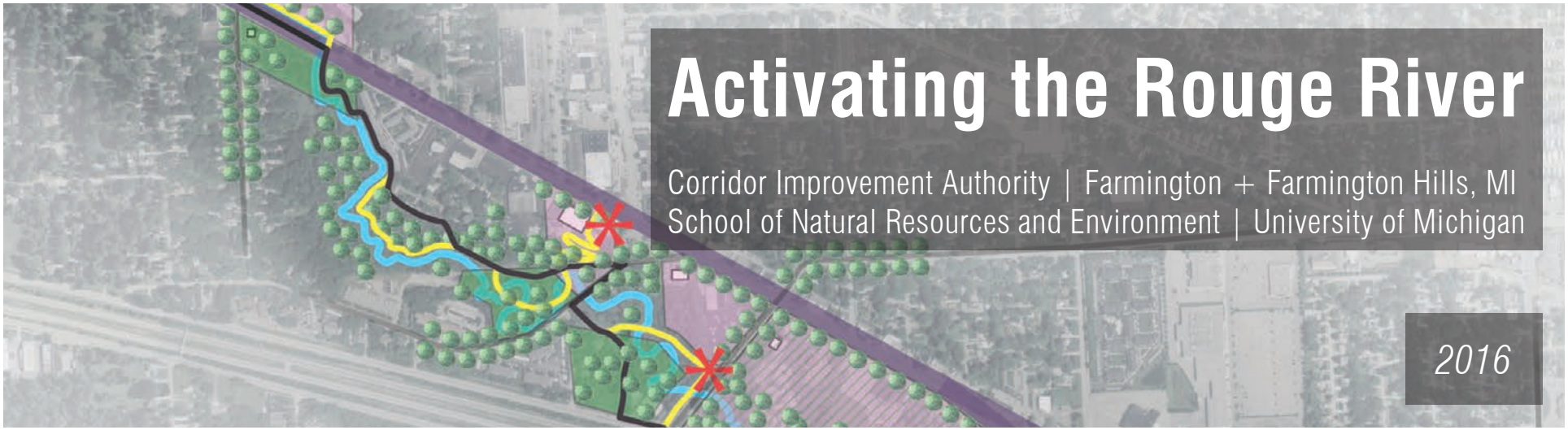

Activating the Rouge River

Corridor Improvement Authority | Farmington + Farmington Hills, MI
School of Natural Resources and Environment | University of Michigan

2016

Activating the Rouge River

Farmington and Farmington Hills, MI

Project submitted in fulfillment of the Masters Opus Requirement at the University of Michigan's School of Natural Resources and Environment.

April 2016

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Image of chimney swift on cover from: http://images.nationalgeographic.com/

Executive Summary

The cities of Farmington and Farmington Hills, Michigan have formed the Corridor Improvement Authority (CIA) under the long-term goal of revitalizing the area around Grand River Avenue. The corridor has been recognized for its economic potential given its proximity to the Rouge River, the northern stretch of which flows through town. Long identified as a key natural amenity, the Rouge River currently lacks integration with the community but shows great opportunity to transform the Grand River Avenue area. What follows is an in-depth investigation of the Rouge River's potential for transformation into a trail system capable of improving not only economic development in the area, but community health and well being. To re-engage the community with the Rouge River, existing ecological conditions and development patterns in the area were cataloged and used to inform a design proposal for a trail network system. Integrating the outcome of the ecological survey, field walks, and the community engagement process, a contiguous trail system was developed that consists of multiple types of trails, opportunities for ecological stewardship, and priority sites for larger enhancements such as parks and commercial activity. Implementation strategies to leverage opportunities throughout the Rouge River corridor were developed. Included are results from community engagement, recommendations for invasive species management, information about conservation easements and economic impacts of trails, phasing strategies, and recommendations for improved stormwater management. Three sites were chosen as key locations to showcase how design elements and proposed implementation strategies can be integrated along the Rouge River trail system. As a whole this report presents a grand vision for the Rouge River trail and provides the CIA with specific tools that can assist the CIA as the cities move forward with the revitalization of the Grand River Avenue area.

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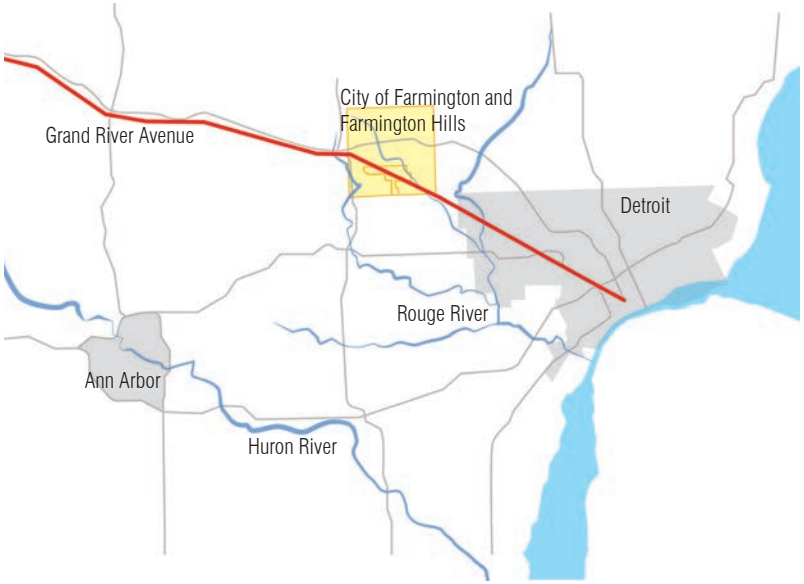
1 Introduction



Regional context

Overview

The cities of Farmington and Farmington Hills, Michigan have unified under the long-term goal of revitalizing the area around Grand River Avenue, which runs through the center of both cities. In order to focus and facilitate the planning and implementation of the Grand River Avenue corridor revitalization, the Corridor Improvement Authority (CIA) was created in 2011, with the two cities working jointly toward this common goal. The process to revitalize the corridor is well underway as the CIA has already begun the public engagement process and created a strategy for Tax Increment Financing to boost development efforts.

The stretch of Grand River Avenue along commercial centers of each respective city is recognized for its potential as an economic engine. However, the development of the two cities has not fully leveraged the Rouge River as a catalyst over the years. The master's project team from the School of Natural Resources and Environment at the University of Michigan was invited to analyze and consider how the Rouge River can be better integrated into the community for robust economic development, better human well-being, and enhanced ecological conservation.

Rouge River

Typical view of Grand River Avenue

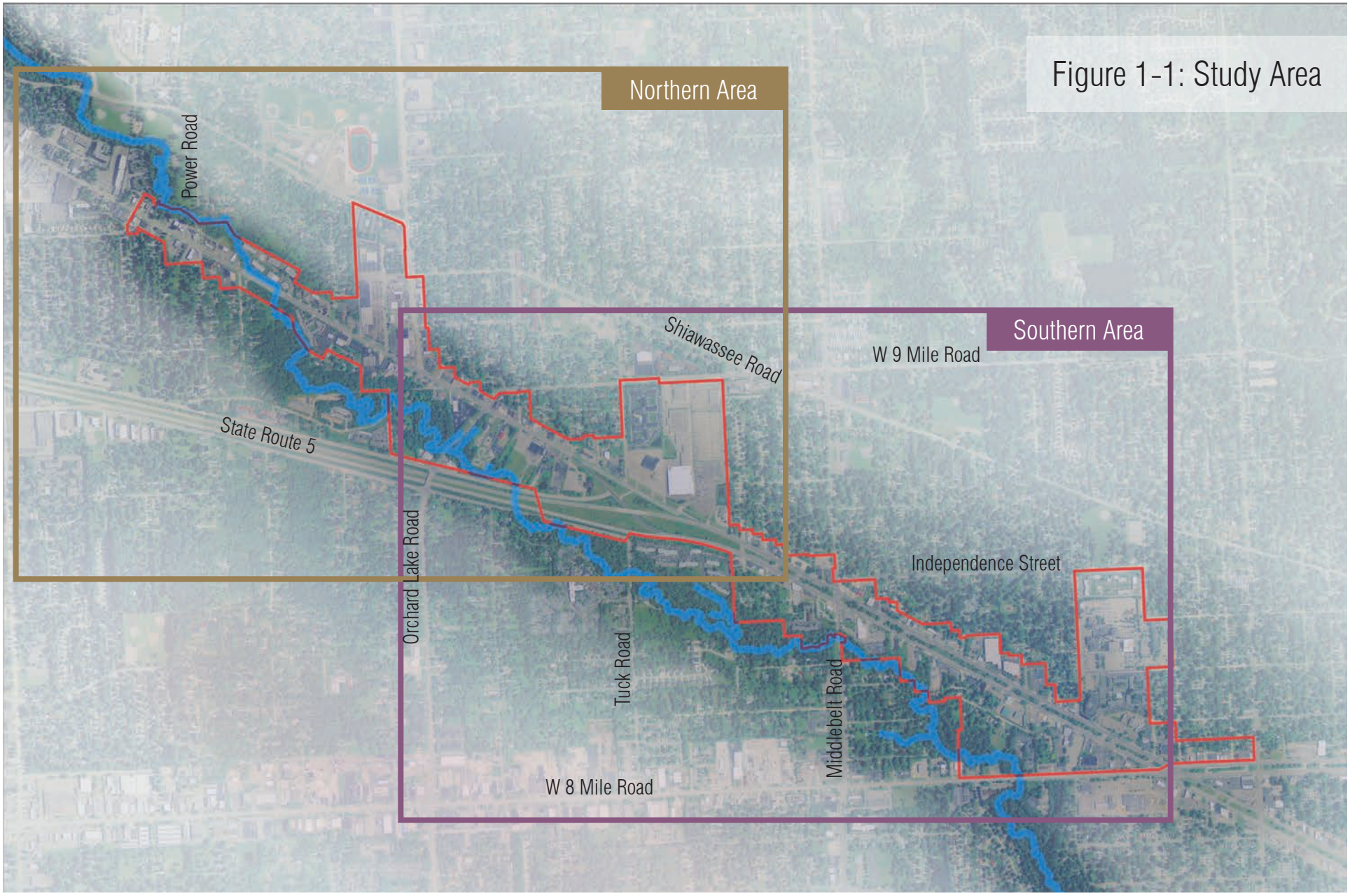


Figure 1-1: Study Area
Northern Area
Southern Area
Power Road
Shiawassee Road
W 9 Mile Road
State Route 5
Orchard Lake Road
Tuck Road
Middlebelt Road
Independence Street
W 8 Mile Road
CIA Boundary
Rouge River
N
0
1/8
1/4
1/2 Miles

Project Goals

A trail system running the length of the Grand River Avenue corridor is considered the central element that can fully activate the Rouge River. The system strives to build upon the existing assets of the community to enhance opportunities for engagement with the river and catalyze the on-going development of the Grand River Avenue corridor. The primary objectives of the proposed trail system and the year-long project culminating in this report are to:

1. Work with the community to reimagine the potential of the Rouge River as an asset

Farmington and Farmington Hills are transforming themselves to increase their attractiveness as communities to live and visit. How can the Rouge River become a part of this transformation and respond to the needs and desires of the community?

2. Recreate connections of the community to the Rouge River

In order for the Rouge River to go beyond an amenity and truly become a part of the community, the members of the community needs to feel, recognize, and embrace the Rouge River as an integral part of Farmington and Farmington Hills. The project aims to make interaction with the Rouge River a part of the daily life of its community, therefore building a sense of community ownership and stewardship towards the Rouge River.

3. Restore the river ecosystem

A healthy river ecosystem supports various habitats and crucial ecological functions. Therefore we must remain cognizant of our reliance on healthy river systems. The project aims to understand the current ecology and proposes ways of enhancing and restoring a healthy Rouge River ecosystem.

4. Promote better health and mental well-being

Research has shown that even a 10 minute break taken in nature can improve one's mental well-being. The project aims to provide opportunities for community members to use the trail system for both short breaks and longer exercises for overall better physical health and mental well-being.

5. Stimulate economic growth

Grand River Avenue is a high traffic road with great potential for economic activity. The project aims to activate the Rouge River as a regional attraction to stimulate economic growth along the Grand River Avenue corridor. By creating highly accessible destinations for commercial and recreational activities, the project reinforces the corridor's reputation as a place people want to be.

Project Study Area

The study area for this project focuses on the Rouge River stretch that was defined to the east and west by the extent of the CIA boundary. The north-south extent of the project was loosely defined by the area of immediate influence by the Rouge River in conjunction with the CIA boundary (Figure 1-1).

Existing Plans & Documents

With the assistance of OHM Advisors, a planning and consulting firm, the CIA successfully engaged the community and gathered preferences to help form the creation of the Grand River Corridor Vision Plan (Vision Plan) in 2013.

Successful on many levels, the Vision Plan generates a set of guiding development principles to frame future action in the area and identifies major institutions to aid in the realization of the plan's goals. With an overwhelmingly positive response from the community, early conceptual plans were proposed in four focus areas along the corridor as well as potential strategies for implementation.

Though the Vision Plan is very robust, the CIA acknowledges that a finer level of detail is needed in focus areas and the corridor at large. As a conclusion to the Vision Plan, eleven Top Priority Actions are identified as next steps for the CIA and their plans for the Grand River Corridor (Table 1-1). One of these action steps is to develop specific plans for providing access to the Rouge River for the community. A broad concept for how this can be accomplished was presented (Figure 1-2).

Figure 1-2: Natural Environment Concept Plan (Vision Plan)

Additionally, the cities of Farmington and Farmington Hills have been working with the Michigan Department of Transportation on a road scoping project for Grand River Avenue spanning the entirety of our project site and extending westward to Ten Mile Road. Various analyses have been done including crash analysis and contamination site inventory. Of particular importance to this project, four concepts for the restructuring of the M-5 intersection at Grand River Avenue is presented. This intersection is located at the center of our study site and currently a significant barrier to the integration and connectedness of any potential trail system (Figure 1-3). Pedestrian access is among the list of priority concerns that is to be addressed by the restructuring of the intersection. As this is an on-going project, no recommendations for better trail connection between Orchard Lake Road and Purdue Avenue are presented in this report.

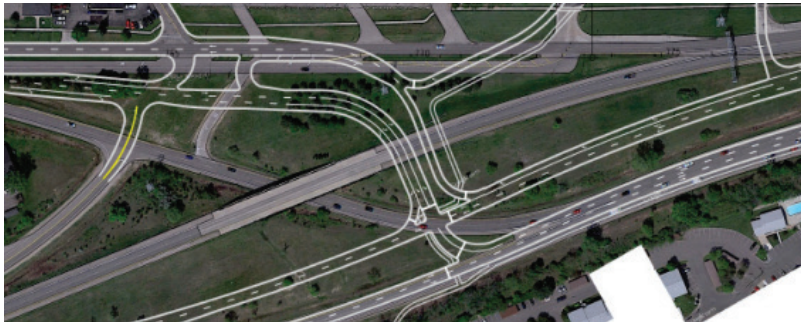


Figure 1-3: Grand River Avenue T-inter with M-5 Concept from the Preliminary Road Scoping Package

Table 1-1: Top priorities as outlined in the Vision Plan; Highlighted items indicate actions that can be addressed by the Rouge River trail development

Top 11 Priority Actions

1. Create a streetscape design for the Corridor that includes concepts for the median and along the street edge, to help unify the Corridor. Traditional lighting, landscaping, public art, road design, non-motorized facilities and utility improvements should be incorporated.

2. Develop a detailed transportation plan that explores the following network concepts: a) Road diet along all or portions of the Corridor; b) Realignment/ reconfiguration of the M-5 split; and c) Realignment of the Orchard Lake Road jog.

3. Better integrate the M-5 freeway into the communities through realignment, new offramps, and alternative alignments at the westbound Grand River Avenue split to M-5.

4. Work with key stakeholders like Botsford Hospital to coordinate connections and redevelopment with their plans for expansion.

5. Allow mixed-use buildings that include upper floor residential as a way to activate key development areas and provide urban-style housing.

6. Draw upon the momentum created at the Botsford Hospital site by establishing a "medical village" of supportive uses within close (ideally walking) proximity.

7. Capitalize on sites with character, like the winery or those with river views, and build a theme around them.

8. Develop regulations that encourage mixed-use and owner-occupied housing options over large-scale rental units.

9. Embrace the Corridor's proximity to the Rouge River by activating the river's edge where possible, developing a nature trail or multi-use pathway, and encouraging businesses that will capitalize on the scenery and natural environment.

10. Plant gardens and landscaping to improve gateways and larger vacant areas in the right-of-way such as in the median at the Grand River Avenue/M-5 split.

11. Create informational and incentive programs to encourage development of green buildings, sites, and neighborhoods.

Planning Approach

This report explores the opportunities presented by the Rouge River and options for how they may be engaged by the community. In accomplishing this task, an interdisciplinary and iterative approach was taken (Figure 1-4). Community, natural environment, existing built fabric, and human experience were balanced in an attempt to achieve the greater vision of re-engaging the Rouge River. In addition to the inventory and analysis conducted by the project team, community input was gathered at key phases of design and integrated into recommendations. This approach seeks not only to create a trail system, but to generate synergy amongst the different elements of community, thus catalyzing a future of environmental responsibility, health, and economic vitality.

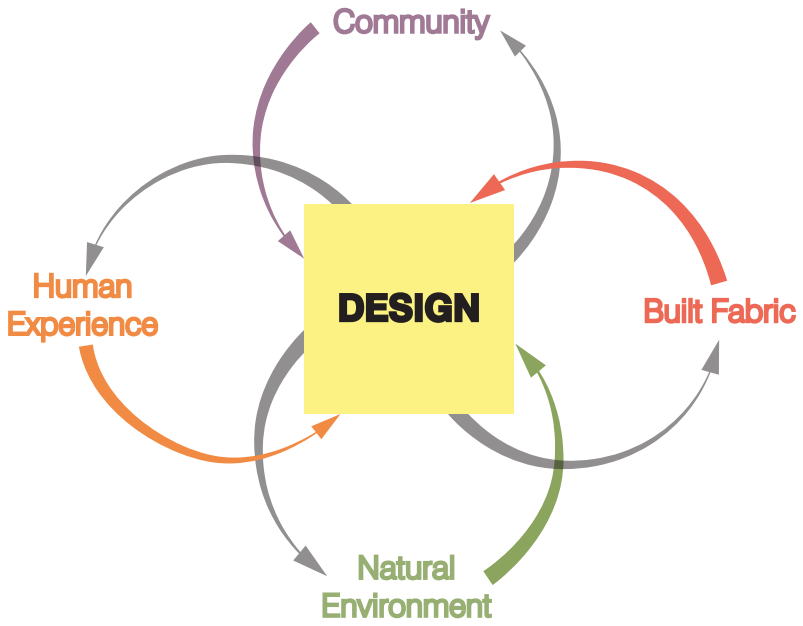


Figure 1-4: The interdisciplinary and iterative nature of the planning approach

Plan Structure

Chapter 1: Introduction
The current chapter presents the context and history of the project. A brief review of existing documents frames the objectives of the report, and an explanation of the planning approach is given.

Chapter 2: Inventory and Analysis
Existing conditions and opportunities of the site will be discussed at length. Topics presented range from the surrounding context, ecological conditions, to the community outreach process.

Chapter 3: Concept Design
This chapter introduces the concept of the trail system along the Rouge River. An explanation of proposed trail types, development patterns, and key features or attractions within the trail network system is presented.

Chapter 4: Project Phasing
Priority sites will be presented along the proposed trail system. Phasing recommendations are presented to ensure success of the project's development through time and continued engagement with the community.

Chapter 5: Implementation Strategies
An overview of design elements and management techniques that relate to the development and eventual implementation of the project is presented to provide a deeper understanding of the proposed concept. Topics covered include trail design, ecological enhancements, stormwater management, economic impact, conservation easements, and legal considerations based on existing conditions. Case studies are also briefly presented to showcase the range of potential in greenway planning. The chapter concludes with a development toolkit that summarizes the strategies and can be used in future planning activities along the Rouge River.

Chapter 6: Focus Areas
This chapter will present detailed designs for three locations along the trail system outlined in the previous chapter. These designs are meant to be catalysts for future implementation and exemplary of what could happen throughout the corridor utilizing the strategies presented in Chapter 5.

Chapter 7: Appendix
This chapter will present supporting images and information of finer detail that were not included in the main body of the report for reference.

2 Inventory + Analysis

Overview

The Rouge River flows through southeast Michigan and discharges into the Detroit River, with its watershed covering 467 square miles across Wayne County, Oakland County and Washtenaw County. In its lower order teachers, the Rouge River is comprised of four branches. The project site is along the Upper Branch of the river in the municipalities of Farmington and Farmington Hills.

The Grand River Avenue corridor has developed centered on travel via the automobile and the Vision Plan identifies the potential and need to transform the area into a more pedestrian and bicyclist-friendly corridor. The Rouge River, long overlooked as an asset to the community, presents the opportunity to create a trail enhancing this non-motorized accessibility. It also presents the opportunity to connect the community to its natural assets, promote a healthy lifestyle, and market the cities as forward-looking and receptive to the needs and desires of the future residents looking for a variety of amenities.

Currently the only direct access to the Rouge River by the Grand River Corridor is in Shiawassee Park just upstream of the study area and Hearthstone Park just downstream of the study area in Livonia. Other points along Grand River Avenue hint toward its proximity to the river through signage or filtered views from bridges. Revealing the values of the Rouge River will be a major step to the economic revitalization of the Grand River Corridor as evidenced by other trail projects.

Grand River Avenue runs primarily parallel along the river corridor and can be dramatically transformed with the introduction of a river trail running through town. In several locations along the Avenue, opportunities for expanded business ventures and new economic development centers exist that can interact with the river more synergistically to create a vibrant experience along the corridor.

Region

The region surrounding the study area is a diverse mix of land uses, habitat types, and people that contribute to the character of southeast Michigan. The northern branch of the Rouge River is only one of the many waterways that comprise the Upper Rouge River Watershed and feed into the Detroit River. Supporting these waterways is a rich network of wetland and floodplain systems as well as forested areas that contribute to a wide array of ecosystem services and support human and non-human populations of the region. Many preserved open spaces add to the connectivity that enhance these networks as migratory pathways, places of flood protection, and recreational amenities, as characteristics of greenways of similar size[1]. The study area along the Rouge River is located in section where increased development has reduced the size of quality habitat patches and increased fragmentation. Increased connectivity of natural areas through the creation of the trail network could enhance habitat quality in the region by providing a key linkage for ecological networks[2] (Figure 2-1).

The same dispersive patterns of development that reinforce the area's important role in maintaining adequate habitat patches also increase the importance of the area servicing as recreational space for public enjoyment. The towns of Farmington, Farmington Hills, Southfield, and Livonia, all in close proximity to the CIA boundary, make up a total population of roughly 260,000 people as of 2013. Given its location in highly trafficked area with development occurring immediately along its edges, the study area has the potential to become one of the most heavily used greenways in the region. Considering the local demographics (Figures 7-1 to 7-3 in appendix), preservation of this natural area and the development of it for public use is very important to provide the many well-documented benefits of natural areas. With such an expansive open space network in the heart of the urban core, those lacking the means to travel and seek out nature experiences and recreational opportunities can now enjoy them close to home for more regular use.

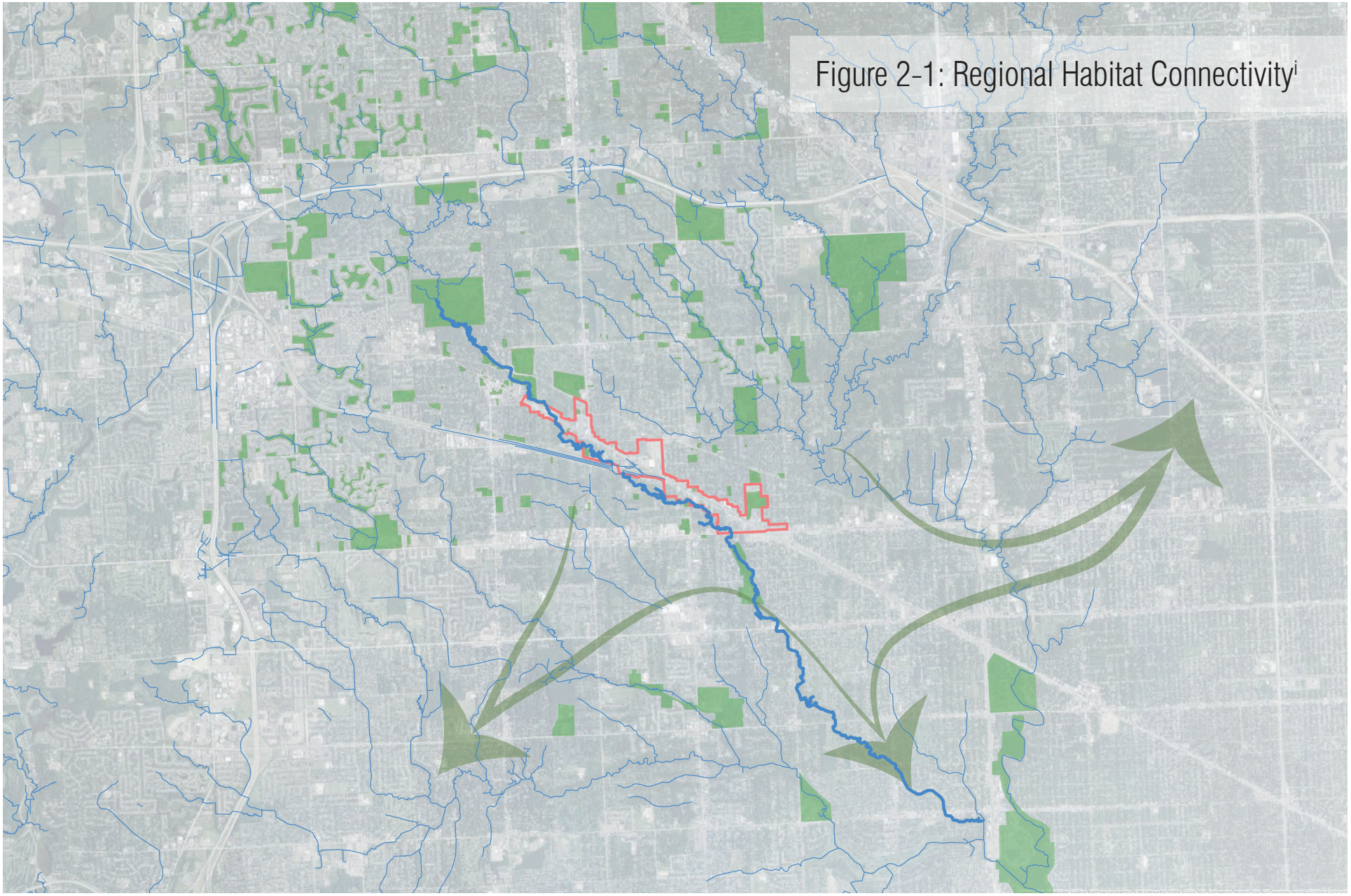


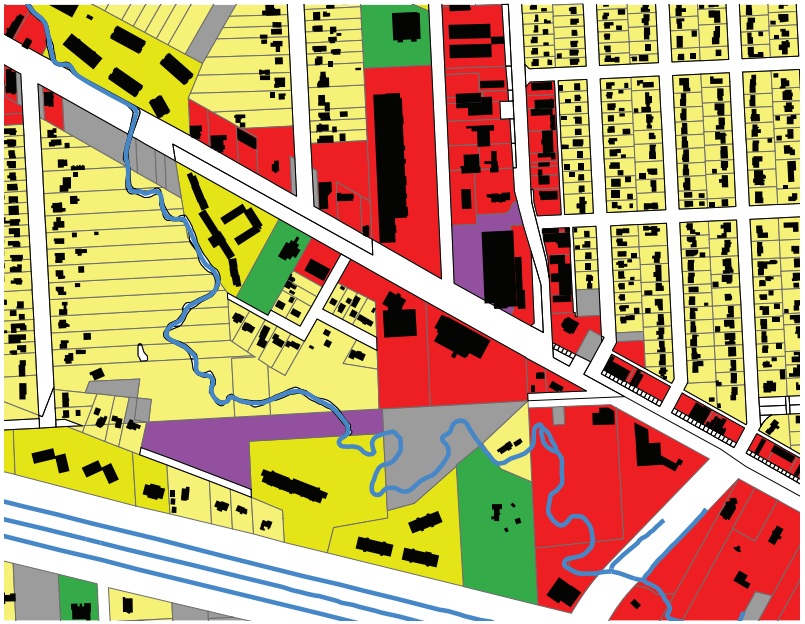
Figure 2-1: Regional Habitat Connectivity[i]
Public, Recreational, Conserved Natural Areas
CIA Boundary
Rouge River Branches
Habitat Connection
0
1/2
1
2 Miles
N

Built Features and Land Use

The surrounding area around the Upper Rouge River branch is primarily low density, single family housing. Retail, primarily of a wholesale and light industrial nature, dominates the uses immediately along Grand River Avenue. Many of these businesses are one story buildings with small footprints and ample surface parking. Where development meets the river, many of the lots are longer, linear shapes that touch the river on their far ends. If retail, as along Grand River Avenue, much of the land remains undeveloped (Figure 7-4 in appendix). This is likely because of restrictions that prevent development from obstructing water flow in the floodplain. Steep slopes that descend down to the water's edge may also prevent use of the back half of the retail parcels (Figure 7-5 in appendix).

Residential lots along the river corridor are also long and linear with the river often defining the far ends of the lots. In many of these cases, the potential of a trail system does not seem to dramatically interfere with residential users as the river is far from built structures and not readily in viewshed. Occasionally, the river bisects residential lots at their midpoint and runs closely along residential spaces. In these places, strategies will be needed to address both the quality of the river trail experience and the negative impact of trail development on housing in close proximity.

In some places, the river defines a border for multi-family residential lots and other uses. Some vacant parcels do exist along the river corridor which present an opportunity for development based on availability but also due to their location, as is the case with the parcel at 8 Mile Road, along the bridge at Grand River Avenue, and along Tuck Road. Their proximity to the Rouge River, Grand River Avenue, and residential area presents high potential for the community to engage the Rouge River for recreational and commercial activities.



Mix of land uses and lot arrangements (see Figure 7-4 in appendix for full map and legend)

Businesses along Grand River Avenue

Access and Circulation

Grand River Avenue, running parallel with the Rouge River, is among the most prominent routes of access to Farmington and Farmington Hills. Stretching from Detroit to the outer suburbs, Grand River Avenue is a multi-lane arterial corridor with a high level of activity along it. The area north of the study area in Farmington has a stronger downtown character with its businesses, pattern of development, and signage. Many businesses are within walking distance from one another with many building frontages meeting the sidewalk, creating a more pedestrian scale distinct. Moving south along Grand River Avenue in the study area, the downtown features quickly give way to the suburban character typical of the area within the CIA boundary. The mix of residential and commercial development has a much more automobile-oriented style of development. Here, businesses generally have parking lots in front of the building which detracts from the sense of walkability along the corridor. Grand River Avenue continues and eventually merges with M-5, another prominent arterial of the area. The intersection is similar to highway interchanges and creates two distinct zones of Grand River Avenue. Along the southern stretch of Grand River Avenue corridor, a landscape median divides opposite directions of travel and has few opportunities for pedestrians to cross the street.

Several other main roads, such as Middlebelt Road, Orchard Lake Road, and Eight Mile Road, connect to the broader communities and intersect both Grand River Avenue and the Rouge River. Orchard Lake is very important in that it is a main route crossing M-5. The segment of Grand River Avenue between Orchard Lake Road and M-5 has higher average daily traffic and turning movements. Middlebelt Road is also a heavily trafficked road. Despite higher speeds, Middlebelt has been identified as a potential gateway to the river trail given its proximity to the river and prominence along the Grand River Avenue corridor.

The areas around the main roads serve as key connection points to anchor development along the corridor and provide gateways to the new urban riverfront experience created. The historic winery serves as a key connection point to the river based on its cultural significance within the community. With its proximity to both the river and Grand River Avenue as well as popular attention given by the community, the potential for the winery to be reimagined as a community gathering place and economic development hub remains high. Shiawassee Park and the vacant lot on 8 Mile Road west of Pearl Street are also identified as potential gateway sites for their importance at either end of the trail system. Space for looped trails along the corridor are limited, but have been identified and matched with potential gateways and access points.

The Grand River Avenue Preliminary Road Scoping Package identified several locations along Grand River Avenue to have high accident rates. These locations have higher than average accident rates but are not on the SEMCOG high frequency crash locations. Lack of pedestrian crossing opportunities along Grand River Avenue is also identified in the report and has a direct effect on the potential accessibility of a trail system.

Historic Winery and Grand River Avenue[ii]

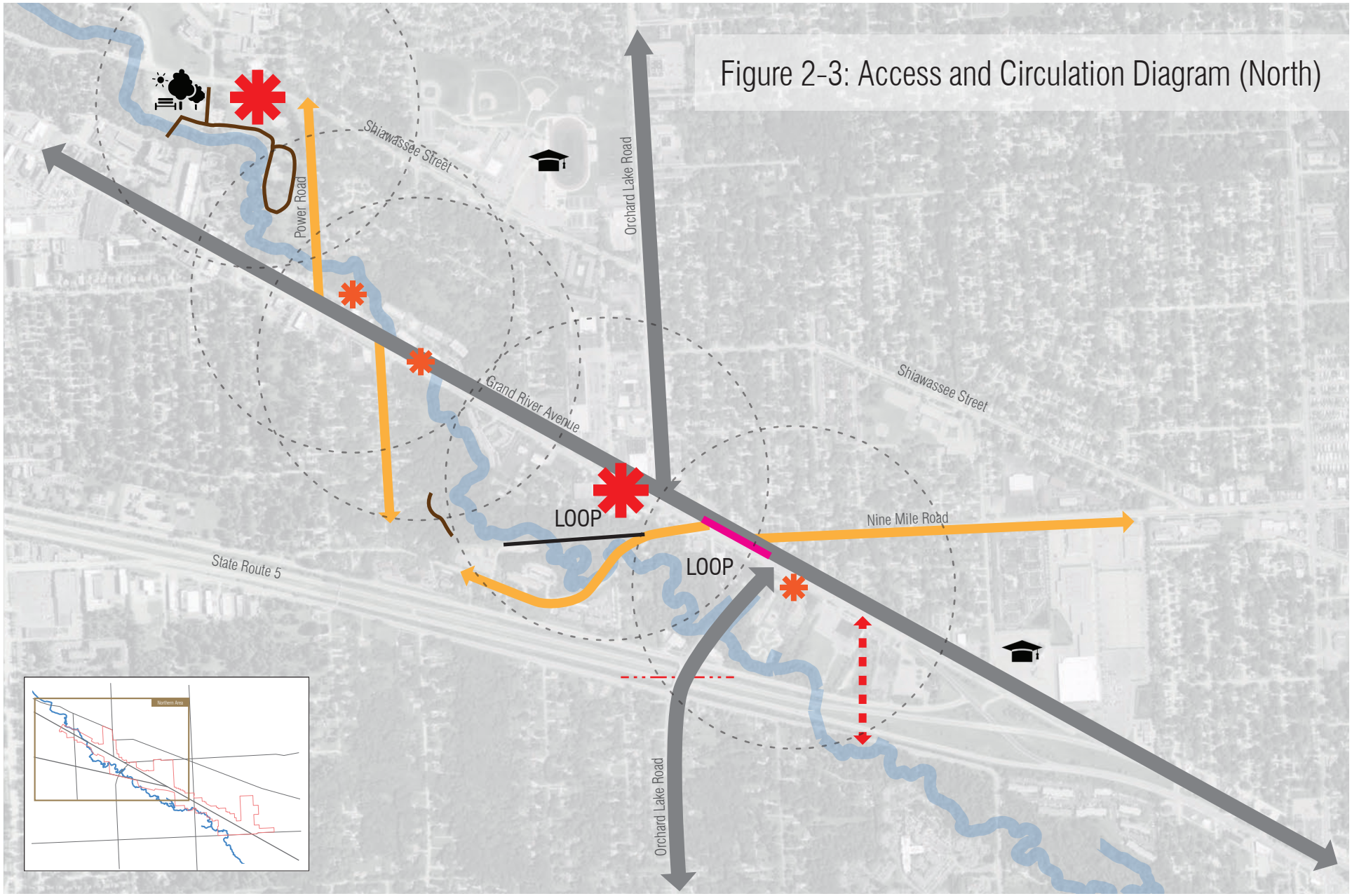
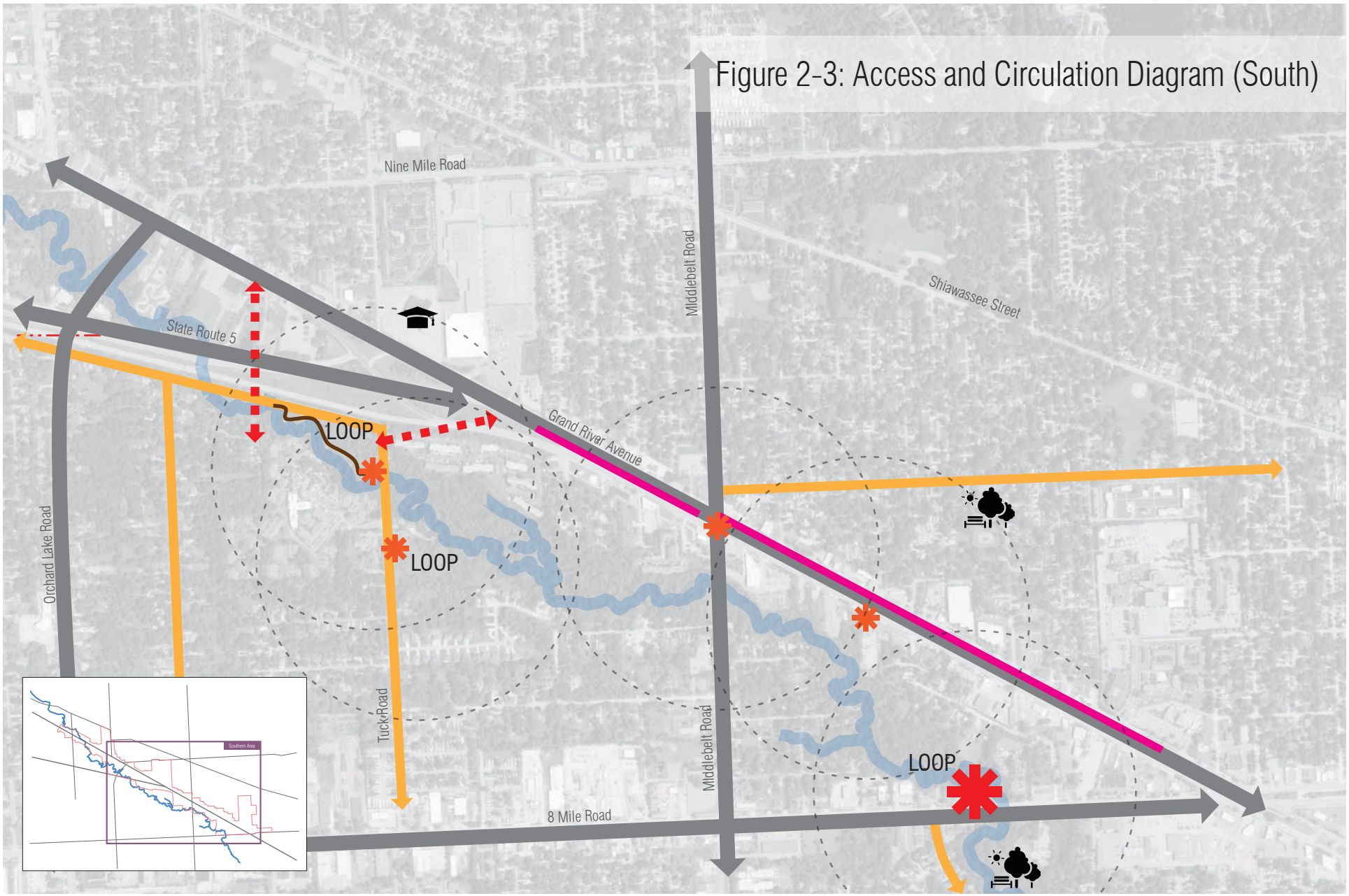


Figure 2-3: Access and Circulation Diagram (North)
Shiawassee Street
Power Road
Orchard Lake Road
Grand River Avenue
Shiawassee Street
LOOP
Nine Mile Road
LOOP
State Route 5
Orchard Lake Road
Match Line
Existing Trails
Potential Gateway
High Traffic Roads
Utility Line
Potential Access
Neighborhood Connector
Missing Access
Schools
High Crash Sites
1/4 Mile Radius
Existing Parks
N
0
1/8
1/4
1/2 Miles

Figure 2-3: Access and Circulation Diagram (South)



Physical Terrain

The area surrounding the Rouge River and Grand River Avenue is primarily a deciduous hardwood forest of varying degrees of seasonal inundation and thickness of vegetation. Primarily within the floodplain of the river, much of the study area is prone to the varying water levels characteristic of smaller order streams. As part of this gradation from dry to wet, the subtleties in vegetation patterns and ecosystem characteristics shift with changes in topography. Steep slopes are very characteristic of the area, many of which create a natural barrier between built and natural areas of the corridor. Slopes of up to 100% are not uncommon in the area and pose considerable challenge in accessing the river in some of the most desirable areas (Figure 7-5 in Appendix).

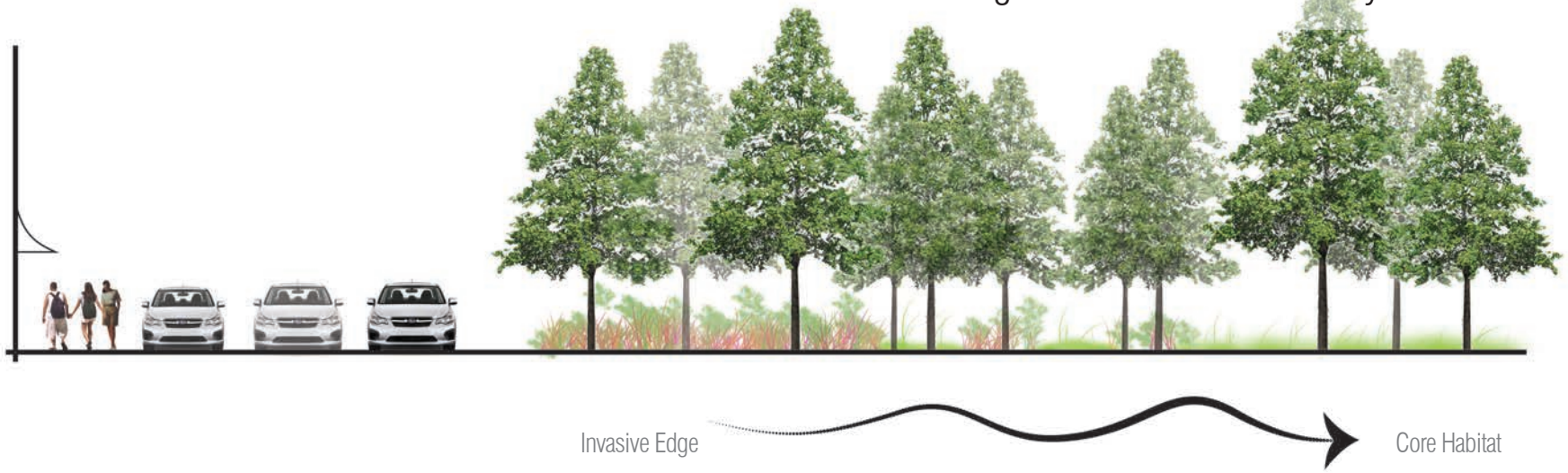
Man made features exert similar influence over the study area. Through time, many of the natural conditions of the corridor have been impacted. Increased impervious cover of the watershed has changed hydrologic regimes, quickening the rate and volume of stormwater reaching the Rough River. In some places, stormwater discharge pipes send this stormwater directly to the river channel. Road construction and other development projects have also directly impacted the topography and stream morphology itself. Where major roads intersect the river, channelization has confined stretches to narrow culverts, altering the stream's relation to its floodplain during periods of high flow.

Development has also had its effect on the vegetative community along the corridor. Bisected by roads and development, the once contiguous floodplain system that served the Upper Rouge River is now a series of smaller patches. With these smaller patches, the general trend of increasing plant density in the understory was observed along the edges of development. Species diversity generally follows these patterns with diversity being highest at the ecotones, however, these spaces were generally found to be heavy in invasive cover (Figure 2-4).

Rouge River meets urban development

Stream channelization under 9 Mile Road

Figure 2-4: Invasive Density at Forest Edge



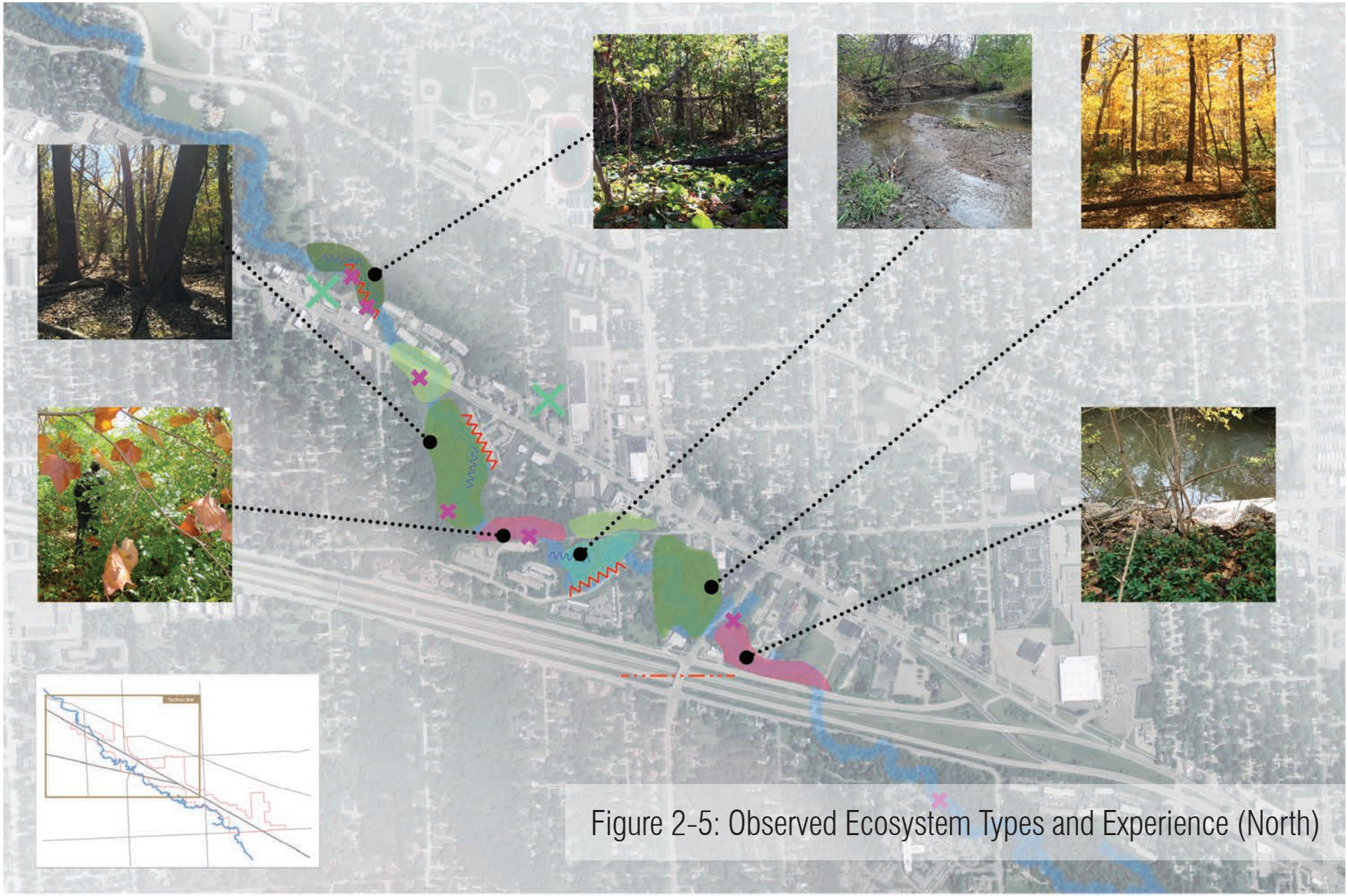
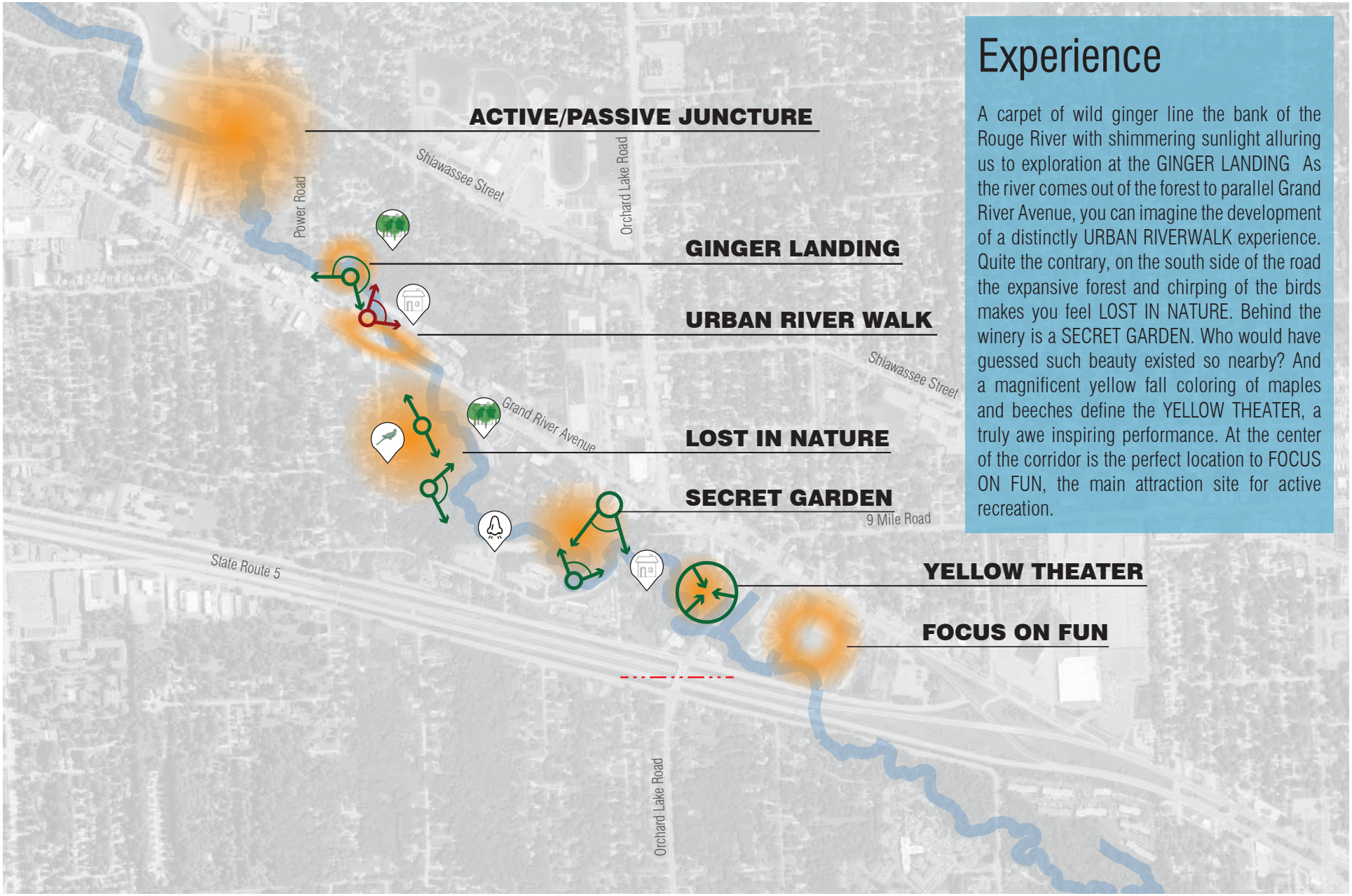


Figure 2-5: Observed Ecosystem Types and Experience (North)



Experience

A carpet of wild ginger line the bank of the Rouge River with shimmering sunlight alluring us to exploration at the GINGER LANDING As the river comes out of the forest to parallel Grand River Avenue, you can imagine the development of a distinctly URBAN RIVERWALK experience. Quite the contrary, on the south side of the road the expansive forest and chirping of the birds makes you feel LOST IN NATURE. Behind the winery is a SECRET GARDEN. Who would have guessed such beauty existed so nearby? And a magnificent yellow fall coloring of maples and beeches define the YELLOW THEATER, a truly awe inspiring performance. At the center of the corridor is the perfect location to FOCUS ON FUN, the main attraction site for active recreation.

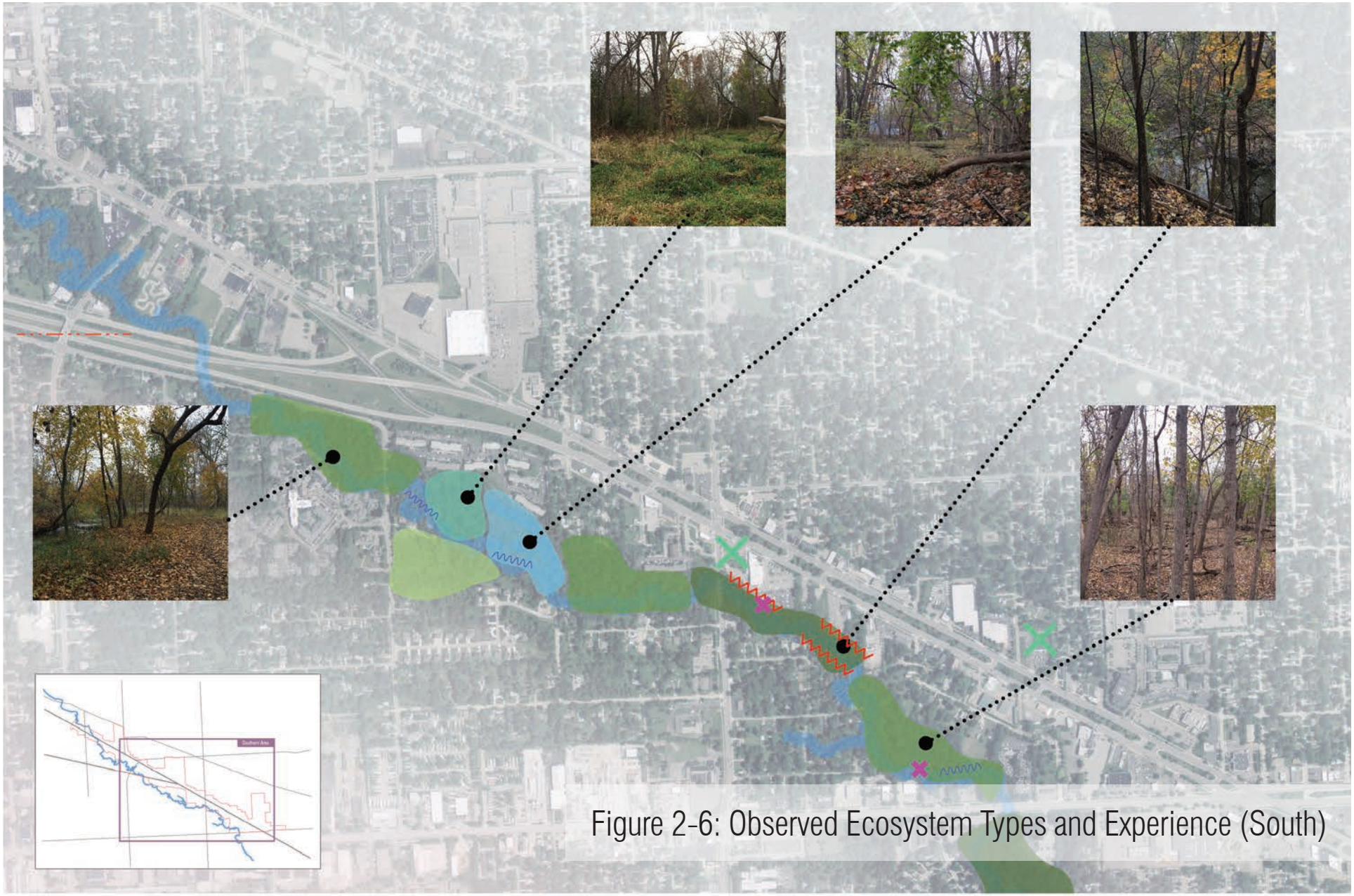
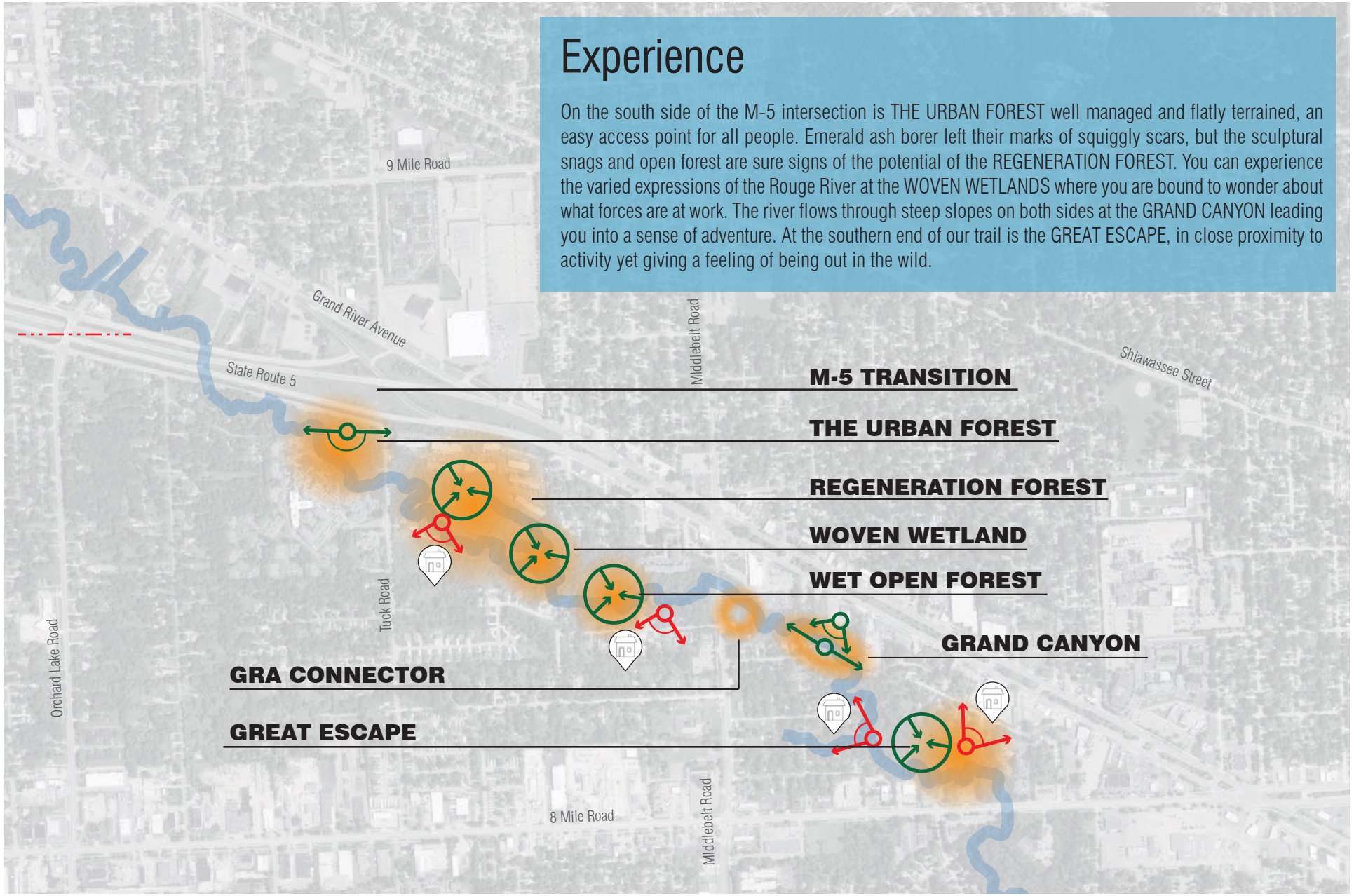


Figure 2-6: Observed Ecosystem Types and Experience (South)

Experience

On the south side of the M-5 intersection is THE URBAN FOREST well managed and flatly terrained, an easy access point for all people. Emerald ash borer left their marks of squiggly scars, but the sculptural snags and open forest are sure signs of the potential of the REGENERATION FOREST. You can experience the varied expressions of the Rouge River at the WOVEN WETLANDS where you are bound to wonder about what forces are at work. The river flows through steep slopes on both sides at the GRAND CANYON leading you into a sense of adventure. At the southern end of our trail is the GREAT ESCAPE, in close proximity to activity yet giving a feeling of being out in the wild.



Vegetation Inventory

Restoration efforts and land management plans often focus on plant communities, as they are vital resources for wildlife and capable of altering the hydrology of a site. When starting any project, it is important to gather information on vegetation to determine what is capable of growing at the site, if there are any rare or endangered species, what resources are currently available for wildlife, if there are invasives present, and what can be expected to grow in the future.

Nonnative plants are an ongoing concern in land management in the Great Lakes region. Some nonnative species become "naturalized" and have little to no impact on ecological systems, while others become invasive and create dense monoculture-like conditions. These plants may negatively impact native plant communities, change the hydrology or soil chemistry of a site, and impact wildlife by reducing browse. The forested areas within our study site have a high degree of invasive species growth, which may come into conflict with land-use goals for the river revitalization. The four main invasive species found at the site are described below, and solutions are suggested in the Implementation Strategies section (Chapter 5) of the report.

Honeysuckle

There are two main species of Honeysuckle in our study area along the Rouge River: *Lonicera maackii* and *Lonicera tatarica*. These are known as Amur and Tartarian Honeysuckle respectively, but since they share very similar traits and life history[3,4], they will both simply be referred to as "Honeysuckle" for this document.

Honeysuckle is a shrub native northeastern China, Korea, and parts of Siberia and Japan[5]. It was introduced to North America in the 1890's as a landscaping plant and for wildlife habitat improvement, however Honeysuckle did not stay confined to gardens and designated restoration areas for long. It was noted as an invasive plant as early as 1924[5], and has since become a problem in many areas. It grows as an upright shrub with arching branches that eventually form dense canopies, capable of shading out many understory plants and tree seedlings[3]. There is also some evidence that Honeysuckle exhibits a trait called allelopathy, where its roots release a compound into the soil that makes it harder for other plants to grow[6].

Honeysuckle can be found in open areas and second-growth forests[5,7]. It can tolerate shade and take advantage of high light levels[8, 9], giving it a wide range of possible habitats. It generally becomes outcompeted in large stands of mature trees, thus it is not found deep in forest interiors[5]. However, given that our study area along the Rouge River is a heavily fragmented second-growth forest, it is unlikely that Honeysuckle will ever become excluded due to natural processes.

Honeysuckle seeds prolifically with clusters of red berries, which are then dispersed by birds[10]. This allows it to spread widely to areas that would otherwise be isolated from invasion. It also experiences less herbivory than most native woody species[4,11], further aiding its successful growth at the expense of native plants. In many studies, Honeysuckle has been correlated with the decline of species richness, native shrub abundance, and growth of native trees[12, 13,14]. It also reduces tree seedling density in invaded forests[3].

Honeysuckle[iii]

Buckthorn

Rhamnus cathartica, also known as Common Buckthorn, is a shrub or small tree that is native to Europe and western Asia[15]. It was imported to North America in the 1800's for medicinal purposes, and later as a hedge plant[16]. It is a fast growing plant that can form dense thickets across a variety of habitats and soil moisture gradients[17], making it ideal for a living fence in agricultural areas.

Buckthorn grows best in disturbed, open places that are fertile and moist[18]. However, it is an incredibly hardy plant that tolerate both drought and flooding[19]. It is highly shade tolerant, but can readily take advantage of light for faster growth[20]. This makes it uniquely able to take advantage of canopy openings, once they occur.

Similar to Honeysuckle, Buckthorn invades most easily at edge habitats[21]. However, unlike Honeysuckle, it can also invade forest interiors[18, 22, 23]. In addition to its general hardiness, Buckthorn has a number of other traits that make it a highly invasive species. It produces copious quantities of black berries[15] that are bird dispersed[24], which allows it to expand its range. Its seeds have a very high germination rate that is enhanced by disturbed areas with bare soil[25]. Like Honeysuckle, Buckthorn is also lacking in predators, as many native herbivores avoid it[26, 27].

Buckthorn creates dense monocultures over large areas that can become almost impassable thickets. This can limit the growth of native tree species simply by shading and competition[3,28,29]. Buckthorn also alters the nutrient cycling and chemical composition of the soil in which it grows, and changes the structure of understory communities[23,30]. It is an invasive that is generally associated with the decline of native plants[31].

Garlic Mustard

Alliaria petiolata, otherwise known as Garlic Mustard, is a biennial herb with small white flowers. It is native to Eurasia but was introduced by colonists to North America in the 1800's for its properties as both an edible and medicinal plant[32].

Garlic Mustard commonly inhabits shaded, moist areas, though it can do well in sunny sites as well. It can be found at many elevations in a variety of light conditions, and on a number of different types of soil[33, 34]. It is a successful floodplain invasive, since it has the ability to survive completely flooded areas for up to four months per year[33]. Like Honeysuckle and Buckthorn, it thrives in disturbed areas and its presence is often correlated to bare soil[34].

Garlic Mustard's success as an invasive can also be attributed to its ability to self-pollinate[35, 36] and the compounds in its leaves that discourage herbivory[37, 38]. The mustard plant produces copious seeds[39, 40] that remain viable in the soil for up to 10 years[41], which makes eradication difficult.

Garlic Mustard forms dense monoculture stands that can cover hundreds of square meters and displace native species in invaded habitats[42,43,44]. Its invasion has been associated with the decline in native plant diversity[45]. Scientists generally consider it to be a serious threat to understory communities[43].

Buckthorn[iv]

Garlic Mustard[v]

Privet

Privet (*Ligustrum vulgare*) is a branched semi-evergreen shrub native to Europe that was introduced to North America during the colonial period[46]. It was widely used as a hedge plant by homeowners and along highways in the early 1900's[47]. It has since escaped cultivation and has become naturalized or invasive in eastern North America and the Midwest. It is not considered to have reached the level of infestation of other invasive shrubs such as Honeysuckle[48], but is still a species of note as it is found quite commonly along the Rouge River.

Privet, like many other shrubby invasives, can grow in a variety of conditions. It thrives in full sun and along stream banks, but can tolerate shade, drought, and almost any kind of soil[49,50]. Consequently, Privet is most likely to be invasive in riparian areas and forest edges, both of which characterize our study area along the Rouge River. Like Honeysuckle and Buckthorn, Privet is a prolific seeder; it can produce more than 10,000 fruits per plant and relies on birds and other animals to disperse seeds widely[51]. Privet can form dense thickets that displace native species in natural areas[52].

Privet[vi]

Shrub Removal Priorities

Honeysuckle, Common Buckthorn, and Privet are included under one invasive shrub cover map because they are all removed with the same methods and tools. During volunteer workdays, all three invasive species would be targeted at once. It should be noted, however, that Honeysuckle comprises the vast majority of shrub cover.

High Priority

If the CIA values the Yellow Theater area as a cultural asset worth preserving, the Honeysuckle infestation should be removed from the section of forest between 9 Mile and Orchard Lake Rd, north of the river. If Honeysuckle overtakes the whole area, it may shade out maple tree seedlings and prevent forest regeneration in the long term. This area is not yet fully colonized and if action is taken soon, the area has a good chance of successful shrub eradication after several years. Given the site's experiential and ecological value, the prospect of losing the Yellow Theater to dense invasive cover makes ongoing management in this area a high priority.

The southernmost portion of the CIA boundary by 8 Mile Road is proposed as another short term priority. If the CIA decides to pursue our design suggestions for a community recreation area and a trail loop here (see Chapters 3 and 7 for Concept and Focus Area Plans), action should be taken to remove shrubs immediately. Thickets of invasive shrubs, primarily Common Buckthorn and Honeysuckle in this case, will come into direct conflict with the recreational value of the site. The invasives are currently at an early stage of colonization, but will quickly become less manageable if not removed soon.

Medium Priority

There was very little shrub invasion in the sections of forest South of M-5, especially the area directly east of Middlebelt Road. Here, shrubs can be eradicated relatively easily, and yearly walkthroughs with volunteers can prevent it from spreading again. This area should be attended to as soon as a reliable volunteer base can be mobilized, before the shrubs spread further.

Long-term Priority

The worst of the shrub invasion are in the two sections of forest surrounding Orchard Lake Rd, and the section of forest near the right-of-way behind the winery. To create a trail, shrub removal must take place to make those areas passable. It should be noted that the large tract of unmapped forest continuing from the bridge over the Rouge River also becomes densely invaded with Honeysuckle. This will also need to be removed eventually in order to create a contiguous trail.

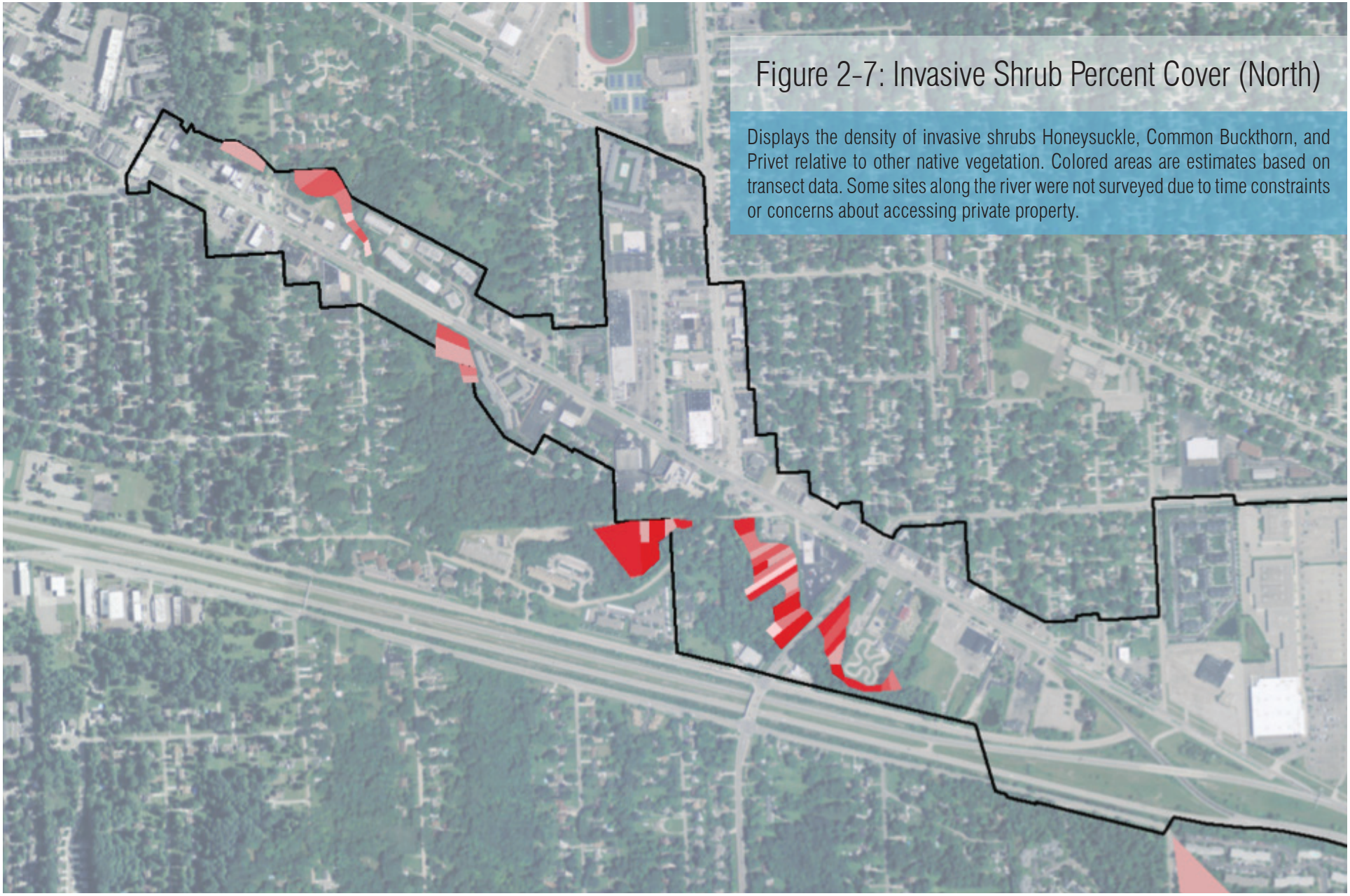


Figure 2-7: Invasive Shrub Percent Cover (North)

Displays the density of invasive shrubs Honeysuckle, Common Buckthorn, and Privet relative to other native vegetation. Colored areas are estimates based on transect data. Some sites along the river were not surveyed due to time constraints or concerns about accessing private property.

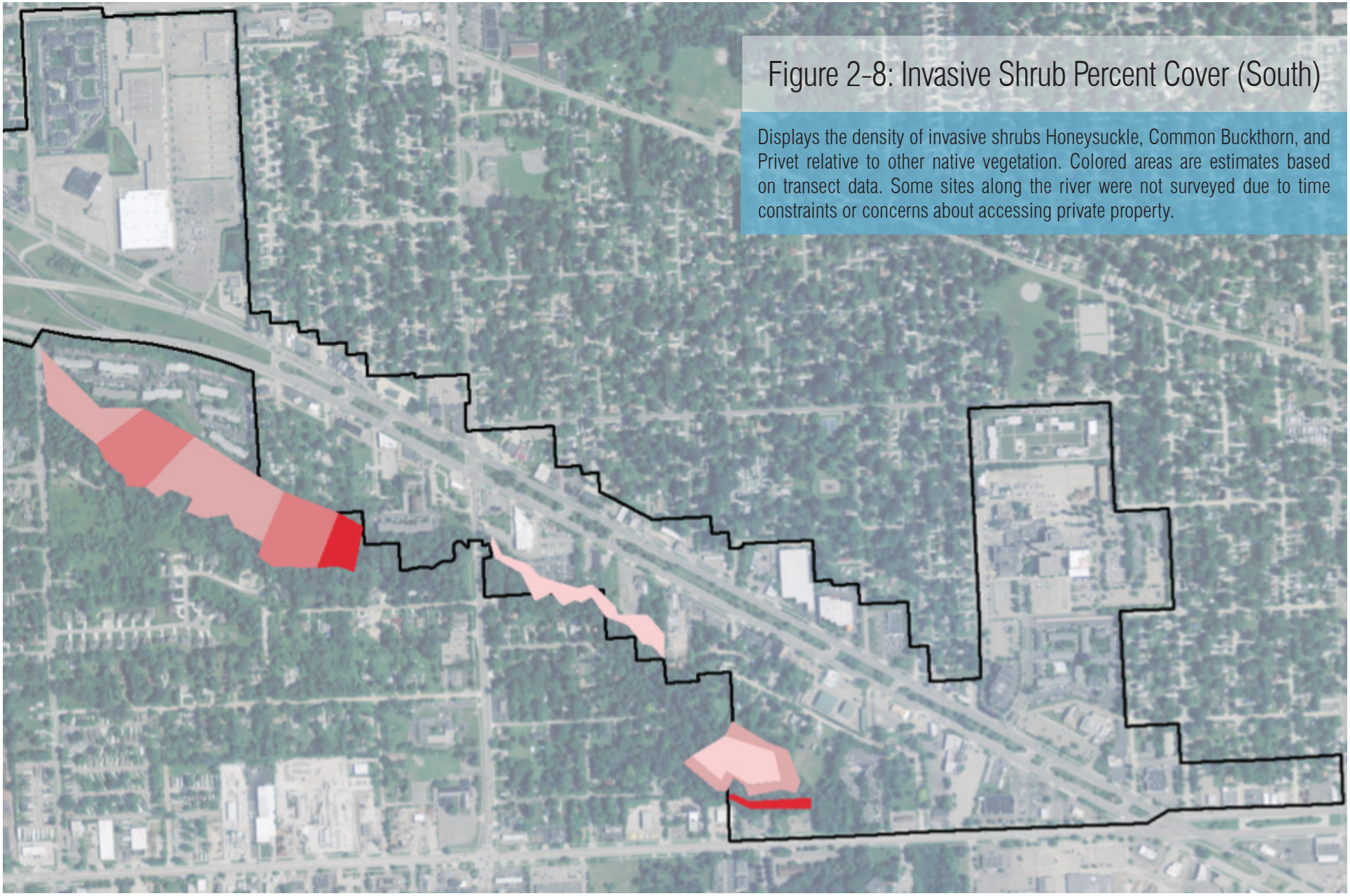


Figure 2-8: Invasive Shrub Percent Cover (South)

Displays the density of invasive shrubs Honeysuckle, Common Buckthorn, and Privet relative to other native vegetation. Colored areas are estimates based on transect data. Some sites along the river were not surveyed due to time constraints or concerns about accessing private property.

Garlic Mustard Removal Priorities

High Priority

Garlic Mustard should be removed first from the section of forest between 9 Mile and Orchard Lake Road, north of the river. Similar to our concerns about shrub invasion for this area, Garlic Mustard could outcompete native seedlings and interfere with stand replacement. Furthermore, the invasion is only pronounced in a few sections along this tract of land which increases the likelihood of successful control of the species.

The area behind the Historic Winery should also be given a high priority, as it is not a heavily invaded site. This increases the likelihood of successful control of the species in this area. With the site's potential for a trail system fully integrated with Grand River Avenue and opportunities for economic development, efforts to maintain the integrity of the site should be moved forward.

Long-term Priority

Most of the forested areas along the river besides our top priority sites are colonized with relatively equal intensity. Once a volunteer base can be mobilized, planners should choose whichever areas provide the community with the most enjoyment and access to natural areas and begin Garlic Mustard removal efforts there.

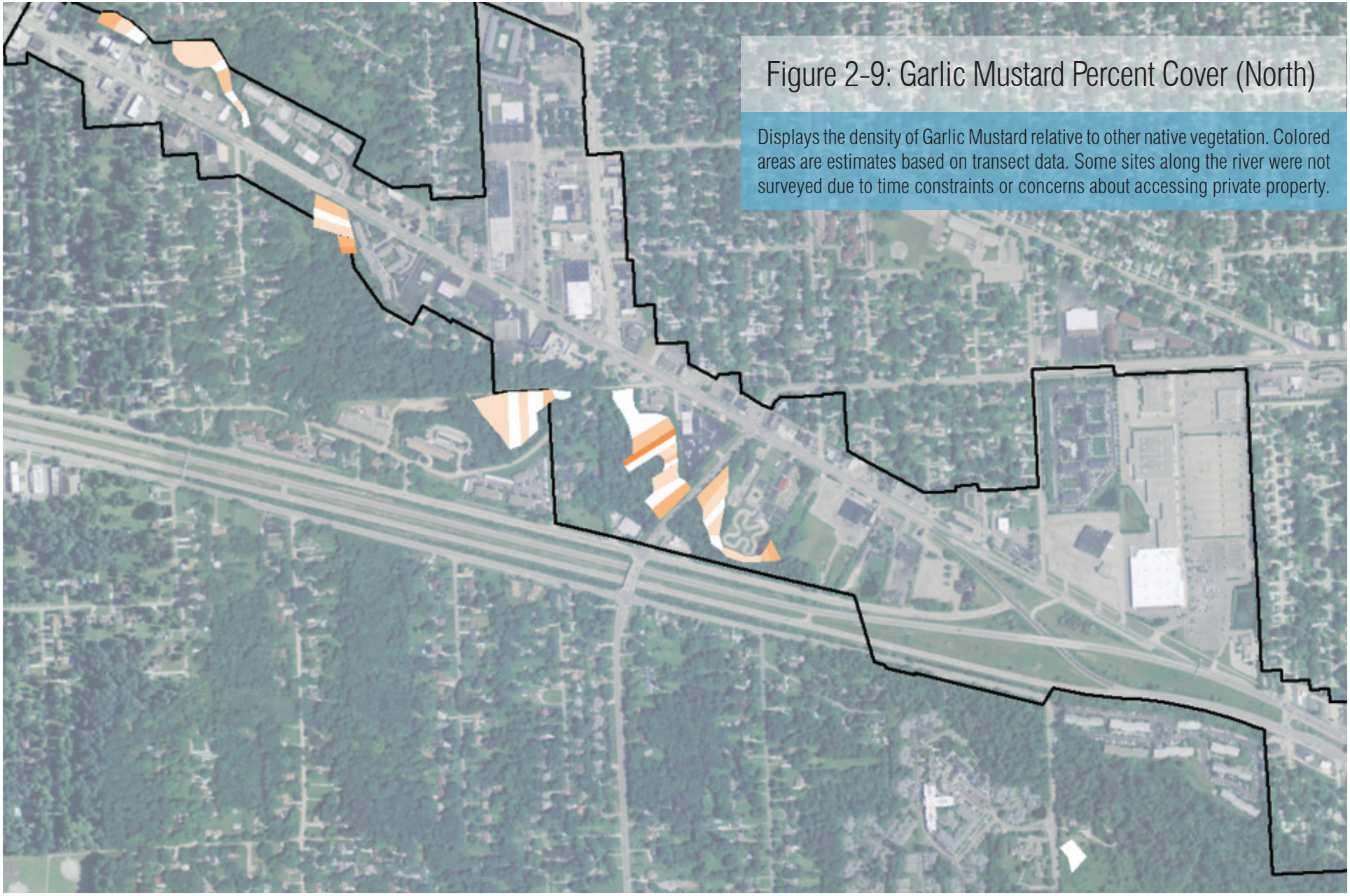


Figure 2-9: Garlic Mustard Percent Cover (North)

Displays the density of Garlic Mustard relative to other native vegetation. Colored areas are estimates based on transect data. Some sites along the river were not surveyed due to time constraints or concerns about accessing private property.

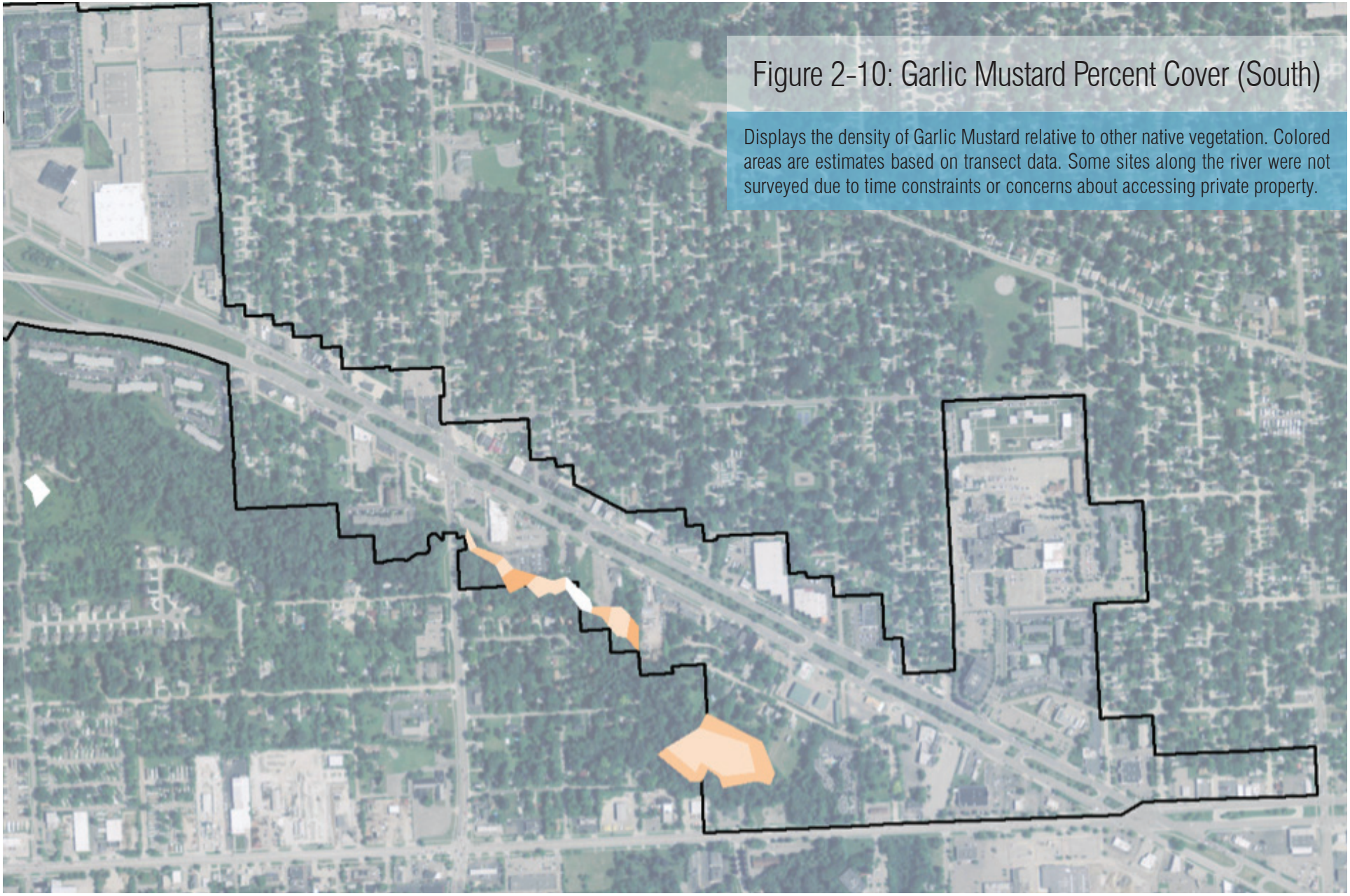


Figure 2-10: Garlic Mustard Percent Cover (South)

Displays the density of Garlic Mustard relative to other native vegetation. Colored areas are estimates based on transect data. Some sites along the river were not surveyed due to time constraints or concerns about accessing private property.

Novel Invasions

There are several kinds of invasives species that generally have a lower impact on natural areas than the ones identified in this report. Of great concern, however, is the occurrence of Oriental Bittersweet (*Celastrus orbiculatus*) east of Power Road. Oriental Bittersweet is a fast growing invasive vine that can eventually topple over trees and strangle out native vegetation. It was found in low density in the areas displayed in Figure 2-11 and should be removed immediately to prevent a large amount of future work and ecological damage.

Other invasives that were found during vegetation surveys include Moneywort (*Lysimachia nummularia*), Dame's Rocket (*Hesperis matronalis*), Japanese Barberry (*Berberis thunbergii*), Multifloral Rose (*Rosa multiflora*), Common Periwinkle (*Vinca minor*) and Lily of the Valley (*Convallaria spp.*)

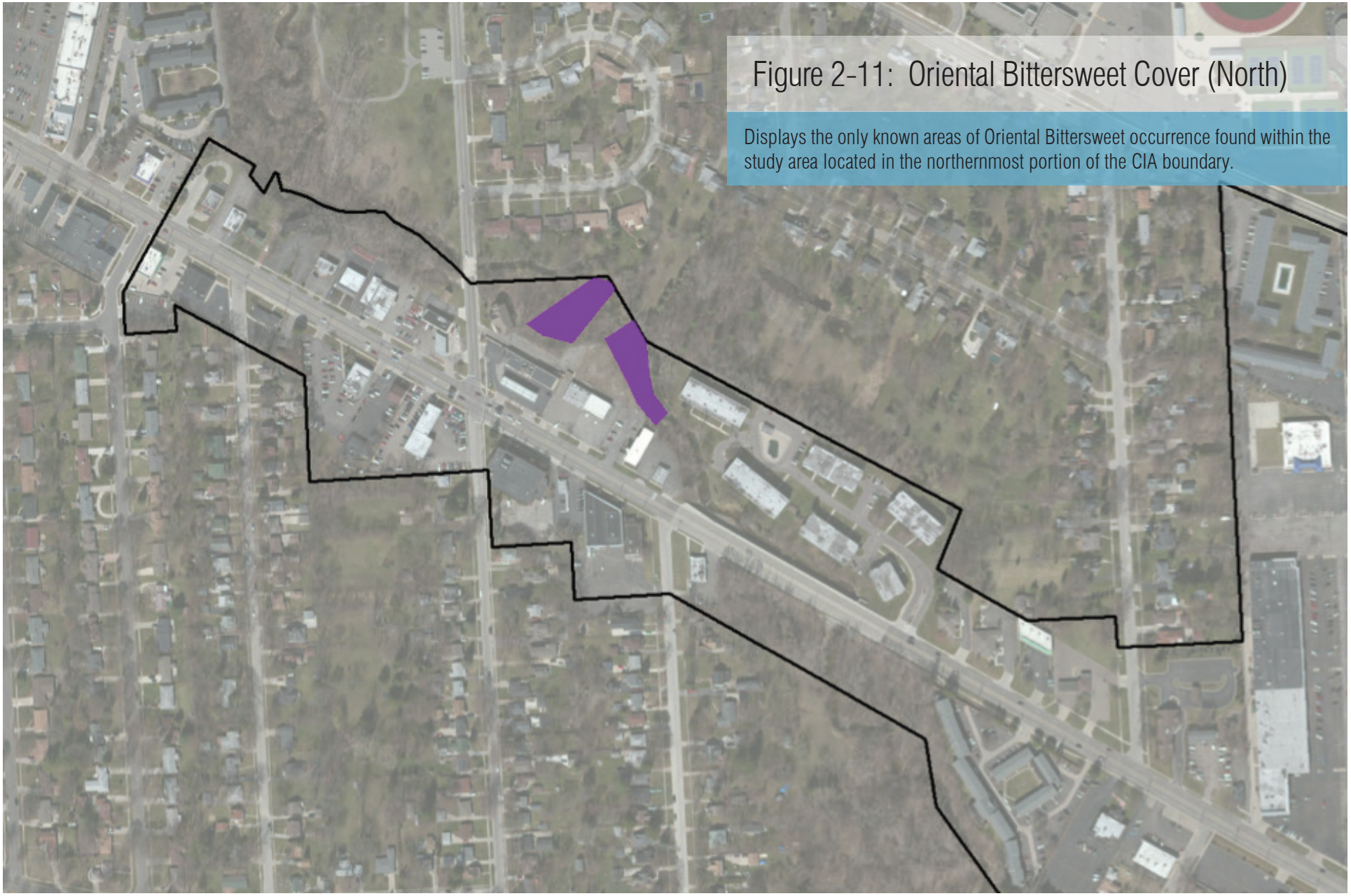


Figure 2-11: Oriental Bittersweet Cover (North)

Displays the only known areas of Oriental Bittersweet occurrence found within the study area located in the northernmost portion of the CIA boundary.

1-20% Oriental Bittersweet Cover

0 1/8 1/4 1/2 Miles

N

Emerald Ash Borer and Ash Death Along the Rouge

The Detroit area was the epicenter of the Emerald Ash Borer (EAB) invasion when it was discovered in 2002. Not only is it thought to be where the invasion began, but the high prevalence of ash planted as street trees created monoculture-like conditions that ensured the spread of the emerald ash borer[53]. EAB affects the three most common types of ash species in the Midwest: white, green, and black ash. For all three species, mortality of trees greater than 2.5 cm in diameter exceeded 99% in the greater Detroit area by 2010[54]. There are two locations along the Rouge River that show a noticeable amount of tree mortality caused by the EAB (Figure 2-12, 13). EAB-related mortality was determined by a high number of dead trees and the presence of the serpentine shaped excavations on the logs, which are marks left by EAB larvae feeding on the inner wood[55].

Ecological Impacts

The almost complete loss of adult ash trees from southeastern Michigan forests and river systems has numerous ecological effects. Just 15 years ago, ash trees were among the most common fast growing woodland and riparian trees in the northeastern United States. They provided food and habitat for a variety of wildlife species. Beavers, rabbits, and porcupines in particular feed on the bark of young trees[56]. Ash seeds, which used to be available in copious amounts, were eaten by ducks, song and game birds, small mammals, and insects[53].

Ash trees occupied a unique niche in wet areas where few other tree species grow. It acted as a foundation species that regulates ecosystem processes and community structure. Specifically, it had a strong influence on evapotranspiration, which helps control the site water table[57]. Evapotranspiration is the sum of evaporation from the sun and the movement of water through plants. Larger plants, such as trees, can take up large amounts of water during rain or floods and store it for slow release into the atmosphere.

In general, forested wetlands are characterized by widely fluctuating water levels created by precipitation inputs. Water tables in these areas tend to be the lowest in mid to late summer, when evapotranspiration is peak levels[58].

Example of marks left by Emerald Ash Borer[vii]

Map of areas with EAB death

Figure 2-12: 2002 Aerial Image (Pre-EAB Invasion)[viii]

Figure 2-13: 2015 Aerial Image (Post-EAB Invasion)[viii]

Several studies have suggested that the loss of ash trees raises the water tables in wetlands and floodplains, and causes a slower drawdown of water levels after rain. This can cause a shift in the vegetation from trees that can tolerate flooding to herbaceous plants that depend on it[57]. If this pattern is repeated at a large scale, it may create slightly more severe flood conditions and slow floodplains from drying out after rain.

Erosion and Flooding

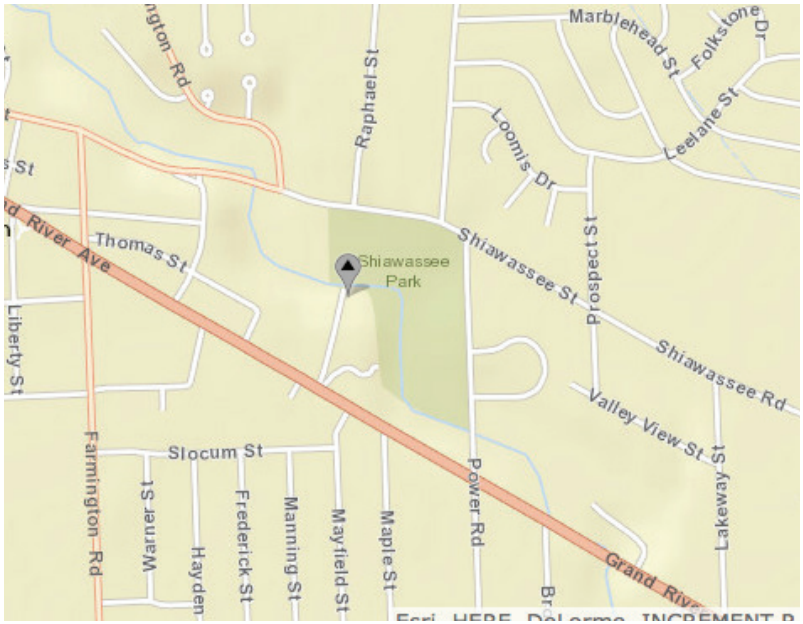
The United States Geological Survey (USGS) has a gauge along the Rouge River at Shiawassee Park, just a few meters upstream of where the CIA boundary begins. The USGS estimates the drainage area feeding into the part of the river is 17.5 square miles.

The hydrographs produced during rain events confirm our observation that the Rouge River is a "flashy" river with high peak discharge. This can be seen in how steeply the water levels rise and fall after rain events compared to a pre-development scenario (see USGS hydrograph on page 43). Most of the land around this section of the Rouge is impervious surface, so that precipitation does not infiltrate into the ground, entering the water slowly, but instead it accumulates into drainage points and reaches the river at a much faster rate. This direct drainage of water into the river can lead to water pollution as well as erosion.

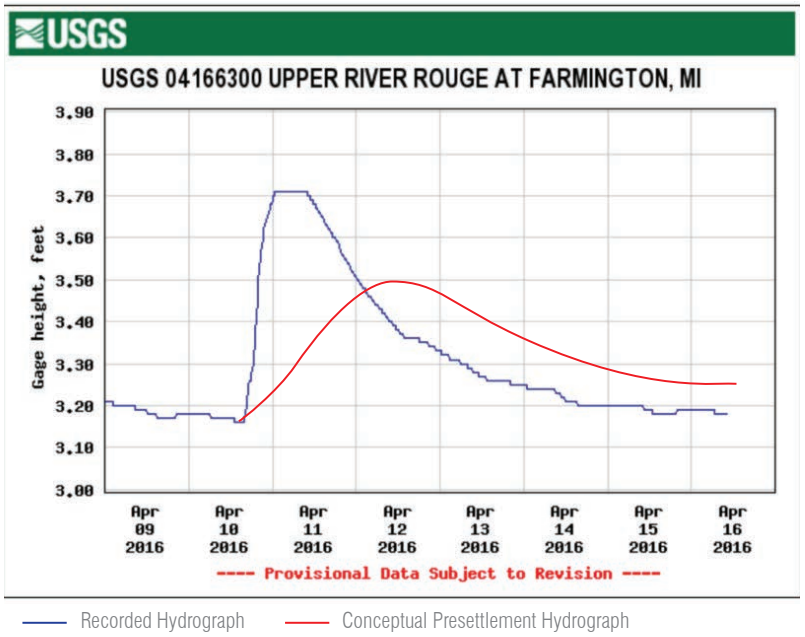
Flashy rivers usually have a fair amount of bank erosion, as can be seen in many areas along the Rouge River. Though the floodplain is still intact in many places along the river, some areas of widespread erosion have created a situation where only the greatest storm events cause water levels to reach a point where water can flow over the banks into the larger floodplain basin. As outlined in Chapter 5, the Corridor Improvement Authority should consider implementing stormwater solutions as a part of the trail development. Additionally, any future development plans, including streetscaping, should incorporate Low Impact Development technologies to reduce the amount of stormwater runoff reaching the Rouge River.

Spring melt flooding near Shiawassee Park

Uprooted vegetation from a major flood event



Location of USGS guage[ix]



Hydrograph after a rain event at Shiawassee Park[x]

Stormwater outfall that empties directly into the Rouge River

Incised banks near the Yellow Theater

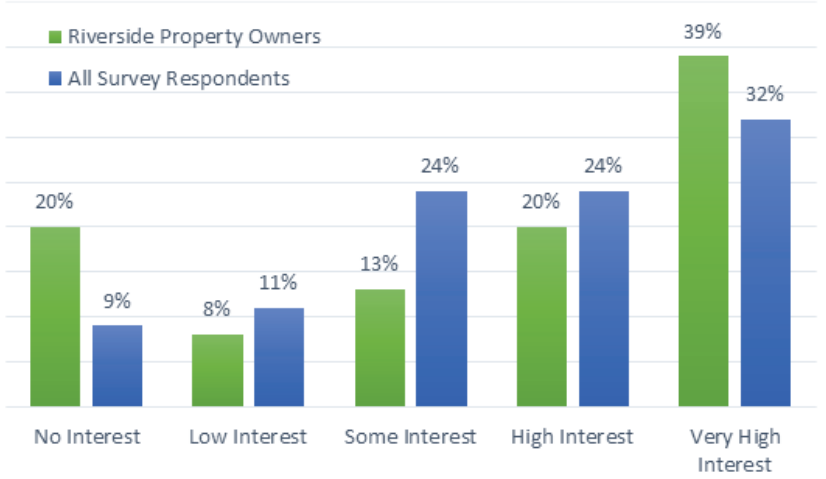
Community Engagement

Methodology

Four methods were used to collect feedback from the communities of Farmington and Farmington Hills regarding the trail design, concerns about implementation and upkeep, and revitalization of the Grand River Avenue corridor area. Surveys were distributed at the Farmington Hills Farmer's Market in September 2015, paper surveys were sent to property owners along the river in early December 2015, and a link to an online survey was sent to community members during this time as well. In addition to the surveys, two open houses were held in February and March of 2016. Surveys were handed out at the Farmington Hills Farmer's Market during the first phases of the community engagement process. After receiving 22 surveys from the Farmer's Market outreach, the survey was shortened and simplified and most of the data from the initial 22 surveys was not used in the final data analysis. However the interactions at the Farmer's Market allowed the study team to learn more about the concerns of the community through personal interactions, while also informing the public about the river plans, as well as giving the survey format a test from the community. The Farmer's Market surveys were a mutually beneficial exchange of information that influenced the final form of the surveys that were sent out by mail and online.

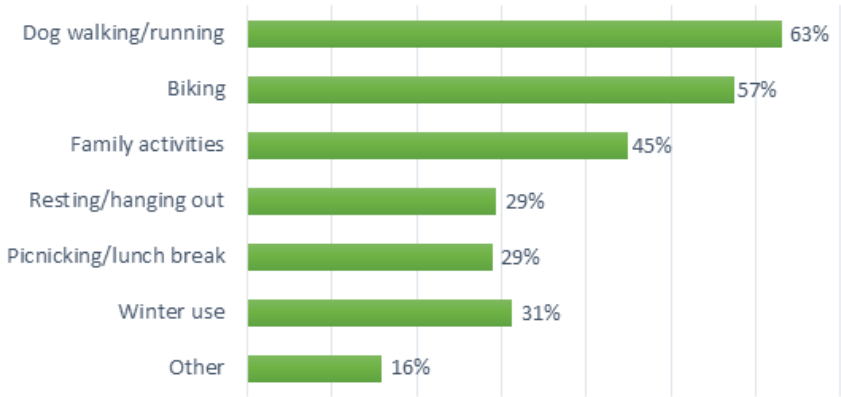
For the online survey a link was sent to several email list serves in the Farmington and Farmington Hills communities in early December, 2015. A news release was sent to the Farmington Hills website, Facebook page, and general e-newsletter/listserv, which has over 1,200 subscribers during this time to advertise the online survey. Information about the project and the online survey also appeared in local media outlets including the Farmington Observer, Farmington Press, Farmington Voice, Farmington Patch, and to the Greater Farmington Area Chamber of Commerce e-newsletter. In early December 2015, the City of Farmington sent 355 mail surveys, and the City of Farmington Hills sent 42 mail surveys, to properties adjacent to the river within the study area, which included residential and commercial properties. After the initial advertisements and mail surveys were sent out in early December, respondents had one month to respond to the survey. Property owners with riverside property will be most directly affected by the trail designs, which means that survey contributions from this group were especially important.

Figure 2-14: Interest in Trail System



Interest level score on a scale of 1-10 (1=no interest, 10=very high interest). For this graph: 1=no interest; 2, 3 = low interest; 4, 5, 6 = some interest; 7, 8, 9 = high interest; 10=very high interest.

Figure 2-15: Expected Type of Trail Use



Each mail survey also provided a link to the online survey as an alternative, as well as encouraged any residents, business owners, or employees of the property to fill out the online survey.

Results

We received a total of 214 responses from the mail and online surveys; 28 mail and 186 online responses. The response rate for the mail surveys was between 7% and 15%. Some mail survey respondents may have used the online survey, instead of returning the mail survey. At least 61 of total respondents were riverside property owners within the study area. Due to a delay in recording property owners with the online survey, the actual respondents of riverside property owners might be slightly more than recorded.

Interest in Trail System

Riverside property owners tended to have stronger positions regarding the trail concept (Figure 2-14). Riverside property owners are split in their interest level, with much stronger interest than disinterest in the project, while only a few property owners fall in the middle range. Understandably, riverside property owners show a more polarized split between those owners who are highly enthusiastic about the recreational trail, and those who are opposed to the plans. Almost 60% of riverside property owners have at least a high level of interest in the trail and almost 40% have a very high interest level in the trail. Out of the 61 respondents in total, twelve property owners with property adjacent to the river were not interested in the river trail. Five property owners had a low level of interest. Eight had a medium interest level. Twelve property owners had a high interest and 24 property owners with a house adjacent to the river had a very high interest level.

Desired Activities

Many community members felt strongly about having more access to open space for dog walking (Figure 2-15). Conversations at the Farmer's Market, comments from the surveys, as well as comments at the community open house reflected the wish for more dog walking opportunities in the area. Biking is another activity that was frequently mentioned in the surveys and at the Farmer's Market as an activity that is especially interesting to community members.

Figure 2-16: Obstacles to Using the River Corridor

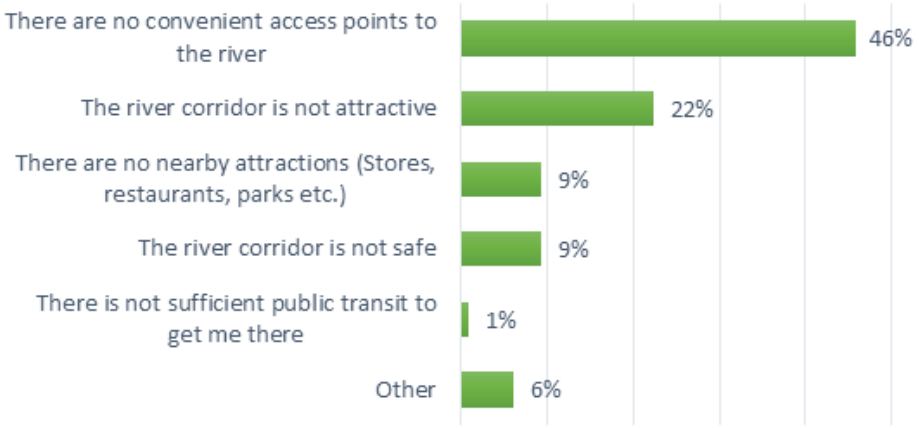
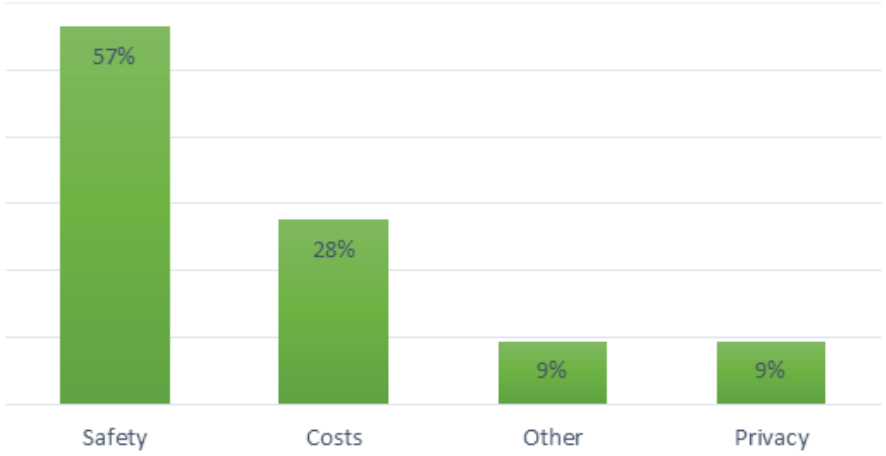


Figure 2-17: Greatest Concerns Regarding Trail System



Local Knowledge of Development Potentials

As part of the survey, respondents were asked where the greatest opportunity for river access exists along the Grand River Corridor. Many respondents agreed that the winery would be a great place to expand river access. Respondents mentioned that the winery is already transforming the area into a Beautiful Bird Sanctuary in order to help support the Chimney Swift Birds, so that additional focus on the natural amenities would be a natural fit. Parking was raised as an issue both at the winery as well as more generally throughout the study area. Other comments emphasized the importance of having an access point as close to downtown Farmington as possible as well as creating connections - including bike lanes - to existing parks such as Heritage Park.

Major Concerns

Final survey comments were overwhelmingly supportive of the revitalization plans. However there are many concerns regarding safety both on the trail, and on the way to the trail. Safety is by far the most pressing concern community members have with regard to the trail (Figure 2-17). The same pattern of high concern for safety, rather than cost or privacy, emerged when responses of riverside property owners were separated from responses of all respondents. Several respondents mentioned that walkability is a major problem along this area of the Grand River Corridor and that high speed traffic could create dangerous conditions for walking and biking along the Grand River Corridor, unless major changes are made to increase pedestrian safety. Some respondents voiced concerns for the privacy of homeowners, and for having to pass too closely by private property while using the trail. Some respondents are concerned that visitors will get lost on the path, or become tired, and cross through private property to return to the road.

Farmer's market tabling

"A community that is able to intermingle in a setting like a trail along the river will grow in a positive way. More people involved in cleaning up the Rouge and becoming knowledgeable about our planet are all good."

"This is much needed. It would support many small businesses and also increase opportunities for physical fitness in our great cities!"

"…It's not a place I go to walk for that reason (unsafe for walkers), even on the sidewalks, and there is no way that I would take a back trail in that area. I would not feel safe. I know that there are other people in Farmington who feel the same way."

"It has never had any attention since I was in high school. It is nice to have something to look forward to."

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i. Canopy cover data from Farmington and Farmington Hills. River layer from the Michigan Data Library.
ii. Google Streetview
iii. http://www.invasive.org/eastern/images/768x512/1237020.jpg
iv. https://www.nps.gov/plants/alien/fact/img/rhca1.jpg
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ix. http://waterdata.usgs.gov/mi/nwis/nwismap/?site_no=04166300&agency_cd=USGS
x. http://waterdata.usgs.gov/nwis/uv/?dd_cd=02_00065&format=img_stats&site_no=04166300&set_arithscale_y=on&begin_date=20160308&end_date=20160315

3 Concept Plan

Overview

Synthesizing the fruits of analyses and community feedback, we propose the concept plan to illustrate the Rouge River Trail and its relationship to the Grand River Corridor. The trail is designed to provide easy access to the river for the community and to uncover the secrets of the long overlooked Rouge River. The trail system includes pedestrian trails and bike trails linking nodes of nature oriented recreation and commercial activity along the Grand River Corridor. The concept plan engages the Rouge River to Grand River Avenue, capitalizing upon the river's potential to enhance human well-being, economic development, and sense of environmental stewardship. The linear trail system with multifarious anchor points contributes to a strong corridor system with various attractions, high accessibility, and high desirability for future development in surrounding areas. The Rouge River Trail will maximize upon the values of the river as a precious natural asset and economic development catalyzer in the City of Farmington and Farmington Hills.

Steep slopes, the floodplain, and close proximity to private properties are the three major limitations to locating the trail along the Rouge River. These conditions place a constraint on the width, the surface material, and suitability of use type of the trails. We took the social and environmental condition along the river into deep consideration and proposed the trail system to include both pedestrian trails and bike trails. Pedestrian trails, with higher tolerance to slope and wetness, are located to closely follow the river. On the other hand, the bike trails are greatly constrained by available space and steep slopes, and will diverge from the pedestrian trail to follow existing contours or utilize the existing roads. In this way, we ensure the accessibility and connectivity of the trail, while also maximizing the experience along the Rouge River and keeping disturbances due to construction and budget in check.

River trail precedent[i]

Community Open House

An Open House for community members of Farmington and Farmington Hills was held on February 4th, 2016 at the Spicer House in Farmington Hills. The Open House was held in order to inform the community about the project's progress and provide an opportunity for community feedback on the trail system design. The Open House was well attended with around 35 participants. After an introduction from representatives of the cities and the CIA board, the project team gave a twenty minute presentation and a question and answer session followed. The question and answer session reflected a variety of concerns, many of which have been expressed through the surveys as well. In particular, there were many concerns about privacy and safety. Some of the concerns about privacy and safety will be addressed through the design of the trail, which is discussed in more detail in Chapter 5. The project team emphasized that the suggested phasing concept allows for gradual implementation with discrete benefits at each phase, while providing the community the opportunity to reconsider and become comfortable with the ideas presented for the next phase. In this way, concerns will also be addressed as the project develops through the phases and the Grand River corridor improves along the way.

Throughout the evening several different kinds of responses to the trail concept were offered. Some community members were enthusiastic supporters of the project and happy to assist along the way. Some of the most enthusiastic community members were also riverside property owners. They were looking forward to utilizing this new outdoor space on a daily basis. Community members with riverside properties who were strictly opposed to the idea of the Rouge River Trail fell on the other end of the spectrum of responses. These community members seem to be a relatively small fraction, even within the pool of property owners. Some riverside property owners expressed support for the general concept of a trail, as well as the idea of connecting the community to nature. Continued conversations to ensure a transparent planning process, and the successful implementation of initial phases of the trail system will be necessary to prove to these community members that the trail system is safe and an overwhelmingly positive addition to the Farmington and Farmington Hills communities.

For the second half of the Open House, participants were provided with maps of eight focus areas that had been selected by the project team and a list of potential activities (see Figure 7-8 in appendix). One of the goals was to discuss the eight preliminary focus areas in order to select three priority areas for detailed designs. The second goal was to gain feedback on four different types of activities, and to assess what types of activities are most desired by the community. Participants contributed suggestions and comments in three groups in order to help inform the design of nodes along the trail.

The activities were divided into family activities, relaxation activities, event space and economic development. In response to these four different types of activities, comments and ideas presented by the participants included nature signage and exercise signage such as trail markers, as well as bird houses to support ecological health. Comments included adding "fun little structures" such as tire swings and a tree house, and providing access to the woods for kids to play in forested, "wild areas." Providing opportunities for barbecue and picnic tables was mentioned as well. Many community members displayed strong desires to walking dogs in a park or on a trail. The winery was emphasized as a good place to focus economic development. Most participants agreed that there is no immediate need for an outdoor event space, but that a small pavilion is a good idea. Participants also gave feedback for specific design sites and provided input about which sites may have the best potential for the activities discussed. A full set of the comments can be found in Figure 7-9 in the appendix.

Community open house at the Spicer House in Farmington Hills

Pedestrian Trail

The proposed pedestrian trails and bike trails run parallel in some locations and diverge in others along the Rouge River corridor (Figure 3-1). The pedestrian trail follows the river, starting from Power Road, linking the landmarks of Shiawassee Park, the Historic Winery, Botsford Senior Community Center, and ending in the periphery of Botsford Hospital at West 8 Mile Road. It also walks visitors through different ecological environments along the river and provides multiple prominent natural recreation spots. The major ecological features to explore along the river corridor include upland forests, wetlands, seasonal marshes, and sandbars. Pedestrian trails put less stress on the natural environment and allows a more intimate experience of the ecological system to the community. Combinations of nature trails and boardwalks are proposed to account for site characteristics and budgetary concerns. Details of the different trail types can be found in the Strategies section.

Pedestrian trail precedent[ii]

Bike Trail

The implementation of a bike trail is greatly limited by construction difficulties along the Rouge River. Route preferences were given to areas with less steep slopes and less impact to the forest. Where it cannot follow the river, the bike trail diverges and utilizes the Grand River Avenue and adjacent roads to preserve its connectivity. In places where the bike trail runs alongside the pedestrian trail, pleasing vegetation barriers are placed between the pedestrian trail and bike trail to enhance the experiences of both the biker and pedestrian while also adding safety. Bike stations are sited on gateways and access points, where bikers can access the pedestrian trail and explore the river area by foot. To enhance an enjoyable riding experience, the bike trails will be paved with asphalt.

Bike trail precedent[iii]

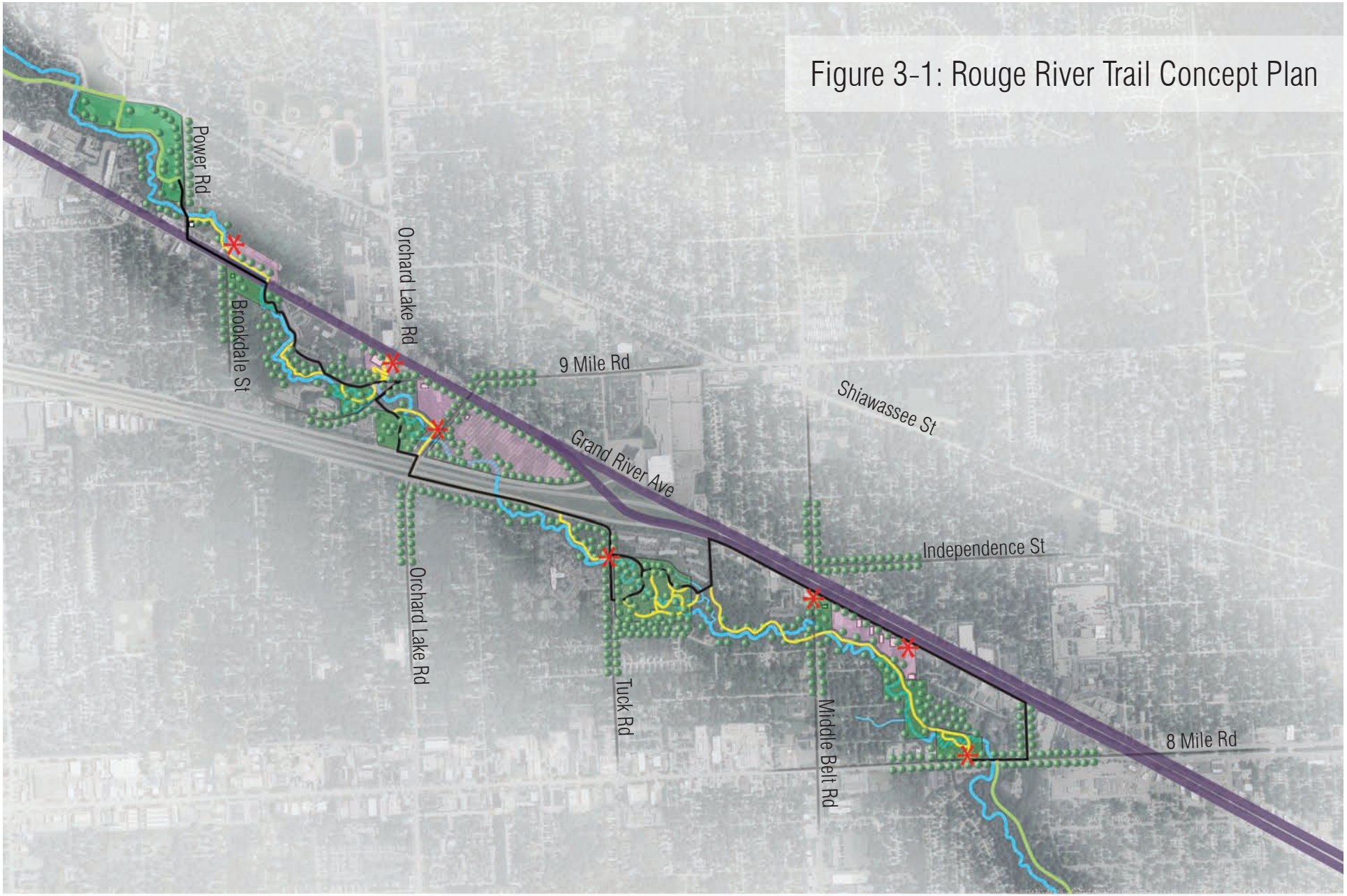


Figure 3-1: Rouge River Trail Concept Plan
Power Rd
Brookdale St
Orchard Lake Rd
9 Mile Rd
Grand River Ave
Shiawassee St
Independence St
Orchard Lake Rd
Tuck Rd
Middle Belt Rd
8 Mile Rd
Passive Recreation
Active Recreation
Commercial Development
Commercial Development with Active Recreation
Grand River Avenue
Pedestrian Trail
Regional Trail
Multi-Use Trail
Rouge River
Gateway and Access Points
0 1/2 1 2 Miles
N

Places of Importance Along The Rouge River Trail

Integrating the Rouge River Trail with Grand River Avenue presents a strong opportunity for revitalizing the Grand River Corridor, which can improve economic performance, enhance public health, and increase property values along the Grand River Corridor. Based on site analyses and community feedback, places of attraction with the greatest potential for economic development and natural recreation were identified (Figure 3-2 to 3-3). Gateways and access points are identified as major destinations along Grand River Corridor with ease of access to the trails.

Shiawassee Park

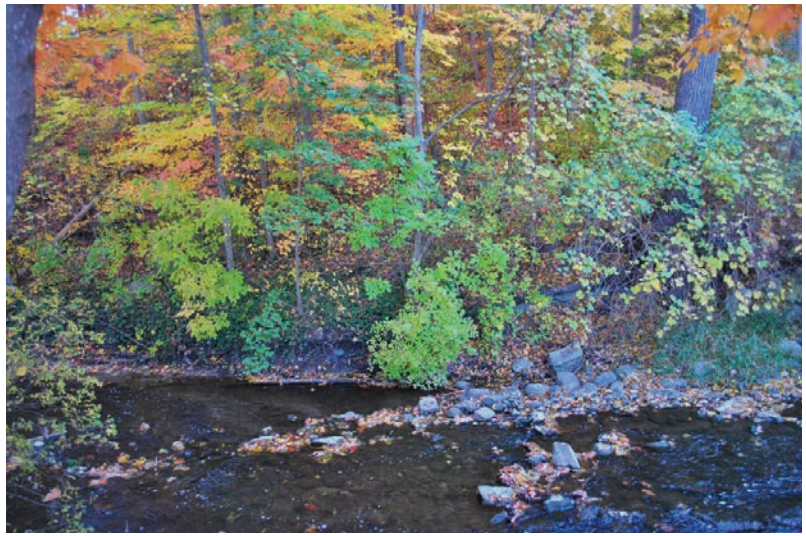
This is an existing park at the north end of the Rouge River Trail. It is a popular park that is well loved by the communities with paths for walks along the river, quiet seating and picnic areas, baseball fields, and a children's playground. We consider Shiawassee Park to be a critical connection to the Rouge River Trail, where visitors are invited to further explore the Rouge River.

Urban River Walk

Hugged by Brookdale St and Grand River Avenue, the urban river walk site utilizes the steep slopes as a barrier from the busy street and the residential area, while providing access to the river. The trail has the potential of following Grand River Avenue on both sides of the road. Along the north side of the road, a cantilevered boardwalk alongside the bridge, and partly over the river will be needed, with a connection across Grand River Avenue made under the bridge.

The Historic Winery

Prominent as a historic site on Grand River Avenue, the historic winery displays the local history with distinctive architectural style. It is a gateway site since it is one of the most exciting and promising sites on Grand River Avenue for economic development. While restaurants and outdoor seating will attract waves of visitors to this site, down the forested hills, the river is just around the corner. Trails in this nature area are to be ADA accessible and it would make a great place to go for a walk on a daily basis to experience the wetland meadow on a boardwalk. Facilities for rest and relaxation should be provided. This site is chosen for detailed design for its great potential as an economic development site along the Rouge River Corridor. The design can be found in Chapter 6.



Shiawassee Park[iv]

Urban River Walk

Precedent: boardwalk under the bridge

The Historic Winery

Precedent: outdoor seating for restaurant[v]

Yellow Theater

The best place to visit in the fall season will be the Yellow Theater, which is located just to the east of the winery and west of Orchard Lake Road. The Yellow Theater is hidden behind commercial properties along Grand River Avenue, where a beautiful stand of sugar maples grows in the floodplain. This is also the perfect spot for birdwatching, and listening to the joyful singing of various bird species. Only a pedestrian trail is designed in this area to keep the integrity of habitat and its serenity.

Focus on Fun

This site along the river is surrounded by Orchard Lake Road, M-5, and Grand River Avenue and has great potential for the integration of economic development and active recreation engaging the river. The pedestrian trail will follow the river but also connect to the commercial or retail buildings to the front of the lot. Together with the Historic Winery and Yellow theater, the Focus on Fun area will contribute to a 1 mile long economic corridor, integrated with natural recreation, and perfect for a weekend destination.

Yellow Theater

Focus on Fun

Precedent: wetland boardwalk[vi]

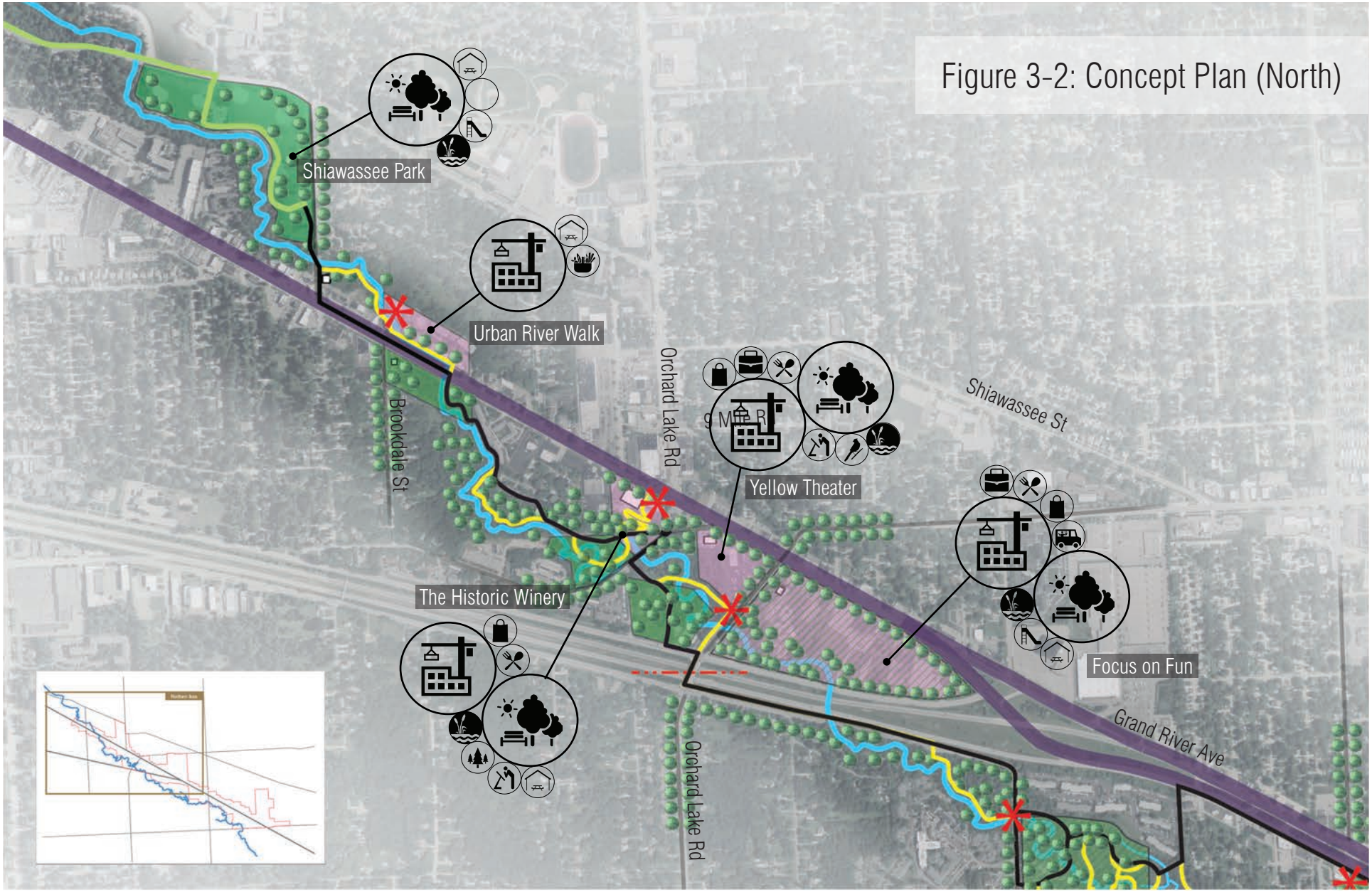


Figure 3-2: Concept Plan (North)
Shiawassee Park
Urban River Walk
Brookdale St
Orchard Lake Rd
9 Mile Rd
Yellow Theater
Shiawassee St
The Historic Winery
Focus on Fun
Grand River Ave
Orchard Lake Rd
Passive Recreation
Active Recreation
Commercial Development
Commercial Development with Active Recreation
Grand River Avenue
Pedestrian Trail
Regional Trail
Multi-Use Trail
Rouge River
Gateway and Access Points
0
1/8
1/4
1/2 Miles
N

Neighborhood Nature Area

Located in the neighborhood on Tuck Rd with regeneration forest on site, this area offers a pure nature experience of various ecosystems such as the upland forest, dead ash forest, wetland, seasonal marsh, and the riverfront. This site is the perfect area to serve as an outdoor classroom, with educational signage displays. Recreation activities such as birdwatching and family bike riding can be accommodated on this site close to Tuck Road for the community's enjoyment. A bike trail will take advantage of the flat terrain on the site to create a loop ride to explore the different ecosystems. The sensitive wetland area is opened only to pedestrian traffic to lower the environmental impact. Trails at this site are to be ADA accessible. This site is chosen for detailed design as an example of neighborhood nature park along the Rouge River corridor. The design can be found in Chapter 6.

Neighborhood Nature Area

Grand Canyon

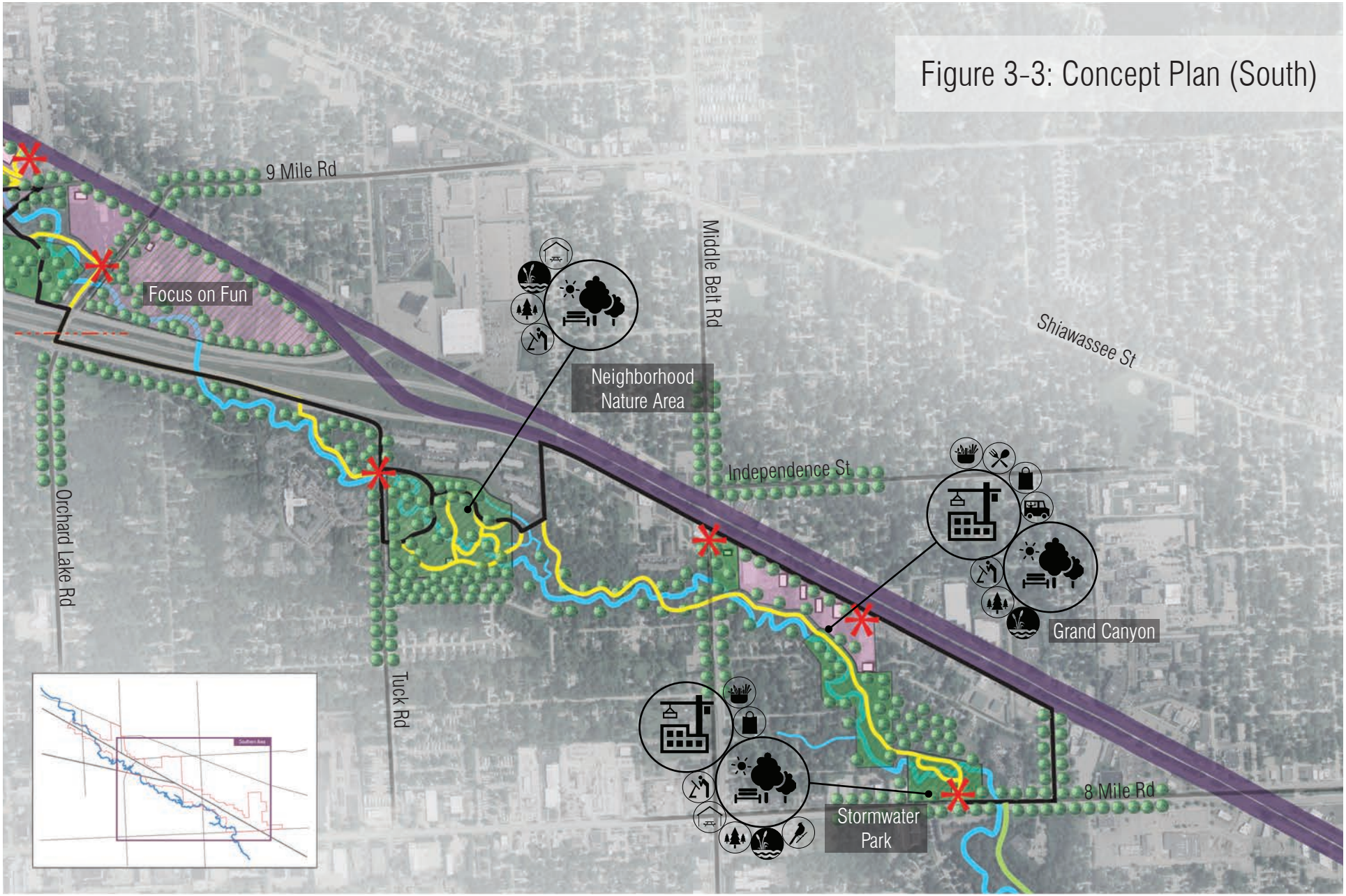
Since the riverbank becomes notably steep in this area, only a pedestrian trail is proposed. The river valley offers the experience of looking at the Rouge River from a higher eye level, with a view of the meandering stream and the open forest below. A gateway and access points are proposed for this site in order to integrate commercial development and natural recreation. The proposed bike trail utilizes Grand River Avenue to ensure its continuity throughout the Grand River corridor.

Grand Canyon

Stormwater Park

The site where people can take a great escape to the nature and waterfront area includes a floodplain area, approximately 15 feet lower than by W 8 Mile Road which it faces west of Pearl Street.. The currently vacant site is to be utilized as a commercial activity site with ADA access to the nature area to the back of the property. Only a pedestrian trail is proposed in the nature area due to the notably steep slope. This site is chosen for detailed design as an example of floodplain enhancement and economic development integration. The design can be found in Chapter 6.

Figure 3-3: Concept Plan (South)



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i. http://www.auburnhills.org/departments/parks_and_recreation/parks_and_facilities/index.php
ii. http://www.candgnews.com/news/local-trio-takes-passes-tough-test-michigan-shore-shore-trail
iii. trailsmichigan.com/Milford-Trail-95.php
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vi. http://www.michigantrailmaps.com/member-profile/3/35/

4 Project Phasing

Overview

The designs proposed in the previous chapters are made with the long-term vision in mind. In order to implement and construct the whole stretch of the trail system, specific sites and trail segments will need to be worked on in phases. This chapter will introduce the strategies and present example sites that we see as appropriate for each phase. Improvements on Grand River Avenue and other roads identified as neighborhood connectors to enhance pedestrian and bicyclist experience throughout the corridor should be considered and implemented at all phases.

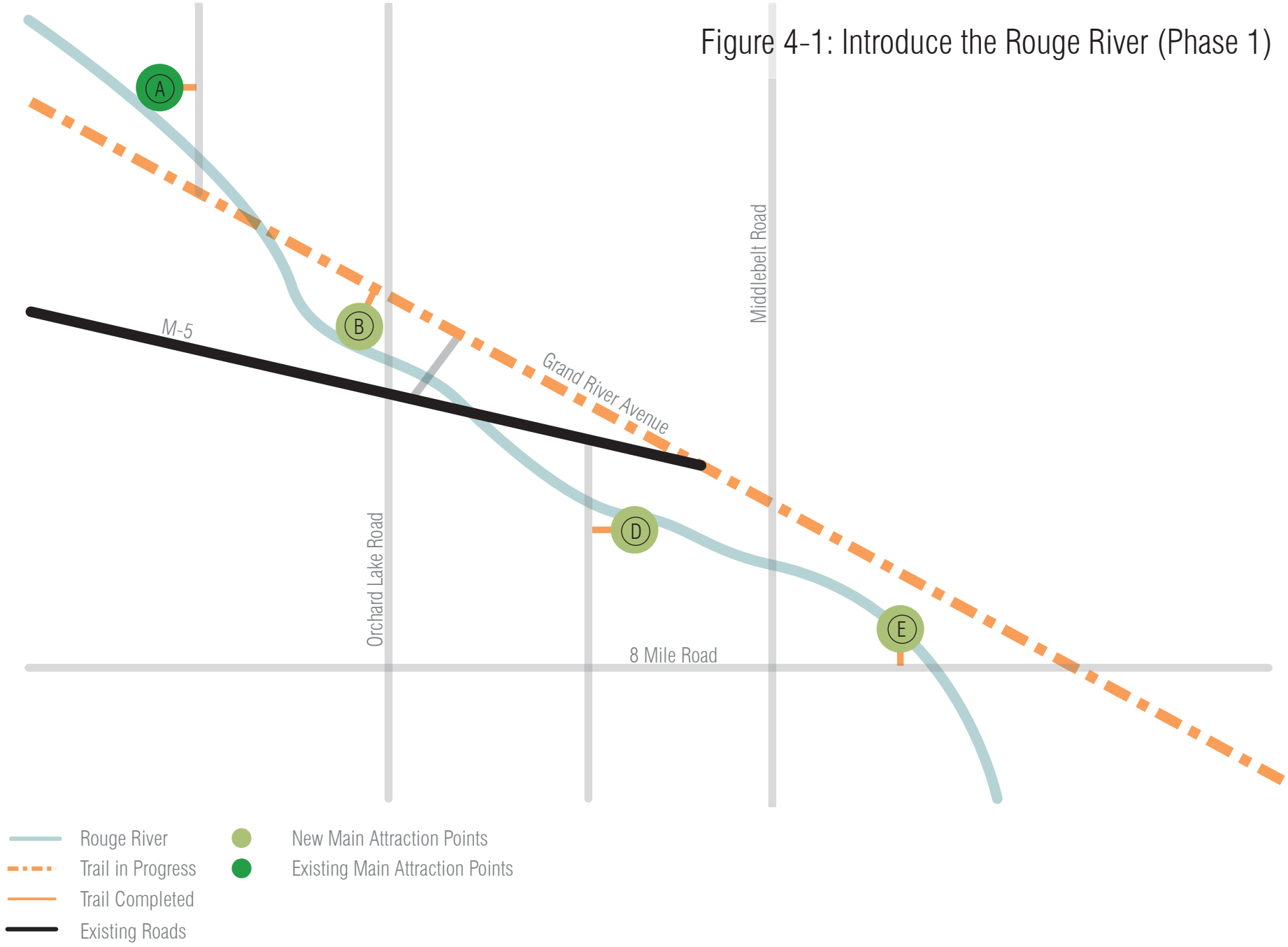
Phase 1
Introduce the Rouge River

In the initial phase of implementation, focus should be placed on creating places that provide the community with opportunities to interact and to enjoy the Rouge River. This may include passive or active recreation and economic development. The sites should have easy access from existing roads and provide a range of experiences in order to introduce the community to the Rouge River and build support for continuing to expand the Rouge River Corridor connection. With respect for the safety concerns regarding a trail passing through residential backyards, the trails in this first phase will mostly consist of self contained loops within the project sites. Community engagement with the river can take place in the form of events, as well as ecological restoration days, in order to raise support and comfort levels of the community with the idea of a greater trail system.

Example Project Sites

A. Connection from Shiawassee Park to Grand River Avenue
B. The Old Winery
C. Botsford Trail and connection to Vacant Lot on Tuck Road
D. Vacant Lot on Tuck Road
E. Vacant Lot on 8 Mile Road West of Pearl Street

Figure 4-1: Introduce the Rouge River (Phase 1)



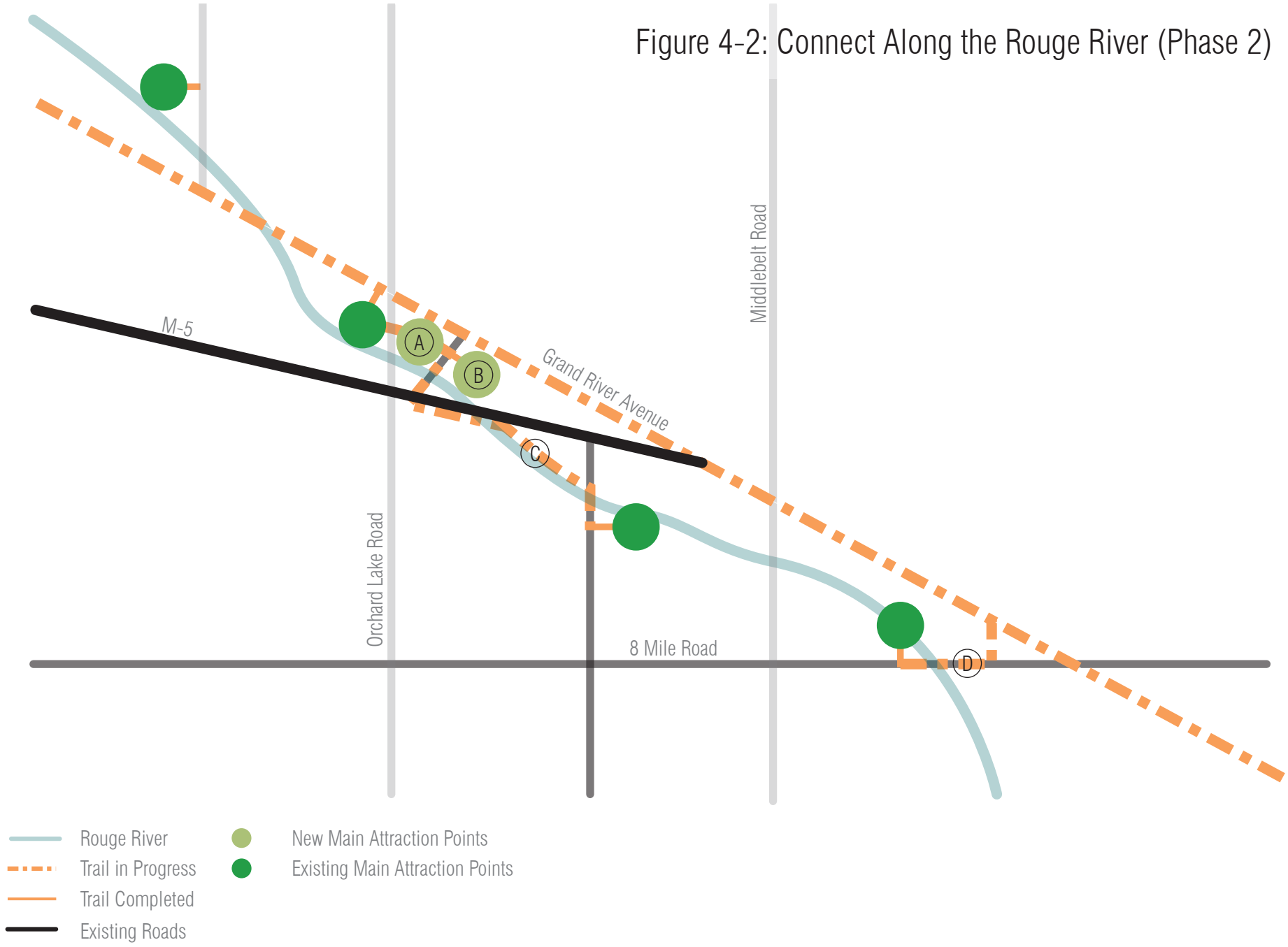
Phase 2
Connect Along the Rouge River

The second phase will continue to develop distinct sites for recreation and/or economic development, and will also begin to connect some of these sites with trails. The trails will begin to support a more comprehensive experience along the Rouge River, and present the community with the concept of how the trail network can be implemented in a safe way. Neighborhood connectors should be implemented with high priority to enhance pedestrian and bicycle access to and between the developed sites from phases 1 and 2.

Example Project Sites

A. The Yellow Theater
B. Focus on Fun
C. Connection from The Old Winery – The Yellow Theater – Focus on Fun – Botsford Trail – Vacant Lot on Tuck Road
D. Connection from Grand River Avenue to Vacant Lot on 8 Mile Road West of Pearl Street

Figure 4-2: Connect Along the Rouge River (Phase 2)



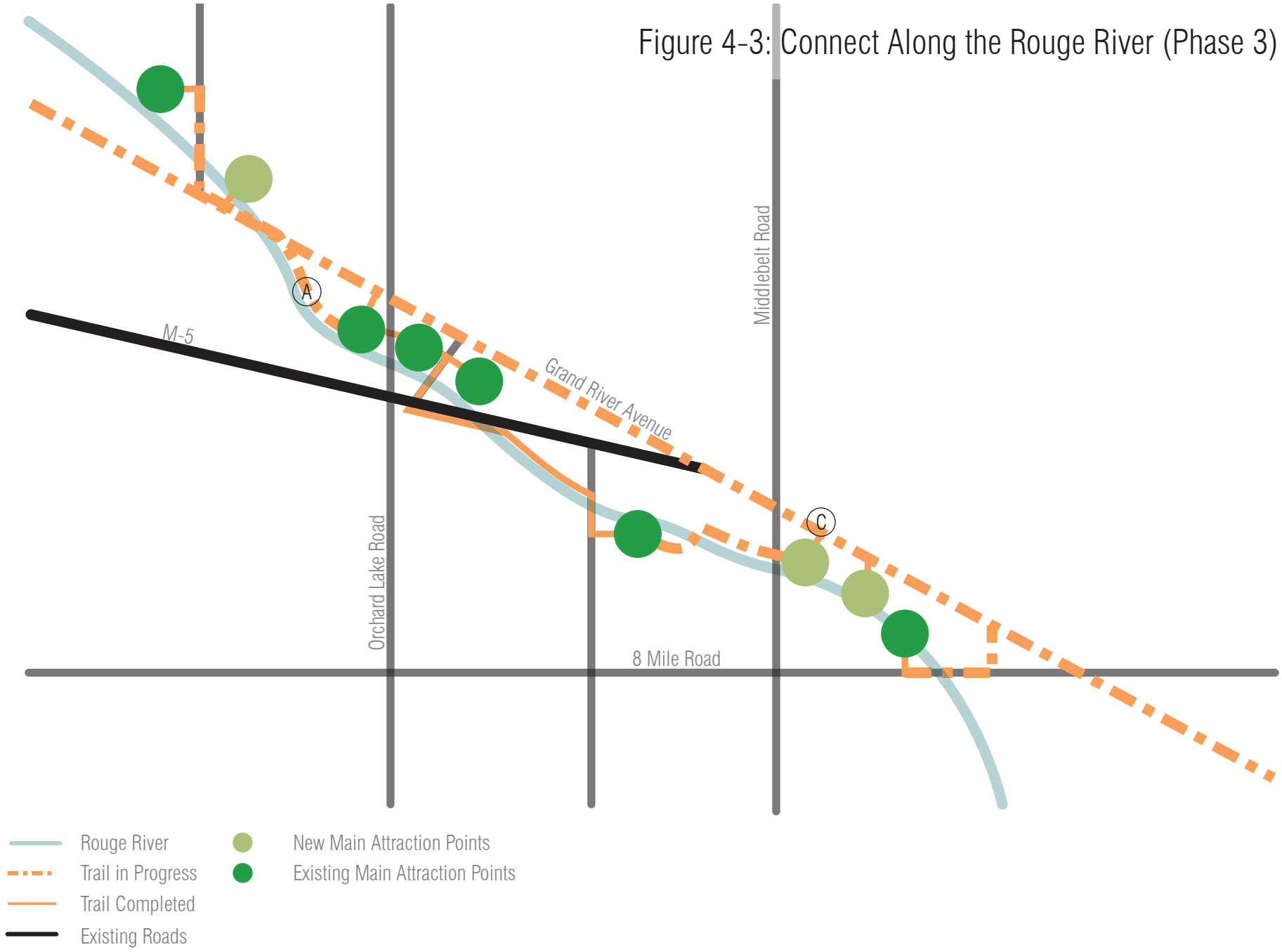
Phase 3
Connect Along the Rouge River

The third phase will build upon the previous phases to create a trail system that extends throughout the entire length of the Rouge River corridor. By this point, the community should feel comfortable with the idea of the Rouge River trail system and supportive of having the project completed. Many sections of the trail will traverse private property, which means that close and transparent communication will be necessary to gain and retain support.

Example Project Sites

A. Connection from the intersection of Grand River Avenue and Power Road to the back of the Old Winery
B. Connection from the Vacant Lot on Tuck Road to Purdue Avenue
C. Connection from the Vacant Lot on Tuck Road to the Vacant Lot on 8 Mile Road along the Rouge River
D. Intersection of Grand River Avenue and Middlebelt Road, and connections to the trail system along Middlebelt Road

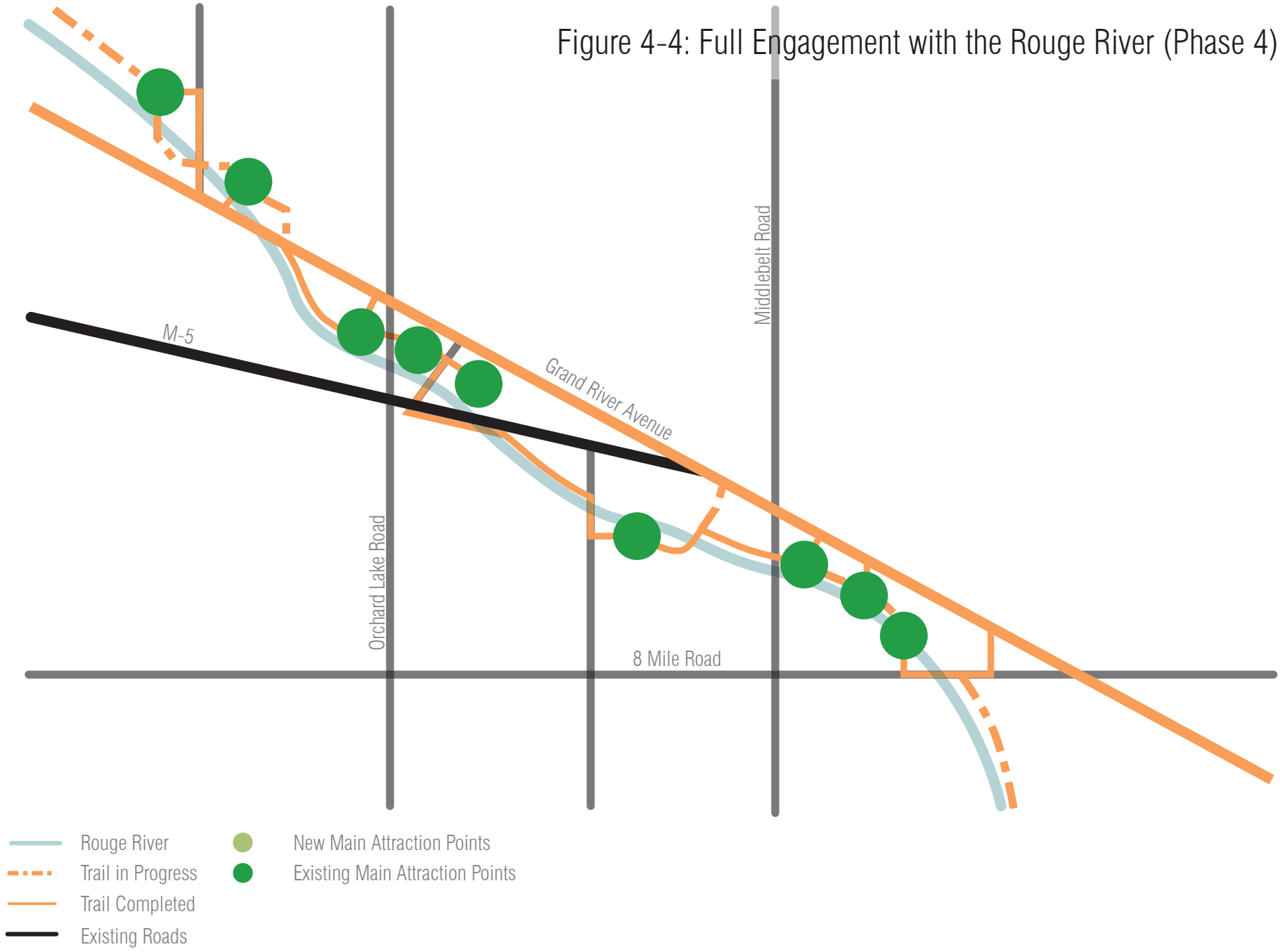
Figure 4-3: Connect Along the Rouge River (Phase 3)



Phase 4
Full Engagement with the Rouge River

The final phase will continue to enhance the connection from the surrounding neighborhoods to the trail system, and provide alternate routes along which pedestrians and bicyclists can travel along the Rouge River corridor. Continued maintenance of trails implemented in previous phases are essential, and improvements may be made as necessary or desired.

Figure 4-4: Full Engagement with the Rouge River (Phase 4)



5 Implementation Strategies

Overview

The inventory and analysis phase found variability in site conditions and management requirements throughout the Rouge River corridor. In this section, a collection of strategies and methods for trail development, suitable locations for their implementation, and additional resources to be consulted in understanding the concept plan and focus area plans are presented. The summary table at the end of the chapter serves as an initial directory for imagining what can take place along the corridor as opportunities for implementation arise.

Gathering Spaces

Destinations along the trail system are an important element in enhancing the experience of traversing the trail system. They can take the form of economic developments or plazas along more developed areas or a simple structure or open space in a more park like setting. These sites provide trail users with a purpose of using the trail, a location to rest, as well as to serve as a starting point. Some examples are given below.

Retail / Commercial Development

Attractive retail and commercial development are effective ways of getting people to start to recognize the existence and values of the Rouge River in their daily lives. They should be built to enhance existing development areas and serve to vitalize activity along main roads. Existing and new developments should incorporate other design features presented in the report so that the people can engage with the Rouge River corridor. While retail and commercial developments can serve as catalysts for the implementation of the trail system, the high initial cost will present itself as a challenge. A successful development will also create some noise which will need to be considered when more passive uses are desired nearby.

Outdoor Seating

Outdoor seating is recommended especially for restaurants and cafes for the customers to experience being by the river corridor. It can serve as an additional attraction for the use of these businesses. Some form of overhead protection, heating systems, or retractable walls can be implemented for four season use of the seating area. Outdoor seating is recommended for retail / commercial developments and can be accomplished with relatively low costs.

Plaza / Patio

While outdoor seating provides gathering space for customers and other users of a development, plazas or patios can be implemented for use by the general public. This type of gathering space is suitable in more heavily foot-trafficked locations, and provides the opportunity for the community to engage one another. Plazas can be designed for a range of sizes and sited to enhance the user experience of other design features.

Outdoor dining space and canopy[i]

Plaza and lively outdoor space in a commercial area[ii]

Pavilion / Gazebo

Pavilions and gazebos can be located in parks as a staging site for active recreation, for barbecues and picnics, or for quiet reflection and leisure. They can be sited in open areas or amongst the woods, and can serve a double function as an overlook.

Treehouse

Treehouses have a similar function to pavilions, but provide an elevated view of the forest.

Open Space

Open spaces have lower initial costs than many of the other types of gathering spaces and are versatile in their use. Much of the Rouge River corridor is forested so where existing conditions are more open, potential use as open spaces should be considered to support active recreation.

Dog Park

Community outreach results show that there is a strong desire from the community to have more dog friendly environments. Dog parks can be located in areas easily accessible from residential neighborhoods.

Garden

Gardens can serve as a transition between the more naturalized river corridor trail and the more developed roads and economic activity sites. A beautiful garden may prompt people to take the first step out to explore the river corridor. The garden could be purely aesthetic, or be themed to showcase plants of cultural or historical significance to the community or exhibit plants that serve stormwater management functions as an example.

Dog park and play area[iii]

Public garden combined with open space[iv]

Passive Recreation

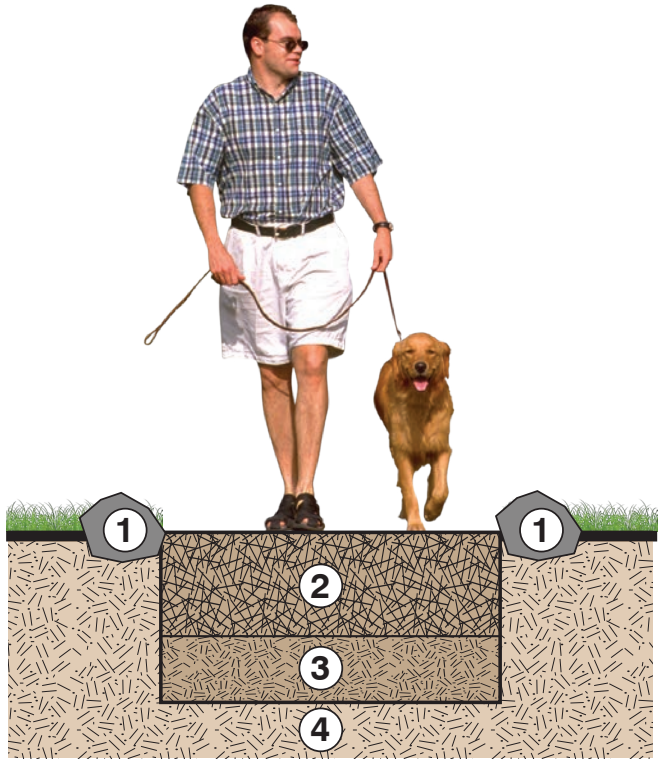
The primary form of passive recreation will come from the use of trails. Different types of trails will need to be implemented along different stretches along the trail network. The preferred trail type will depend upon expected user groups, intended use, and site conditions. The primary users considered for the trail network are pedestrians and bicyclists. The Federal Highway Administration (FHWA) breaks down bicyclists into three categories; Group A: advanced bicyclist who can navigate most traffic conditions, Group B: basic bicyclists who are not as confident and require special provisions for bicyclists, and Group C: children and families. For the proposed trail network, Groups B and C are the target bicyclists for which the bicycle and multi-use trails will be designed.

One of the greatest challenges in creating the trail network is the floodplain, within which much of the trail will be located. Flooding in the spring, or after large storm events, can severely damage the integrity of the trail over time, or even from a single instance, if it is not properly constructed and maintained. It is important that a detailed analysis of drainage is conducted prior to laying down the trails and to provide locations for water to flow through to avoid inundation of the trail if possible.

The best accepted surface for frequently flooded trails is concrete, though it should be noted that concrete is the most expensive option for the installation and repair of trails. The hard surface is most capable of withstanding the forces of water. Having transverse saw cuts will further relieve the pressure. Subgrade geotextile layer and cross-slope both on the surface and below the trail is also important to ensure proper draining. Other measures include placing rocks along the trail to intercept and dissipate the flow of floodwater and significantly reduce the volume. Water-proofing or other products can also be used as a preventative measure to mitigate damage. In order to minimize the impact of trails on the river system, trails should follow existing contours wherever possible and retain a vegetated buffer from the river. Where views are desired, overlooks may be installed.

Considering the importance of preserving as much vegetation along the riparian buffer as possible and the anticipated construction budget, we propose asphalt surfacing for bicycle trails and a mix of asphalt, boardwalk, and nature trail segments for pedestrians. The Kalamazoo River Valley Trailway Master Plan[1], Time Saver Standards for Landscape Architects[2], and information from Rails-to-Trails Conservancy[3] were consulted in designating the following trail types.

Figure 5-1: Pedestrian Trail Detail



1 Rocks for erosion control
2 Mulch or gravel, 3” min
3 Compacted soil
4 Subbase

Pedestrian Trails

Pedestrian trails will have a minimum width of 48 inches. The surface material will be fine gravel, mulch or natural earth depending on the site characteristics. Fine gravel and mulch surfacing is recommended for areas that are flat, dry, and relatively accessible for maintenance. The change in material through the length of the trail will provide a dynamic and rich experience. Both surfaces do require some maintenance which may be provided by volunteers. Natural earth surfaces are the least expensive method of trail building and can also be built and maintained by volunteers. It may also be created as the initial phase of trail building to be turned into hard surfaces when additional funding is available.

Bicycle Trails

Two way bicycle trails should have a minimum width of 10 feet, with an additional 2 feet shoulder on either side. Bicycles require 3.5 feet of drive lane and 2 feet of clearance. Taller vegetation should be cleared from the shoulders and any signage placed off to the side as well. Asphalt surfacing is recommended to provide a smooth ride that can be created with smaller machinery and less impact on the ecosystem.

Multi-use Trails

Multi-use trails will be a direct combination of the pedestrian and bicycle paths, with a minimum of 2 feet vegetated median in between. The median can serve as one of the bicycle trails' shoulders, provided clearance is maintained. With the pedestrian and cycling uses physically separated, this layout of the multi-use trail provides a sense of safety and security. It also allows for the ease of diversion between the two trails to create experiences tailored towards the different travel speeds. In addition, the divergence and convergence of pedestrian and bicycle trails enhance safety through "eyes on the path" where you may come into the view of other people at any given time.

Pedestrian Boardwalks

Boardwalks are the least intrusive method of creating a trail through wetland and more fragile floodplain environments. Boardwalks allow water to flow underneath as well as vegetative growth and decomposition. Use of wood treated with toxic chemicals, such as railroad ties, should be avoided. Instead recycled plastic or concrete foundations should be used for posts. Composite decking is also an alternative that may have lower long-run maintenance costs than traditional wood boardwalks. It should also be noted that the surface of boardwalks can get slippery in wet weather.

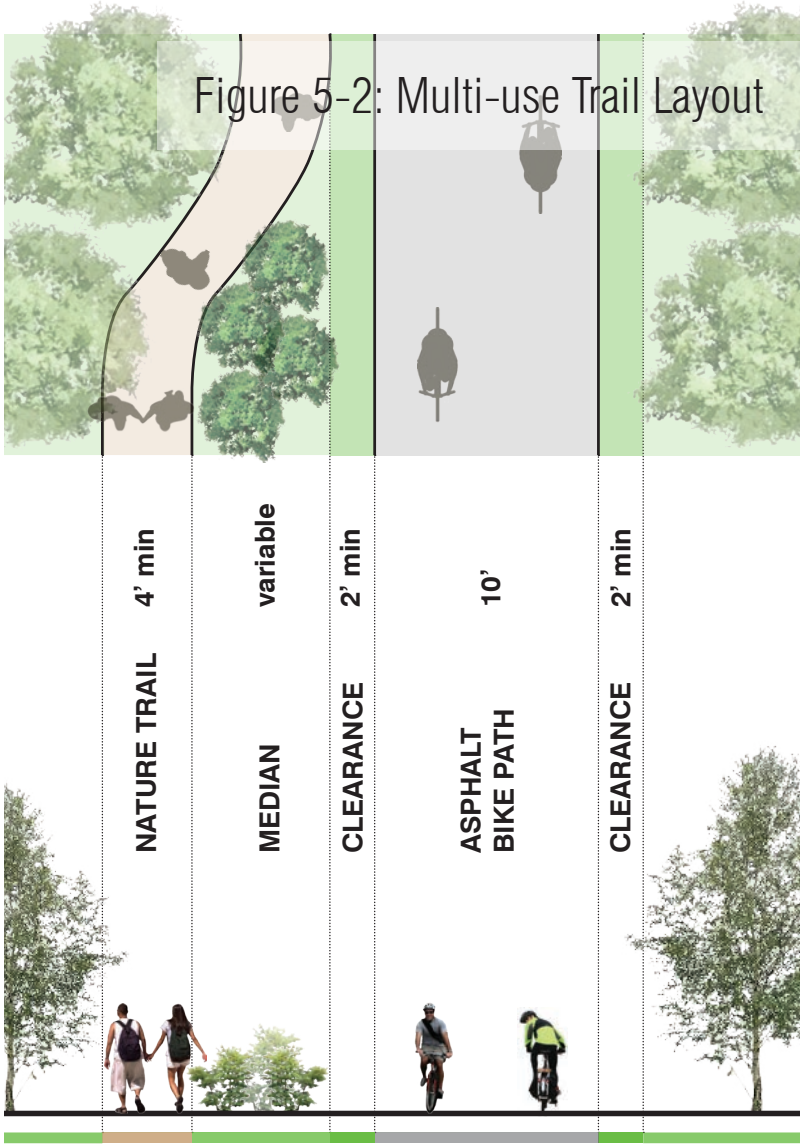
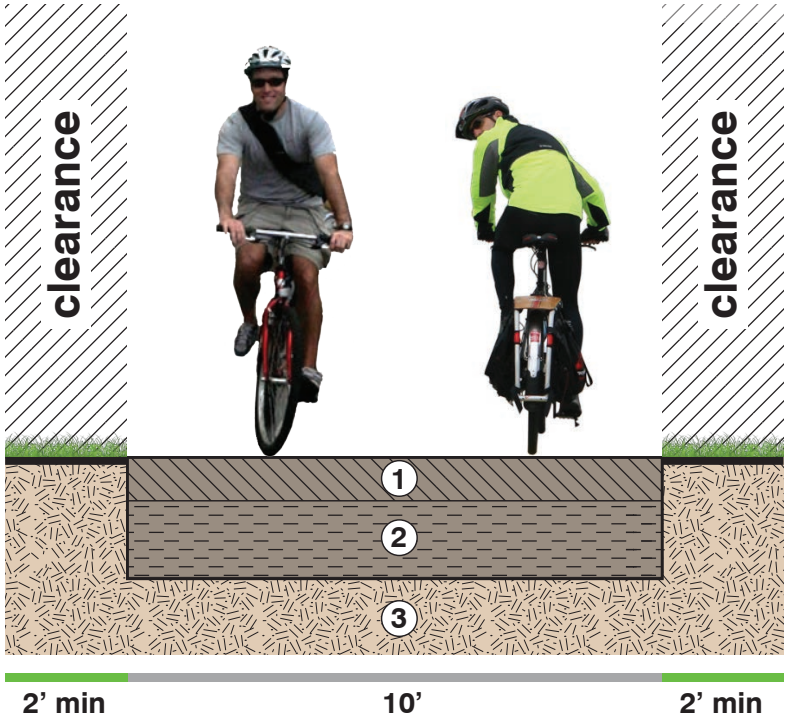


Figure 5-2: Multi-use Trail Layout

Bicycle/Multi-use Boardwalks

Boardwalks that accommodate bicyclists will follow the same recommendations as the pedestrian boardwalks. However, they will need to be constructed with 48 inch high railing for bicyclists' safety. In order to provide a safer and more engaging natural experience for the pedestrians, separate pedestrian and bicyclist boardwalks are recommended over multi-use boardwalks where possible. Should multi-use boardwalks be required, increasing the width may be necessary to ensure safe passage and a quality experience.

Figure 5-3: Bicycle Trail Detail



1. **Asphalt surface court, 1 1/2 "**
2. **Asphalt base court, 2 3/4 "**
3. **Subbase**

Neighborhood Connectors

Neighborhood connectors must have sidewalks for safe pedestrian travel. A minimum of a 6 foot width is recommended. Street trees are also desired to providing shade and separation from the roadway. Bike lanes or bike paths shall be implemented depending on the availability of space. Sharrows - roads with clearly identified bike access to be shared with cars - are a cheap and effective way to begin raising awareness of bikers. Driver education should take place concurrently to ensure bicyclist safety. However, sharrows are not appropriate for all roads and should be limited to lesser trafficked roads. Where there is heavy traffic, buffered or protected bike lanes are desirable and should be considered as part of road dieting plans. Use of planters as protection for the bicycle lanes provides not only safety, but also the opportunity to create character that defines and brands the corridor. Where space is limited or maintenance for vegetation may not be provided, bollards or fences can substitute planters.

Figure 5-4: Neighborhood Connectors and Roadway

Ramps

Ramps provide access up and down slopes for people with disability or with small children in strollers. While the entire stretch of the trail system may not be fully accessible, it is strongly recommended that all paths in and around main attraction sites along the corridor to have ADA accessible ramps as necessary.

Bridges

Bridges not only allow trail users to cross the river, but also to experience it in a different light. Views from a bridge enables the most direct observation of what goes on in the river channel, as well as the opportunity to see changes in flow over time. Slopes along the Rouge River can be steep with limited space for trails, but bridges allow trail users to continue their excursion by crossing to flatter banks.

Benches

Benches situated along the trail provides opportunities for rest and immersion in the environment. The knowledge of frequent benches along the trail may increase the comfort of those less physically able and promote use by a wider population base.

Observation Decks

In locations of particularly important or interesting views, observation decks can signify their value and provide opportunities to observe and engage. Educational signage can accompany the observation deck to further provide information.

Trailhead

One of the main responses to reasons for not utilizing the Rouge River corridor in the survey was the lack of access points. Trailheads will clearly indicate where there is access to the trail system and provide relevant information such as maps and any notices. Parking, bike repair stations, and staging areas should also be provided as necessary.

Ecological Improvements

Invasive Species Management

Invasive species are non-native organisms that outcompete and threaten native species and their associated habitats. In the US, considerable resources are spent on managing invasives that have colonized areas where they interfere with economic activity, transportation, or enjoyment of the outdoors[8]. Invasive plants can not only outcompete native plants, but can change entire ecosystem structures, affect erosion, and impact diverse arrays of organisms that depend on specific plants for food, habitat, or protection[9].

Along the Rouge River, it would take further research to determine the exact effects invasive species are having on native plants and ecosystem structure. However, it is already clear from the dense thickets of Honeysuckle along the river that shrubby invasives have an impact on the abilities of the community to enjoy the river corridor. In some areas, shrub coverage of Honeysuckle, Privet, or Buckthorn already create such dense stands that it is difficult, if not impossible, to traverse. This may impact trail building efforts and will cut off access to the forests for those who want to explore. The Rouge River trail corridor is a heavily fragmented floodplain area, which is ideal habitat for further growth of invasives. If left unchecked, invasives shrubs could spread, eventually cutting off forest access entirely.

Garlic Mustard is another species of concern: while it does not limit mobility along the river in the same way as the invasive shrubs, it has the potential to outcompete native plants and create monoculture stands. This may come into conflict with the community's desire to preserve the ecology of the river and learn and appreciate a diverse array of native plants. Though resources may be limited to deal with invasives, there are several management options that may control the situation and build community stewardship around the river at a relatively low cost.

Prioritize Managed Areas

In invasive species management, an ounce of prevention is worth a pound of cure. Locating areas that are free of invasives and periodically removing undesirable plants is the best way to avoid spending a lot of time and effort removing a more established population later on. Once more pristine sites

Safety

Safety has been mentioned as the primary concern by the community based on our surveys, and the sentiment has been reiterated at the two open houses. This is consistent with the planning of many trails. However, previous studies show that even where apprehensive voices from residents are heard in the planning stages, most people do not experience problems once the greenway trail opens. The Rails-to-Trails Conservancy conducted a study looking into 372 trails across the United States and the crimes that take place there[4]. Results showed that in all contexts - urban, suburban, and rural – crimes were very rare, occurring in 3% of all trails. The incident rates on the trails were significantly lower than the national crime rates, and parks are found to be two to three times safer than people's own homes, on average. Minor crimes, which include littering and graffiti are more common, and are reported in nearly a quarter of all trails. They are usually of minor effect and do not harm adjacent properties. Trespassing occurred in less than 5% of all trails. Studies by others including the Pinellas County Metropolitan Planning Organization in Florida[5] and Eugene Oregon[6] support the relative safety of trails.

Crime prevention through environmental design (CPTED) is a widely used set of design standards to minimize criminal activity. The principles are not specific to trail design but are widely accepted for all settings, including trails. While the actual strategies to be implemented will vary by individual site conditions, it lays out four principles:

1. Natural surveillance: Keep high visibility of users by other people. Criminals generally do not like to be observed.

2. Natural access control: entry and exit are clearly defined to direct people to go only to where they belong. This may be done by use of physical barriers such as fences or vegetation, or through implementing psychological barriers such as signs and designated paving materials for the trails. People walking in the designated areas should not look out of place.

3. Territorial reinforcement: Distinguish private and public areas to show that the area is maintained. People take better care of areas they feel are their own and are more likely to respect what they see as someone else's territory. Fences, pavement treatment, art, signs, good maintenance and landscaping are some elements that can be utilized.

4. Maintenance and management: Related to territorial reinforcement, well maintained areas present the sense of security and social cohesion. Unwanted activities are much more likely to occur in dilapidated areas.

In following these standards, the trail safety guidelines from San Jose, California[7] present the following discrete guidelines:

> Ultimately the best way to increase personal security on trails is to increase the number of users. The presence of other users on a trail tends to make all trail users feel more secure.
>
> - Orientate homes and business to offer views of trails.
> - Maximize visibility of the trail from arterial roadways when possible.
> - Post signage with typical safety notices for dips, bends and other potential challenges with an alignment.
> - Offer amenities and features as a means to increase usage and discourage illegal behavior.
> - Try to avoid "box canyons," areas where the trail corridor is fully enclosed by dense vegetation, walls backs of buildings, or other barriers.

Eliminating overgrown vegetation, minimizing hiding spaces, installing security lighting at trailheads and call boxes are measures that can be employed to promote safety. To increase the number of eyes on the trail, patrols can be conducted either by the police, the public, or a combination of the two.

are checked, it is best to focus on removing satellite populations rather than large stands of invasives. If shortages in time or resources prevent removal of an entire stand before the plant goes to seed, the remaining plants will drop seeds and the area will be colonized the following year. However, if it is possible to completely eradicate one small population, it will not contribute to the soil's seed bank the following year. Areas must be revisited for several years to remove seedlings that sprout from the existing seed bank. Using the invasive cover maps included in this report will help managers decide which areas to prioritize based on density and how each areas is being used.

Use Volunteers

Volunteers are often an integral part of natural resource management in semi-urban areas. For example, Nichols Arboretum in Ann Arbor has about 500 volunteers who annually donate their time to invasive species removal and other management tasks[10]. While such a high degree of volunteerism is made possible partly by the sheer number of students at the University of Michigan, the citizens of Farmington and Farmington Hills have indicated in our survey that restoration to support a healthier Rouge River ecosystem is important to them. In the online and mail surveys, 62% of respondents reported that it is "very important" and 30% reported that it is "somewhat important."

Connecting the community to the Rouge River corridor through the trail system, offers an opportunity for creating a culture of stewardship within Farmington and Farmington Hills. There is at least one organization that is already in existence that may be able to help coordinate volunteers in management activities. The Friends of the Rouge (FOTR) is a 501c(3) nonprofit organization with the mission to "promote restoration and stewardship of the Rouge River ecosystem through education, citizen involvement and other collaborative efforts"[11]. FOTR holds volunteer workdays throughout the year to clean up trash, remove invasives, and plant natives. Some of these workdays in the past have already been held in Farmington Hills within sight of the CIA boundary[12]. This shows there is already community interest and infrastructure to manage invasives along the Rouge.

Locate Resources for Management

Invasive species removal doesn't have to cost much. Removing Garlic Mustard, for example, simply requires volunteers, some garbage bags, and a truck to take bags to a local composting facility. Shrub removal, however, requires tools, herbicide, and potentially even the use of a chipper to dispose of plant waste. Some grants such as the Great Lakes Restoration Initiative may be available to fund invasive species removal. See the Grants section for more detail.

Local volunteers removing invasive species[v]

Removal Methods for Invasive Species

Garlic Mustard: This plant is typically removed via hand pulling. Garlic mustard has a relatively thick taproot that comes up easily if the plant is pulled at the base. Breaking off the stem without taking out the root can allow for resprouting and should be avoided. Only adult plants should be targeted, and more than 85% of each discrete population must be eradicated for control efforts to have any effect[13]. To prevent removed garlic mustard from resprouting or the seeds from being spread by animals, plants should be bagged and transported to a municipal composting facility. Only dispose of plants at facilities that use high heat, which kills viable seeds.

Honeysuckle, Buckthorn, and Privet: Shrub removal tends to be slightly more material intensive, but luckily the same method can be used for all major shrubby invasives along the Rouge River. Honeysuckle, Buckthorn, and Privet are usually removed by cutting the stems to ground or knee height with saws or loppers, and applying herbicide[14,15,16]. Herbicide (usually glyphosate or triclopyr) can be applied by either painting the cut wood or injecting directly into the stump. Both methods have proven to be effective. Dead woody material is typically chipped or stacked in brush piles.

Habitat Enhancements

Tree Planting: Given the importance of trees in forested river systems, the CIA may want to consider replanting trees in the areas affected by Emerald Ash Borer. There are a number of tree planting grants available in Michigan. These are further described in the Grants section. It is important to note that many state extensions have lists of ash alternatives that include exotic and invasive species. A list of native species recommended for replacing ash is included in the appendix.

Meadows: Meadows are habitats of predominantly grass and forbs and support a diversity of flora and fauna. In the predominantly forested Rouge River corridor, open habitats are rare and in the case where existing meadows are found, enhancing them by planting additional species of sedges and forbs should be considered to provide varied experiences along the trail.

Pull the Garlic Mustard from the root, pack the removed plants in bags, and dispose like garbage[vi]

Cut shrubby invasive species and apply herbicide[vii]

Stormwater Management

Given the large amount of impervious surface in the area, reducing the impacts of stormwater runoff must be made a priority to preserve the integrity of the river. Methods range from large scale approaches that will increase the river's ability to accommodate increased water volumes upstream to methods that can be scaled to the residential level, both of which are essential in managing stormwater in the region.

At the larger scale, areas where the river and its floodplain have become disconnected must be restored to reduce flooding risk during storm surges. This can be done through stream channel modifications and wetland creation that strategically control where the river can overflow its banks and reduce the velocity and amount of water flowing through the channel.

Many small scale storm-water management practices fit into a broader category of Low Impact Development (LID) technologies and can be thought of as a way to retrofit more traditionally engineered stormwater systems of urban areas. These strategies rely on decentralized, semi-natural controls that are able to infiltrate, store, and detain water run off. Rain gardens, which detain water and increase infiltration, and rain barrels, which temporarily store and detain water, are two common forms of retrofit LID technologies. LID systems bring the added benefits of treating stormwater pollutants before reaching natural waterways and adding aesthetic value to urban areas. In comparison to rain barrels, rain gardens are thought to be the more effective practice for reducing peak flows[17].

Channel Modifications

With increased upland development, the morphology of the river itself is forced to change to accommodate the higher volume of stormwater reaching river systems. As the velocity and volume of water in the river increases, erosion occurs along the banks or the bottom of the river, as part of the river's natural self regulation[18]. If the water volume of typical storm events reaches the river too quickly, erosion along the banks accelerates. This can cause the morphology of the river channel to become unstable and increase the risk of flooding as the river and its floodplain are disconnected[18,19]. Sustained erosion in urban rivers can cause bank failings and flooding, especially where the stream is constricted and culverted to flow under roadways.

Two methods for restoring the natural functioning of the floodplain include: 1) cutting into the steeper sections of the river banks where floodwaters would historically flow out into the broader floodplain and 2) raising the elevation of the stream channel at its base to ultimately reduce the height of the banks in relation to its depth and normal water flow[20]. Using either method, bank levels should be adjusted to have overflows occur for 1 to 2 year storm events[20].

The first method of restoring the floodplain function can be thought of as 'fast forwarding' the effects of the increased water flow through the stream by removing high banks where the floodwaters would normally flow out into the floodplain (Figure 5-5). Seeking equilibrium with the volume of water in its channel, the amount of sediment carried in the water, and the channel width itself, the stream cuts into the banks to widen itself[18]. As mentioned, if left unchecked this can have undesired effects in urban areas and reduces the quality of habitat. Cutting into the banks then allows the river to function normally at both normal levels and peak discharges[20]. Normal levels do not impair bank stability as the more gradual slopes can hold up to the flowing water. Similarly, peak discharges and flood events are managed by the floodplain where the excess volume flows out into the broader landscape and is stored to reduce the flooding risk in downstream environments. This is often most successful on the outside of the stream channel where the river bends[20]. At these bends, erosion is strongest on the outside edge of the river channel where the water velocity is highest[18]. Water coming around the bend will release out into the floodplain with a sheet flow over the restructured banks, rather than a channel to divert water flow which may cause new erosion problems.

The second method, raising the bottom elevation of the stream channel, is a less intensive method to reconnect the river to the floodplain but often poses challenges in permitting requirements[20]. As compared to the first method of cutting into the banks, this method requires less removal of soil after reconstruction and lessens the impact on the forest since topography of the floodplain is not alternated, only the river channel itself. Returning soil eroded and scoured from the base of the channel from increased water flows, the method seeks to 'rewind' the effects of increased urban development on the river[20] (Figure 5-6). By raising the base elevation of the stream or river, the

Figure 5-5: Bank Cutting

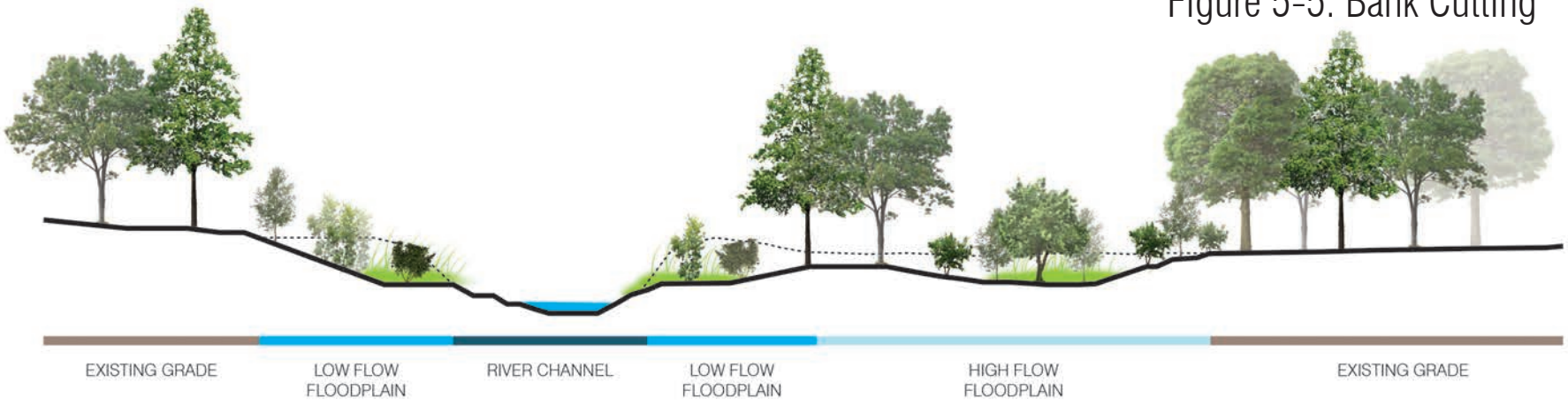
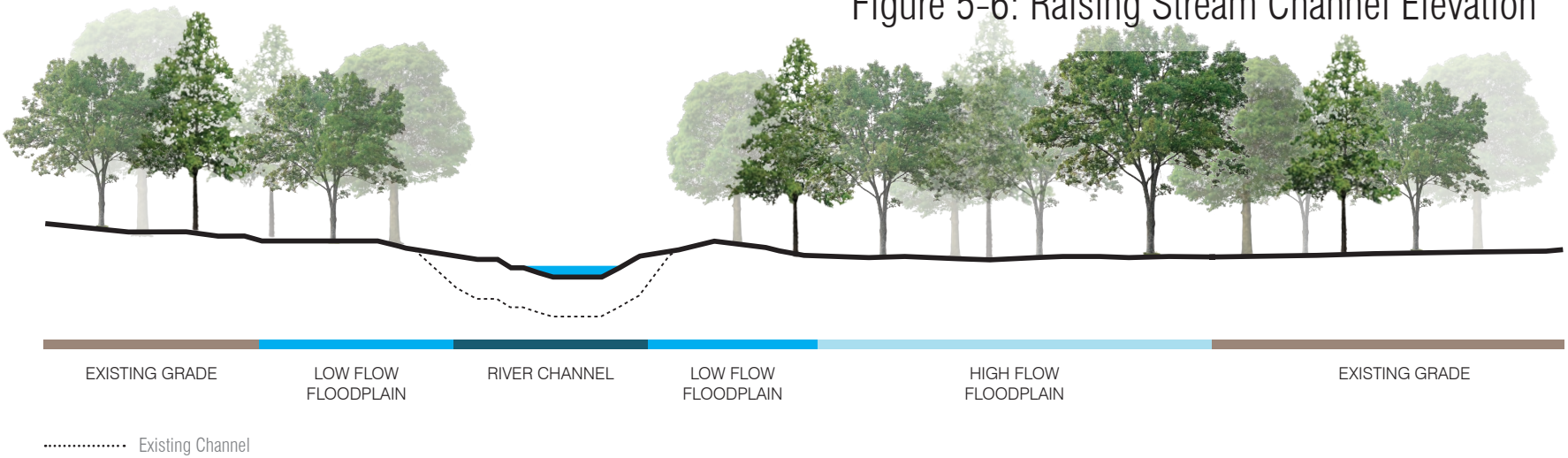


Figure 5-6: Raising Stream Channel Elevation



Phasing Success - An Example from the Platte River Trails in Denver, CO[38]

The Platte River Trail is a multi-use trail that runs through downtown Denver, Colorado. It runs 28.5 miles and consists of asphalt, cinder and concrete segments. The trail is unique in the sense that it was not developed based on a master plan that spans the entire stretch. Instead it was designed and implemented in piecemeal fashion to accommodate specific neighborhoods and raise support for future segments. The planning process was led by the nine person Platte River Development Committee (PRDC), formed in 1974 specifically to include members representing diverse constituents along the river and to promote transparent debate. In order to speed up the process, none of the members were bureaucrats, however city resources were made readily available to the committee.

The Platte River was highly polluted and completely neglected as an asset at the time the PRDC was formed. Instead of creating a fully developed master plan, which often run the risk setbacks in implementation, the PRDC acted quickly, focusing initially on implementing four segments of the trail as a way to raise publicity and support. At the same time, they ensured coherence between the segments by standardizing the furnishings that would go in all segments. With clear goals and freedom provided by the lack of designated authority - PRDC could act as if they had all authority because they were not placed inside the boundaries of authoritative rules - construction bids were placed just 5 months from the first PRDC meeting and the first segment completed in another 8 months.

Not everything went smoothly and according to plans for the PRDC. Funding was a continuous issue and both public and private sources of funding needed to be found. Construction bids often came out significantly higher than expected, forcing postponement or redesign at a smaller scale. Push back from opposing organizations or city council members occurred on multiple occasions. Yet public prominence, brought upon by means such as media exposure, mailing brochures and a grand opening ceremony, quickly led to increases in supporters.

Volunteer crews took a significant role in the construction of the trails, as well as in river cleanup and tree planting. The support for the trail system – and for the new look it gave the communities – generated through visible changes taking place, had resounding effects as neighbors upgraded their properties to keep up with the raised aesthetic standards.

The strategy PRDC utilized in creating a positive atmosphere and minimizing negative feelings very much reflected their incremental approach. They pushed forward in achieving their goals until significant push-back came about, at which point they moved on to tackle other issues. In this way they were able to continue making progress, all the while increasing their support base, which enabled them to proceed forward with the postponed goals when they revisited the issue. In terms of funding, they succeeded in tripling their funds in three years as they successfully advocated and received support from public and private sources. The incorporation of the Greenway Foundation as a tax-exempt fund played a significant role as well.

Ease of implementation and continued maintenance were also at the top of their considerations. Innovative floating foot bridges that prevent clogging at bridges during flood events, and self-composting toilets to circumvent the need for extending sewage lines, are some examples of design features used. To ensure continued maintenance, they obtained a mill levy to pay for drainageway cleanups, and also organized a volunteer group called the Greenway Trail Rangers to both patrol the trails and to clean up the waterway, in addition to full-time employees in charge of taking care of the trail itself.

The Platte River is now a popular destination for recreation[xiii]

water level is brought closer to the top of banks, thereby making it easier for water to flow out into the floodplain during peak discharges or flood events. Regardless of the method used to restore the river's connection with the floodplain, bank stabilization with riprap, fallen trees,and large woody debris is required to hold the banks in place[18]. Bank stabilization efforts can also occur in the absence of large scale projects to restore the stream's connection to the floodplain. Valley spanning logjams and weirs are especially beneficial as a method to force water out onto the floodplains during storm events in a way that emulates natural processes. These methods also serve to increase habitat quality within the stream channel. Professional engineers specializing in wetland restoration and fluvial engineering should be consulted for further details to examine each project site.

Wetland Enhancements

In addition to more intensive methods of bank stabilization and floodplain connection, the cities of Farmington and Farmington Hills may want to consider enhancing existing wetland areas. Some of these areas exist naturally and others were created by the loss of ash trees along the river creating opening in the forest canopy and raising the water tables.

Wetlands are immensely diverse areas that can attract many species with the food and habitat they provide. They act as a sponge in precipitation events, soaking up and storing rain water which prevents flooding and erosion. The diverse array of microorganisms that live in wetlands filter polluted runoff that comes from urban landscapes and help purify stormwater before it reaches the Great Lakes system. Though these habitats provide vital ecosystem services and economic benefits, over 40% of Michigan's wetlands have been lost since settlers arrived in the state[21].

Residents in urban areas can become concerned about the possibility of wetlands becoming breeding grounds for mosquitoes when wetland projects begin near their homes. However, healthy wetlands actually help control mosquito populations. Wetlands provide habitat for natural enemies of mosquitoes such as dragonflies, damselflies and water striders. These insects help keep pests in check. Mosquitoes are opportunistic insects that thrive in any area that collects standing water-- old tires, hollow logs, littered cans, etc. These places do not support the insects that eat mosquitoes however, so they are more of a problem in areas without healthy wetlands[22]. Functioning wetland systems can provide many ecological benefits that are an asset to the community.

Potential Enhancement Sites

We have identified a possible site for wetland restoration by 8 Mile Road, which is further detailed later in this document. However, there are several other sites that are good candidates for wetland enhancement or restoration.

One potential site is near Tuck road and Route 5 (Figure 5-9). The area already has wetlands that were identified in the 2005 wetland inventory by the Michigan DEQ. There is a significant perimeter around the river with hydric soils, and some areas identified by the DEQ to have potential for wetland restoration. The existing wetland areas could potentially be enlarged by channel diversion or some grading of the banks.

Another potential site for wetland enhancement is behind several commercial lots, between 9 Mile Road and Orchard Lake Road. The area to the right of the river, close to 9 Mile Road (see Figure 5-7,8) has flat topography that remains wet after storm events, but does not appear to be a part of the immediate floodplain for minor storms. It has been identified by the DEQ to have high restoration potential based on its soils. Closer to Orchard lake road is an open area lacking vegetation that becomes inundated during storm events. Standing water remains in this depression for a significant portion of the spring and early summer. This area may even be a potential breeding ground for mosquitoes, though this has not been assessed in the field. If the depression could be better connected to the floodplain, plantings added, and natural enemies to mosquitoes introduced, the site could become a healthier wetland and contribute more to the functioning of the river ecosystem.

Figure 5-7: Potential Restoration Sites at 'Yellow Theater'[viii]

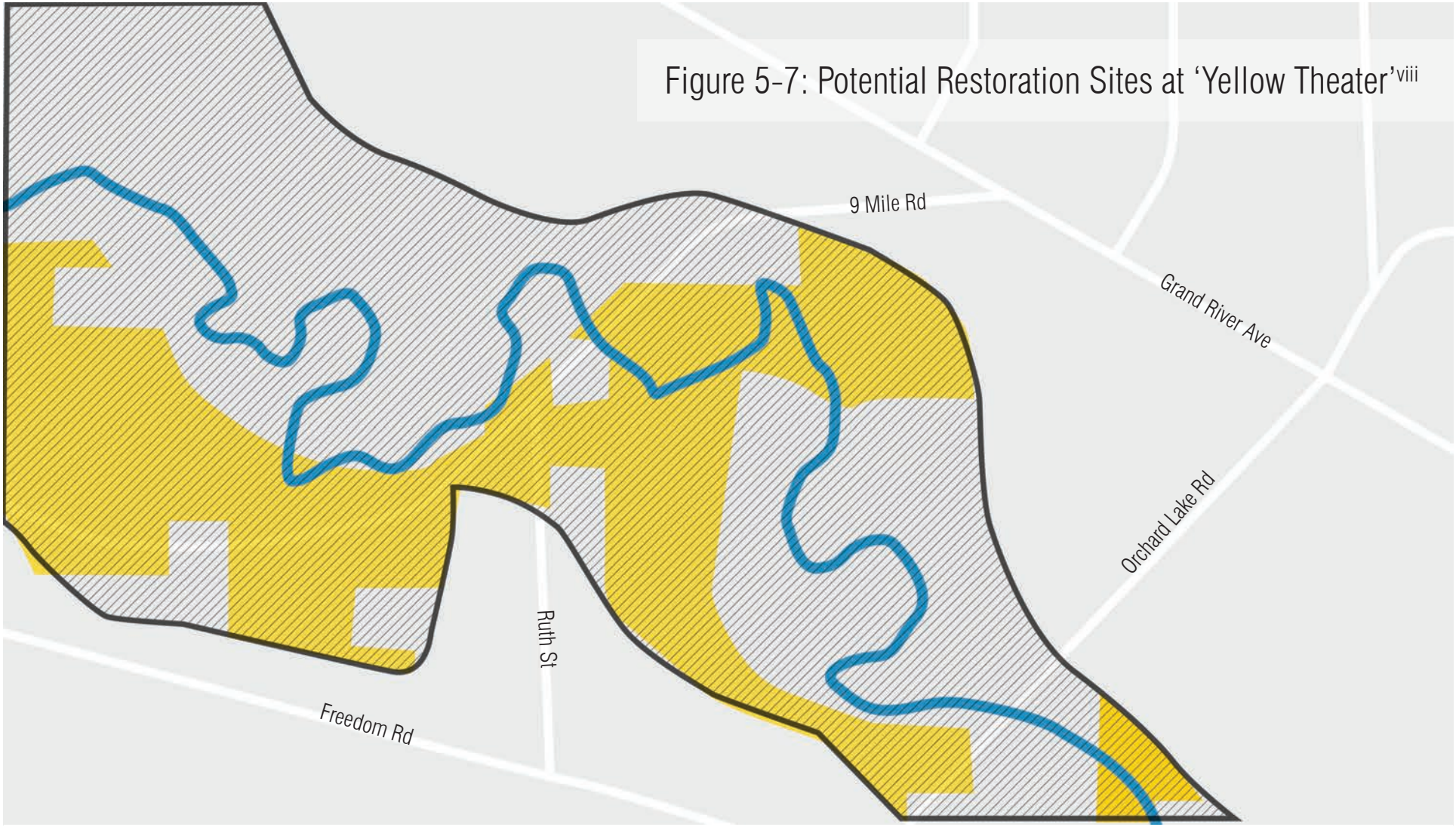


Figure 5-8: Potential Restoration Areas at the 'Yellow Theater' Site[ix]

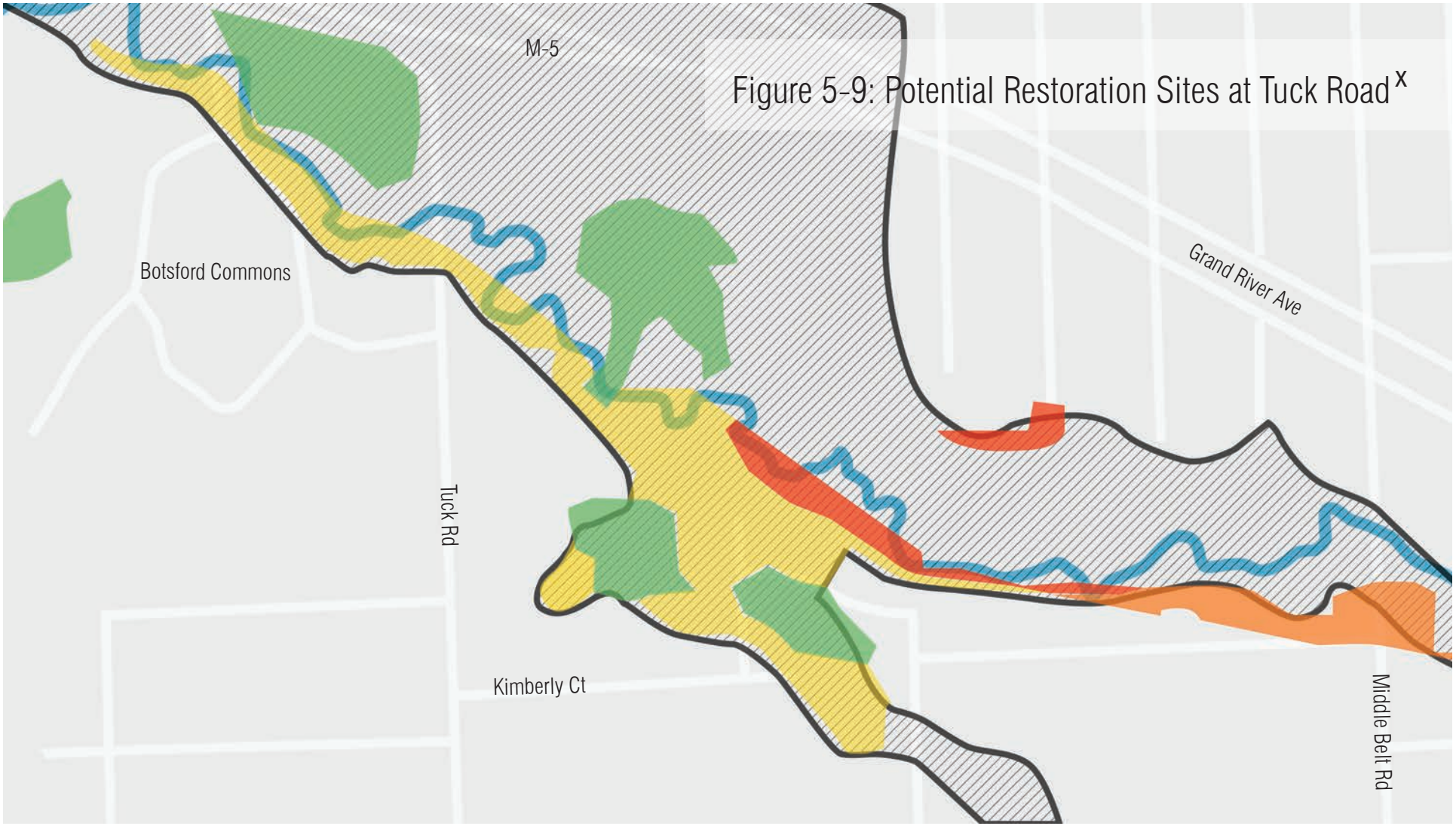


Figure 5-9: Potential Restoration Sites at Tuck Road[x]

Rain Gardens

The Southeastern Oakland County Water Authority describes rain gardens as depressions in the landscape with deep rooted plantings, designed to trap, absorb, and filter stormwater runoff. This decreases the amount of runoff that enters the Rouge, and improves the quality of water that reaches the Rouge through groundwater sources. Rain gardens are designed to drain within 48 hours of a major rainfall.

Rain Barrels

Rain barrels are typically installed below downspouts to collect and store rainwater runoff from roofs. Storing this water and releasing it later to irrigate gardens or lawns can help divert water away from urban rivers during precipitation events. Installation of rain barrels is easy and particularly effective where space limitations prevent other methods of stormwater management. However, proper functioning is dependent upon participants releasing the captured water periodically so that the rain barrels have the capacity to capture additional runoff during rain events.

Tree Planting

Trees play an important role in taking up water from precipitation. Not only do they move hundreds of thousands of gallons of water per year through evapotranspiration, but full tree canopies can also retain significant amounts of water from rain events[23]. In addition, water trickles down the trunk and is infiltrated into the ground so that on average a total of 30% of rain is captured by some species of trees[24]. This helps reduce the amount of water that goes directly into rivers when it rains. Greater tree coverage generally reduces flashiness.

Funding for green infrastructure and planting street trees may be covered in the GLRI's category of Urban Watershed Management Implementation. Both may also qualify for an EPA Urban Waters Small Grant. See Grant section for more details.

Community Engagement

Surveys and Open Houses

Surveys and open houses were two tools used in considering the proposals made in this report. Details can be found in their respective sections. Both tools are important ways of continuing to reach out to the community to provide information and maintain transparency, as well as to receive feedback to reflect the voices of the community.

Volunteer

Volunteers for managing invasive species are presented in the invasive species management section. However, volunteers are valuable assets in many other facets of the trail system as well. They can take part in the construction of the trails, help out with events to promote the trail system, and help maintain the trail system just to name a few. Their involvement will heighten their sense of stewardship and belonging in the community, with potential cascading positive feelings towards the greater community. Volunteers are often the greatest supporters and also be natural advocates for the trail system. In addition to existing volunteer groups active in the area, reaching out to companies located in the community to hold company volunteer days can be an effective way to gather volunteers and strengthen the connections between them and the community.

Community Patrols

As mentioned in the safety section, having eyes of the trails is the best way to create a safe and comfortable trail system. Community patrols can be either professional or volunteer led and be an effective way to not only enhance safety but also to engage the community and nurture a sense of stewardship towards the trail system. The patrol crew could additionally take on roles of cleaning up the trails as in the case of the Greenway Trail Rangers of the Platte River Trail or be educated on the history and nature of the area to provide information to the visitors as in the Pinella Trail volunteer patrols.

Trails as a Catalyst - An Example from the Capital Area Greenway in Raleigh, NC[39,40,41]

A similar situation of river preservation and public engagement to the Grand River Corridor can be found in Raleigh, North Carolina, where citizens were concerned about rapid expansion and urbanization, and became dedicated to retaining greenery and open spaces. Dating back to 1972, the Capital Area Greenway is recognized as the birth of the modern greenway concept. It is the oldest greenway in North Carolina and one of the largest urban greenway systems in the United States. The original design, "Raleigh: The Park With a City in It", remarkably stated ahead of their times that "the natural features of Raleigh make it economically sound and financially realistic…to create a network of parks (and) green open spaces…(that) can enhance Raleigh's already distinctive environment and insure…adequate recreation facilities for the future." Its ambitious goals included providing "alternative(s) to the automobile for short commuter trips." and even that "eventually, a Raleigh citizen might walk or ride his bicycle … to almost any part of the city."

A network of parks and green open spaces contributes to the system that serves the city and adjacent portions of Wake County. The greenway winds through the city, following the city's two major Creeks - Crabtree and Walnut. It connects neighborhood and communities that have unique social and demographic characteristics, with a multi-use trail system, by providing access to different user groups safely and conveniently. The greenway plan aimed to limit urbanization and actually brought population explosion in a desired manner, after the city's greenway plan was written in 1989. The size of the greenway system also doubled in 5 years. The trail system stretched out to adjacent municipalities, and the newer sections were maintained by the state.

During the planning process of this significant greenway system, a multi-faceted approach to public participation was developed to provide opportunities for geographical, topic specific, and policy related input from citizens. The coordinated public participation included a series of community meetings, visioning sessions, online engagement, stakeholder interviews, and online and mailed surveys. Key themes, such as continuing to expand and connect the greenway trail system, increasing access to trails from residences and developing greenway connections closer to homes were reflected in the new plan.

An evaluation of the city of Raleigh's park master planning process was conducted to determine the efficiency of citizen participation in decision making. One major issue identified in the evaluation was a lack of community-wide participation and transparency. Due to unrepresented constituencies in the community meetings, the interest presented was limited to a certain group of community members. Therefore, park program elements were introduced but not desired by the majority of the local residents. The authenticity of the process was questioned by the neighboring residents as program elements lacked visible public support.

Since overcoming multiple difficulties during the proposal, design and implementation stages, today the Capital Area Greenway consists of 114 miles of trails. The new greenway plans are looking to double the trail mileage in coming years with an additional 120 miles that connect to the existing greenway. Besides providing wetlands to filter water, and cool the city and green spaces for animals and birds, the greenway is also a place to which nearly half a million city dwellers can escape into nature to relax and restore themselves.

CAG trail network extending throughout the city[xiv]

Resources

Oakland County Water Resources Commission: Website contains a variety of detailed guides for planning, planting, and maintaining residential rain gardens. Planting suggestions are specific to the Upper Rouge River Watershed.
https://www.oakgov.com/water/Pages/publications/rain_gardens_jp.aspx

The Water Resources Commission has fewer resources, but does have a document with basic information about rain barrels and where they can be purchased.
https://drive.google.com/file/d/0B_a0xSLJbhfOa2RxbFI4eFZsalk/view

Friends of the Rouge: Rain Gardens to the Rescue Program: FOTR's Rain Gardens to the Rescue Program is a series of workshops "designed to teach people about rain gardens and how to create rain gardens of their own." Though the program is targeted at Detroit residents, the first workshop on May 23rd is open to the public. See FOTR's website for more information.
http://www.therouge.org/our-work/river-restoration/growing-sustainable-water-Solutions-rain-gardens-to-the-rescue-program

Grants

Funding green infrastructure and planting street trees may be covered in the GLRI's category of Urban Watershed Management Implementation. Both may also qualify for an EPA Urban Waters Small Grant. See the following sections for more details.

Great Lakes Restoration Initiative (GLRI): The GLRI is a series of federal grants that began in 2010 aimed to protect and restore the Great Lakes. Local governments and nonprofits are eligible to apply for funding, so Farmington and Farmington Hills could both submit proposals. As the upper Rouge is within the Lake Erie watershed, the stretch of river along the CIA corridor qualifies for grants.

Formal raingarden in Downtown Lansing[xi]

Naturalized raingarden at Turkeyville Rest Area, MDOT[xii]

The GLRI website outlines five focus areas for the grants:

"Focus Area 1: Toxic Substances and Areas of Concern — includes pollution prevention and cleanup of the most polluted areas in the Great Lakes

Focus Area 2: Invasive Species — includes instituting a "zero tolerance policy" toward new invasions, including preventing the establishment of self-sustaining populations of invasive species such as Asian carp

Focus Area 3: Nearshore Health and Nonpoint Source Pollution — includes a targeted geographic focus on high-priority watersheds and polluted runoff reductions from urban, suburban and agricultural sources

Focus Area 4: Habitat and Wildlife Protection and Restoration — includes bringing wetlands and other habitat back to life, and the first comprehensive assessment of the entire 530,000 acres of Great Lakes coastal wetlands to target restoration and protection efforts using the best science

Focus Area 5: Accountability, Education, Monitoring, Evaluation, Communication and Partnerships — includes the implementation of goal- and results-based accountability measures, learning initiatives, outreach and strategic partnerships"

Specifically, the 2015 request for applications included the following categories:

Invasive Species Prevention
(EPA-R5-GL2015-ISP)
Invasive Species Control
(EPA-R5-GL2015-ISC)
Urban Watershed Management Implementation
(EPA-R5-GL2015-UWM)
Agricultural Watershed Management Implementation
(EPA-R5-GL2015-AWM)
Maumee River Watershed Nutrient Prevention Pilot Project
(EPA-R5-GL2015-MNP)

The RFA for 2016 has not yet been announced. If they are similar to last year, the CIA could apply for funding to control invasive species, and implement rain gardens or rain barrel programs for urban watershed management. The GLRI has also funded many wetland restoration and creation projects in the past -- if the CIA wishes to engage in wetland enhancement along the river, this could be a possible source of funding. See http://www.greatlakesrestoration.us/ for more information

Urban Waters Small Grants: In the 2015/2016 grant cycle, the EPA requested projects that addressed water pollution caused by urbanization and run-off. Solutions such as rain gardens, rain barrels, and tree planting suggested in the Flooding and Erosion section could fall under this category. This grant places a high emphasis on tie-ins between these projects and environmental justice. From the EPA's website: "The mission of EPA's Urban Waters Program is to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. For the 2015/2016 grant cycle, EPA seeks to fund projects that address urban runoff pollution through diverse partnerships that produce multiple community benefits, with emphasis on underserved communities."

In the 2015/2016 Request For Proposal document, the EPA defines underserved communities as "communities with environmental justice concerns and/or susceptible populations. Communities with environmental justice concerns include minority, low income, tribal, and indigenous populations or communities in the United States that potentially experience disproportionate environmental harms and risks as a result of greater vulnerability to environmental hazards."

See https://www.epa.gov/urbanwaters/urban-waters-small-grants for more Information.

DTE Energy Foundation Tree Planting Grants: This program is aimed to increase the number of trees within service territory of DTE Energy. Grants are available to governments, schools, and nonprofits. Acceptable uses of funds include tree planting in parks, right-of-ways, city streets, nature study areas, school grounds, and neighborhood revitalization projects.

See http://www.michigan.gov/dnr/0,4570,7-153-30301_40936_74679_74684-125033--,00.html for more information

DNR Community Forestry Grants: Grants up to $20,000 to "provide information and technical assistance to municipal governments, schools, nonprofit organizations and volunteer groups for urban and community forest activities such as tree inventories, management plans, planting and other maintenance activities."

See http://www.michigan.gov/dnr/0,4570,7-153-58225_37985-125031--,00.html for more information

A full list of Michigan DNR grants are available here: https://www.michigan.gov/dnr/0,4570,7-153-58225---,00.html There are several trail maintenance and development grants with the DNR, but they require partnership with state government in order to apply.

Conservation Easements

Trail easement agreements are created in order to help create recreational trails in communities that can be enjoyed by all. Due to the many potential benefits of public access to greenspace, and the tax benefits and flexibility of easement agreements, these agreements have become increasingly common over the last three decades. The easement agreements are a good option to pursue if the community is interested in enjoying public green space, without an outright purchase of the land. The alternative to an easement agreement is for the public agency to purchase land.

A conservation easement is a legal agreement between a property owner and an easement holder that transfers some of the property rights from the owner to the easement holder. Conservation easements are unique agreements between the landowner and the easement holder[25]. Each easement may be a little different, or substantially different, in order to meet the landowner's needs and the conservation objective. The easement agreement includes limitations on the kind of structures and the type of activities that are allowed on the land. The easement agreement is set up in perpetuity, which means that it will be transferred from one land owner to another[25]. Changes to the easement are only rarely undertaken, and can be permitted by a court if proficient reasons are presented that conditions affecting the original easement agreement have changed.

Tax Benefits of Conservation Easements in Michigan

Federal Income Tax Benefit

The owner of a conservation easement can qualify for a federal income tax deduction. The Tax Reform Act of 1976 and the Reduction Simplification Act of 1977 were the first pieces of legislation to include tax benefits to owners of conservation easements. Since then, the National Conference of Commissioners on Uniform State Laws created the Uniform Conservation Easement Act (UCAE) in order to help states create statutes that would lead to more effective enforcement of easements. The act assists states in making use of the federal tax code for conservation easements, and addresses enforcement problems with the easement legislation[25].

In 2006 Congress passed new legislation on tax benefits for conservation easements, which greatly increased the incentive for landowners to convert some of their land to an easement. This legislation incentivizes conservation easements through a greater income tax deduction. The federal income tax deduction depends on the value of the conservation easement and the income of the easement owner. In response to the greater incentive, and the increase in conservation easement donations, the IRS also became more concerned with accuracy of the land valuation process[26,27]. Consequently it is important that only qualified real estate appraisers are hired for this process. The appraisal will have to be done with much attention to detail and documentation of the appraisal process. In order to determine the value of the conservation easement, the appraiser has to determine the fair market value of the property, before the easement is part of the property. The value of the property is then

Community Engagement: An Example From the SW Corridor Park (Boston, MA)[42,43]

The Southwest Corridor Park in Boston, Massachusetts is a 4.7 mile linear park system that stretches from the core of Boston to its outer limits, ending at the southern terminus of Olmsted's Emerald Necklace, Franklin Park. It was created in 1989 after Bostonians defeated an effort to construct a highway through the city and inner ring suburbs. In the wake of mass demolitions performed to make way for the proposed highway, the city moved forward with a plan, at the urging of the public, to relocate a mass transit line to the area and create a park system along its stretch. The project serves as a strong example of what is achievable with a strong commitment to community engagement throughout the planning and implementation process.

The SW Corridor Park is unique in the sense that it reaches a high percentage of Boston's population as it travels through many residential neighborhoods. Starting in the heart of the wealthier Back Bay neighborhood, the greenway travels south above the depressed train tracks, largely on landscaped platforms. Further along, the SW Corridor travels between the Roxbury and Jamaica Plains neighborhoods, whose boundaries have been historically defined by the rail line running through the area. With the rail line now below grade, the SW Corridor Park plays an important role in providing a higher quality of life in the area and a public meeting ground for Bostonians.

One of the defining successes of the linear park system has been its capacity to bridge these two neighborhoods, while maintaining an identity for both areas. Jamaica Plains, one of Boston's first streetcar suburbs before annexed by the city, was a working class, predominantly Irish neighborhood, while Roxbury was the heart of black Boston. Initially met with apprehension from the two communities, plans for the park system were eventually championed by residents thanks to the detailed and rigorous public engagement process. Members of these two neighborhoods, who returned meeting after meeting, eventually met on a middle ground and shared a set of interests and concerns. Through bimonthly fliers, open office hours at participating planning firms, public meetings, as well as satellite offices created on larger park sites along the corridor, the design team was able to capture the full community vision and bring it to life by working closely with the public during each stage of the process.

The framework for the SW Corridor Park was developed by planners and designers that took into account its overall structure, connection to neighborhoods, crossing points over the train tracks, and materiality. Within smaller sites along the corridor, other design teams were responsible for individual parks. Working with community members of that neighborhood, the designers were able to add a richness to the project that ensured a park tailored to their desires was created. Given the diversity of neighborhoods and residents along the corridor, the result was an eclectic group of public spaces and elements linked by a common theme and tread along the linear greenway.

Volunteers on the SW Corridor Park[xv]

evaluated with the easement restrictions. The difference of the fair market value and the property value with the easement, is the easement value[26]. This means that if the land is difficult to develop, such as a wetland area, or if the easement is in an undesirable location, far from roads and utilities, the conservation easement value will be lower than land that has a high potential for development, leading to a lower easement appraisal value.

Besides requiring a sound appraisal process, new easement agreements also must adhere to additional criteria that are specified in the tax code in order to qualify for tax benefits[27]. The IRS specifies that the conservation easement must have a conservation purpose that is justified. This means that it must protect valuable natural resources, the protection of which will be a benefit to the public and/or it must allow the public to use the easement. The public can benefit indirectly through the protection if special natural resources and habitat are protected, as well as through the protection of valuable farmland. The public can also benefit directly if the easement is opened up to the public for recreation and education. In this case the land would fall under the criteria of an easement qualifying for tax deduction, because the public is able to interact with the land and benefit from it directly[25,27]. Other important criteria to qualify for tax reductions are that the easement agreement must be in perpetuity and the easement holder must be a qualified organization, such as a land trust, or a government[28].

State Property Tax Benefit

Since 2006 the state of Michigan gave another important tax benefit to owners of conservation easements by eliminating the so-called Pop Up Tax[27]. The elimination of this Pop Up Tax means that when land donated as a conservation easement is sold, or the owner is transferred through inheritance, it will continue to be taxed at the same rate as before. Before this legislation, the value of the land after ownership transferred, became the same as State Equalized Value (SEV), which means that it was taxed at the new assessed land value. This meant that the new owners of the land often would have to pay several times the amount in taxes as the previous owners. Especially when land is inherited, the new landowners may not be able to pay the new tax rate, and consequently some families are forced to sell some of the land. With the elimination of the Pop Up Tax however, the tax rates on the conservation easement stay the same, so that the new landowners are able to hold onto the land more easily.

Conservation easements hence can serve as a federal income tax deduction, as well as help eliminate the Pop Up Tax in the state of Michigan. In terms of property taxes, there is no requirement that the township lowers property taxes for a property owner after part of the land has been converted to a conservation easement. Although the township is not required to grant this request, landowners can apply to their township for lower property taxes after the easement has been donated.

Trail Easements and the Rouge River Project

Conservation easement agreements are often crafted as trail easements for the purpose of providing public access to a trail. There are many examples of trail easement agreements available through different trail organizations, such as American Trails or the Michigan Trails and Greenways Alliance. During the process of trail easement acquisition, the two types of tax incentives should be explained to landowners. During this process it is also important that the holder clarifies that there is no guarantee that the owners will qualify for an income tax deduction. The deduction depends on the value of the trail easement and the owner's taxes. In some cases, it may not be worthwhile to prepare for a tax deduction if the land given up for the trail is not worth much[29]. A good real estate appraiser can be asked to appraise the value of the trail easement. When it comes to preparing an agreement, a sample trail easement agreement can be prepared and presented to the landowner preemptively. To finalize the trail easement, the conservation easement owner and holder will need to engage the help of legal counsel to craft an agreement that will best meet the owner's and the trail's requirements[29].

Trail Greenways and Property Values

As more communities around the United States are creating public recreational trails, also referred to as greenway trails in the literature, questions have arisen around the economic impact of these trails to the immediate surroundings, as well as the impact on the larger community. Although it is relatively easy to describe benefits of greenways qualitatively, it is more difficult to show benefits quantitatively[30]. Since each greenway is connected with a completely different set of variables, it is also difficult to predict how a greenway will affect different communities. Nevertheless, the literature on the effects of recreational trails on property values of homes nearest to the trail shows that most of the time the presence of the trail has not changed property values, or has produced a slight increase in property values. Especially nature areas similar to the ones proposed in this report, as opposed to specialty parks, golf courses and urban parks, have been shown to increase property values[31]. Over time, the chance of higher property values due to the greenway, may lead to an increase in property tax revenues available to local government.

In the discussion of greenways, and greenway trails, a distinction can be drawn between trails with only a few feet of green space on either side, and the greenway as a large natural area with a significant width of natural area, where the recreational trail is only a small part of the natural area. The effects of the wider greenways are more comparable to parks. In the case of the natural areas surrounding the Rouge River in Farmington and Farmington Hills, most of the natural areas have a greater width and could be categorized more as a greenway that is similar to parks. This means that the literature on parks and property values can also be considered for the Rouge River greenway plans.

Nicholls and Crompton[30] used the hedonic pricing method to assess property values in Austin, TX in three neighborhoods in relation to their proximity to the Barton Creek Greenway. They found that property values increased significantly with proximity to the greenway, in two of the three neighborhoods studied. The third neighborhood saw no significant change in property values. However property values saw a significant decrease when they were located adjacent to greenway entrances, which are more heavily used areas. This observation falls in line with studies that have shown that when parks are heavily used, especially when they have been designed for sports and large gatherings, rather than quiet nature recreation, the adjacent properties may experience a decrease in values. The results from the Austin, TX study are in line with many other studies over the last three decades that describe effects of greenways on property values. It has been observed that most of the time property values will either respond positively to the presence of the greenway, or have no response[30]. Crompton[32] completed a literature review of studies that have specifically examined the effects of greenway trails on property values through surveys of property owners. Most of the greenway trails in these studies were fairly narrow. The dominant theme among the studies seemed to be that property owners perceived the trail to have a neutral influence on their property's saleability and value. Between the different studies, about 20% to 40% of respondents were under the impression that the greenway trail would increase their property's value and saleability.

In addition to the studies of greenway trails, there have been many studies focused on the effects of parks and open green space on property values. Literature on the effects of parks on property values can be found as far in the past as the evaluation of the effects of Central Park on property values, completed by Olmsted in the early 20th century[33]. Since then there have been a variety of studies on the effects of parks. There are fewer accounts of effects of trails, or greenway trails. Since the proposed Rouge River recreational trail is surrounded by fairly wide nature areas, the literature on parks can also be applied to these plans. Crompton's[34] review of literature focusing on the effects of parks and open space on property values, showed that close to all of the literature reviewed demonstrated a positive effect on property values. Depending on the size of the park area, the design and the usage, prices of properties that are adjacent to the parks in these studies increased about 20%. If the park is heavily used, the proximate properties may not have as much of an increase, but properties around the park a bit further away may see an increase due to their relative proximity to the park[34]. The National Park Service[35] completed a review of greenway literature and concluded that the effects on property values of a given trail greenway, or park, depend on the amount of open space present, recreational access and the type and frequency of use. In cases where there is access to a lot of open space, with more limited recreational use and use frequency, property values tend to increase immediately near the amenity. In areas where there is heavy use of the open space, proximate properties may not experience an increase in value, and could experience a decrease in value. In this case property values in the immediate neighborhoods may experience an increase in value instead.

In summary, the literature of the impact of open space and parks, as well as literature specifically examining greenway trails, mostly shows that the greenway's impact on property values is positive or neutral. Only in some cases, generally when there is an especially high level of use of the park or greenway, has the impact of the greenway seen a negative effect on directly adjacent property values, but an increasing effect on property values of more distant properties is also the case in these instances. It seems that the Rouge River greenway trail would not experience the intensive use described in some of the studies, which has been observed when parks are designed for large social gatherings and athletic activities, rather than quiet forest and wetland natural areas. In fact, it has been suggested that the quiet forest and wetland areas are much more desirable for property owners than parks that include athletic fields and large social gathering spaces[36]. Natural areas, in contrast to specialty parks, urban parks and golf courses, have the highest potential for an increase in property values[31].

Besides a possible increase in property values and increase in saleability of properties, greenway trails can be an investment that may be beneficial to the community as a whole from an economic development perspective. Greenways have been connected to an increase in attraction of future businesses and residents[37]. In Crompton's study, respondents from small companies in Colorado rated access to recreation areas, open space and parks as the most important factor among six quality of life factors. Although it has to be considered that this study was conducted in Colorado and the results may not apply in other areas in the same way, the study concludes that access to parks and recreation may have a higher impact than has been previously suspected on a community's potential for economic development.

From an economic perspective, described here mostly from the angle of property values, it is safe to say that especially with regard to natural forest and wetland areas, the greenway's impacts will be positive or neutral. There is a significant chance for a positive impact from the establishment of a greenway, such as the Rouge River trail greenway, that reaches from a possible increase in tax revenue for the local government due to an increase of property taxes, positive economic effects for the community as a whole through a greater attractiveness of the area for businesses and residents, positive health and social effects for the community, all the way to beneficial ecological impacts.

View of Rouge River and quality habitat from Grand River Avenue

Planning Toolkit

DESIGN FEATURES

TOOL	PRIMARY FUNCTION
Gathering	
Retail / Commercial Development	Attract visitors and enhance the economy of the area
Outdoor Seating	Engage restaurant/cafe customers to the outdoor environment
Plaza / Patio	Provide public gathering space in a well traversed location
Pavilion	Provide gathering space within a larger destination site
Treehouse	Provide a view and intimate experience from canopy level
Open Space	Provide versatility to host various activities under the sun
Dog Park	Provide a place for dog owners to let their dogs exercise
Passive Recreation	
Nature Trail	Allow pedestrian access into the drier areas of the river corridor
Bike Path	Allow bicycle access to the river corridor
Boardwalk	Allow access into wetland areas for enjoyment
Neighborhood Connector	Provide a comfortable access along roads connecting to the trail system
Ramp	Allow easy access to sites for physically less able people
Bridge	Cross the river to experience more of the natural area
Bench	Provide a location to sit and enjoy the site or rest
Observation Deck	Provide the opportunity to observe a special natural feature
Trail Head	Signify the entrance to the trail and provide relevant information
Garden	Allow for a beautiful and controlled engagement with natural elements
Habitat Enhancement	
Invasive Species Management	Enhance the native natural habitat
Tree Planting	Replace gaps in the forest canopy formed by emerald ash borer
Meadow	Support a diversity of fauna and flora in an open area
Stormwater Management	
Channel Modification	Return the river hydrology to its natural state
Wetland Enhancement	Enhance they hydrology of the site
Rain Garden	Capture, treat and infiltrate stormwater runoff prior to reaching the river
Rain Barrels	Capture runoff from rooftops
Erosion Control	Prevent further degradation of the river channel

DESIGN FEATURES	TOOL	SPACE NEEDS	MAINTENANCE	COSTS	COMMUNITY EQUITY	WELL-BEING	NOISE	CLEAN STORMWATER	REDUCE FLOODING	ENHANCE HABITAT
	Gathering									
	Retail / Commercial Development	○	○	○		○	◯			
	Outdoor Seating	◯	○	◯	◯	○	◯			
	Plaza / Patio	◯	○	◯	◯	○	◯			
	Pavilion	○	◯	◯	○	○	◯			
	Treehouse	◎	◯	◎			◎			
	Open Space	◯	○	○	◯	◯	◯			
	Dog Park	◯	◯	○	◯	○	◎			
	Passive Recreation									
	Nature Trail	○	○	○	○	◎	○			
	Bike Path	○	○	○	○	◎	○			
	Boardwalk	○	◯	◯	○	◎	○			
	Neighborhood Connector	○	○	◯	○	◯	○			
	Ramp	◯	○	◯	○	◎	○			
	Bridge	◯	◯	◯	○		○			
	Bench	○	○	○	○		○			
	Observation Deck	◯	○	◯	○		○			
	Trail Head	○	◯	○	○		○			
	Garden	◯	◎	○	○	◯	○			
	Habitat Enhancement									
	Invasive Species Management		◎	○						◎
	Tree Planting	○	○	○					○	◯
	Meadow	◯	○	○				○		◯
	Stormwater Management									
	Channel Modification	◎	○	◎				◯	◎	◎
	Wetland Enhancement	◯	○	◎				◎	◯	◯
	Rain Garden	○	○	◯	◯			◯	○	○
	Rain Barrels	○	○	○					○	
	Erosion Control	○	◯	◯						◯

◎ High ◯ Medium ○ Low *The scales are relative to each tool.

	TOOL	PRIMARY FUNCTION
PLANNING / IMPLEMENTATION	Community Engagement	
	Survey	Gather general information from a wide population
	Open House	Gather more in depth information from a smaller population
	Volunteer Day	Enhance the sense of stewardship in the community
	Community Patrol	Enhance safety and the sense of stewardship in the community
	Other	
	Grants	Receive funding from external sources
	Easements	Gain access to private property

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Image credits:
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6 Focus Areas

Overview

Based on community feedback and significance along the corridor, three areas have been selected for more detailed design exploration. Concepts that take advantage of each site's unique characteristics were developed and later finalized to showcase the full potential of the trail. These sites have the potential to become cherished areas by the community and fully integrate the trail with development, ecological networks, and community well-being. While each focus area contains site specific elements, many features can be replicated throughout the trail corridor to create unity as one travels through the area. The focus areas serve as an example of how the trail typologies function on a finer level of detail and how key destinations along the corridor can serve multiple functions and user groups. With careful consideration of other nodes, a dynamic experience can be created along the river trail using many of the ideas presented in the following designs.

The Historic Winery

9 Mile Road and Grand River Avenue

A true gateway to the river trail and community, the Historic Winery invites visitors into the site to experience some of the treasures of the Rouge River and the Farmington Area. Viewing the iconic Detroit United Railway Powerhouse building and tower in the distance, visitors are already struck by the character of the site as they approach the winery from afar. Whether coming to enjoy a quiet walk by the river, dinner at the new local restaurant and the patio overlooking the forest, or even another day at the office, the beauty of the winery's setting is undeniable. Combined with the activity within the building, the site creates a lively and engaging experience at the winery that integrates the economic development of the site with the river itself.

To the east of the winery building, the upland portion of the site offers visitors with flexible open space that can host a variety of events and activities in a more formally designed setting. Here, one can imagine lounging in the grass, catching the last of the afternoon sun before returning home after a walk, or listening to the sounds of laughter and play while enjoying lunch on a shade-dappled patio. A small loop in the walking path surrounds an open lawn area and rain garden features that help treat and store rainwater from the winery and parking lot. Ornamental trees add to the rich sensory experience and seasonal interest of the site. Views from the top of the hillside reveal that the winery is much more than first meets the eye as one peers through the forest to catch glimpses of the river.

View of Historic Winery and former powerhouse smokestack

Design boundary for Historic Winery

Figure 6-1: Existing Conditions at Winery Site[i]

Moving from the winery building beyond the patio, the path turns the corner, gently leaning into the hillside. Tucked into the edge of the forest, a ramp begins that slowly brings visitors out into the broader landscape. The continuation of the rain garden theme draws people down to the river's edge as they watch it cascade down the hillside, appearing and reappearing along the ramp's stretch. Just beyond the base of the ramp, the rich colors of the enhanced wetland feature mimic the rain gardens above. Turning the culverted former stream reach into an asset, the enhanced wetland combines the ecological services of wetland systems with design sensibility, as a boardwalk sweeps through to create a beautiful meeting place among the reeds.

In the floodplain forest beyond the stream's wetland area, a treehouse offers a view from above. With the winery tower as a beacon, one can easily meander along the pathway following the stream's banks. Surrounding the treehouse like a moat, an unexpected shade garden appears in the low-lying channel the river used to flow through. Out on the main path again, the landscape opens up to a meadow that runs the length of the site east to west. Here, the walking and bike paths run side-by-side as they emerge from the dense forest to the west and move along the base of the winery on the hillside. At the eastern edge of the site, a trailhead forms the junction of the ADA ramp, pathways, enhanced wetland, and small accessible parking lot off of Nine Mile Road.

Existing lot behind the Historic Winery building

Edge of existing forest opening looking toward the Historic Winery

Figure 6-2: View Toward Patio and Ramp

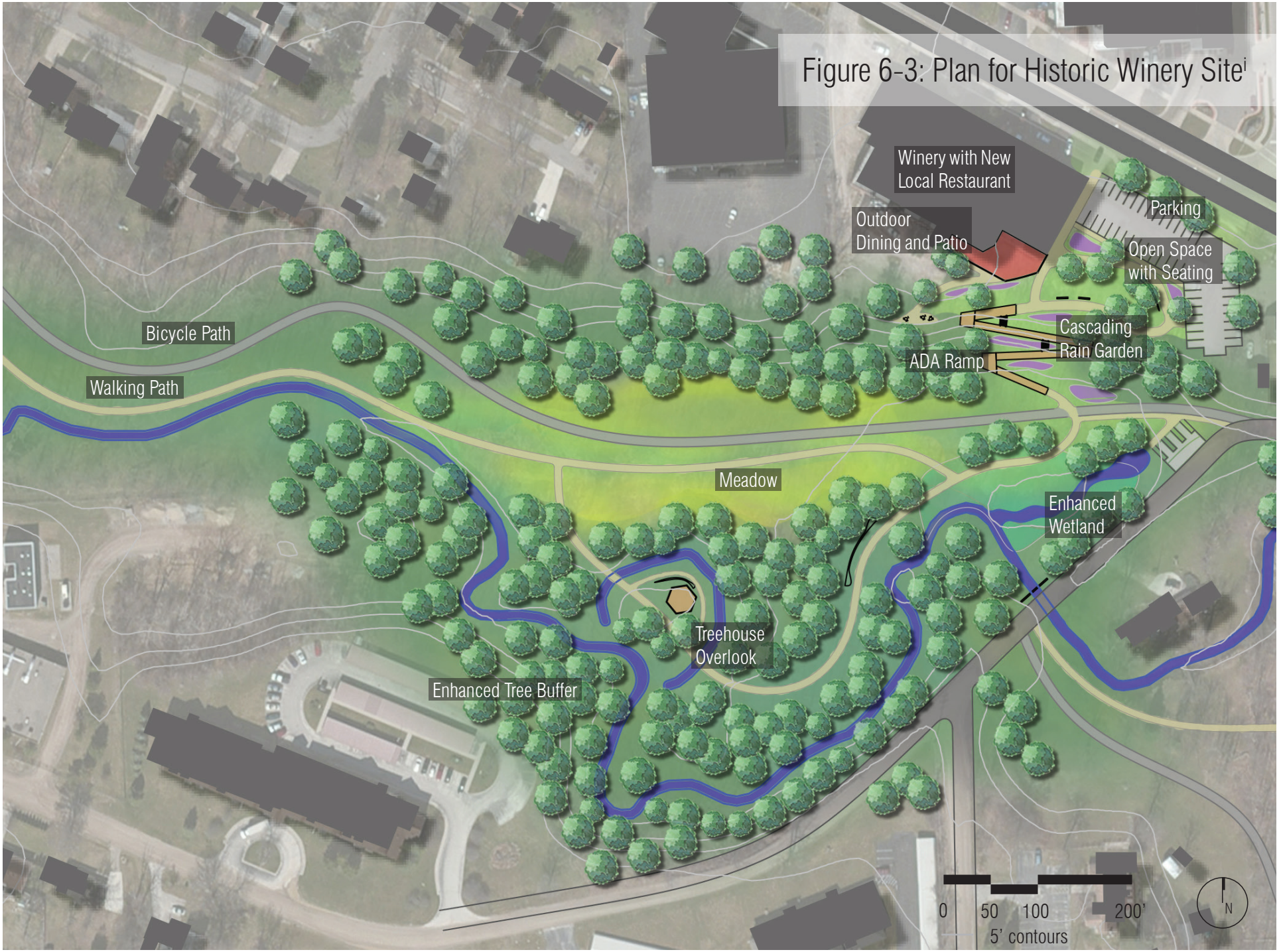
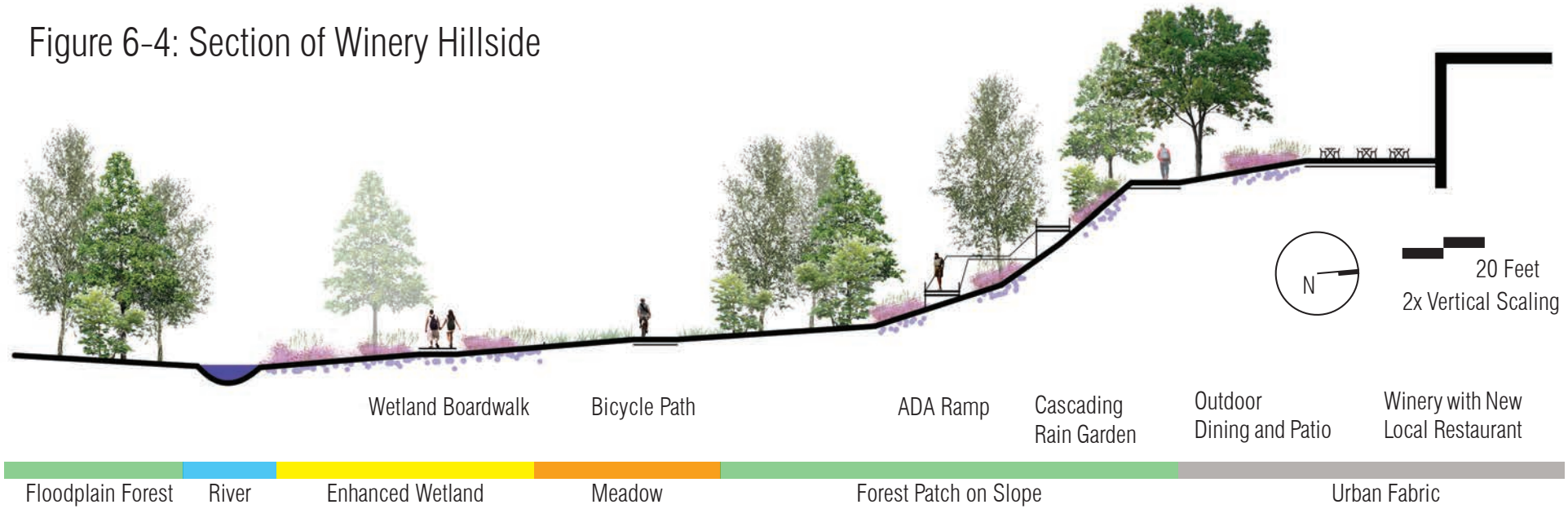
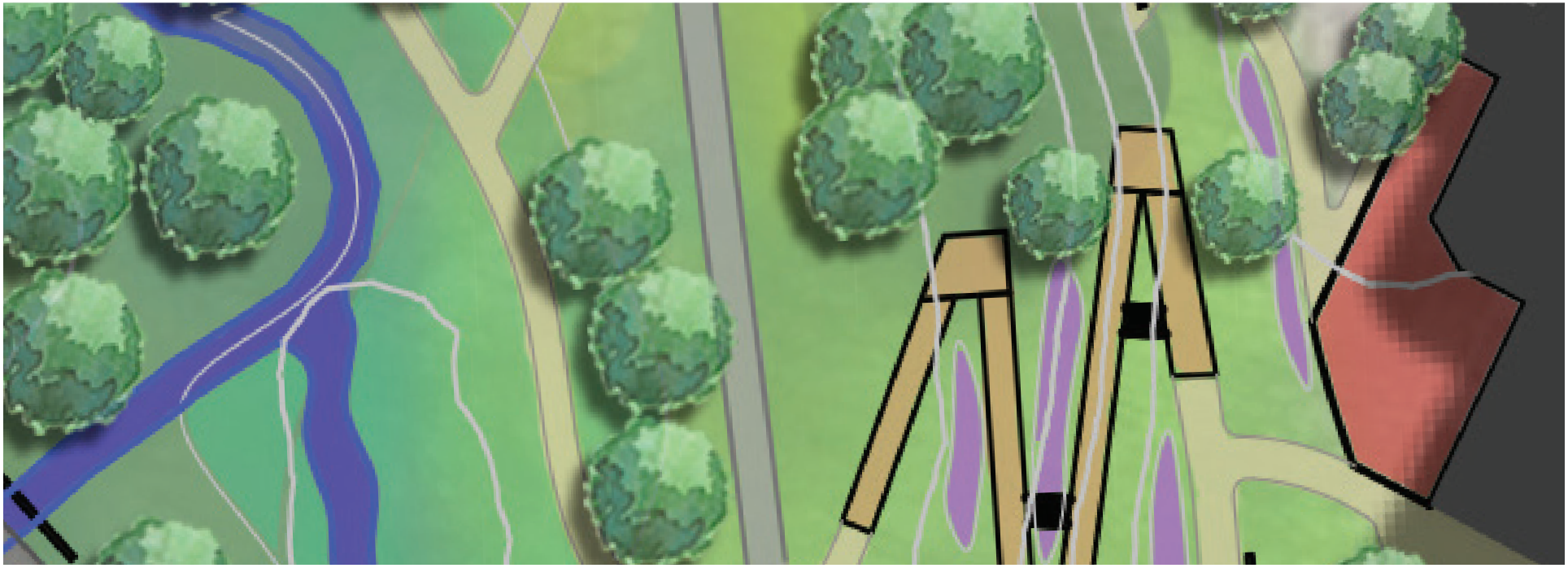


Figure 6-3: Plan for Historic Winery Site[i]

Figure 6-4: Section of Winery Hillside





Treehouse Overlook[ii]

Cascading Rain Garden[iii]

ADA Ramp[iv]

Outdoor Dining and Patio[v]

Meadow[vi]

Enhanced Wetland and Boardwalk[vii]

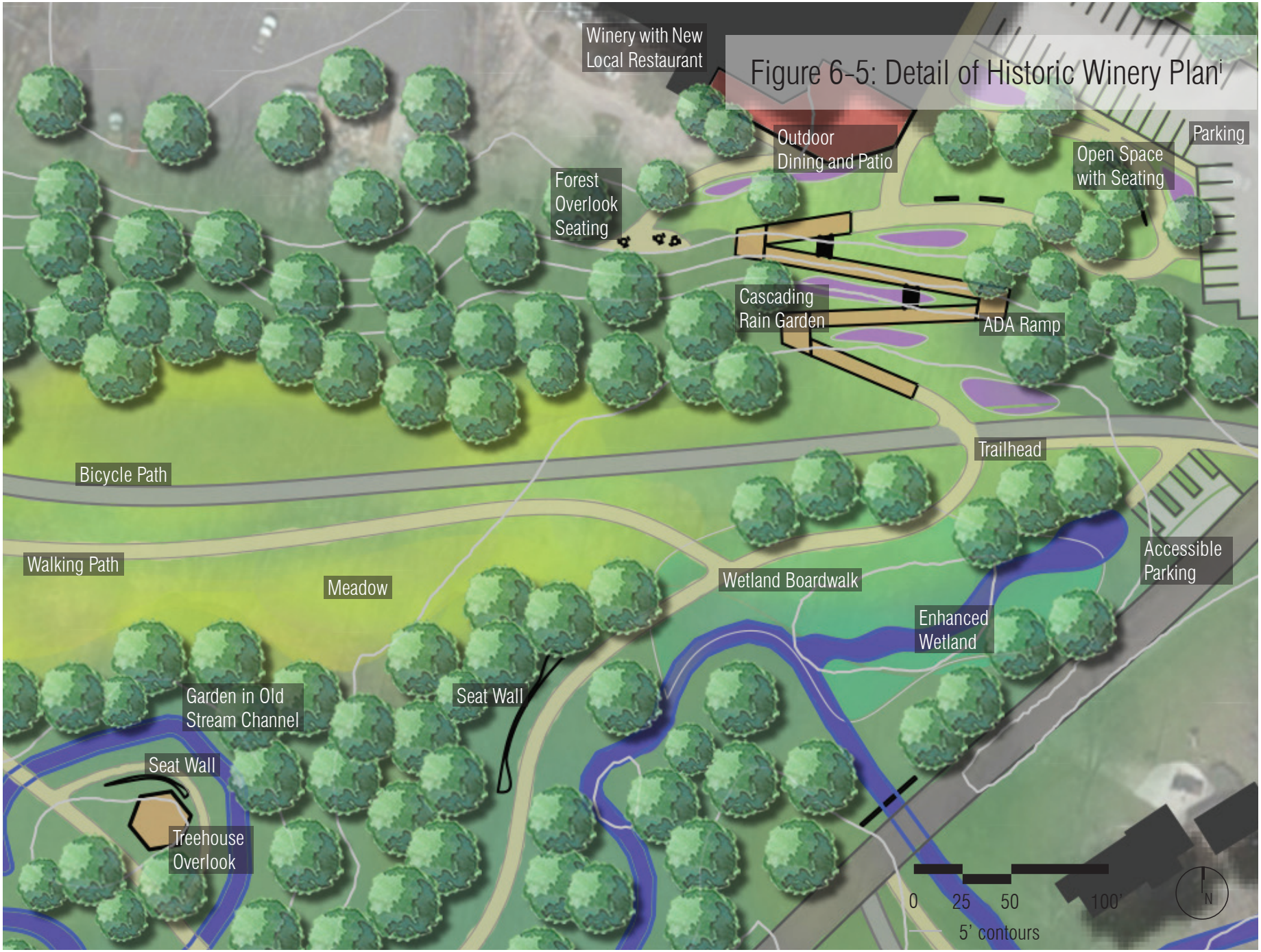


Figure 6-5: Detail of Historic Winery Plan[i]

The Tuck Rd Nature Area

Vacant Lot on Tuck Road

The Tuck Rd Nature Area is tucked into the neighborhood to the south of Grand River Ave. A five minute walk from Botsford Commons and adjacent residential area, this nature area serves the community with an easy access to a variety of landscapes and ecological systems for recreation and education. This nature area also provides open space and pavilions for community events and activities to take place. A fenced-in dog park occupies part of the open area, where owners let their dogs free off-leash to run and socialize in a safe environment.

Design boundary for Tuck Rd Nature Area

Existing meadow wetland

Existing vegetation

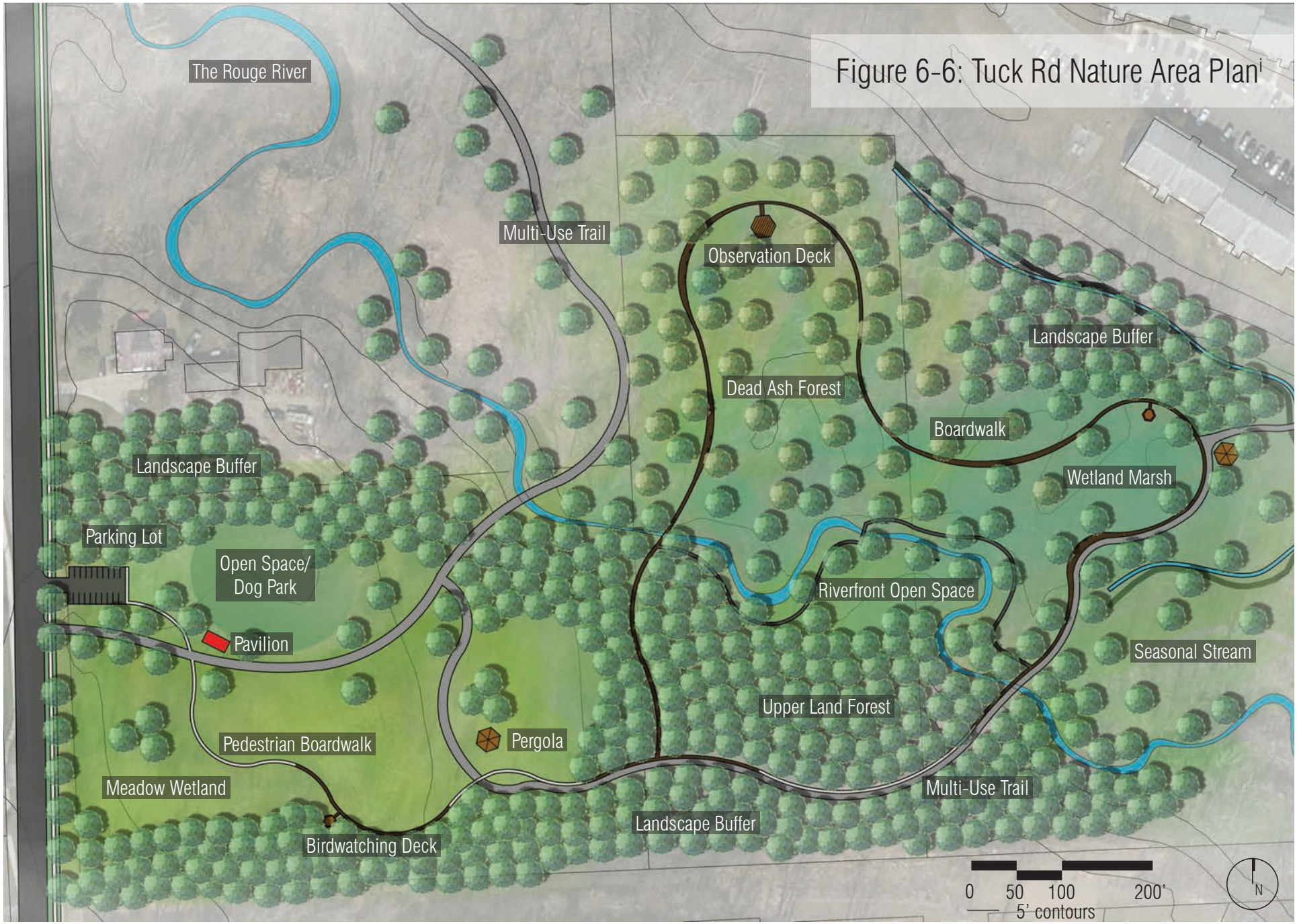


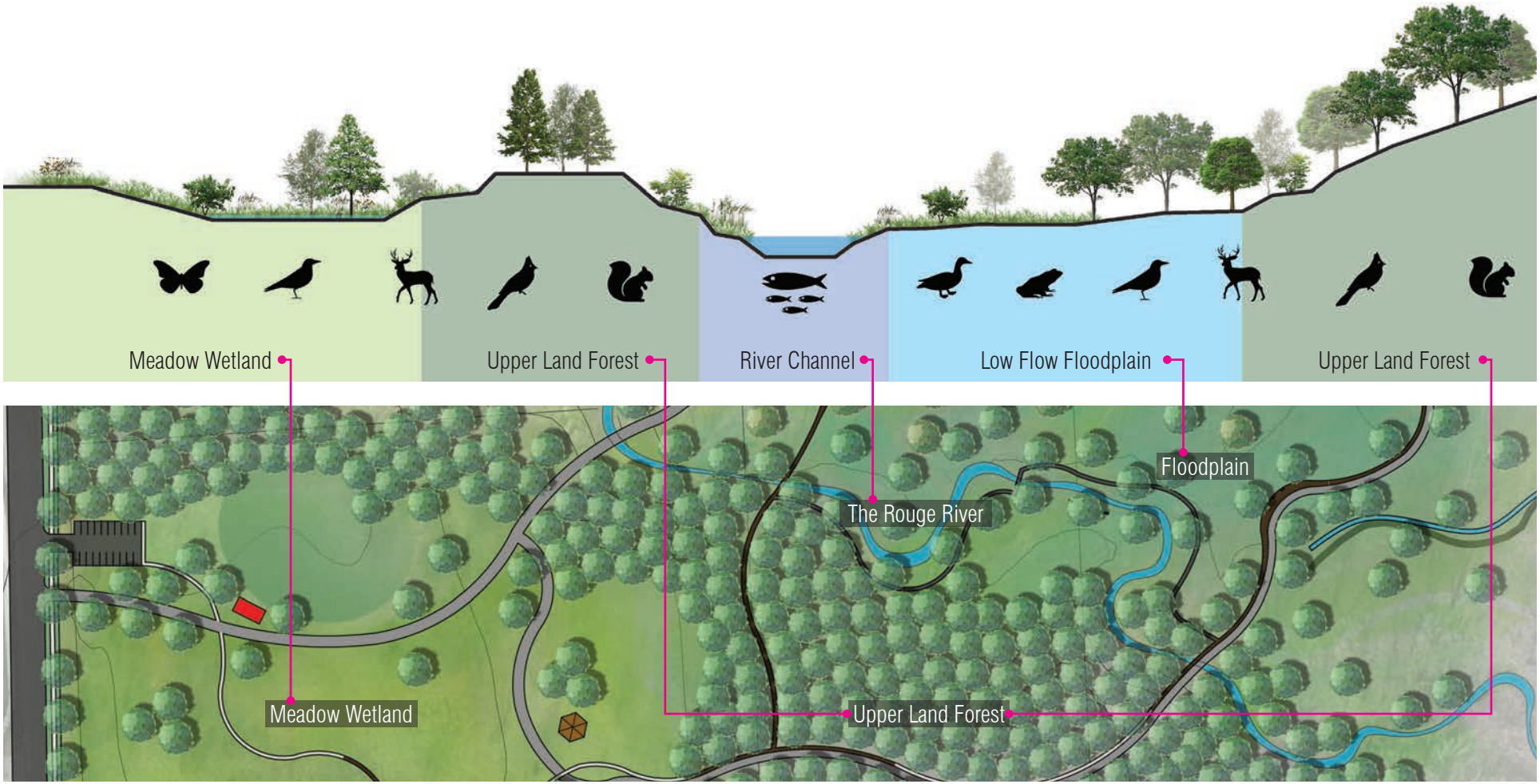
Figure 6-6: Tuck Rd Nature Area Plan[i]

Figure 6-8: Wetland Meadow Visualization

The design keeps riverfront and forest areas quiet and peaceful by locating the open space, event pavilion, and multi-use trail near the entrance to the site. The amenities of the site shape the community gathering space for the neighborhood, while also providing a rest stop for those who use the longer Rouge River Trail. The multi-use trail touches the periphery of the site to reduce construction impact on the sensitive river system and noise disturbance to the tranquil nature experience in the forest and on the river front. With the activities located on the frontage of the park, the majority of the nature area is preserved for quiet enjoyment of nature. A boardwalk runs through the floodplain and seasonal marsh to allow walkers to immerse themselves in the riverfront habitat.

Visitors experience various nature habitats and ecological systems within the Tuck Rd Nature Area. Walkers enjoy the chatter of birds as they hike through a wetland meadow that meanders into a marshy floodplain. The design of the site preserves many of the existing nature areas, strengthening their unique characteristics. Following the curving trail, the wetland meadow, upper hill forest, dead ash forest, marshy wetland, and the riverfront come into sight like chapters in a book. Education signage and sitting areas with each unique habitat provide for a better understanding of the ecosystem. Near the edge of the wetland, a birdwatching deck allows for birdwatching, listening to bird songs, and identifying different species with signage. The pergola on top the hill offers an expansive view of the whole wetland meadow area with the birds singing in a close distance. Visitors rest at the pergola and then set forward to explore the floodplain area, where observation decks are set for enjoyment of the river's beauty.

Figure 6-7: Habitat Types and Floodplain Section



The 8 Mile Stormwater Park

Vacant Lot on 8 Mile Road

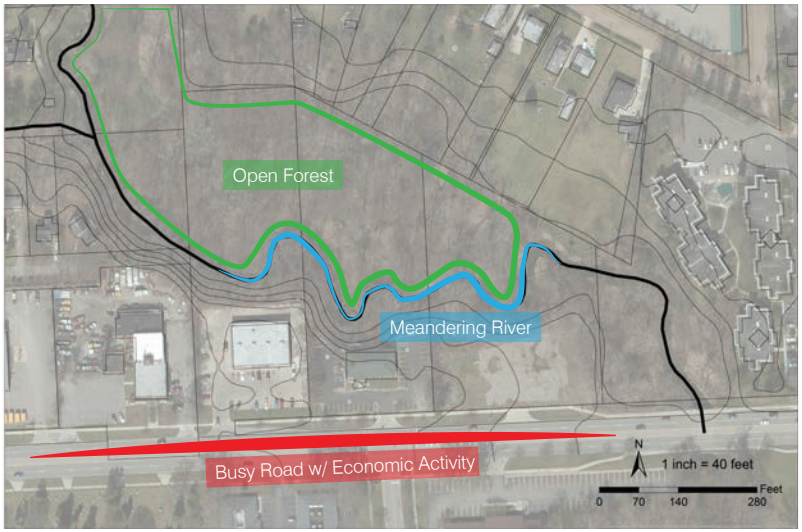
The 8 Mile Road Stormwater Park entrance is set on the current vacant lot on 8 Mile Road west of Pearl Street, and segways into an open forest by the river on the back side of the lot and adjacent office buildings. On the east is a condominium complex and single family residential neighborhoods to the north and west. The site is also on the southern end of the study area and directly across from Hearthstone Park to the south of 8 Mile Road. Following the context within which this site is situated, great potential exists to integrate economic activity, ecological restoration, and gateway functions to the Rouge River trail system.

The parking space for the site is shared and connected to the existing parking space of the adjacent office building to reduce the number of curb cuts and create a more pedestrian and bicyclist friendly environment. The realignment of the parking spaces allows for a greater buffer between the paved areas and the slope down to the river valley. Rain gardens can be planted in this vacated space to filter stormwater runoff and create a lively welcome experience.

An ADA accessible ramp connects to the enhanced floodplain where one can witness the workings of nature through the changing seasons and weather conditions. The meandering shape of the Rouge River signifies a slower flow at this location and a likely bottleneck caused by the installation of the culvert under 8 Mile Road. The flashiness of the Rouge River has eroded the banks and the river is several feet below grade from the surrounding forest floor. The relatively wide remnant open forest to the north side of the river creates the opportunity to restore the connection between the river and the floodplain. Benefits of the enhanced floodplain includes creation of wildlife habitat, diversified experience for trail users, and enhancement of stormwater detention capacity. Details on how the floodplain restoration may be implemented can be found in the Implementation Strategies section.

View to the vacant lot from 8 Mile Rd

Design boundary for Stormwater Park



Existing conditions[i]

An urban frontage draws visitors in from 8 Mile Road. A fresh produce station anchors the development, providing healthy food options to trail patrons. The mill in the store frontage honors the historical significance of the mill industry to the community and acts as an iconic structure and stormwater feature visible to all that pass by. Mills have in the past also served as a community gathering space, a function which the adjacent plaza space fills. As a gateway site for the trail system, bicyclists stop here to rest and get reorganized.

Flowers and grasses from rain gardens capture all stormwater runoff and create a cheerful atmosphere. The wetland garden draws in plant material from the rain garden as well as from the floodplain below, which creates a beautiful natural ambiance. The lawn area has benches and picnic tables for visitors, and nearby workers relax on their lunch breaks. The pavilion in the garden offers a view of the Rouge River for those who don't have the time to explore the trail.

A looped boardwalk trail ambles through a sequence of restored floodplain and remnant forest patches for a quick but varied experience of the river. Observation decks and benches are positioned in a way that reveals the diverse characteristics of the ecosystem. One of the benches is settled next to a riffle where visitors can relax and enjoy an auditory experience of the river.

Before

After

Before / After image of floodplain enhancement

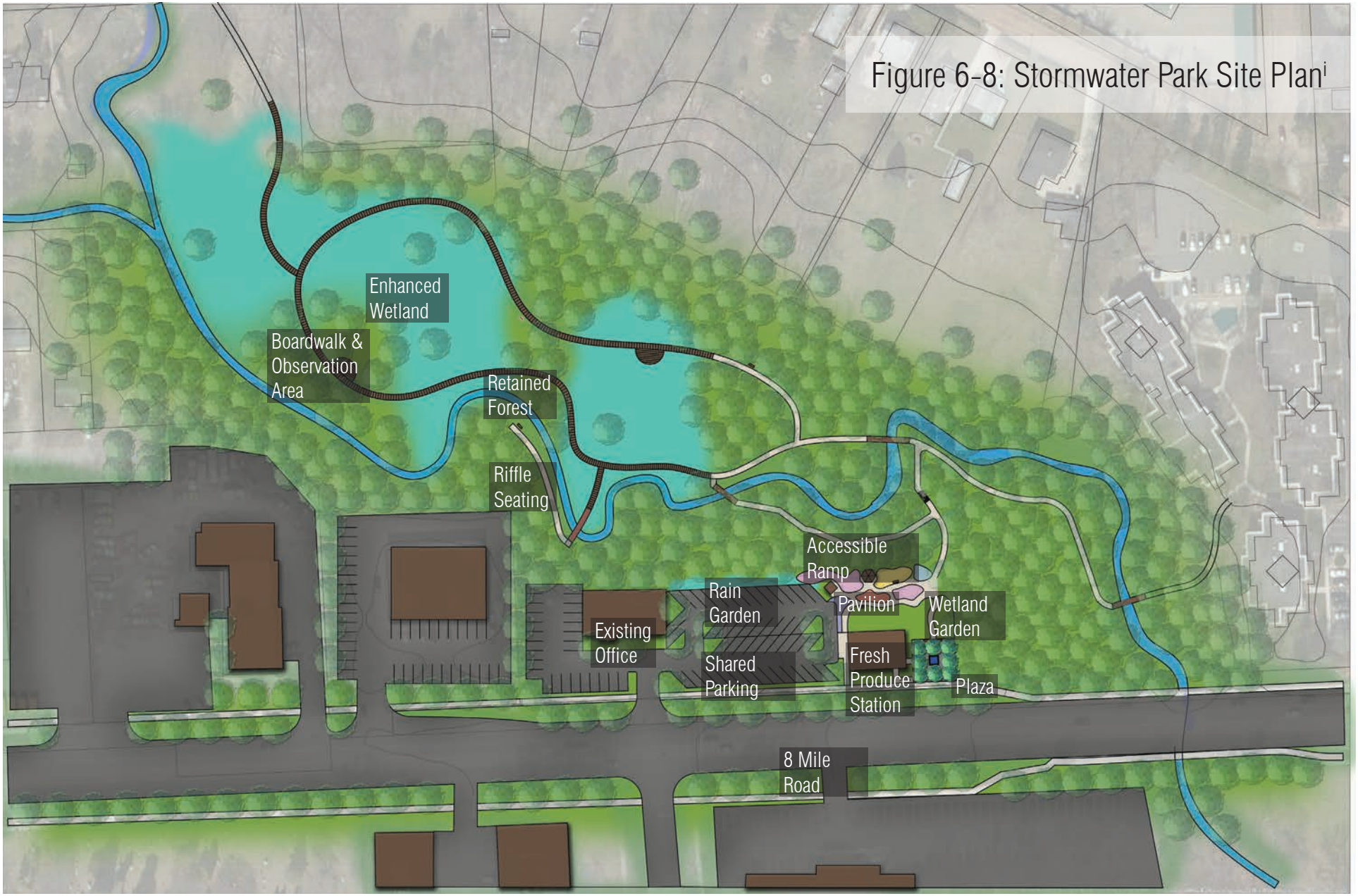


Figure 6-8: Stormwater Park Site Plan[i]

Figure 6-9: Public Gathering Space at the Plaza

The plaza creates a comfortable space for people to gather and socialize.

Figure 6-10: Produce Station and Mill Feature

The fresh produce station has a mill that turns with stormwater runoff from the roof, a tribute to history mixed with sustainable practices.

Image credits:
Images not listed here were taken by members of the master's project team.

i. 5 foot contours, Rouge River location from the Cities of Farmington and Farmington Hills. Building outlines from SEMCOG.
ii. https://thetreehouseguys.com/wp-content/uploads/2015/10/bigoakledge189.jpg
iii. http://xerismartwatersolutions.com/wp-content/uploads/2015/10/swale-picture-300x200.jpg
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7 Appendix

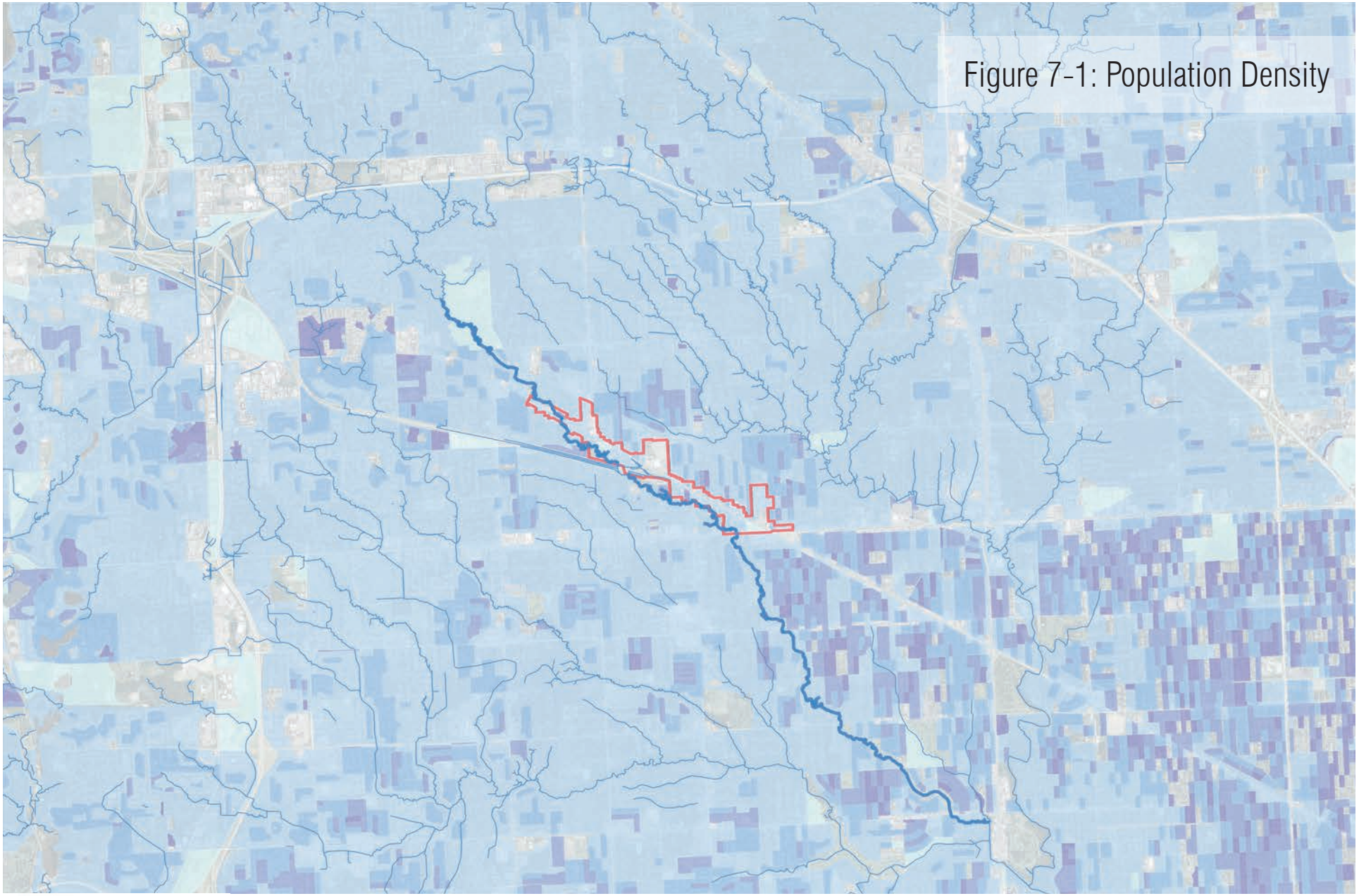
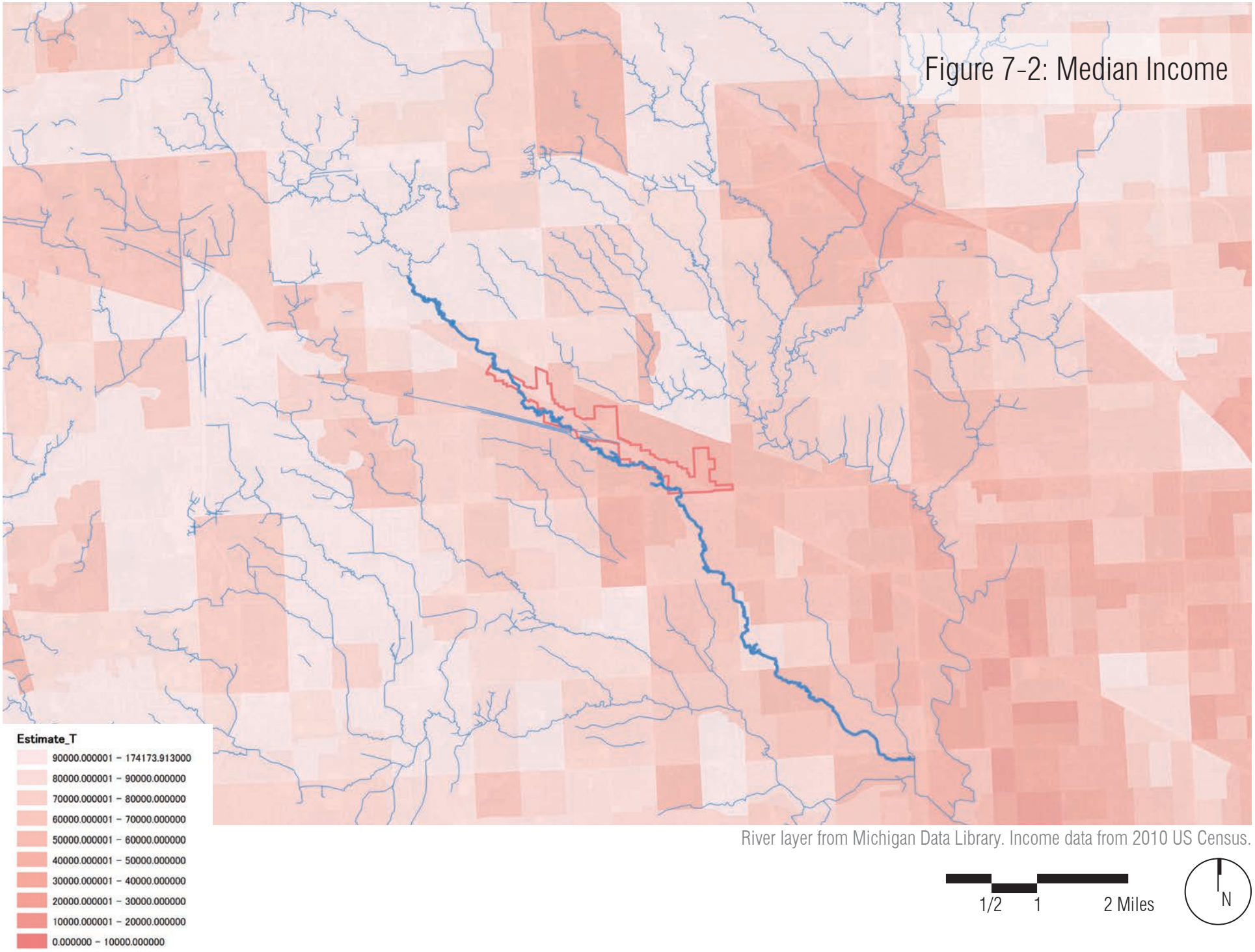


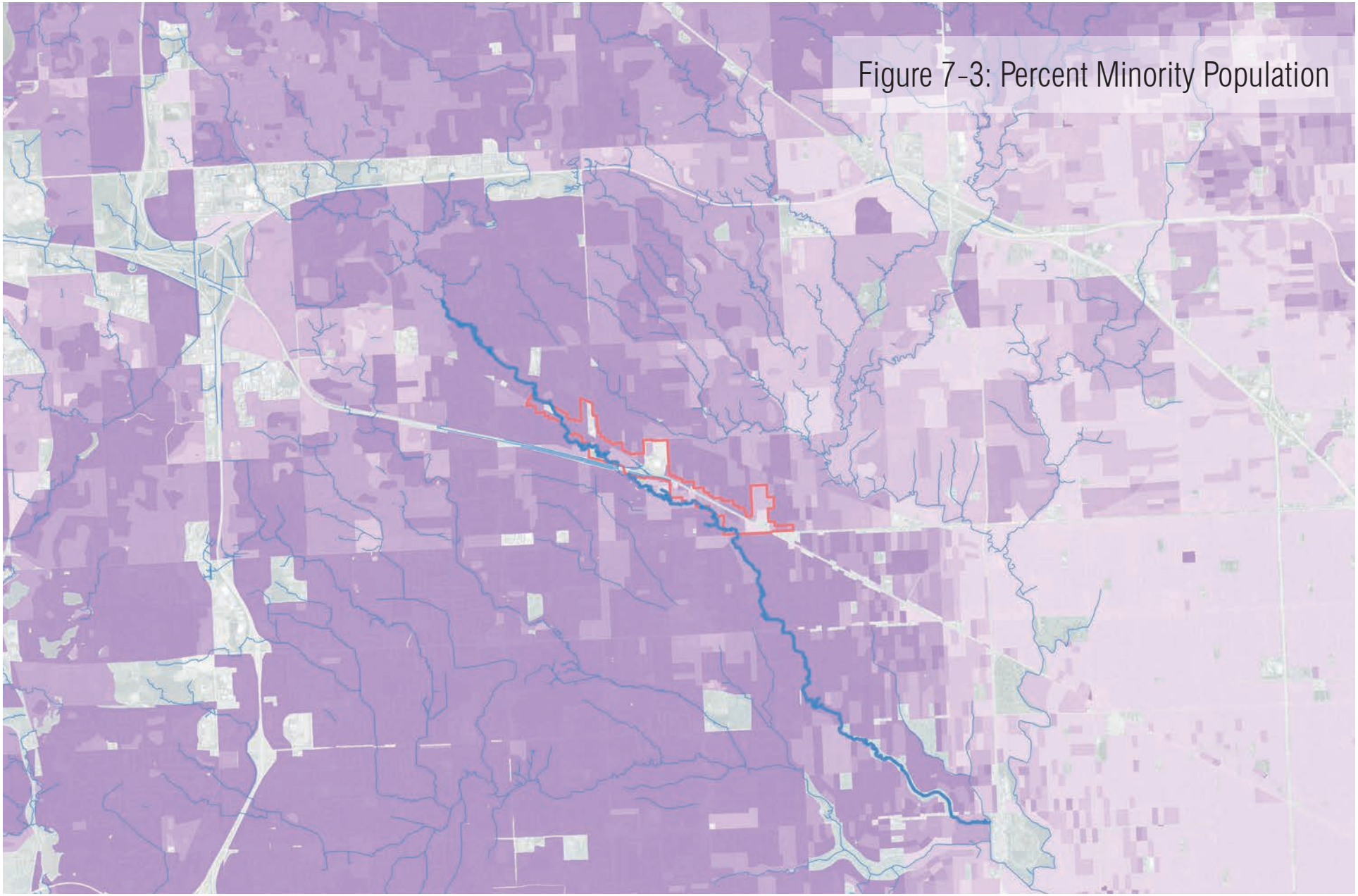
Figure 7-1: Population Density
Pop_Den
0.000000 – 300.000000
300.000001 – 4500.000000
4500.000001 – 6500.000000
6500.000001 – 8500.000000
8500.000001 – 10000.000000
River layer from Michigan Data Library. Population data from 2010 US Census.
1/2
1
2 Miles
N

Figure 7-2: Median Income



River layer from Michigan Data Library. Income data from 2010 US Census.

Figure 7-3: Percent Minority Population



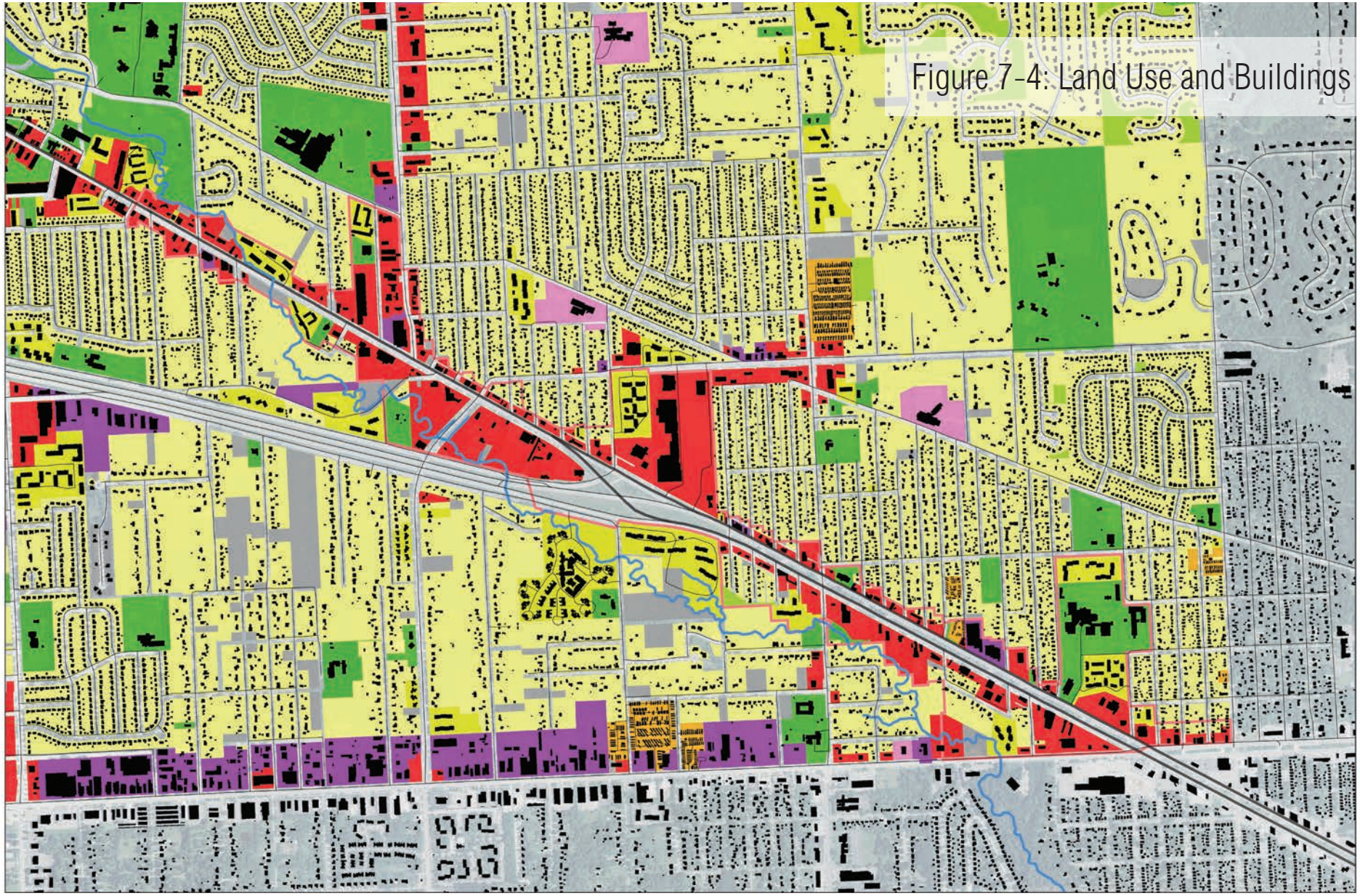
Percent_Wh
- 0.000000 – 20.000000
- 20.000001 – 40.000000
- 40.000001 – 60.000000
- 60.000001 – 80.000000
- 80.000001 – 100.000000

River layer from Michigan Data Library Race information from 2010 US Census.

1/2 1 2 Miles

N

Figure 7-4: Land Use and Buildings



Commercial/Office
Industrial Transportation/Utility/Communication
Multiple Family
Single Family,
Vacant
Public/Institutional Recreation/Conservation

Building layer from SEMCOG. Landuse from Cities of Farmington and Farmington Hills

1/8 1/4 1/2 Miles

N

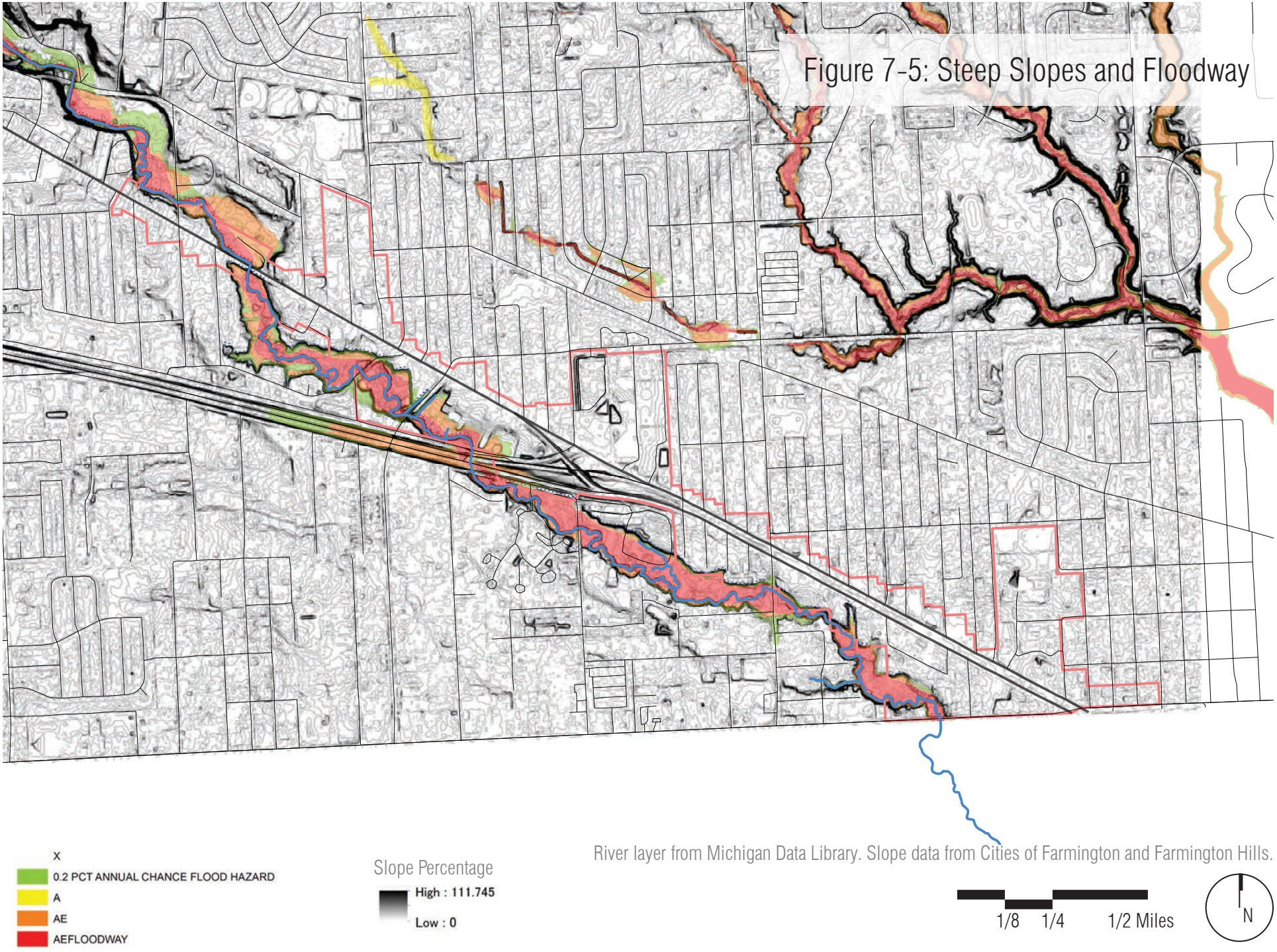


Figure 7-5: Steep Slopes and Floodway

River layer from Michigan Data Library. Slope data from Cities of Farmington and Farmington Hills.

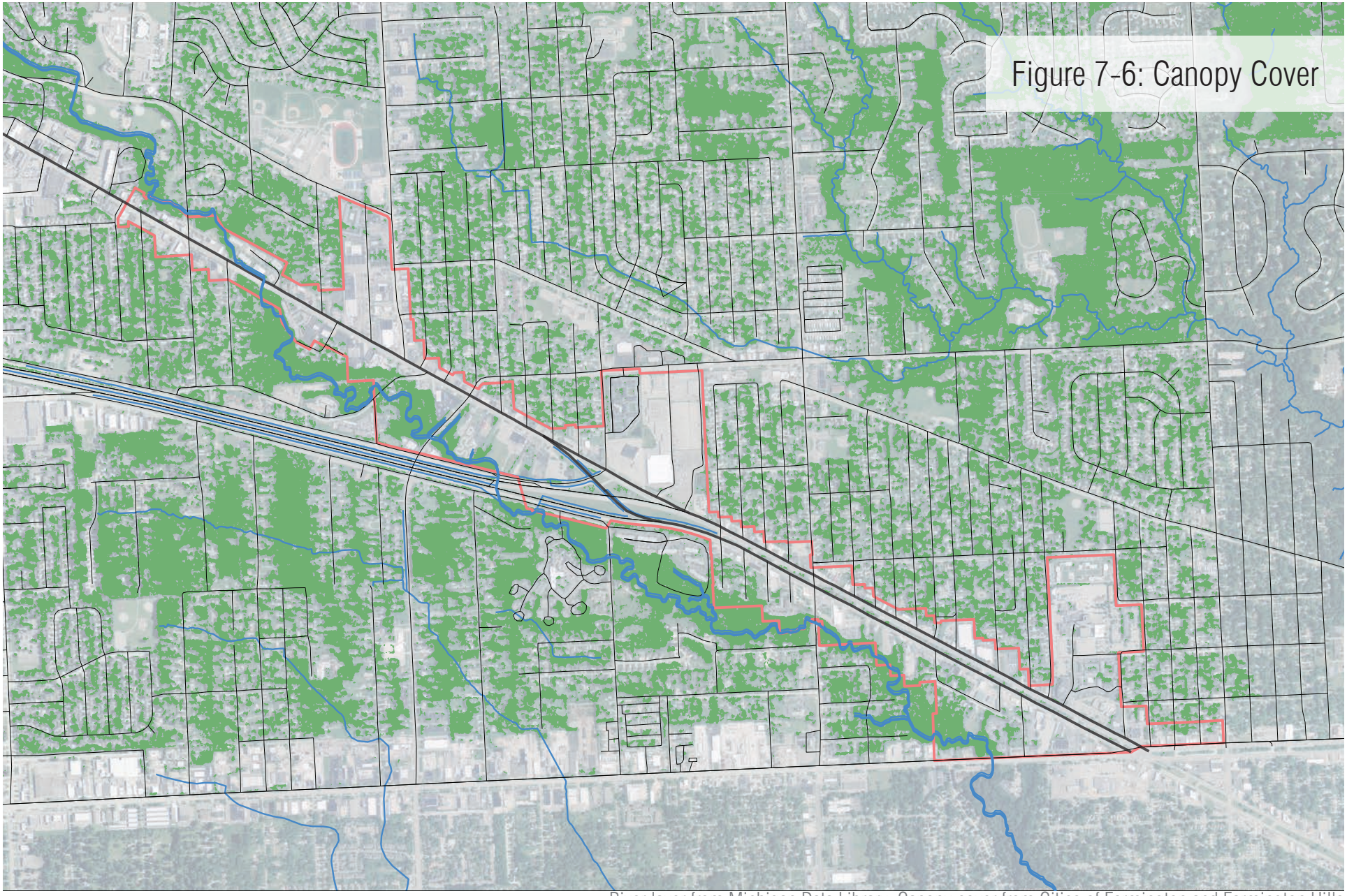


Figure 7-6: Canopy Cover
River layer from Michigan Data Library. Canopy cover from Cities of Farmington and Farmington Hills
1/8 1/4 1/2 Miles
N

Tree Planting

We have included recommendations of trees to plant, should Farmington Hills choose to replace lost ash trees along the river. There is a large amount of online material from arborist companies and state extensions that recommend ash replacement trees that are exotic or even invasive. It is important to research trees before making planting decisions, or ask an arborist about native trees.

Not all trees are suited for street plantings or floodplains: many will die if their roots are under water for too long because they cannot get enough oxygen. The trees listed here are adapted for occasional flooding.

Large Trees
Acer saccharinum (Silver Maple)
Acer rubrum (Red Maple)
Platinus occidentalis (American Sycamore)
Populus deltoides (Eastern Cottonwood)
Quercus bicolor (Swamp White Oak)
Salix nigra (Black Willow)

Small trees/Shrubs
Celtis occidentalis (Northern Hackberry)
Cephalanthus occidentalis (Buttonbush)
Cercis canadensis (Redbud)
Cornus amomum (Silky Dogwood)
Cornus sericea (Red Osier Dogwood)
Sambucus canadensis (Common Elder)
Staphylea trifolia (American Bladdernut)
Viburnum lentago (Nannyberry)

Vegetation survey methods

To determine plant cover along the length of the river, samples were taken using a transects method. Transects were established from the start of the river bank radiating outward a 90 degree angle to the forest edge. Transects were set 25 meters apart, and length was varied based on size of forest cover and distance from the river to the road. Each time a plant intersected the transect, the species was recorded as well as its spatial location along the transect. This provided an estimate of ground cover and the relative amount of understory space occupied by each plant.

GIS

Along each transect, the total ground cover was summed and the percent of invasive species relative to total vegetation cover was calculated. Invasives were grouped into two categories: Garlic Mustard, and invasive shrubs, which included Honeysuckle, Buckthorn, and Privet.

Full plant list (observed species):

Tree
Acer negundo (Box Elder)
Acer nigrum (Black Maple)
Acer rubrum (Red Maple)
Acer saccharinum (Silver Maple)
Acer saccharum (Sugar Maple)
Fagus grandifolia (American Beech)
Juglans nigra (Black Walnut)
Morus alba (White Mulberry)
Plantanus occidentalis (Sycamore)
Populus deltoides (Eastern Cottonwood)
Prunus serotina (Black Cherry)
Salix nigra (Black Willow)
Tilia americana (Basswood)

Other
Alliaria petiolata (Garlic Mustard)
Arctium minus (Common Burdock)
Arisaema triphyllum (Jack in the Pulpit)
Asarum canadense (Wild Ginger)
Berberis thunbergii (Japanese Barberry)
Carex grisea (Wood Gray Sedge)
Carex radiata (Eastern Star Sedge)
Celastrus orbiculatus (Oriental Bittersweet)
Cercis canadensis (Redbud)
Circaea lutetiana canadensis (Enchanter's Nightshade)
Collinsonia canadensis (Canada Horsebalm)
Convallaria (Lily of the Valley)
Dactylis glomerata (Orchard Grass)
Erythronium albidum (White Trout Lily)
Fagus grandifolia (American Beech)
Fraxinus americana (White Ash)
Fraxinus nigra (Black Ash)
Geum canadense (White Avens)
Glyceria striata (Mannagrass)
Hedera helix (English Ivy)
Hesperis matronalis (Dame's Rocket)
Impatiens capensis (Jewelweed)
Laportea canadensis (Wood Nettle)
Lingustrum vulgare (Privet)
Lonicera maackii (Amur Honeysuckle)
Lonicera tatarica (Tatarian Honeysuckle)
Lysimachia nummularia (Moneywort)
Menispermum canadense (Common Moonseed)
Myosotis scorpioides (True Forget-me-not)
Oxalis acetosella (Wood Sorrel)
Parthenocissus quinquefolia (Virginia Creeper)
Persicaria virginiana (Jumpseed)
Podophyllum peltatum (Mayapple)
Rhamnus cathartica (Common Buckthorn)
Rhus glabra (Smooth Sumac)
Ribes americanum (American Ribes)
Ribes cynosbati (Prickly Gooseberry)
Rosa multiflora (Multifloral Rose)
Rubus occidentalis (Black Raspberry)
Solanum dulcamara (Bittersweet Nightshade)
Solidago canadensis (Canada Goldenrod)
Thalictrum dioicum (Meadow Rue)
Toxicodendron radicans (Poison Ivy)
Ulmus americana (American Elm)
Urtica dioica (Stinging Nettle)
Vinca minor (Common Periwinkle)
Vitis riparia (Riverbank Grape)

Detailed resource on rain gardens:
https://www.oakgov.com/water/Documents/environmental_unit/rain_gardens_for_rouge.pdf

Figure 7-7: Online Survey Questions and Results

Survey Results

Survey Method: online and mail survey
Number of Total Respondents: 214
Collection of Responses: 12/5/2015-1/1/2016

Question 1: Did you know that the Rouge River runs through town?

Yes: 86%
No: 13%

Question 2: What is your level of interest in the trail?

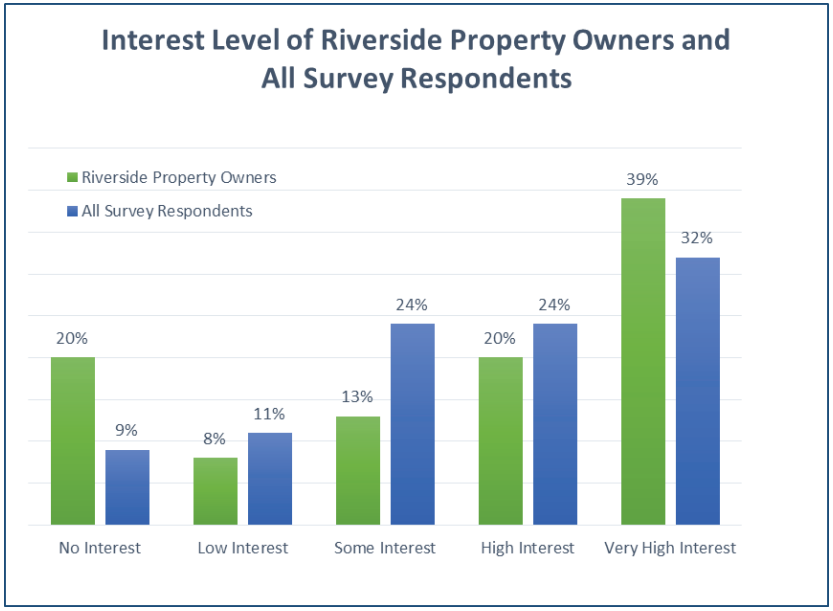
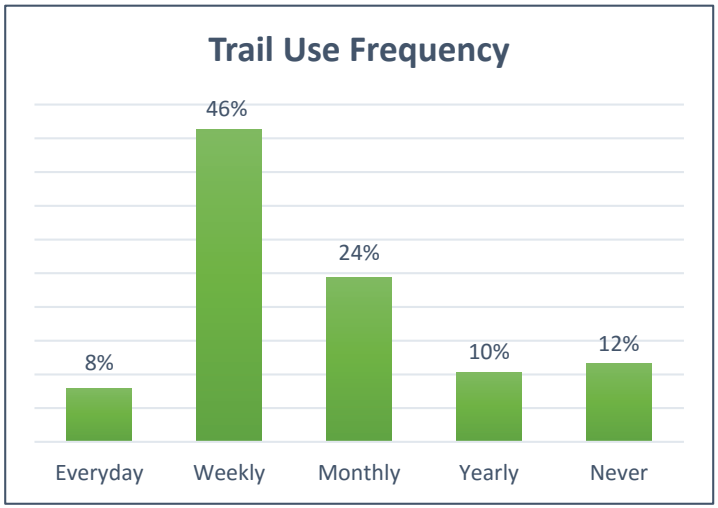
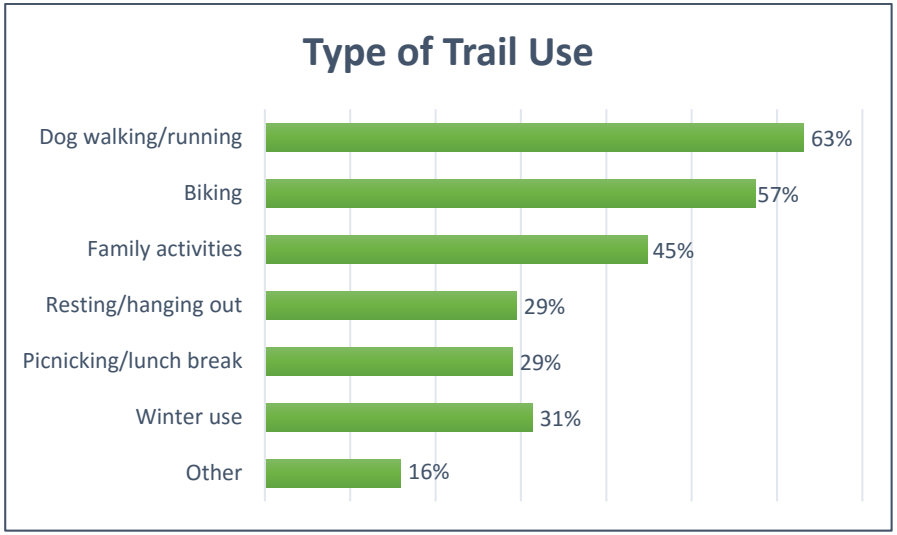


Figure 7-7: Online Survey Questions and Results

Question 3: How often would you use the trail?



Question 4: How would you use the trail?



Question 5: What places along the river do you visit most frequently?

Most Frequented			Second			Third		
N1	76	44.70%	N1	24	14.80%	N1	24	15.70%
N2	18	10.60%	N2	58	35.80%	N2	14	9.20%
N3	14	8.20%	N3	15	9.30%	N3	51	33.30%
N4	2	1.20%	N4	6	3.70%	N4	11	7.20%
N5	17	10%	N5	21	13%	N5	21	13.70%
N6	6	3.50%	N6	2	1.20%	N6	6	3.90%
N7	2	1.20%	N7	8	4.90%	N7	3	2%
N8	7	4.10%	N8	1	0.60%	N8	4	2.60%
S1	9	5.30%	S1	13	8%	S1	1	0.70%
S2	11	6.50%	S2	5	3.10%	S2	7	4.60%
S3	1	0.60%	S3	2	1.20%	S3	5	3.30%
S4	0	0%	S4	2	1.20%	S4	0	0%
S5	2	1.20%	S5	0	0%	S5	0	0%
S6	1	0.60%	S6	0	0%	S6	1	0.70%
S7	2	1.20%	S7	2	1.20%	S7	1	0.70%
S8	0	0%	S8	0	0%	S8	0	0%
n/a	2	1.20%	n/a	3	1.90%	n/a	4	2.60%

Figure 7-7: Online Survey Questions and Results

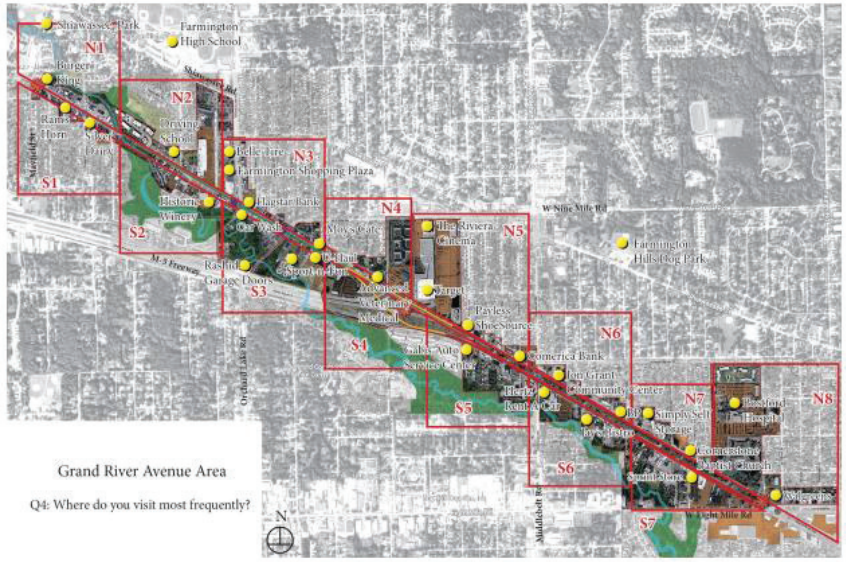
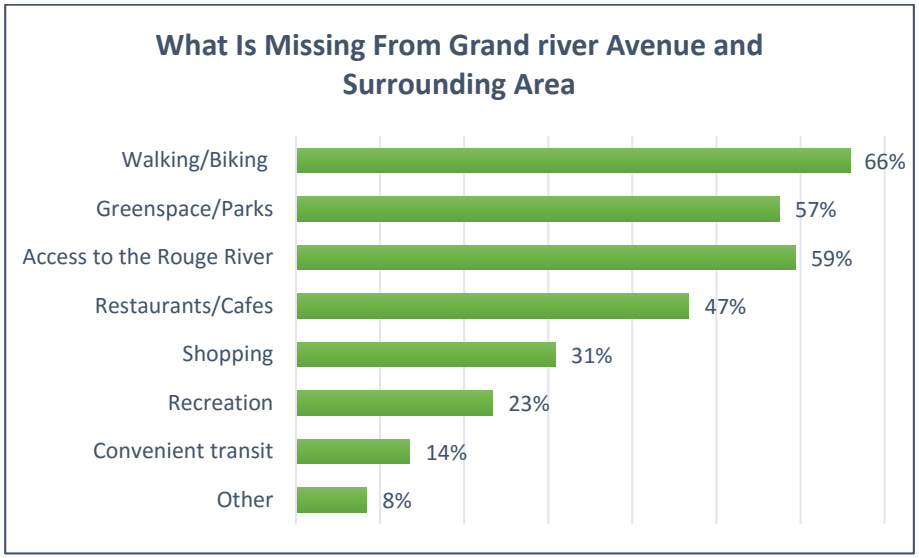


Figure 7-7: Online Survey Questions and Results

Question 6: What do you think is missing from Grand River Avenue and the surrounding area?



Question 7: What prevents you from using the river corridor?

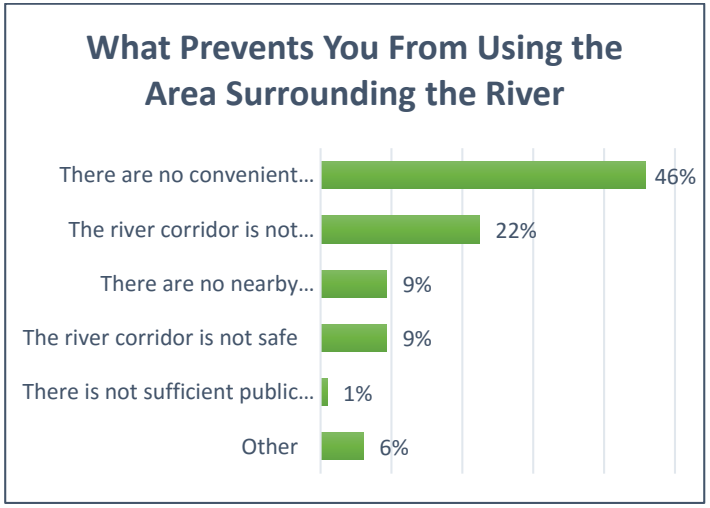
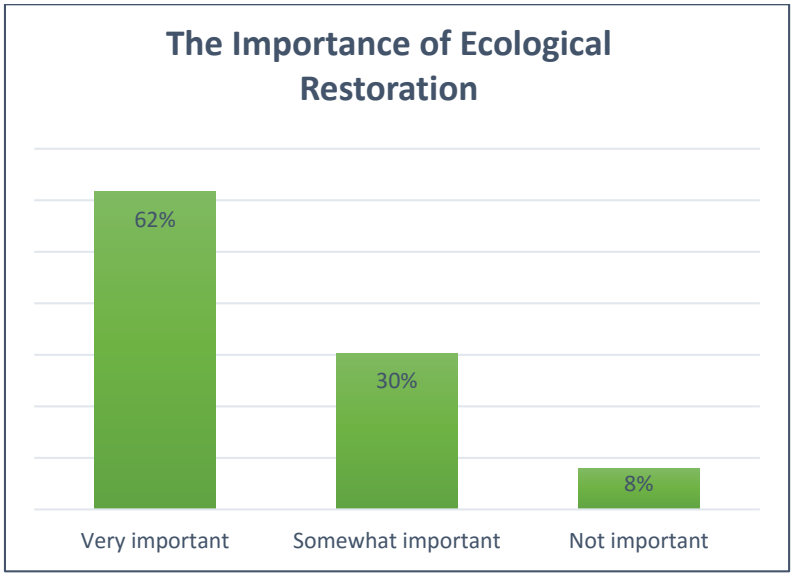


Figure 7-7: Online Survey Questions and Results

Question 8: How would you rate the importance of ecological restoration to support a healthier Rouge River ecosystem?



Question 9: What are your greatest concerns about the Rouge River Trail?

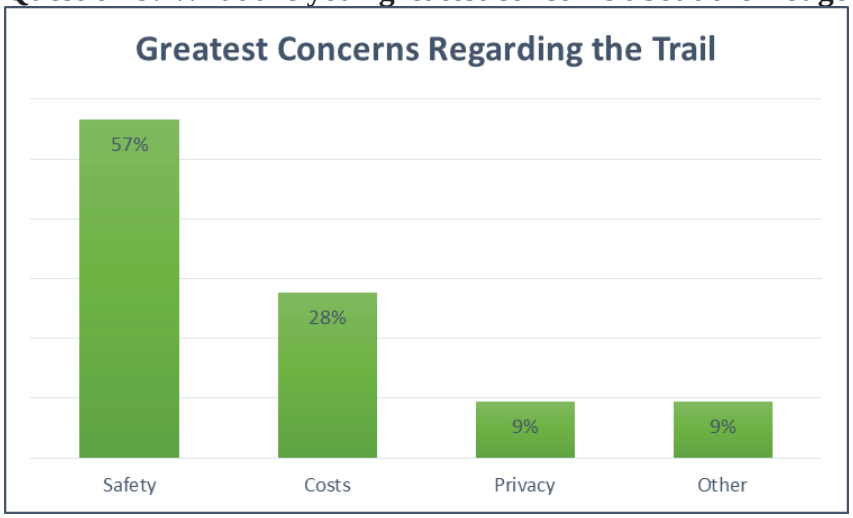
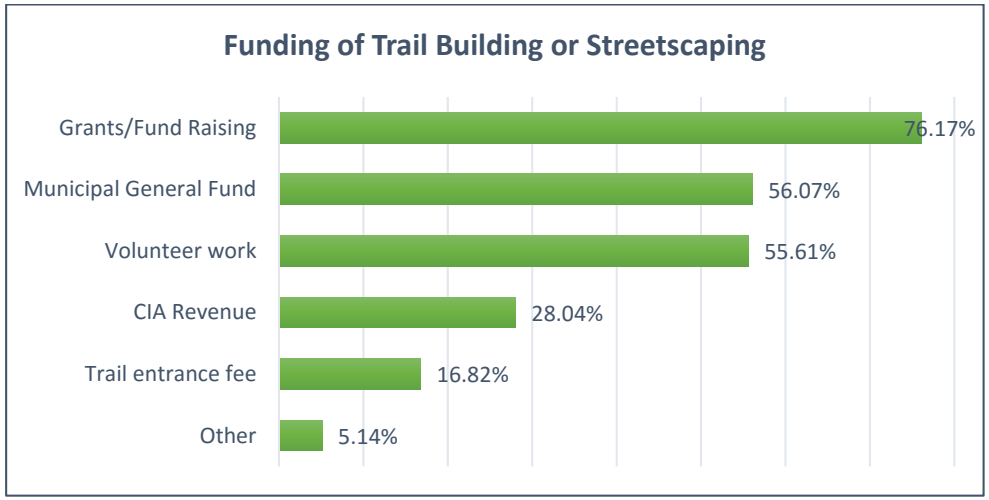


Figure 7-7: Online Survey Questions and Results

Question 9 Comments:

- That it wouldn't be completed in my lifetime
- Being mindful of nature's needs first
- Taking away from current trail
- Noise and traffic safety
- No concerns at all
- Accessibility
- Safe access
- Will it be maintained?
- Leave it alone if that is best for environment I can walk other places
- Poor design, traffic noise, maintenance of trail
- Impact on natural systems/wildlife
- People falling behind on the upkeep of the trail
- Designed with a connective overall plan
- It will attract too many people and cause traffic problems. Also it will become a hangout for people who only want to cause problems. You'll have young people having sex in the park and doing drug deals, just like at the other park areas
- This is my land! You have no right to use it.

Question 10: How should projects like trail building or streetscaping within the focus area be funded?



Question 11: Within the redevelopment area, what places along Grand River Avenue represent the greatest opportunity for river access, development or recreation? (*e.g. Winery for access*)

Ideas for river access points:

- Middlebelt Road-small bridge that goes over the road (especially utilizing the vacant lot where McDonald's used to be)
- 8 Mile Road and at Grand River and Middlebelt
- Orchard Lake Road (mentioned several times)
- The Old Maxfield Training Center area
- N3 to N8 (no effects to neighborhood privacy)
- N6 and N7, N4 and N5, N2 and N3, N1 and N4
- Connecting downtown Farmington to Heritage Park via the old Farmington Road hill
- The section between Grand River and 9 Mile/Ruth St
- Between Orchard Lake and Power Road
- The property for sale next to the drycleaners on the riverside
- Behind Sports and Fun and behind Danboise
- The property near the water retention plant on 9 Mile
- Near the bridge over Grand River
- Freedom Road
- The M5 intersection with Grand River
- N5 Target and Gabis Auto for access
- Along the southern side of M5 and the existing Botsford Trail.

A Comment on Development: "The existing park near Power Rd is already an established site for river access, complete with parking and fairly good (if poorly marked) access to the largely commercial Grand River buildings. There also is a fair amount of free space available both along the river there, and behind the existing businesses along the slope, to provide excellent views. Many of these buildings themselves are ripe for redevelopment, and no small number are available or nearly so. I would enjoy seeing a natural amphitheater there, or even a building/business with a focus on arts containing such a purpose and a great inspirational view. It seems

to me this could easily draw from existing neighborhoods and provide traffic to existing businesses, with fairly minimal adverse impact (for example, maybe worse traffic on event days, but this is already true for days when the sports uses are busy). The park in general there seems quite under-utilized. As an example, I was quite surprised at the city's interest to put an ice skating area in the already-crowded Riley Park area."

Question 12: Highlights of Comments

Highlights of positive remarks:

"This is much needed. It would support many small businesses and also increase opportunities for physical fitness in our great cities!"

"I think Farmington Hills could greatly benefit from becoming more bike friendly.. A trail along the river would add to that."

"A community that is able to intermingle in a setting like a trail along the river will grow in a positive way. More people involved in cleaning up the Rouge and becoming knowledgeable about our planet are all good."

"So glad to live here and have all the benefits already in place."

"It has never had any attention since I was in high school. It is nice to have something to look forward to."

"Access to nature is always a priority.....Farmington being a walkable/bikeable community would be enhanced with more access to nature trails."

"This is A Wonderful Opurtunity!!! Not only for residents but for everyone in surrounding community's as well..."

"Revitalization is what will keep our community relevant and a desirable area."

"Walkability and public transit are the 2 most important factors of revitalization. Give people a safe option and a reason to get outside."

"I drive each morning to work on Grand River (from Botsford Hospital area) to Drake Road - revitalizing it would be wonderful as well as maintaining the revitalized corridor. Thank you :)"

Figure 7-7: Online Survey Questions and Results

“The Rouge River Trail in Canton is my favorite trail and I'd love to see it be modeled after that.”

“This is a great idea. Get it done.”

“Transparent communication and easy to find information about the development.”

“Love that this project has come to the forefront!”

“Great idea. I would be interested in volunteering.”

“Thank you for creating a great trail idea.”

Highlights of concerned remarks:
“I do not believe it will create a revenue stream significant to justify the cost of the clean-up and maintenance forever.”

“You better respect the private property rights of those directly adjacent and just outside the areas of concern. The private property rights of those there should take supreme precedence over any attempt to do something "collective"”

“…It's not a place I go to walk for that reason (unsafe for walkers), even on the sidewalks, and there is no way that I would take a back trail in that area. I would not feel safe. I know that there are other people in Farmington who feel the same way.”

“I don't think this is where our focus should be. The river runs through private property. I don't want to walk in someone's back yard. We have Shiawassee and Heritage. Improve them.
These are great ideas and in dire need.”

“The river runs through our backyard. North of that is Folsom Rd. and then M5. The area north of the river on our property and the neighbors' is flood plain. We would not appreciate a public path traversing our private property backyard.”

“The trail you are proposing uses my property. You have no right to use it and I will sue the city if you try to use it.”

“Area seems old, dilapidated and unappealing.”

Other remarks and suggestions:

"Would be nice to have picnic tables in a couple overlook areas."

"… I think the real "value" in the river is from the condos and northwest up to the park, where there is minimal private property, higher commercial density, and less protected wetland and floodplain to deal with."

"It would be nice if a path along the river could connect to Shiawassee Park, which has a lot of activity but not much trail length for those wanting to exercise."

"Signage would help as a low-cost initial step."

"I'd like to see a paved bike path off the street that is safe to ride. Secure bike racks in downtown Farmington would also be nice."

"Work with the state to remove M-5 near Grand River and turn it into a boulevard. There is no need for cars to drive 75 mph through our community and turning it into a boulevard would slow traffic, reduce noise, and increase property values and opportunities for redevelopment. This should be integrated into a plan for the Grand River Corridor."

"There is enough pavement and development around the river. There should not be anymore. Turning some of the underused parking / abandoned commercial into greenspace would be a better use of funds."

"…To see downtown revitalized would make such a difference to the "feel" off the community. It would certainly raise property values overall, and make people less likely to make quick decisions about leaving the community."

"Walkability is key. Please incorporate walkability into plans for the corridor. As an example, there is no easy/safe way to cross Grand River between the winery and the shopping center across the street."

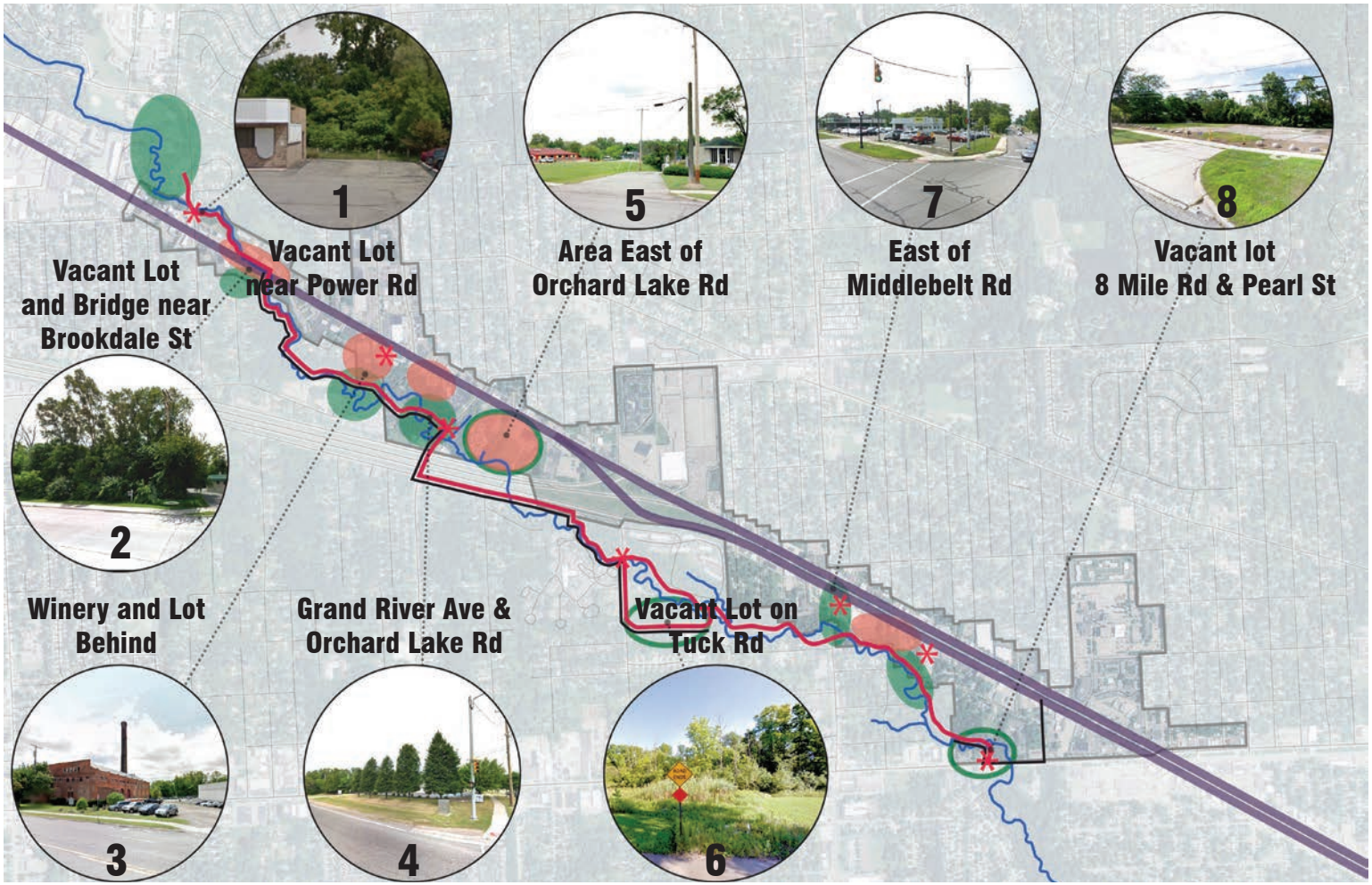
"Once renovated it must be patrolled and maintained!"

Figure 7-8: Open House 1 Printouts

Concept Plan + Priority Locations

We identified 8 sites with priority of potential future development0. But what kinds of activities could make the best use of the site? We would like to invite your participation and listen to your insight to make the best decision together.

For example, there are 6 sites that support family activities, but not all are needed. Which 3 sites do you think have the most potential for family activities?



Amenities

- 3 sites with Family Activities: Playgrounds, educational signages
- 2 sites with Outdoor Event Space: Pavilions, restrooms
- 4 sites with Relaxation Area: Benches, picnic tables
- 3 sites with Economic Development that engages Rouge River and its surroundings: Cafes, restaurants, retail
- Other

Figure 7-8: Open House 1 Printouts

Priority Locations

1 Vacant Lot
Grand River Ave & Power Rd

Potential Amenities:

- Family Activities
- Relaxation Area
- Economic Development
- Other

2 Vacant Lot and Bridge
Grand River Ave & Brookdale St

Potential Amenities:

- Relaxation Area
- Economic Development
- Other

3 Winery and Lot Behind

Potential Amenities:

- Family Activities
- Relaxation Area
- Outdoor Event Space
- Economic Development
- Other

4 Grand River Ave & Orchard Lake Rd

Potential Amenities:

- Family Activities
- Relaxation Area
- Economic Development
- Other`

Figure 7-8: Open House 1 Printouts

Priority Locations

5 Area East of Orchard Lake Rd

Potential Amenities:

- Family Activities
- Relaxation Area
- Outdoor Event Space
- Economic Development
- Other

7 Grand River Ave & East of Middle Belt Rd

Potential Amenities:

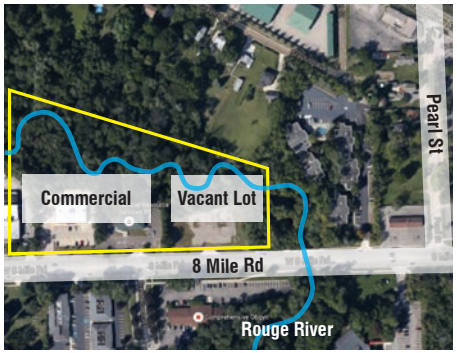
- Family Activities
- Relaxation Area
- Outdoor Event Space
- Economic Development
- Other

6 Vacant Lot on Tuck Rd & Kimberly Dr

Potential Amenities:

- Family Activities
- Relaxation Area
- Other

8 Vacant Lot W8 Mile Rd & Pearl St



Potential Amenities:

- Relaxation Area
- Economic Development
- Outdoor Event Space
- Other

Figure 7-8: Open House 1 Printouts

Family Activities

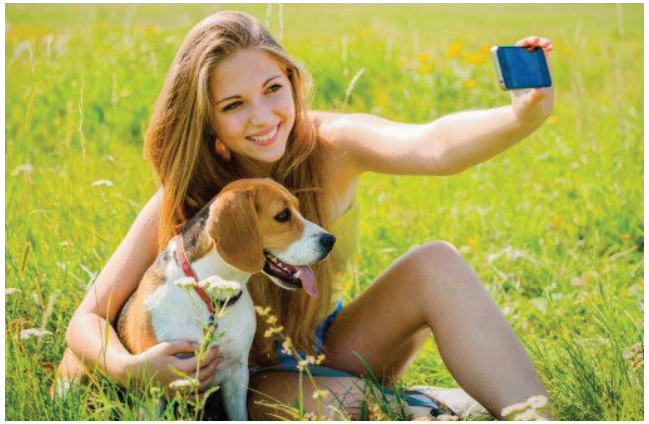


Figure 7-8: Open House 1 Printouts

Family Activities: Choose 3 Best Locations

Notes:

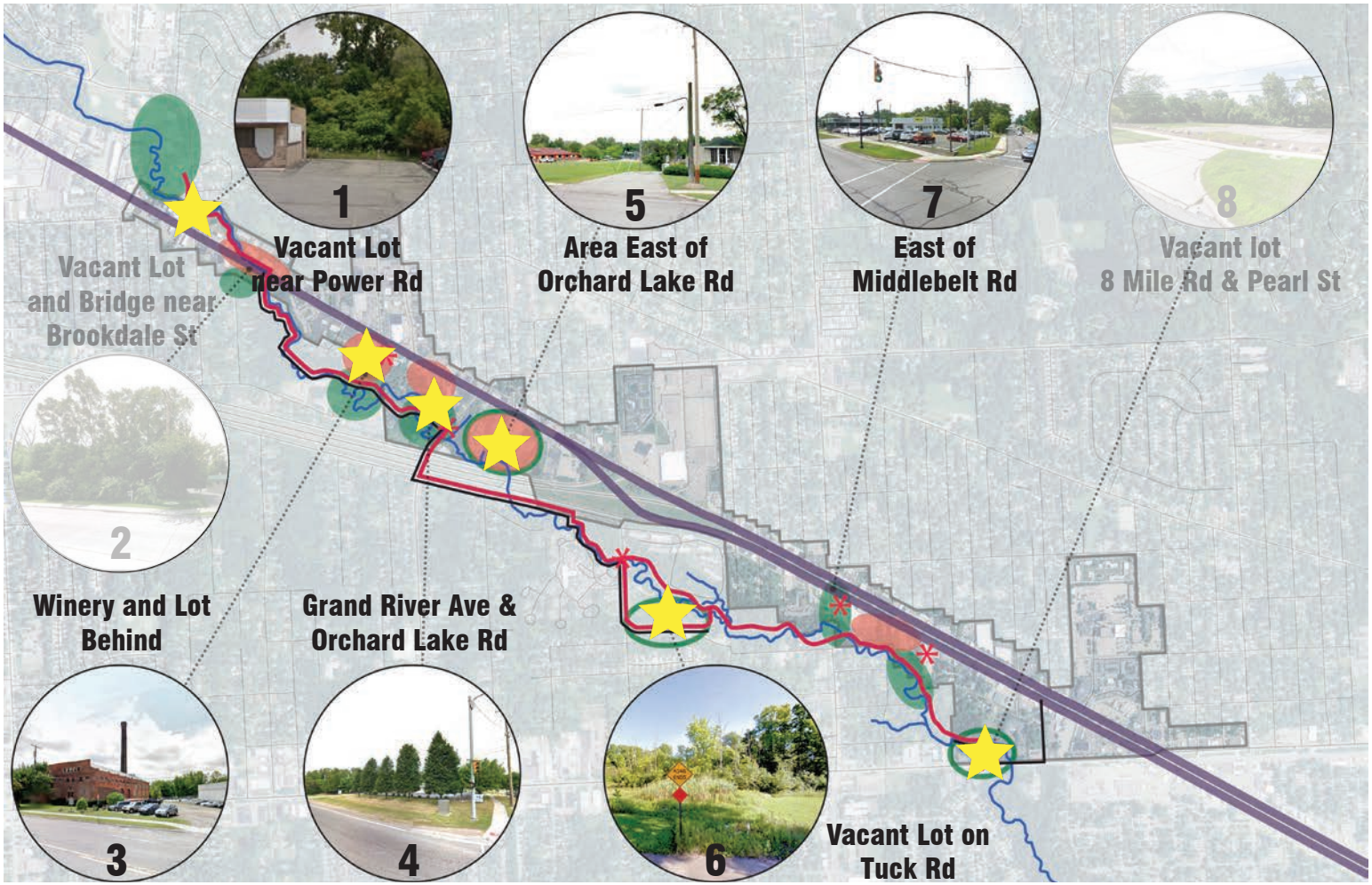


Figure 7-8: Open House 1 Printouts

Outdoor Event Space

Figure 7-8: Open House 1 Printouts

Outdoor Event Space: Choose 2 Best Locations

Notes:

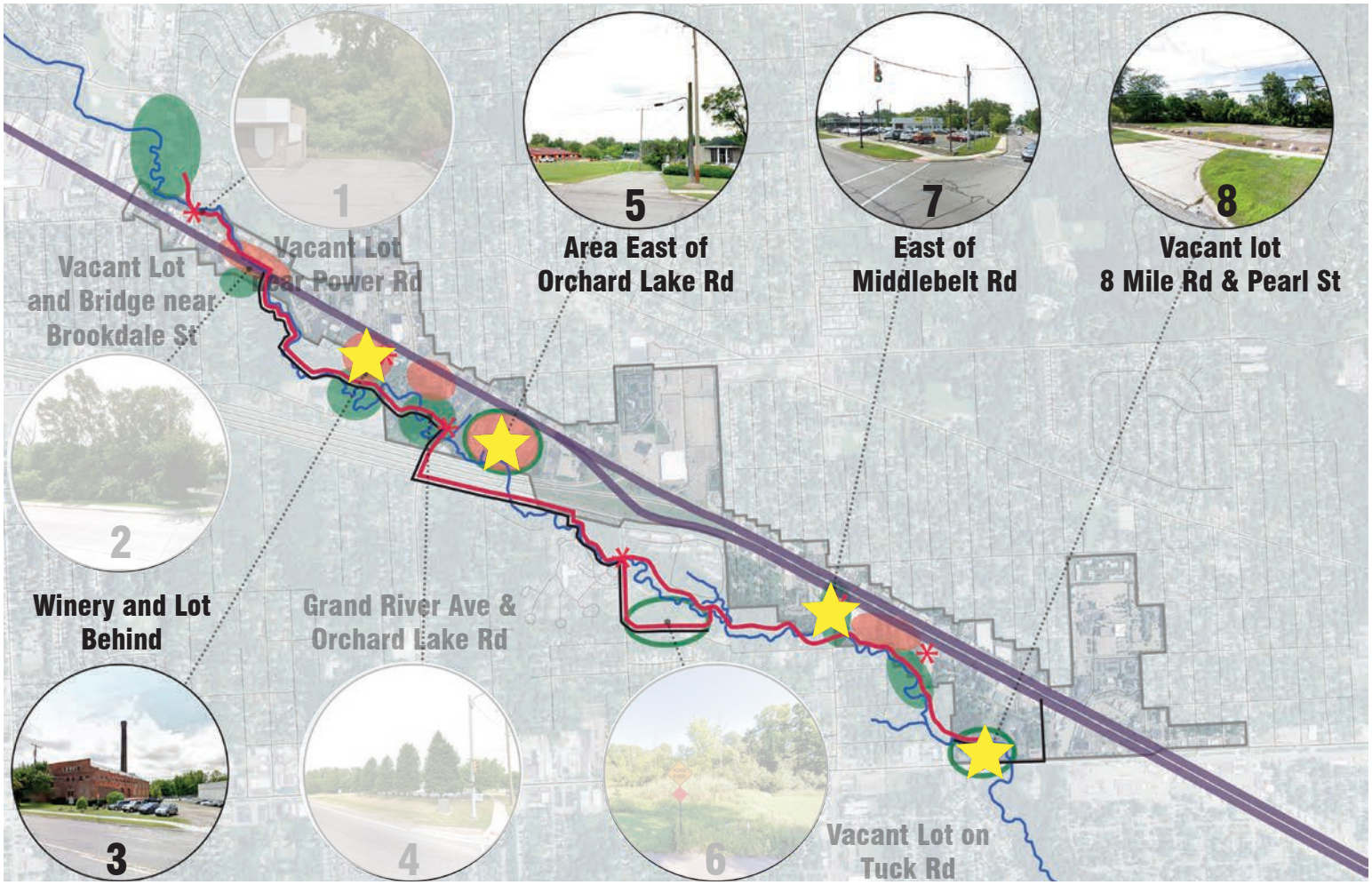


Figure 7-8: Open House 1 Printouts

Relaxation Area

Figure 7-8: Open House 1 Printouts

Relaxation Area: Choose 4 Best Locations

Notes:

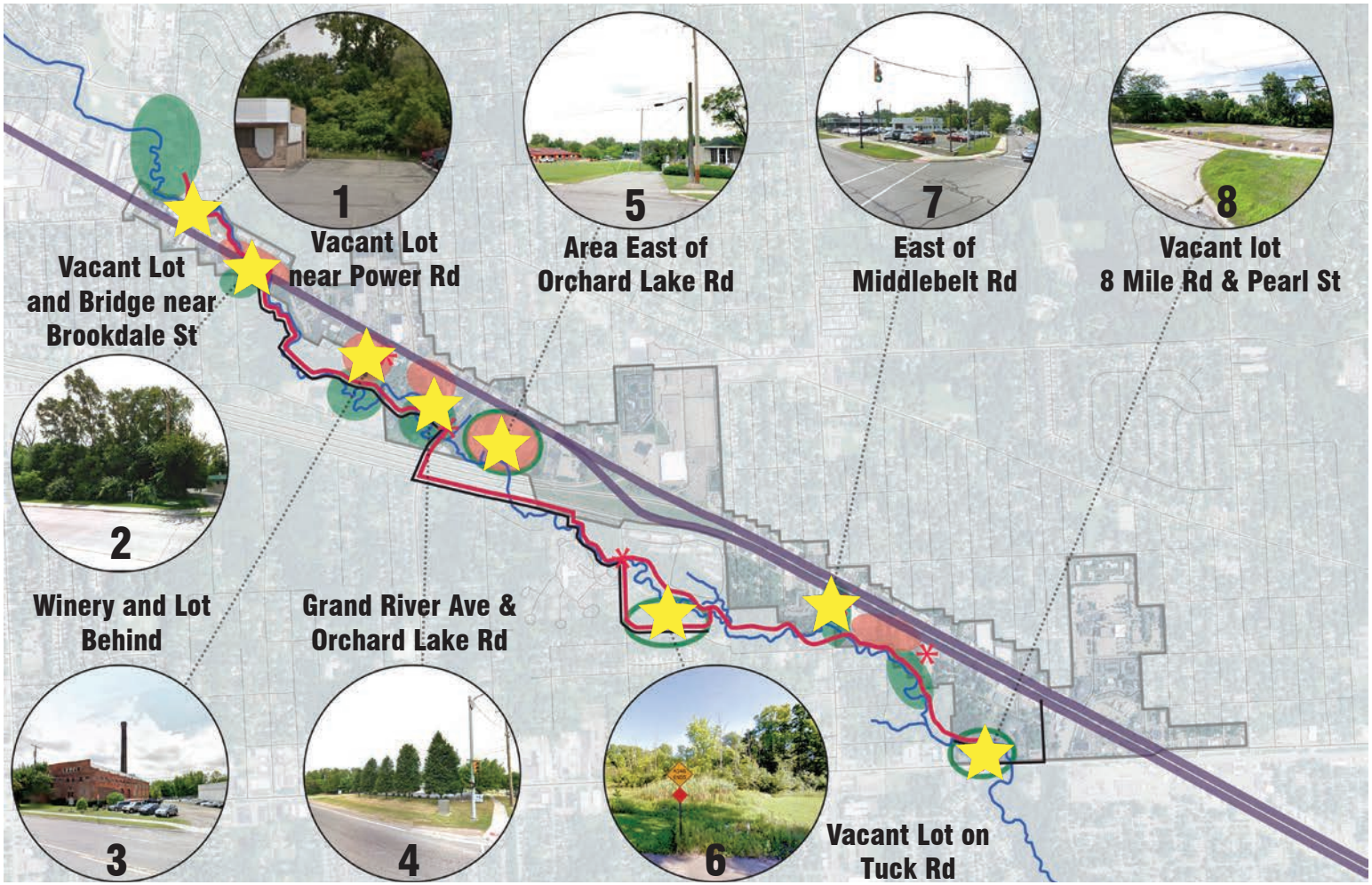


Figure 7-8: Open House 1 Printouts

Economic Development

Figure 7-8: Open House 1 Printouts

Economic Development: Choose 3 Best Locations

Notes:

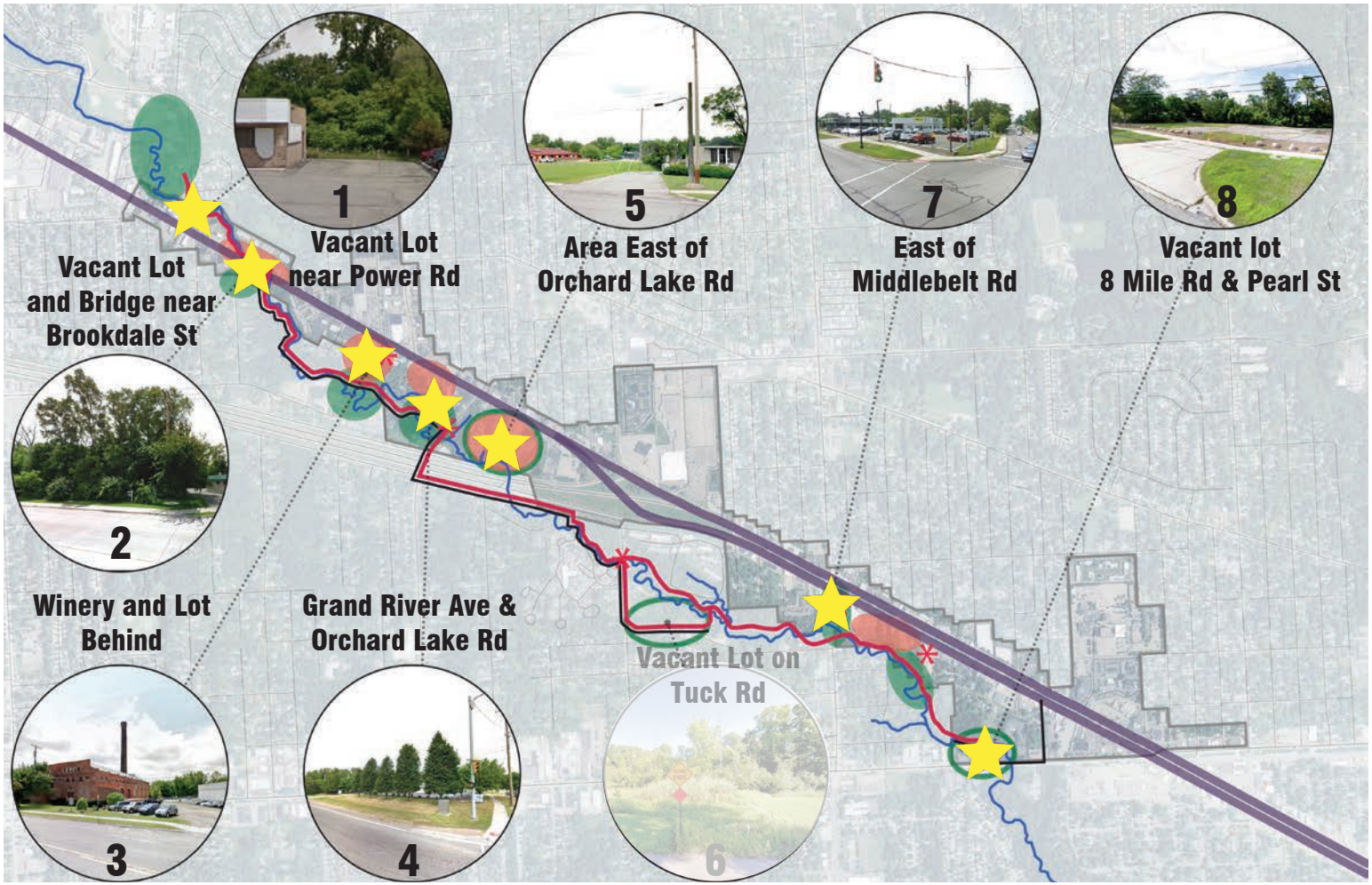


Figure 7-9: Community Open House 1 Feedback

Community Open House

Number of participants: 35
Date: February 4th, 2016
Location: Spicer House, Farmington Hills, MI
Notes from the open house breakout sessions:

Group 1

Family Activities:

- Nature education (educational signage)
- Ability to just explore and play in nature
- Way-finding signage and mile markers for runners/exercisers
- Bird houses-nesting places for birds and bats
- Small bike segment
- Fishing
- Experience the continuity of the river
- Build a stewardship program and support
- Prevent honeysuckle encroachment

Sites

Site 1. Requires clean-up, could serve as an entrance and so should be a gathering space with benches
Site 3. Allow trail to reach water, there is lots of space

Relaxation Area

- Benches
- Infrastructure integrated with nature
- Tire swings
- Hammocks
- Picnic tables
- Bike stands
- Restrooms
- Dog walking

- Educational opportunities-access for the high school?

Sites:
Site 5. Lots of activity already-Sports and Fun-hectic, noisy
Site 2. Too steep for walking or economic activity; better for relaxation

Outdoor Event Space

- Already have two areas
- Vision Plan plans for this already in place
- Pavilion-barbecue might be nice

Economic Development

- Ice cream stand
- Small grocery
- Economic development only worth it if the trail is popular, or on weekends
- Food trucks
- Winery-café

Group 2

Family Activities:

- Pet areas-walking/dog park
- Just access to the forest to explore nature
- Parking access
- Biking
- Picnic/seating (Site 1-Silver Dairy)
- Access to the woods

Relaxation

- Pedestrian access
- Experience various terrains

Event Space

- By Botsford on Grand River Avenue
- Riley, Heritage Park, existing

Group 3

- Education signage (to identify trees and other wildlife)
- Winery for economic development (resting, overlooking the river)
- Picnic areas in the forest, rather than near the roads
- Concern-flooding
- Picnic and resting in the forest
- Brenda's Restaurant and the lot near Middlebelt (probably would be happy to have the trail near Middlebelt)
- Event space? Already existent at Shiawassee Park
- Need quaint little amenities (swings, treehouse, not a large playground)
- Barbeque opportunities
- Safety crossing the road is a big concern
- A walking trail would draw people to the community
- Parking! At loops and trailheads-Park and then loop around Grand River Avenue and/or the forest
- Handicap access
- Floodplain boardwalks -skeptical about the feasibility of boardwalks
- Hospital - Boardwalk to river (small restaurant)-catering to people who work there and patients
- Shuttles (Public transport link to trail - Botsford to downtown Farmington shuttle)
- Zip lines
- Tree house
- There are too many playgrounds already
- For the kids, focus on the river and unique areas
- Dog walkers-dog park desired
- Bike trail-conflict with walking
- Trail vs. path – distinguish between nature trails and paths
- Bikers and walkers are incompatible
- Not large enough for longer rides (maybe for families)
- Skating rink
- Bridge on the other side of river of Tuck Road

Figure 7-9: Community Open House 1 Feedback

- Exercise stations-like in Edward Hines Park
- Creating a nice loop through the natural area and then a retail strip

Sites
Site 2. This site is not the best site- potential for overlooking the river, relaxation area-only if Grand River Avenue becomes more walkable
Site 2. It has very steep slopes – could have a rest bench
Site 5. Tough for economic development

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 3- Concept 1

Preserve the tranquility of the site by creating an upland area focused on development and allowing the area close to the river to become a passive area for nature walks and education. Create two parking lots that allows for ADA access to both the winery and the river. Discover the beauty of the river with a view from above.

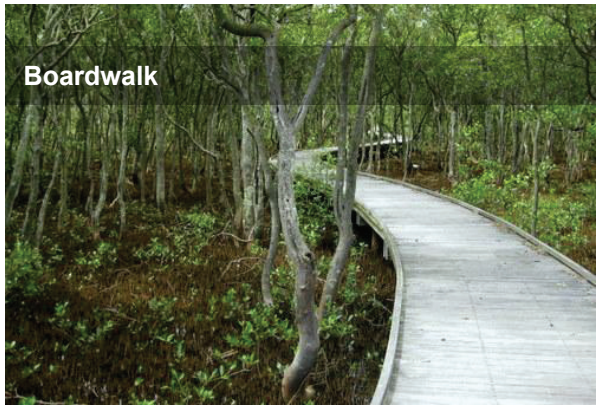


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 3 Concept 1

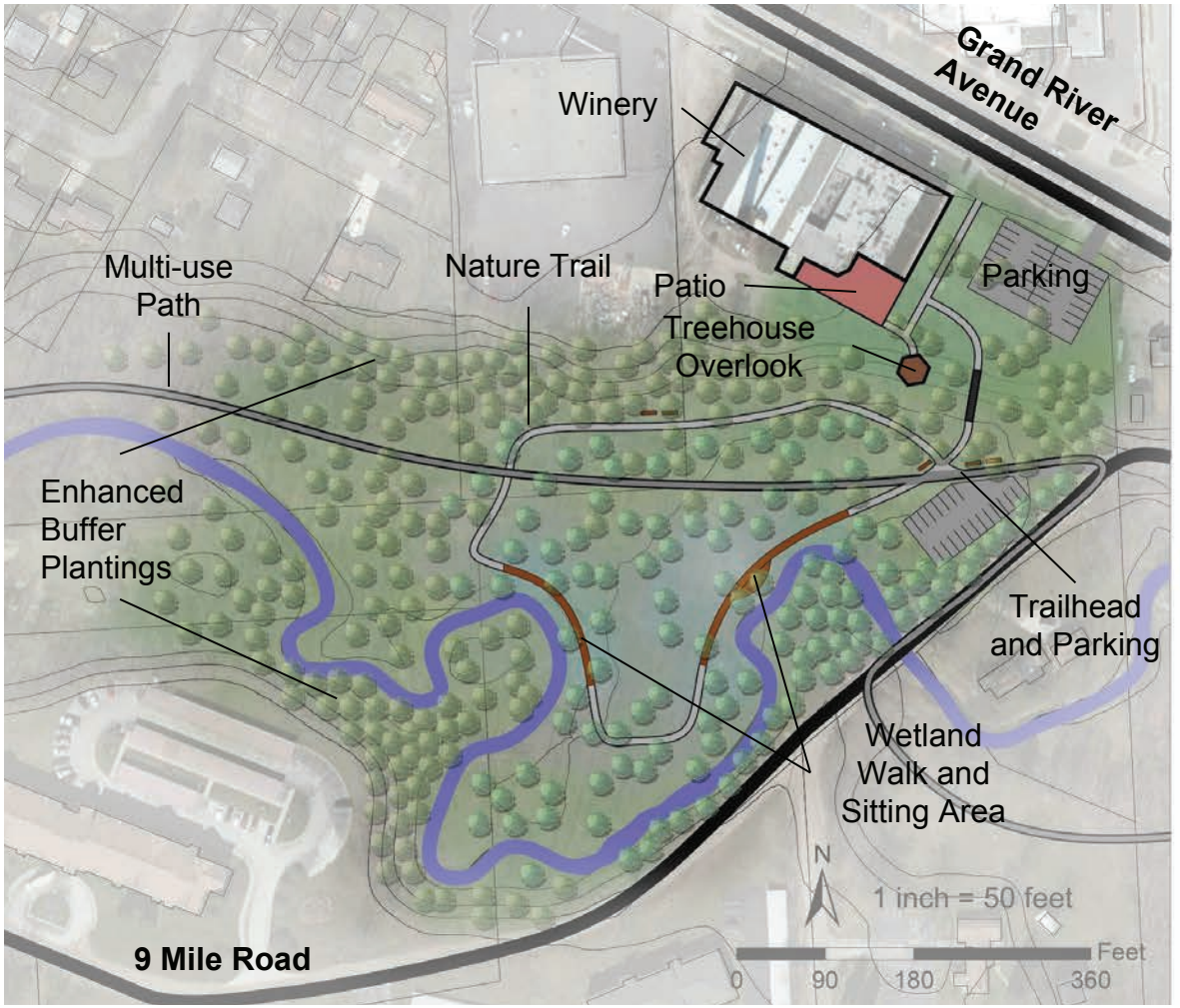


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 3- Concept 2

Create a lively and engaging experience at the winery that integrates the economic development of the site with the river itself. A raingarden cascades down the hillside with the ADA ramp and draws the visitor out into the landscape below. An enhanced wetland feature bridges the gap between the winery and river and becomes a meeting place for those in the area.

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 3 Concept 2

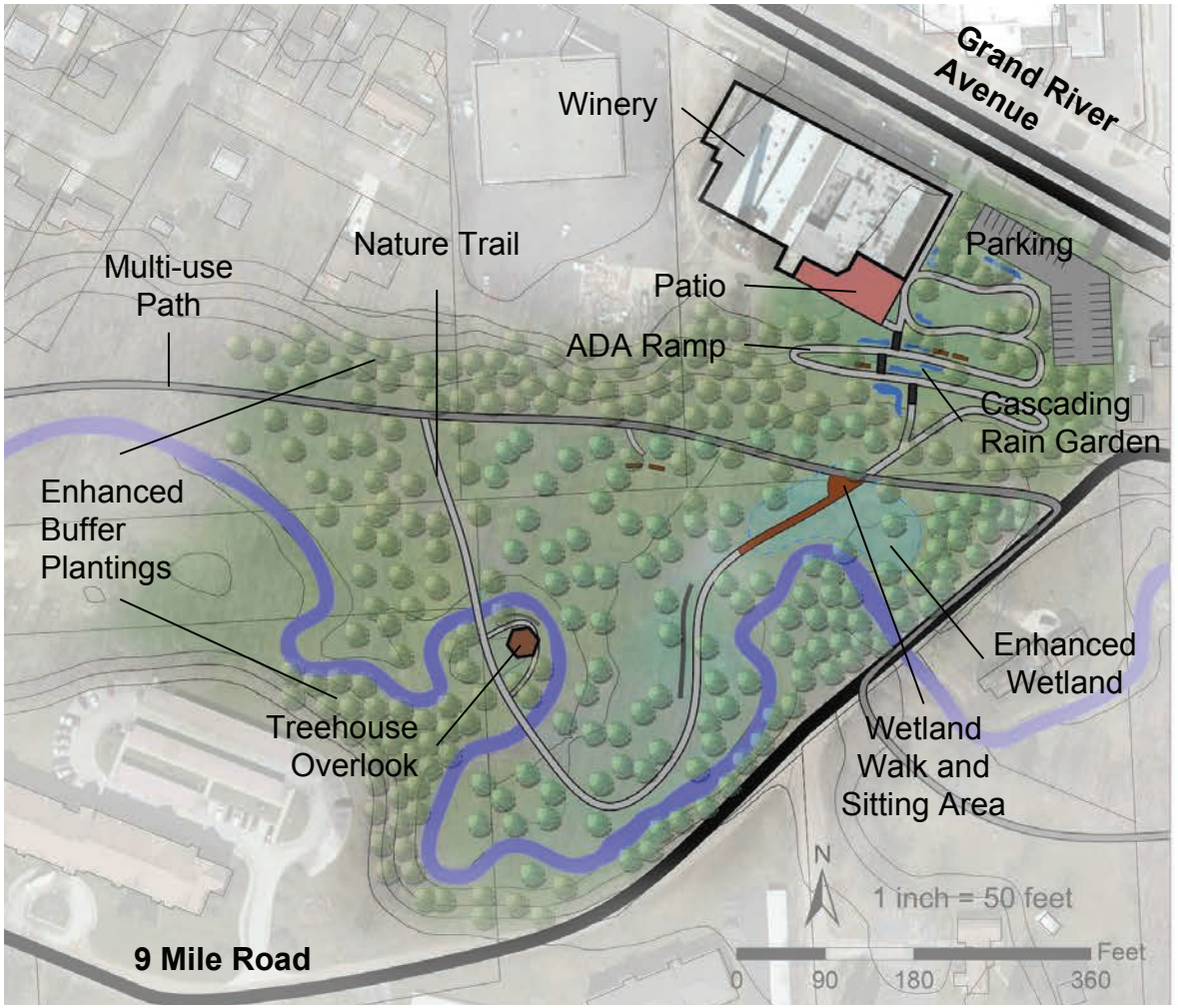


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 6- Concept 1

The design keeps riverfront and forest areas quiet and peaceful by locating the open space, event pavilion, and Multi-Use Trail near the entrance to the site. Therefore, the nature area in the back is preserved for quiet nature enjoyment and education experience only.

Visitors will experience various ecological environments from upland forest, dead ash forest, marshy wetland to riverfront walking through the site.

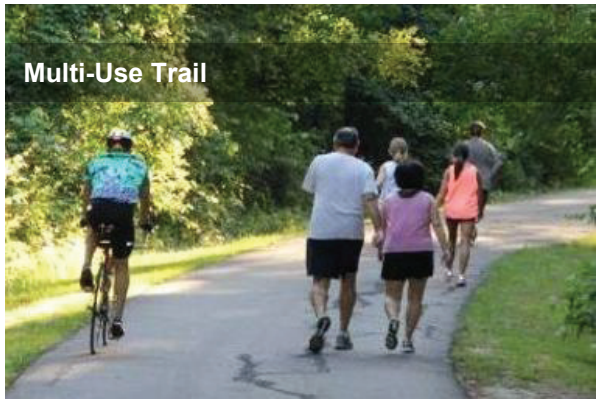


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 6- Concept 1

Quiet Riverfront

Passive Recreation

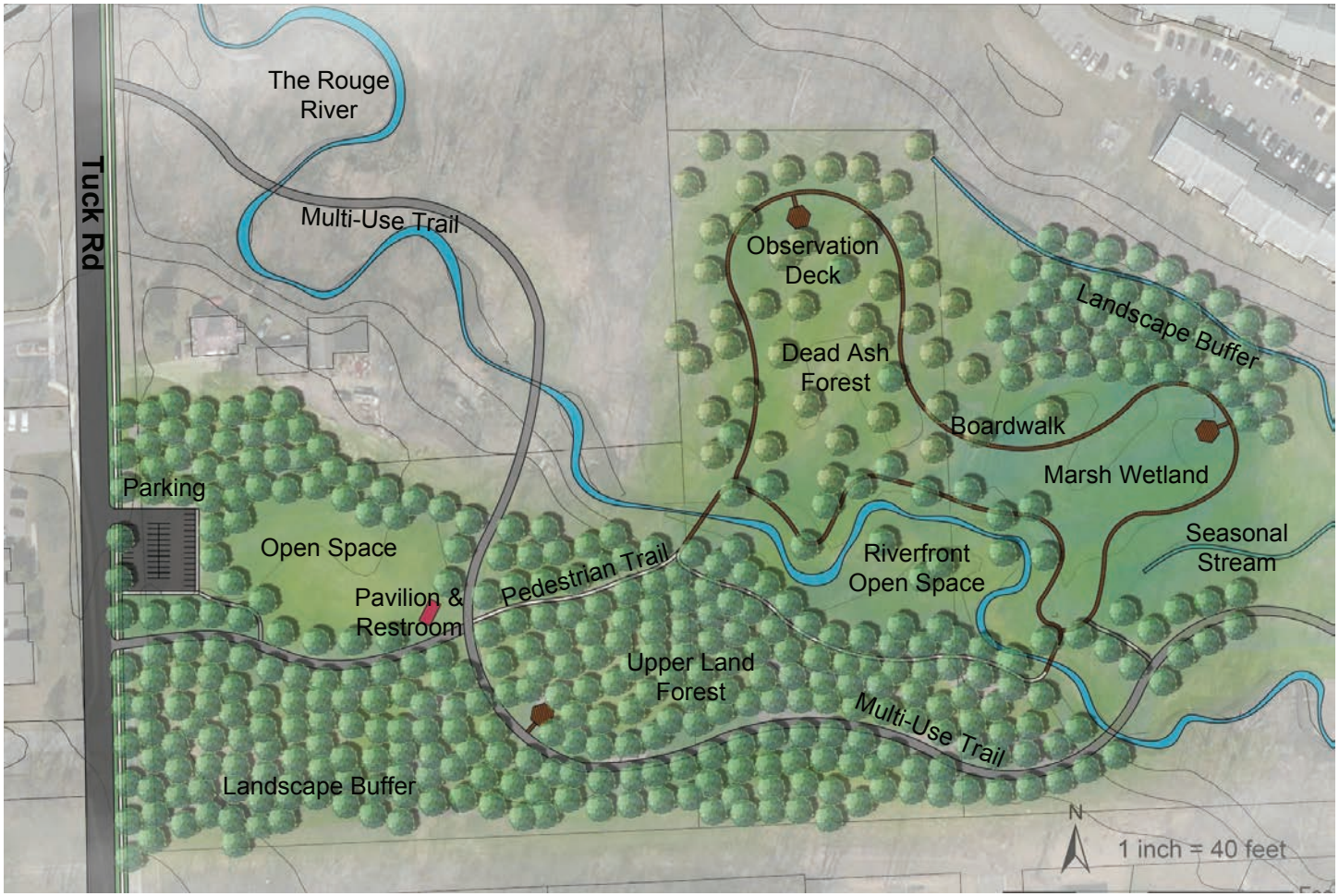


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 6- Concept 2

The design creates a sequence of rooms of open space from the entrance to the river front. Therefore, the nature area in the back is activated with various recreational activities connected by Multi-Use path. The boardwalk path in the wetland and riverfront area is only for walking to reduce human impact.

Visitors can take their dog for a walk while experience various ecological environments from upland forest, dead ash forest, marshy wetland to riverfront walking through the site.

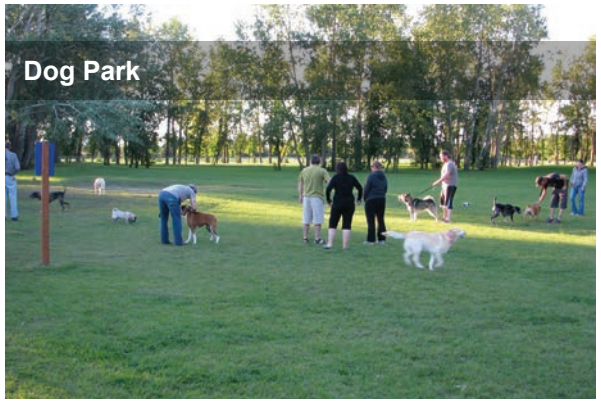


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 6- Concept 2

Active Riverfront

Active Recreation

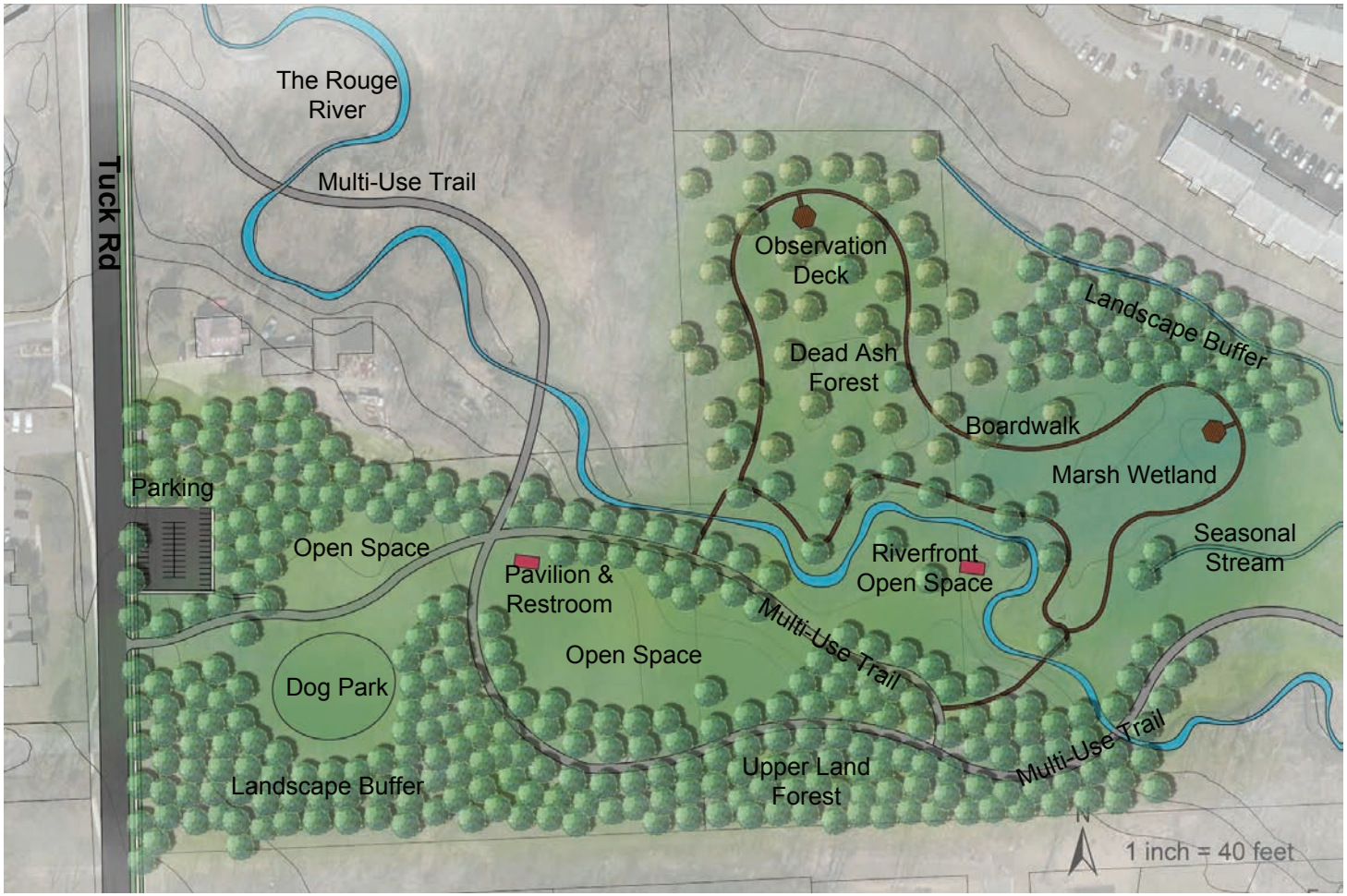


Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 8- Concept 1

The first concept seeks to integrate a more vibrant economy into the river corridor.

An organic produce station is proposed with outdoor seating area and a community garden that extends to the entrance of the trail. The parking lot is connected to the one of the neighboring office to decrease the number of driveways that cuts across the sidewalk. The connected shared parking lot is also used as a tool to take away some of the parking spaces that abut the slope in the back, and create raingardens to collect runoff.

The community garden provides opportunities to actively engage nature as well as a gathering space in form of a pavilion located at its center. A pergola with flowering vines is located at the end of the path through the garden, creating an entrance experience to the trail. The trail goes down into the floodplain by stairs and makes a loop in the open forest, as well as providing a connection for the residents of the apartments to the northwest.

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 8- Concept 1

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 8- Concept 1

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 8 Concept 1

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 8- Concept 2

The second concept is that of a stormwater park.

The Rouge along this stretch meanders significantly indicating a potential bottleneck during high flow events. This concept proposes cutting into the eroded banks and reconnecting the Rouge back to its natural floodplain. The wetland area (which could be made larger) will detain some of the flow relieving stress from down-stream areas. A boardwalk loop will guide visitors through the wetland, with posts made from ash killed by emerald ash borers in the areas located throughout to indicate the heights to which the river floods. Along part of the river, riffles will be created as a way to generate an auditory experience with seating provided to enjoy a relaxing time.

Up by the parking lot, a demonstration rain garden will showcase some of the plants down in the floodplain and to signify the function of this site. There is also an overlook and picnic area with an ADA ramp connecting to the floodplain.

Figure 7-10: Initial Focus Area Concepts Presented to Farmington and Farmington Hills

Site 8 Concept 2

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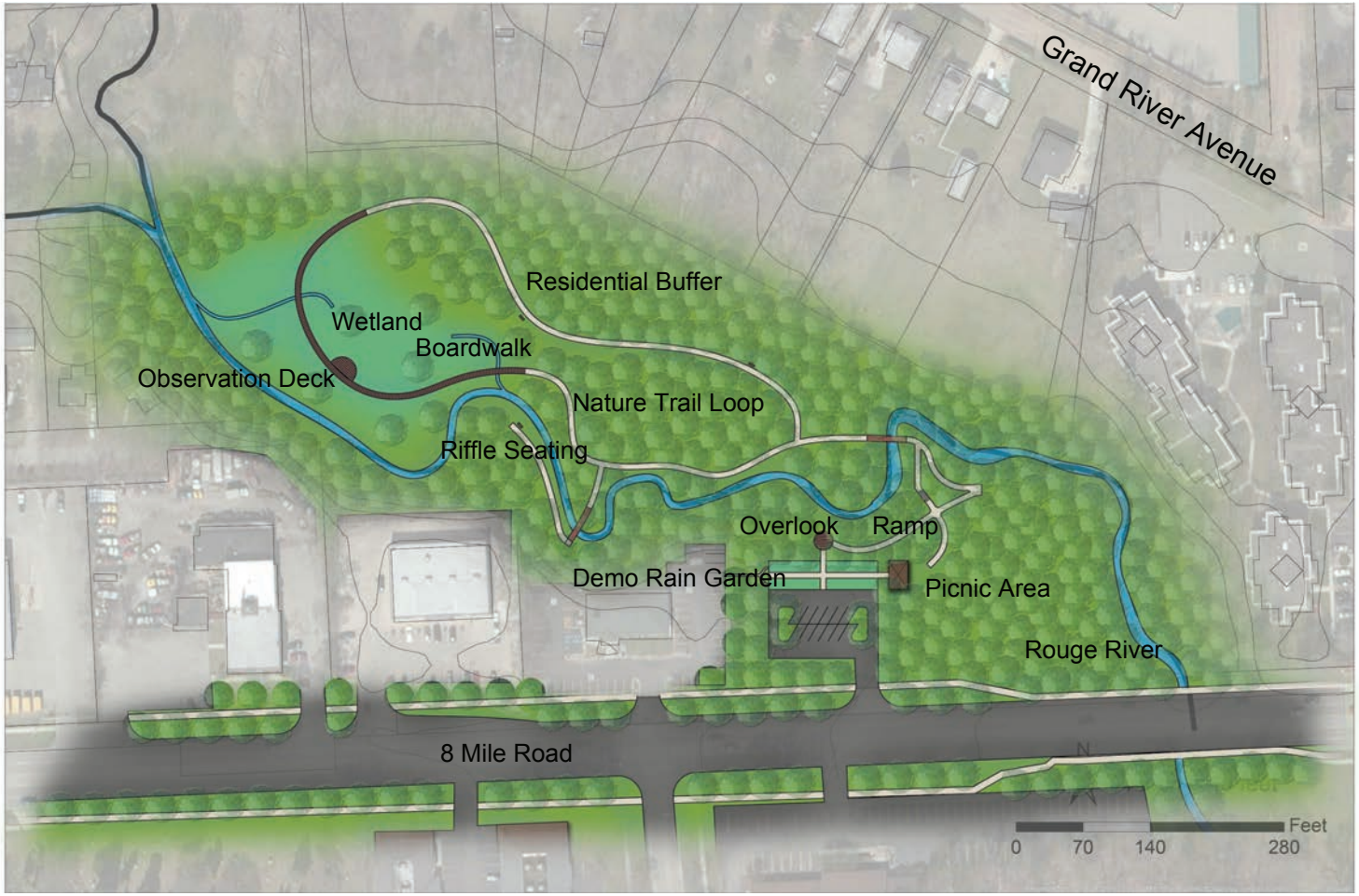

Activating the Rouge River

Farmington and Farmington Hills, MI

April 2016