker et al., 2010). Allard et al. (2017) examined the case in Detroit in 2009, there was no significant evidence that black and low-income communities had less food access. Nevertheless, residents shared their concern on food safety and desire for local sources of food (Rose, 2011).

Green infrastructure is currently more and more used to mitigate climate change and achieve health benefits. However, considerable justice and equity issues are also embedded in the design and implementation of green infrastructure projects. Green infrastructure is often distributed inequitably based on race and social class (Carmichael et al., 2019). Carmichael et al. (2019) surveyed 21 Detroit residents on their perspectives on green infrastructure approaches and over 70% of the participants appreciated its value. The barriers were, however, limited financial resources, technical knowledge, and property ownership to implement green infrastructure.

2.3 Detroit's Gentrification and Displacement

Gentrification, while often associated with neighborhood revitalization, can often result in displacement of existing residents and changing demographic composition (Galster & Peacock,1986; Glass, 1964). Regardless of specific geographic location, gentrification occurs in places with relatively affordable housing stock, often impacting marginal communities, and resulting in the physical renovation of existing housing stock and infrastructure (Lees et al., 2008). It can also be exploitative, where developers anticipate and take advantage of neighborhood revitalization (Dillon & Fanning, 2018).

Detroit has gone through considerable urbanization and then neglect over the past decades. Ryan (2012) argues that Detroit's major challenge today is making use of existing vacant open space that contributes to economic redevelopment and repopulation while balancing the needs of existing residents, social equity demands, and environmental concerns.

Despite the major impacts from private actors and capital, the public sector can play an important role in neighborhood transformation. This can include investing in physical infrastructure, structuring land-use decisions, and incentivizing business locations (Zuk et al., 2018). Take urban green space as an example, recent research shows that the establishment of new parks in historically disinvested neighborhoods can result in housing price or rent increases and displacement of low-income people of color who were intended to benefit. This phenomenon has been called environmental gentrification (Anguelovski et al. 2018; Gould & Lewis 2016; Immergluck & Balan, 2017).

Marcuse (1985) was the first to propose implementing an "anti-displacement zoning" policy to combat negative gentrification

pressures and displacement in New York City. He visualized five floating zones to control for managing the most negative impacts, including "Discouragement Zones" or "Mature Development Zones" where the areas were already significantly developed and essentially no new development would be allowed; "Encouragement Zones" or "Inclusionary New Construction Zones" where most development would be strongly supported. Staten Island was a successful example of an encouragement zone, which resulted in the new development of business and residence districts as well as public waterfront parks after the 1980s. Taking such an approach requires governments to specifically target local community residents to ensure that interventions would match local desires. Los Angeles Councilmember Herb J. Wesson, Jr stated in his motion (2019) "Development projects should help to build up an area in need of economic investment so that members in the community can make use of these local amenities and improve their everyday lives." and proposed to create "anti-displacement zones" around high-end, unaffordable residential developments by preventing rent increases within a two-mile radius of these developments for three years. Later that year, the county moved forward a larger vision of the Housing Ordinance including the anti-displacement strategies (Los Angeles County Moves Forward Key Housing Ordinances, 2020).

Besides residential displacement, the public investment could also evoke commercial change, as rent increases, local stores go out of business, or are forced to leave, resulting in changes in employment patterns and affordability of goods and services. Federal and local governments have implemented various policies to promote and protect small businesses (Marcuse, 1985; Zuk et al., 2018).

Meanwhile, efforts have been made by scientists to quantitatively measure and predict gentrification in cities. Scholars incorporate a diversity of metrics based on available Census Bureau data including income, race, educational attainment, housing values, rent, and various proxies for investment or disinvestment. Galster and Peacock (1986), relied on demographic data including income, age, race, and proximity to the central business district, university, and park to test for Philadelphia neighborhoods in the 1970s. Their results indicated little consistency in the dominant contributor of gentrification in Philadelphia. Landis (2015) used income growth for analysis and comparison of gentrifying neighborhoods. Rigolon and Németh (2020) concluded that park function and location are strong predictors of gentrification, whereas park size is not; greenways parks with an active transportation component triggered gentrification more than other park types, and new parks located closer to downtown tend to foster gentrification more than parks on a city's outskirts.

Likewise, planning and design efforts can be made to address the problem through improving the cleanliness and safety of surrounding neighborhoods, or through increasing financial opportunities. Drawing from the experience of Berlin, Germany, Draus et al. (2019) suggests that Detroit can avoid gentrification through active engagement between planning team officials, residents, and business owners, and consider adjacent functioning and ownership in greening projects. The term "reparations" is used to acknowledge the histories of the neighborhood, the beneficiaries of projects, consideration of those underserved by public policy in the past, and the promotion of inclusion in the city in green space design.

Planners should also incorporate the potential impacts of the location and function of new parks to assess whether they might trigger environmental gentrification. As small parks also foster gentrification, planners and policymakers should strive to address deep-rooted inequities for accessible park acreage by adding substantial amounts of new green space in park-poor, low-income communities of color, while also providing and protecting nearby affordable housing and dedicate specific funds for housing (Immergluck & Balan, 2017).

According to a report distributed on ASLA 2015 Annual Meeting & Expo (Pitera et al., 2015), an alternative to environmental gentrification is "Just Green Enough" which accomplishes clean-up without gentrification and displacement of long-term residents (Figure 2). This can be achieved by intensive community outreach and involvement, respect for the site context and history, smaller-scale interventions, and finally, rethink what counts as" green" and "environmental". The project should be "just green enough" to satisfy the community members without attracting exploitative attention from developers. Also, urban greening projects should be multifunctional that provide not only environmental benefits but also recreational use, therapeutic value, food source, and space for community gathering. Speck (2012) believes that an "urban triage" would also inevitably happen during the revitalization of Detroit when infrastructure investments go largely to the city's densest and most-prosperous neighborhoods at the expense of outlying areas (Safransky, 2014; Marohn, 2014).

While green projects can cause environmental gentrification, avoiding investment in high-performing greenscape for poor and vulnerable neighborhoods for the risk of population displacement is not best practice. Public investments in green space can have long-term social and economic impacts that lift up neighborhoods. From 1869, the development of the Boston Park System improved the physical environment of the city and elevated the living conditions of all residents. Although the park system was not created specifically as an economic development tool, researchers and residents now realize those parks brought in continuous environmental, social and cultural value (Hardy, 1980; The Trust for Public Land, 2008).

HOW TO BE "JUST GREEN ENOUGH"

- Intensive community outreach and involvement
- Respect for context/ history
- Smaller scale interventions
- Rethink what counts as "green" and "environmental"

Figure 2. Advice on "Just Green Enough" (Pitera et al., 2015)

2.4 Developing an Equitable Development Plan – A Participatory Process

An equitable development plan is a relatively new concept in planning philosophy that aims to revitalize disinvested communities (von Hoffman, 2019). It is different from the traditional process by inclusion of residents of the community where projects are taking place. Allowing community members to shape urban development is viewed as a way to increase buy-in and increase the real social and economic benefits for development projects. This is essential for low-income and minority groups as it provides economic opportunities and affordable living (von Hoffman, 2019).

The concept of equitable development planning evolved over the past 50 years. Originally coined by the urban planner Carlton Eley, equitable development is defined as approaches that meet the needs of underserved communities and individuals through projects, programs, and/or policies that reduce disparities while fostering places that are healthy, vibrant, and diverse. Later definitions emphasize the participatory process while specifying the types of people who should gain from the effort (Treuhaft, 2016). Equitable development efforts should strive to eliminate racial inequities, allow lower-wealth residents to live in healthy, safe neighborhoods that reflect their culture, provide them with economic opportunities, and enable the residents to influence decisions that affect their neighborhoods (Treuhaft, 2016). In the 1990s, the community development field went in two directions of "people-based" and "place-based" programs, but both embraced individual opportunity programs and comprehensive community development schemes.

We envision our project to be both people- and place-based. A successful participatory planning process would build on strengths and resources within the community (Detroit URC Board, 2011). Local Community-based organizations such as the Detroit Community-Academic Urban Research Center (Detroit URC) have long-lasting experience in developing and implementing participatory research principles and have conducted hundreds of projects locally. Working with CBOs to connect community members is an essential action to take.

Also, an Equitable Development Plan process should promote collaborative and equitable partnerships in all planning phases and involves an empowering and power-sharing process (Detroit URC Board, 2011). In the past, residents in Detroit have expressed resistance to particular green infrastructure approaches (i.e., street tree-planting programs) because of an absence of inclusion in decision-making about species to plant and long-term maintenance responsibilities (Carmichael & McDonough, 2018). Workshops were hosted by the City of Detroit from the framework plan phase of Joe Louis Greenway's development, and more is yet to be done in future phases suggesting a long-term commitment to community engagement. However, research to date has found that broad participation is a real challenge. The time requirements for in-person participation are a limiting factor for many and this is exacerbated along with sociodemographic characteristics (Carmichael & McDonough, 2018).

A large concern seems to be how a community might influence the design of projects that affect their neighborhoods. For example, a community-based participatory study modeling the health impacts of extreme heat exposure in Detroit was conducted by U-M scientists and Local Community-based organizations where issues of inclusion were raised. Community members expressed that they would like to see more direct benefits such as education and intervention tools to protect vulnerable residents and work toward policy solutions (Ziegler et al., 2019). One possible way to better solicit feedback on neighborhood projects might involve the use of mobile applications (Apps). Apps can be designed to collect design priorities, diffuse new findings, and collect feedback from community members. They are appealing particularly to young adults, who tend to be disengaged in public affairs (Castells et al., 2006; Clark et al., 2013; Harris, 2009) but use urban green space regularly, and likely address the challenges of in-person feedback that is difficult given full schedules.

Finally, it is important to recognize that this kind of public planning process requires a great investment of time and resources by city governments. The city has committed $20 million to build the first phase of the Joe Louis greenway and is seeking funding from philanthropic, state, and federal grants (Detroit Greenways Coalition, 2020). In such large-scale urban greening projects, phasing is introduced due to budgetary constraints and for ensuring adequate management given their large-scale. We plan to provide data-driven reasoning to prioritize design and implementation efforts to first mediate environmental justice issues in the most underserved neighborhoods.

3

STRATEGY & ASSESSMENT

3.1 Visionary Equitable Development Plan

Drawing on the experience of equitable development plans developed by jurisdictions across the United States, we proposed the future vision and adopted robust tools to support equitable decision-making and propose strategies and performance assessment plans to promote smart growth, environmental justice, and equitable development.

We layout our vision of equitable development:

- *In Future Detroit, all people will have equitable access to environmental and social-economical resources and linked together by the greenway. Our city's neighborhoods will be diverse and include the green space, multi-use path, community service, and amenities to provide a liveable environment, thrive residents' quality of life, and create Equitable and Sustainable Communities.*

The equitable development plan is committed to creating an equitable, vibrant, and sustainable community. Urban planning, neighborhood revitalization plans, public and private investments, site design, programs, and policies are desired to avoid gentrification and displacement, meet the community's needs and provide equitable access. Therefore, quality of life outcomes such as equitable access to public facilities, living wage employment, healthy environment, and affordable transportation is equitably distributed for the people currently living and working there and new people moving in.

This equitable development plan of Joe Louis Greenway is designed to enhance both social and ecological equity and sustainability. Joe Louis Greenway activates a linear corridor to link social infrastructure, to make up the public realm, to enhance a livable, accessible, connected, and vibrant community. With art invention, streets also serve as a celebration of the city's culture and character, both in the past and future. Ultimately, The Joe Louis Greenway prompts new urban mobility in Detroit, the Non-motorized Transportation (NMT) system, which will flourish accessibility, mobility, connectivity, safety, amenity, and social identity for all.

3.2 Decision Support Tool

3.2.1 Framework of the Decision Support Tool

To assist the implementation of the equitable development plan, we create a decision support tool (DST) and develop performance metrics of Joe Louis Greenway. DST is an information system that facilitates the decision-making process (Antunes et al., 1994). The proposed DST can be a strategy or analytical tool to guide the equity development plan, implement the Joe Louis Greenway framework, support underrepresented groups and assist involved stakeholders in critical complex decisions, and finally guide regions to equity and sustainability (Andrienko et al., 2003; Bailey & Grossardt, 2010).

In urban planning and design projects, the technology of geographic information systems (GIS) is generally a critical component of DSTs for spatial analysis and data-driven planning (Arampatzis et al., 2004). In DST Framework, we have organized our database, visualized the geospatial data, conducted spatial analysis and modeling in R, generated performance metrics, and provided inventory analysis for site design.

In detail, This DST is made up of several different tools:

- A database that stores spatial raw data used to calculate variables;
- GIS analysis to manipulate raw data into spatially useful data that store in tables(CSV);
- The Geovisualization of each map as an effective tool for visual communication;
- The Cluster Analysis that reveal patterns and make possible the Multi-Criteria Decision Analysis;
- Site design of one major access point in the best scenario;
- And potentially, a web App that includes the map and area for increasing data transparency and collecting community feedback.

3.2.2 Other Strategies/Tools for Consideration

For this project, we mainly focused on how to use geographic information to understand the implementation of the equitable development plan. However, the policy relevance of this question is also clear. There are also other strategies or tools related to public policy that can be taken into consideration.

Strategies developed by EPA: In 2013, the U.S. Environmental Protection Agency released an extensive new publication -- Create Equitable, Healthy, and Sustainable Communities, which serves as a guide for low-income, minority, tribal, and overburdened communities to build smart, environmentally just, and equitable development using strategies that are accessible and affordable (U.S. Environmental Protection Agency, 2013). The outlined strategies provide design guidance that addresses environmental justice, smart growth, and equitable development in complex contexts like Detroit. The key findings indicate that policy approaches to combating gentrification should include: 1) Facilitating Meaningful Community; 2) Engagement in Planning and Land Use Decisions; 3) Promote Public Health and a Clean and Safe Environment; 4) Strengthen Existing Communities; 5) Provide Housing Choices; 5) Provide Transportation Options; 6) Improve Access to Opportunities and Daily Necessities; 7) Preserve and Build on the Features That Make a Community Distinctive.

Anti-displacement zoning and planning: according to the study done by Peter Marcuse, the policy approach for gentrification and displacement should be conducted in a comprehensive way (Marcuse, 1985): 1) in the areas of abandonment, increasing in public investment and concentrating public resources for the immediate benefit of residents already living in the communities is necessary. 2) in the areas of gentrification, carefully developed and detailed procedures must be adopted to protect and assist the people who are in most need. Some of the zoning policies include a set of "floating zones" that combine a single zoning text applicable anywhere in the city with the flexibility of treatment and selectivity of application based on the requirements of different local communities (National Academy of Public Administration, 2003).

Multiple actions from the city: no single piece of legislation can guarantee the stabilization and affording housing for the residents of a given neighborhood. It is an integrative process that reflects on multiple city's actions regarding housing, planning, and development (Marcuse, 1985). To avoid displacement and gentrification, public investment strategies, housing policies, welfare regulation, taxation, code enforcement, and other local programs and policies should be applied coordinately. This part is out of the scope of this project, thus, they will not be discussed in detail.

3.3 Performance Metrics

Considering that urban green space, infrastructure, and public facilities are the indicators of environmental justice and equity development, it is necessary to develop performance metrics containing the evaluation criteria, indicators, and variables.

The performance metric integrates multi-dimensional factors from the environmental, economic, and social aspect, including environmental justice, community growth, and equitable development, aims to Create Equitable, Healthy, and Sustainable Communities (U.S. Environmental Protection Agency, 2013) that respond to the needs of low-income, minority, tribal, and overburdened communities and reflect their values.

This performance metric will guide our data analysis and site design as Equitable Development Guidelines to address equitable decisions, activities, and strategies.

Our metrics are based on the vision, goals, and strategies in the Joe Louis Greenway framework plan, scientific evidence from literature reviews, and the feedback from public meeting sessions from the City of Detroit. In our DST framework, we include demographic, economic, environmental, and social impact criteria measures for evaluation of our prioritization of sites for construction and design goals

We propose four criteria:

- Provide Equitable Access to green space;
- Promote access to infrastructure facilities;
- Pursue Economic Vibrancy;
- Prioritize Community Design.

The metric supports the analysis of the four criteria with indicators each, for a total of 14 indicators and corresponding measurement of variables.

Multiple quantifiable measures are combined as Indicators of these criteria and included as variables in our database. This has enabled analysis and modeling to obtain rich detail and context from result analysis. We have also identified variables that will require qualitative analysis and professional evaluation to provide additional evaluation criteria for the analysis of the site. Although interpretation may introduce bias, as a need-finding and experience journey of users, it effectively provides valuable multi-dimensional decision analysis attributes.

Table 1. Performance Metrics

Criteria	Indicator	Measurement
Provide Equitable Access to Greenspace	Enlarge green space	area and size of green space
	Increase canopy cover	tree coverage ratio
	Add accessible green space	walkability to green space within 15mins
	Enhance quality of green space	Normalized Difference Vegetation Index (NDVI)
Promote Access to Infrastructure Facilities	Active multi-use path	street occupy
	Access to social infrastructure	access to food/healthcare/grocery within 15mins
	Ensure food security	accessibility to grocery stores, farmer markets, and community gardens
	Implement green infrastructure	financial resources, technical knowledge, and management
Pursue Economic Vibrancy	Provide living wages	household median income
	Encourage employment	jobs density (jobs per acre)
	Control land value	land value change rate
Prioritize Community Design	Preserve community stability	population changes(Migration rate; Emigration rate)
	Build community identity	comprehensive evaluations of qualitative analysis
	Support underrepresented group	statistical analysis of race,income, education attainment

Measurements of Environmental Criteria can be implemented with various gis analysis, including area measurement, canopy cover calculation, network analysis, model of NDVI. Network analysis in GIS is a typical method for assessing accessibility. For this criteria, measurements have to include some observation of streetscape and annual reports of resources. Economic indicators mainly rely on census data to evaluate. It is worth noting that the plan of performance evaluation should control the date of the source to reduce bias.

Quantitative analysis may be more effective to measure community design indicators, and the results will be interpreted by comprehensive evaluations. The raw data will be collected during the participation of community engagement, which implies the potential need for a new community engagement tool to collect data.

For the planners and technical advisory team, Before using, all data will be desensitized and will not contain any private information. Potential data analysis methods include keywords cloud, sentiment analysis, topic classification, and training AI modeling to interpret the data.

The following table 1 summarizes the basis for these indicators under each criterion and how variables measure each indicator.

4

SITE CONTEXT & ANALYSIS

4.1 Detroit and Joe Louis Greenway

Detroit is often described as the birthplace of the American middle class. As a result of the burgeoning auto industry at the turn of the century, the city grew and sustained a substantial workforce and this lasted well into the 50s. Over the following decades, like many other manufacturing cities in the Rust Belt, Detroit was subject to the extreme consequences of economic decline caused by the offshoring of auto jobs. Middle-class residents were particularly hard hit and there are lasting environmental legacies of the auto industry (e.g. environmental pollutants). This was compounded with the effects of corrupt political, policing, and planning systems served only to exacerbate the issues of pre-existing racial inequities (Draus et al., 2019). Nowadays, such impacts still significantly influence the city neighborhoods with specific challenges and opportunities spread throughout Detroit.

As Detroit works to rebuild itself with a dedicated emphasis on equity and racial justice, and a commitment to creating more accessible social and physical infrastructure, the planning and design of the Joe Louis Greenway strives to promote shared dialogue and community-driven authorship with the hope that this process may begin to heal urban trauma and move towards a more inclusive future (Adams & Singleton, 2020).

This 32-mile non-motorized trail, like many other cities' greenways, creates a complete loop linking various communities within the cities of Detroit, Dearborn, Hamtramck, and Highland Park. It ambitiously re-proposes the vacant, abandoned, and contaminated railroad corridors, as well as oversized rights-of-way (Joe Louis Greenway, 2020).

For large-scale greenway planning like Joe Louis Greenway that consists of complex urban systems geographically, demographically, and socioeconomically, the planning projects can take advantage of GIS data and analysis. GIS has long been used in planning to visualize physical elements, man-made or natural, in a way to best realize a particular purpose related to place types, land use, human activity, identity, and community character. We believe that the Joe Louis Greenway

project has great potential in transforming surrounding neighborhoods. In this chapter, we collected data on Joe Louis Greenway neighborhoods from multiple sources, then characterize those neighborhoods to identify target locations for greening projects based on geographical, demographic, and socioeconomic needs. Finally, we use clustering techniques to identify homogeneous groups with similar environmental and socioeconomic characteristics and look into the opportunities Joe Louis Greenway would bring to deal with these specific challenges. All analysis was done in ArcGIS Pro and the R Version 6.2.

4.2 Data and Visualization

To characterize our study area, neighborhoods that intersect with and surround the Joe Louis Greenway route, we compiled a large spatial database summarizing different neighborhood-level measurements at the Census Tracts level. We analyzed 162 Census Tracts using indicators describing access to Greenspace, infrastructure, economic, and community composition as per our performance measure outlined above. Our analysis enabled understanding gentrification pressures and identifying locations where intervention would greatly benefit traditionally underserved neighbors.

Data are collected from the following four aspects, the full data set is attached after this report with a full list of descriptions for each factor (Appendix A).

Demographic: population, race, income, employment (2010-2015)

Ecological: Surface temperature (2018 W, 2018 S), Canopy Change (2011-2016), precipitation (2016), impervious surface

Financial: Vacant parcel counts, mean property sale price

Protential: park, food market accessibility improved by the proposed greenway

The following maps show the key drivers of following analyses:

- **Data Collection**
- **Data Visualization**
- **Statistical Analysis**

Demographic:

According to the 2010 Census data, the population of the communities along the Joe Louis Greenway was 468,088. Most communities are predominantly black (71%), while there are significant white residents (17%), the remaining 12% consist of Asian, American Indian and Alaska Native, Native Hawaiian and other Pacific, Hispanic and Latino, and "Other". From the race diversity map (Figure 3), it could be seen that the communities along the northwest corner (community: Mackenzie, Winterhalter, Durfee, McNichols, Harmony Village, etc) are mostly black-dominated, the southwest is mostly Hispanic, or Latino-dominated (community: Chadsey, Springwells, Vernor-Junction). While the northeast (Hamtramck) has the middle portion while and Asian dominated.

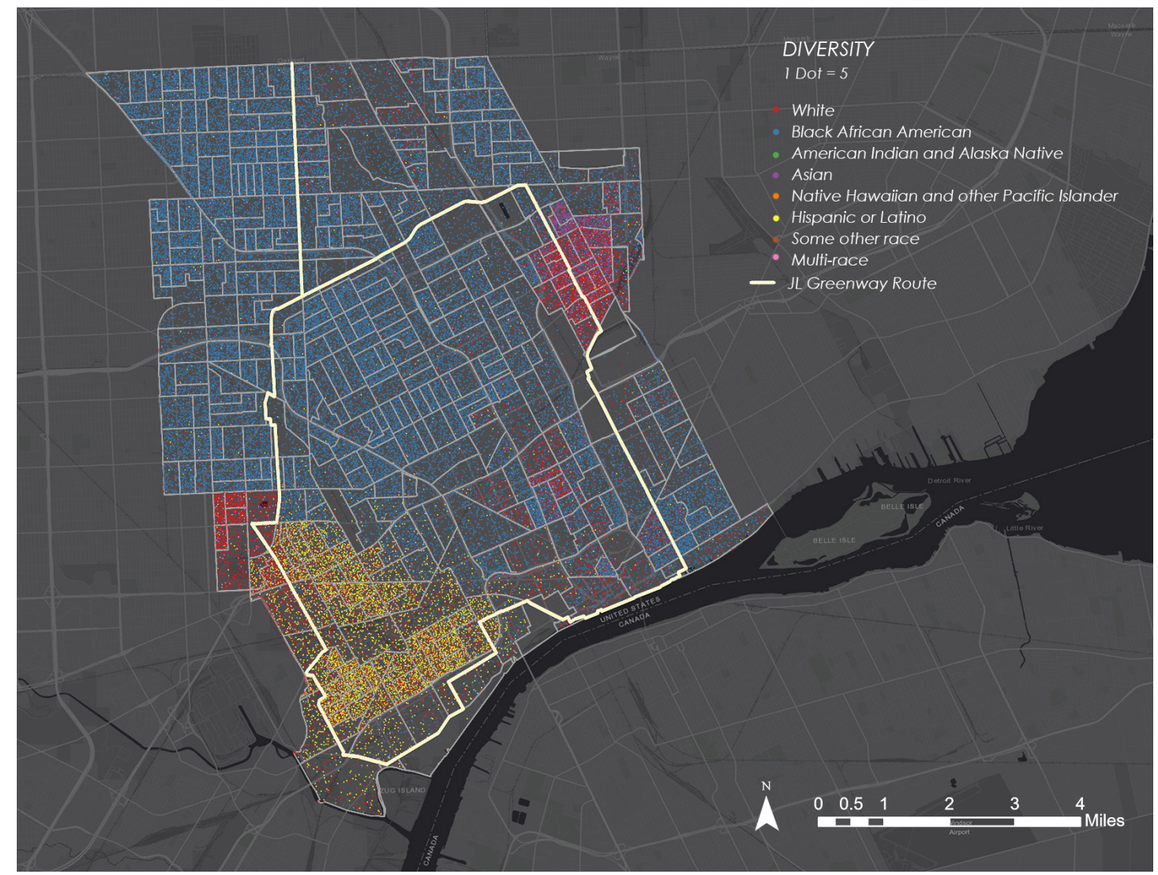

Figure 3. GIS Analysis of Diversity, Data Source: 2010 Census Data (Total Population in Occupied Housing Units by Tenure

Income and Employment:

The Median household income is $25,064 per year, which is significantly lower than the countywide median income of $62,261(U.S.Census Bureau, 2011). The unemployment rate is 12.7%. In addition to the income and employment data collected from census tracts, the following maps are the visualization of workplace area income and employment data collected from 2010 LEHD Origin-Destination Employment Statistics (LODES).

Workplace Area Employment

According to the data from LODES, the employment type could be classified into the following four categories (Appendix B). From the following map (Figure 4), Manufacturing and Logistics, Retail, Hospitality, and Other Services are the two main dominated employment categories along the southwest of Joe Louis Greenway (community: Springwells, Vernor-Junction). As downtown Detroit is located in the southeast corner of the JLG, there are also a lot of workplaces for professional service and Retail and Hospitality in that area.

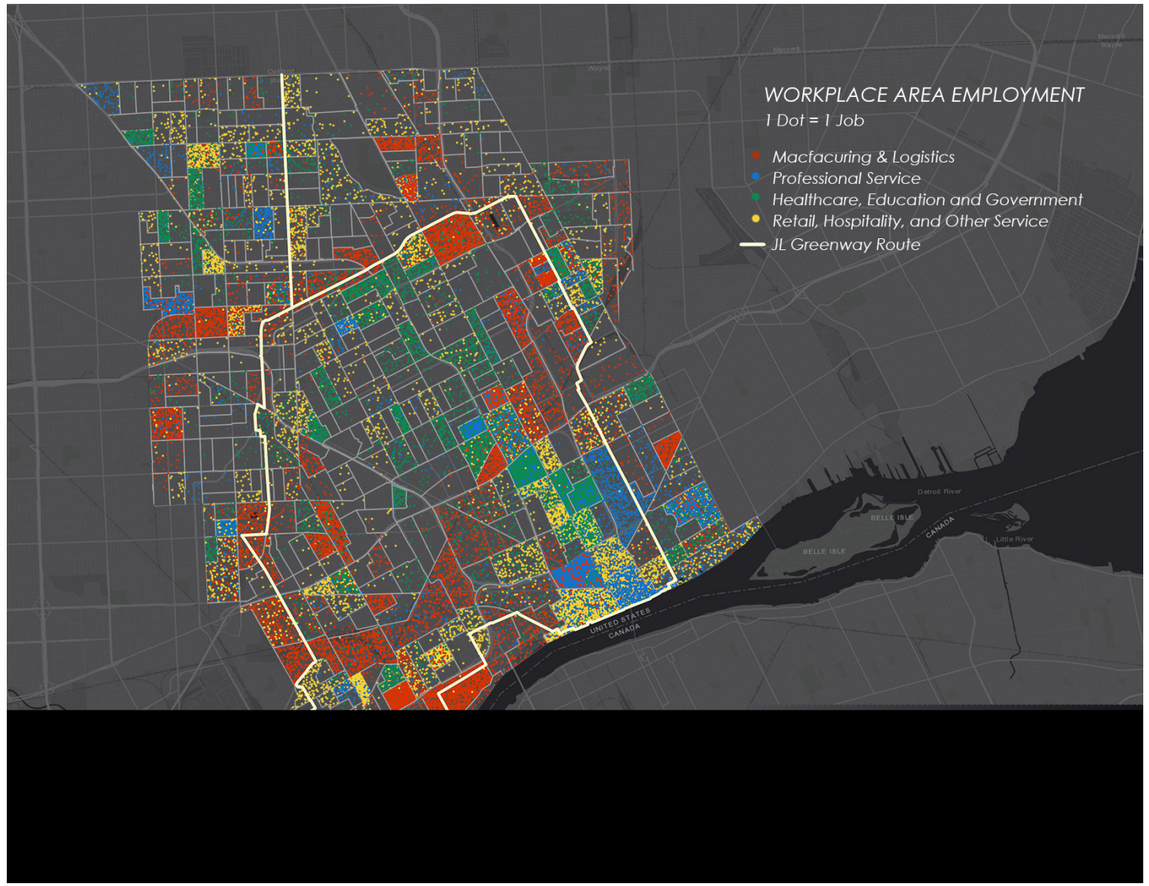

Figure 4. GIS Analysis of Workplace Area Employment, Data Source: 2010 LEHD Origin-Destination Employment Statistics (LODES)

Work Area Income

The Workplace Area employment map and Work Area Income (Figure 5) draw on Census data reported by Longitudinal Employer-Household Dynamics data. One dot indicates one job, and each job corresponds to the monthly salary. High-paying indicates jobs are concentrated in the southwest of JLG where many Manufacturing and Logistics jobs are. While low-paying jobs are concentrated in downtown Detroit.

Figure 5. GIS Analysis of Workplace Area Employment, Data Source: 2010 LEHD Origin-Destination Employment Statistics (LODES)

Appendix E: Qualitative Community Studies

According to the Joe Louis Greenway Framework Plan, Chapter 3: A Community-Driven Process (2020), there are three main segments along the greenway. Each segment has its general characteristics as presented below:

1) Segment 1 (Figure E1) – NW: has the largest concentration of seniors and generational legacy according to average age distribution data. The diversity of churches and cultural pride has created a sense of community and grassroots activism.

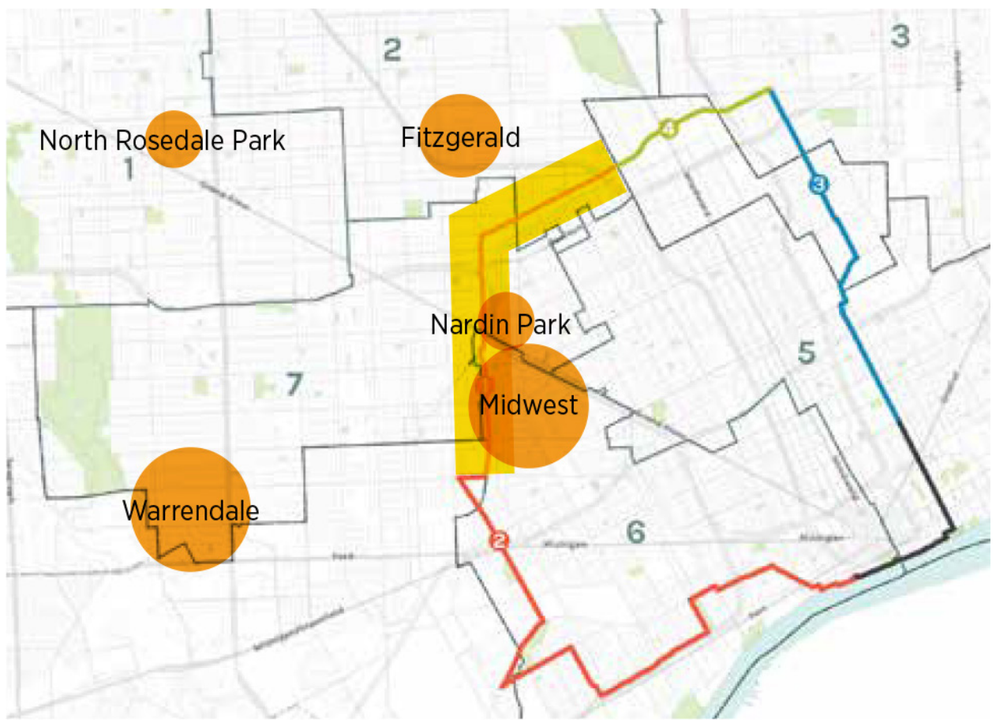

Figure E1. Segment1-NW, Source: Joe Louis Greenway Framework Plan

2) Segment 2 (Figure E2) – SW has the largest concentration of children and families, known for extreme racial, cultural, and linguistic diversity. Being home to many immigrants, these neighborhoods are characterized by tight family bonds. Gentrification pressures are high here due to the cultural vibrancy of the area, proximity to natural amenities, and the central business district.

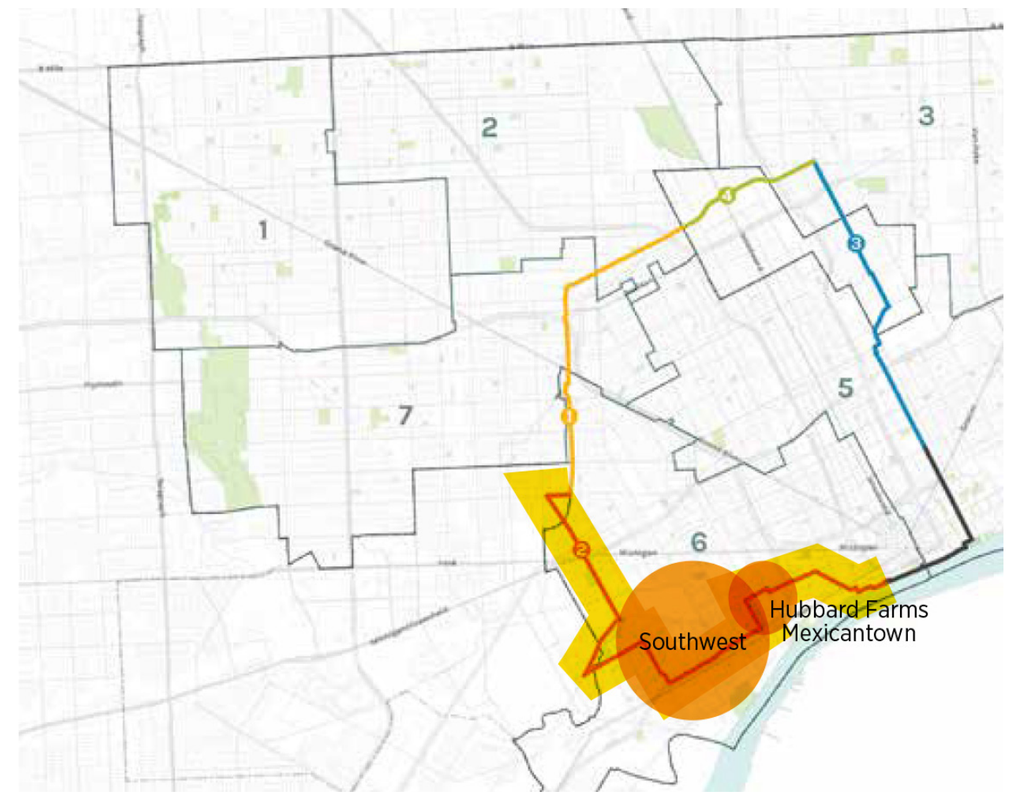

Figure E2. Segment 2-SW, Source: Joe Louis Greenway Framework Plan

3) Segment 3 (Figure E3) – NE: the communities historically known as Black Bottom. Paradise Valley has experienced considerable urban blight and outmigration as a result of the economic decline in Detroit. Derelict housing has been converted to urban farms and ecological projects, increasing green space in these neighborhoods. While this will likely attract gentrification, strong community pride surrounding the black history, as well as the tolerance towards neighbors in such a diverse community may help in combating exploitation and continued displacement forces

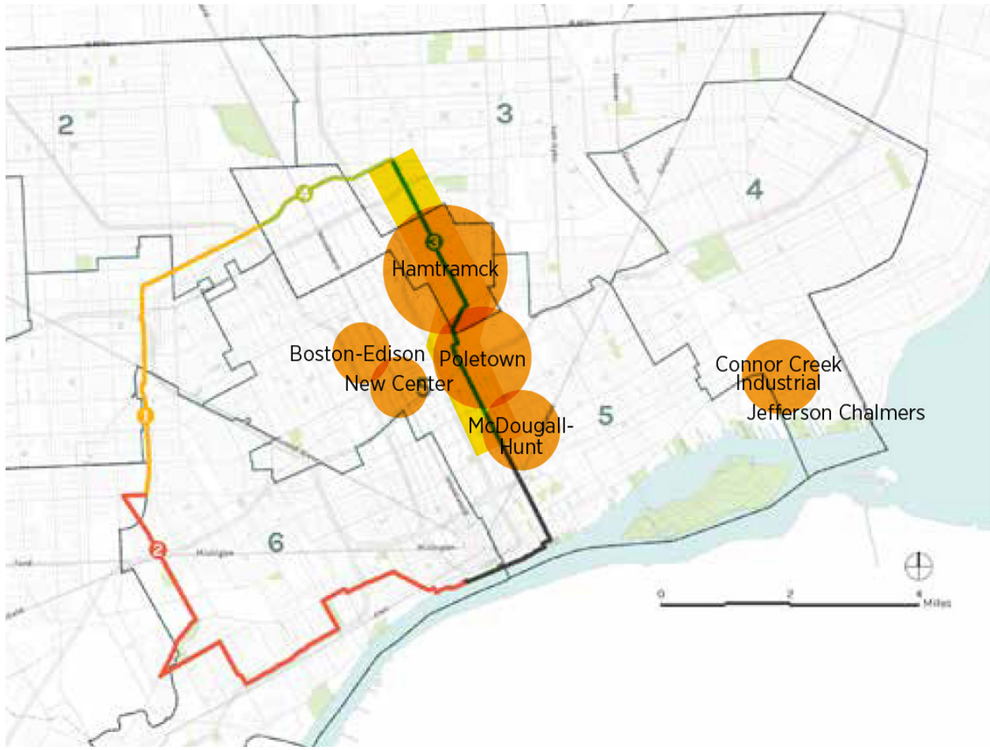

Figure E3. Segment 3-NE, Source: Joe Louis Greenway Framework Plan