Other Urbanisms: A Scalar Approach Towards Pervious Design

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INTRODUCTION

This paper fosters the imaginative capacity of visions for Detroit's future urbanism by understanding the city through the lens of water. This is a distinctly different approach to the pervasive discussions of shrinking cities, centered around the "demise" of the Motor City and wistful reminiscence of Motown's heyday. Whereas current debate is mired in circular reasoning—the solution to Detroit's overwhelming vacancy is less vacancy—our work positions the consideration of urban storm water management as a key tool for generative design strategies that encourage nested, scalar approaches and interdisciplinary collaboration.

Just as water is blind to political borders, dissolving boundaries between quantitative research and experiential intimacy is an essential priority. From transportation networks, to neighborhoods and public spaces, design is the measure of what it is possible. Our research brings together regional analyses of the systems of water infrastructure, and the physical, regulatory and cultural forces that shape Detroit's contemporary urban condition. Within this broad framework our research capitalizes on recent redevelopment initiatives directed towards the revitalization of an abandoned railway corridor, the Dequindre Cut. Located northeast of downtown Detroit, this cut registers an exemplary microcosm of zoning types and conditions of land ownership. The resulting combinatory considerations are therefore representative of the entire city and in this way, the territory of the Dequindre Cut fuels prototypical design research.

From a disciplinary perspective, our research methodologically seeks hierarchical prioritizations of distinct design approaches that rely upon multiple expertises over a singular viewpoint. Neither narrowly contextual nor generically prototypical, our work identifies opportunities that arise within existing regulatory constraints and proposes alternate potential outcomes through the formal exploration of urbanism as imagined through the lens of water.

INTERPLAYS: WATER AND URBANISM

At their core, cities are shaped by water. The story of water has played a central role in illustrating a culturally divided desire to prioritize either industry or the environment. Detroit, like many cities that emerged within the landscape of the industrial Midwest, saw its rivers as uniquely important corridors for transportation and waste disposal. Bounded by the Detroit River to the south, and the Rouge River to the west, the very reason for the emergence of the city was the abundance of water, and its easy access by the river. Water was at the heart of the manufacturing process and the distribution system, and soon attracted a dense rail network to its proximity to ensure efficiency in the land distribution of goods. Understanding water as a utility has long defined the imaginary of water in this region.

Ultimately it took a set of four burning rivers, the Chicago, Buffalo, Cuyahoga and Rouge Rivers, to trigger a paradigmatic shift in our cultural imagination. Views shifted from an expression of pride in the level of industrial success that pollution represented to one of horror and outrage at the physical impact of such extraordinarily degraded water

quality.[1] The 1972 Clean Water Act was the most notable legislation to emerge in response to these new public pressures and remains to serve as the primary law regulating water quality throughout the United States.

The Environmental Protection Agency (EPA) oversees administration of the Clean Water Act, but responsibility for implementation falls primarily on individual states and municipalities. State agencies set water quality standards for individual lakes, rivers and wetlands with guidance from the EPA, and then test the water bodies to determine whether they meet their water quality standard. If a water body meets its standard, the state and relevant municipalities must act to protect this. If the water body fails to meet its standard, the state must determine the cause and implement management plans to correct the situation. Every time a river crosses a state line these considerations begin anew.

Despite such legislation, Detroit's waters are one of the four International Areas of Concern in the Great Lakes Region, a measurement of the levels of degradation of the water quality standards according to the EPA. Since 1969, the Rouge River has undergone tremendous change, transforming from a level of industrial pollution so intense that the river regularly caught fire to a current condition where industrial waste contributes only 2% of the river's pollution.[2] Similarly, the primary contributors to ongoing degradation in the Detroit River are no longer industrial point sources. Instead, the patterns and materiality of urbanism are now the single most important predictors of water quality health.

The condition of imperviousness was first quantified in 1994, as an indexical chart of environmental disturbance owing to the runoff pollution from urban areas.[3] Importantly, imperviousness is characterized as a physical, constructed condition that can be quantified and managed across all scales and stages of land development. Owing to this, levels of imperviousness are now widely utilized as a component of urban stormwater management practices. The application of this understanding relies heavily upon Geographic Information System (GIS) analysis techniques that derive rates of imperviousness from land cover characterizations. Using these methods, the condition of imperviousness is quantified as an impervious coefficient with a value ranging between 0 and 100%. All land cover categories that describe a "constructed" condition fall within a range between 28% (low intensity developed) to 72% (high intensity developed) imperviousness. It is widely accepted that levels above 10% imperviousness have measurably negative impact on aquatic ecosystems therefore water quality decline is directly attributable to contemporary construction practices.

This causal relationship reveals a problematic schism between the disciplines participating in shaping the constructed environment and the disciplines studying "natural" systems. Although current design practice is championing integration, the consequences of historically separating disciplinary expertise between city and nature is manifest. It is perhaps most evident in a cross-disciplinary lack of scalar thinking and in persistent cultural expectations of technical expediency. In response to this, our research posits the question: How can the integration of design disciplines achieve multi-scalar strategies that redefine cultural practices enabled by pervious urbanism?

GREEN BEGETS BLUE

> The production of urban nature not only involves the transformation of capital but simultaneously intersects with the changing role of the state, emerging metropolitan cultures of nature, and wider shifts in the social and political complexion of city life.[4]

History reveals that expedient decisions often effectuate enduring provisional conditions. In 1819 an Act of Congress declared the Detroit River a public highway and in 1825, with the opening of the Erie Canal, the commerce flow to and from the Great Lakes region was no longer separated from the east coast by the Appalachian Mountains.[5] The Welland Canal and the Soo Locks would continue to improve navigability along the entire Great Lakes system, and water transportation fueled Detroit's consolidation as an industrial center. Direct access to water supply and easy waste disposal made the waterfront a very desirable location for industries. The rail would also start its expansion in close proximity to the shoreline. The robust network of rail infrastructure was instrumental in the growth of the Detroit, and served as a spine for the linear development of industrial corridors that extended well beyond the limits of the city. Factories and their associated worker's housing expanded throughout Detroit and outpaced the crude methods of water supply and disposal supporting this growth.

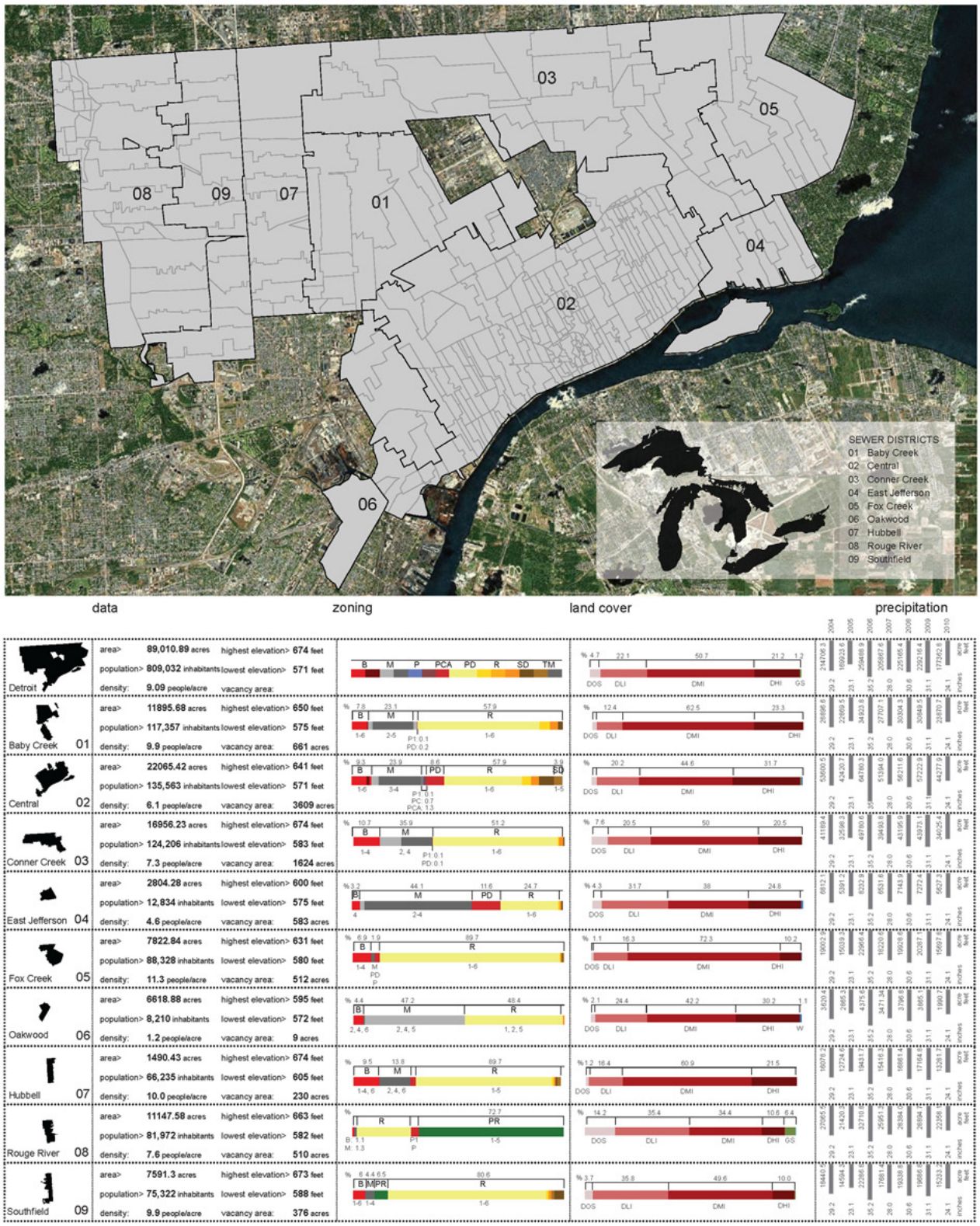

Figure 1. Comparative analysis of the city of Detroit's sewer tributary areas

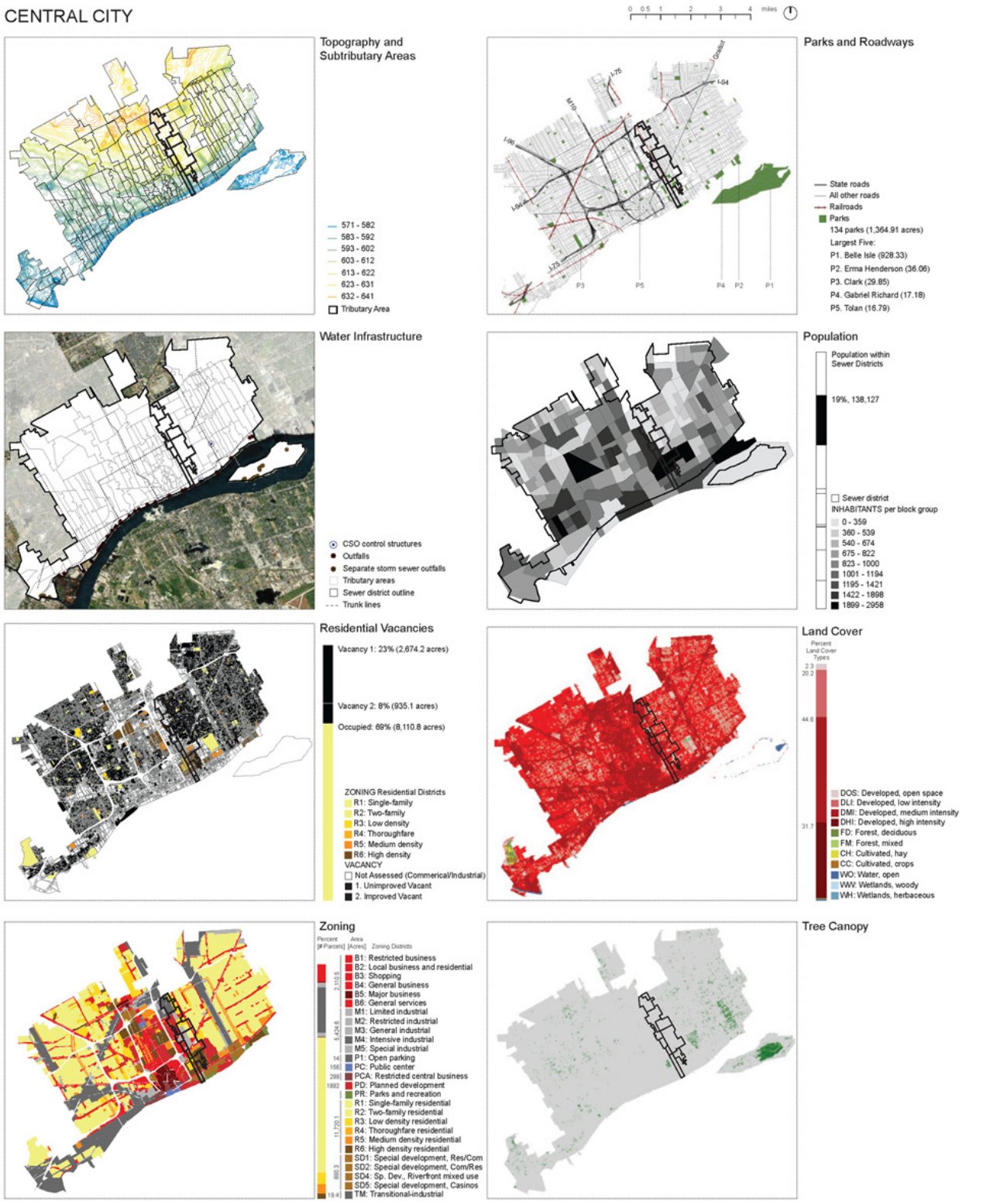

Figure 2. Analysis of the Central City tributary area

> Factories, shops and neighborhoods blurred together indistinguishably, enmeshed in a relentless grid of streets and a complex web of train lines… Rail lines formed the thread that tied the city's industries together. Automobile manufacturing and railroad transportation were inseparably bound in a symbiotic relationship. Every major automobile factory had its own rail yard. Trains brought raw materials and parts to the auto plants and carried the finished products to distributors throughout the country.[6]

A national debate about sewerage systems was concurrently underway and was being heavily influenced by systems in use throughout England. The discussion centered around two fundamental decisions—whether disposal systems should be handled above or below ground and whether sewage and stormwater should be combined or handled separately.[7] In the end, expediency won out and subterranean combined systems were chosen primarily because the construction technology and engineering calculations were readily available for application. The first sewer in Detroit was built in 1836, initiating the practice of combining systems underground by enclosing existing creeks.[8] Once waste was captured and removed, it was directed towards rivers and other waterways, giving rise to the practice "dilution is the solution."

The assignment of administrative responsibilities and oversight of this quickly expanding citywide water infrastructure was made formal in 1853 through the creation of the Board of Water Commissioners. Initially, the Board adopted a conservative approach largely influenced by the fiscal challenges driven by the Great Depression. In 1956, the Board of Water Commissioners appointed a new Superintendent and Chief Engineer. In this position, Gerald J. Remus aggressively expanded the Department's service area to include all of metro Detroit.[9] Today, the Detroit Water and Sewerage Department (DWSD) encompasses 1,079 square miles including Detroit and 126 suburban communities, an area that accounts for approximately four million people, or 43 percent of Michigan's population, and can be directly attributed to the period of growth initiated under Remus's leadership.

The Detroit Wastewater Treatment Plant, is the largest single-site wastewater treatment facilities in the United States, and is also a large contributor to continued water quality challenges. The Wastewater Treatment Plant individually treats an average of 707 million gallons of flow per day and represents one component of a larger infrastructural combined sewer system. Despite the immense capacity of this facility, overflow failures result in the release of billions of gallons of raw sewage into Detroit's waterways each year. Such events, called outfalls, are permitted at 78 locations along the Detroit and Rouge Rivers.[10]

In addition to the wastewater treatment facility, the DWSD oversees 3,433 miles of sewer lines interspersed with 10 pump stations, five combined sewer overflow retention treatment basins and three screening and disinfection facilities.[11] This vast network of utilities is structured around a hierarchy of bifurcating flows that eventually collect "downstream" in interceptors, tunnels that feed waste directly to the WWTP. The entire system can be described by sewer-shed, or tributary, boundaries that help identify how stormwater moves through the network (Figure 1). Within the city of Detroit, there are nine tributary areas. Central City is the largest and most populated. It also has the longest riverfront and as a consequence hosts numerous outfall locations (Figure 2).

While the confluence of the Rouge and Detroit Rivers should represent a uniquely valuable environmental resource, the barrage of outfall events has contributed significantly to the waters being listed, by the U.S. Environmental Protection Agency, as Areas of Concern instead. In response to this ongoing challenge and pressure from the EPA, the DWSD is engaged in a multi-decade program of improvements to its infrastructural system. To date, investment in this project is approaching two billion dollars and is projected to require more capital investment than is being generated by declining tax revenues driven by population loss.

THE SCIENCE OF DESIGN

> Within the imperfect circle of his optical universe, the perfection of that oscillatory motion formulated promises doomed to be broken by the uniqueness of each individual wave. There was no way of stopping that continual alternation of creation and destruction. His eyes sought the ordered and describable truth of a certain and complete image, but instead they wound up chasing after the mobile indeterminacy of the coming and going that deceived and derided scientific inquiry.[12]

At the core of our scalar inquiry is a methodology that is concerned with the performance of design

strategies. Performance must be understood relationally and there are many parallels between scientific inquiry and design research that enable precision to guide innovation within dynamic systems. If the scientific method is understood as the interplay between observation, precision and communication then these terms can be used to elucidate design processes.

In a commencement address to Kenyon College, David Foster Wallace presented an argument in support of the importance of nurturing the development of simple awareness because "the most obvious, ubiquitous, important realities are often the ones that are the hardest to see and talk about."[13] The environmental outcomes of the multitude of decisions we make as designers have recently affected the level of awareness that we focus on this interaction. Initial efforts to recalibrate the cycle of cause and effect have relied heavily upon the quantification of immaterial and imperceptible particles, gases and energy. While our work is more broadly concerned with methods of empowering data within design, we are also ardent urbanists. As such, the obvious, ubiquitous realities that are important contributors to our developing awareness as designers are those that are simultaneously connected to systems beyond perception *and* to physically tangible, cultural practices.

Recent discourse surrounding the application of the classical scientific method within the field of ecology offers clarification of the role of observation. "Good science must start with an observation; one that has biological significance and is founded on current evolutionary theory… A sound theoretical framework is essential to asking relevant questions that advance science and move the discipline forward."[14] Similarly, good design participates in discourse through a sound theoretical framework and its broader relevance—in our case, relevance to the residents of Detroit whose urbanity is shaped by issues of water quality.

Our initial inventory includes data from a series of sources including SEMCOG (Southeast Michigan Council of Governments), Data Driven Detroit, DWSD (Detroit Water and Sewerage Department), lidar data (via Michigan State), Census Bureau (2010 data), precipitation (through the National Oceanic and Atmosphere Administration), outfall magnitude (through the Michigan Department of Environmental Quality) and impervious coverage (through the United States Geological Service).

Initial analyses using this data set include overall runoff calculations using a simplified rationale method to estimate the magnitude of stormwater volumes entering the combined infrastructural system within the city of Detroit. In addition to numerical analyses, we have been heavily utilizing visualization techniques to assess geographic and spatial urban patterns to position a set of diverse approaches towards integrated stormwater management. Towards this end, pairing our data analysis with an understanding of active funding streams in Detroit and areas of active community engagement resulted in the identification of two target areas for design interventions: the Brightmoor neighborhood (a neighborhood of roughly four square miles located in the northwest area of Detroit, along the Rouge River) and the Dequindre Cut (a former railroad corridor connected to the Detroit River in central Detroit).

Both the Brightmoor neighborhood and the Dequindre Cut are sites where the intersection of data and design can be understood to play a paramount role in exploring new approaches towards other urbanisms. Complementing the more "distant" GIS analyses, we are conducting detailed historical analysis of the changes in the physical construction of each site and its relative relationship to the city over time. Towards this end, we are utilizing aerial photography (via Wayne State Library: 1940's-1990's), Sanborn maps (1880's-present) and the Baist Atlas (1880's-1920's) to illustrate and understand how we have arrived to the contemporary conditions shaping the city's relationship to water today.

In addition, the target sites have enabled us to develop a more detailed understanding of present challenges associated with the interaction of stormwater and pollution, derived from the city's industrial past. Both Brightmoor and the Dequindre Cut are "post industrial" sites; one as a workers' housing development constructed in close proximity to previous industrial employers and the other as a transportation corridor servicing a link between industry and the Detroit River. As a result, while we aim to design with water positioned as a cultural trigger, we must simultaneously distinguish between a desire to engage with water and the necessity to understand the very real challenges associated with contaminated

sites. Towards this end, we have initiated a new GIS layer for the detailed tracing of current surface materials to gain precision (current land cover is limited by it's pixel size that equate to 30^2 meters) and enable site-specific design approaches at the scale of neighborhoods and blocks.

CONTINUITY AMIDST FRAGMENTATION

Brightmoor, as a case study, offers the challenge of designing for continuity (of stormwater management practices) within a condition of fragmentation (residential fabric with high rates of vacancy). Both conditions of continuity and fragmentation can be attributed to Brightmoor's origins as a planned community of inexpensive housing for migrants from the Southern United States in the early 1920s. In its current state, Brightmoor consists of relatively small parcels with modest scaled, wood framed, single-family homes spreading from a core of industrial land tied to the Rouge River.

As with many communities in Detroit, Brightmoor continues to struggle with the loss of jobs and population that were responsible for its origins. This is expressed in many ways including the deterioration of infrastructure and a pressing condition of vacancy and arson. Amidst the challenges of blight, however, Brightmoor continues to host pockets of vibrance. This community has been identified by the city of Detroit as a designee of special funding granted through the Neighborhood Stabilization Plan.

Parallel to municipal attention, Brightmoor's residents are actively engaged in reimaging a new future decoupled from industry and water is one consideration that lies at the heart of this. Here, data informs design speculations through the understanding of how current volumes of storm water runoff can be distributed amidst this fabric and work in conjunction with efforts to reclaim an abundance of vacant parcels.

RECOVERING THE LOWLINE'S BACKBONE

The Dequindre Cut represents a different design approach. The recalibration of infrastructure in Detroit presents opportunities that necessitate a long-term strategic outlook prioritizing multi-system integration. Issues of ownership within and around right-of-ways and easements servicing coupled infrastructures present simultaneous challenges and possibilities. While the use of easements has historically been a tool to enable the construction of long lines of a diverse array of transportation, energy and water infrastructures, there have recently been initiatives, such as the High Line in New York City, that have successfully transformed abandoned easement corridors into publicly accessible spaces. The implications of this circumstance are manifold: on one side, establishing right-of-way public spaces requires a high level of municipal engagement to negotiate the means of accessing formerly inaccessible land in addition to the navigation of complex financial structures of private and public matching funds. On the other side, intervening promises the potential of activating a new public realm closely tied to and occupied by citizens explicitly aware of the network of constructed systems servicing the city.

It is well understood that Detroit is struggling with enormous fiscal, structural and political hurdles that impact all aspects of governance. In spite of this, or because of this, Detroit has seen an emergence of grassroots advocacy that has recently superceded the efficacy of the official government. Within this trend, several groups have been successfully advancing an agenda of environmental stewardship through a project-based approach. Established in 2001, the Greenways Initiative has been instrumental in conducting and overseeing a thorough study of the networks of abandoned railroad corridors in southeast Michigan. As part of this, the program funded the study "Planning for Detroit Rail-Trails" in which a set of inventories, maps and assessments of adjacent land ownership patterns and rail corridors abandoned between 1962 and mid-2002 was developed.[15] This study has fueled a host of initiatives aimed at revitalization efforts to develop a regional system of greenways.

The most actively progressing initiative in the city, the Dequindre Cut, is located in the Central District sub-tributary area and has quickly become Detroit's most beloved linear park. The Dequindre Cut is a remnant scar of the former Grand Trunk Railroad line built in 1830. Identified as "corridor four" by the Greenways Initiative, the line links the Detroit River north to Royal Oak, Pontiac, and beyond. By 1920, the intensive use of the line by adjacent industrial plants exacerbated a condition of severe congestion in the transportation network serving the south-eastern portion of the city. In response, the city and owners struck a deal to mitigate the

problem by re-grading the final stretch of the line in order to decouple road and rail traffic. The cut ran 25-feet below grade from Wilkins Street to Jefferson Avenue, and was heavily used until the 1980s. The Dequindre cut sat abandoned for more than one decade until work stemming from the Greenways Initiative produced a cooperative effort to negotiate and purchase 3.5 miles of the line from Canadian National. In its present state, the Dequindre Cut represents one of the city's most prescient urban interventions in the public realm.

The story of the Dequindre Cut Greenway has benefited from the regional investment in similar programs: its unique location and proximity to downtown and the riverfront have attracted both the imagination and support of institutions and citizens alike. The initial design intervention required a joint venture to raise the $3.75 million budget, and is already effectively linking the Detroit River with Eastern Market, two centers of recreational and commercial activity in Detroit. The Greenway also borders Lafayette Park, one of the finest examples of the capacity of the modernist agenda to successfully integrate design practices in the remaking of the city. Overall, the surrounding areas represent a populous mix of mid to high-density residential, between Gratiot and Jefferson, and substantial acreage designated, through a new zoning classification, as "Special Development" to facilitate private investment in the regeneration of former industrial sites along the riverfront.

The physical characteristics of the Phase I work focused on the implementation of a multi-user path, and minimal landscape interventions used to accentuate three entry points into the greenway. Half of the width of the greenway was paved with asphalt for bike and pedestrian use. The second half of the greenway is currently maintained as a lawn with the intention of inserting a light rail line in the future. Overall the intervention has successfully activated recreational activities and non-motorized transportation options, within a corridor that no longer resembles its former industrial nature apart from graffiti and the relics of the bridges that linked the dense network of streets on the ground plane above. Phase II plans intend to extend the greenway from Gratiot north to Mac Avenue. This work will undoubtedly benefit from the success of the first phase, yet will face new challenges given the different composition of the land uses and patterns of vacancy (Figure 3).

The Dequindre Cut is uniquely interesting as an example of coupled infrastructure cutting through a transect of the city that traverses an enormous diversity of zoning types as well as vacancy rates. As Figure 3 illustrates, within the collection of subtributary sewersheds that touch the Dequindre Cut, those districts north of Gratiot represent some of the highest vacancy rates in the city while the territory south of Gratiot is one of the most vibrant portions of the city. Therefore, the resulting combinatory constraints emerging from this relatively narrowly defined territory simultaneously represents the diversity of challenges facing the entire city. Furthermore, the Dequindre Cut represents an important site of emerging urbanisms wherein our work tests a multi-layered approach to water-prone practices that build on the social and cultural landscapes of new public spaces within the city.

The Dequindre Cut Greenway site materializes the sets of constraints relevant to issues of public and private investment, ownership and occupation and for these reasons represents an ideal urban situation within which to test design research hypotheses.

CONCLUSION

If materiality and assembly are our most powerful design tools, then the relationship between building and ground is the fundamental crux of the problem of developing a pervious urbanism. No longer can these considerations be isolated nor can we resolve this problem through mimicry. The aesthetic resemblance of a ground plane to a building or vise versa contributes to a cultural understanding of collective urban priorities but doesn't account for performance criteria. Likewise hyper-articulated technical virtuosity may be calibrated to account for every last photon of a day's solar potential but may not contribute to a cultural investment in the importance of sunlight. The importance of water as a key to other urbanisms lies in its ability to foster research inspired equally by quantitative and qualitative motivations. Our qualitative approach clarifies a measure of impermeability thereby establishing a set of expectations within which material research can proceed. Our qualitative approach privileges representational tools to enable cultural imagination to project beyond the immediate present. If a city decides that its rivers should be swimmable, then the collective opportunities and energy necessary to accomplish this gain focus (Figure 5).

ENDNOTES

1 Hartig, John H. 2010. *Burning rivers: revival of four urban-industrial rivers that caught on fire*. Burlington, Ont.: Aquatic Ecosystem Health and Management Society.

2 Friends of the River Rouge, http://www.theriverouge.org/ (accessed Sept 1, 2011)

3 T.R. Schueler, "The Importance of Imperviousness," in *Watershed Protection Practices*, vol. 1, no. 3 (1994):100-111.

4 Gandy, Matthew. 2002. *Concrete and clay: reworking nature in New York City*. Urban and industrial environments. Cambridge, Mass.: MIT Press.

5 Farmer, Silas. 1884. *The history of Detroit and Michigan*. Detroit: S. Farmer & co.

6 Sugrue, Thomas J., and American Council of Learned Societies. 1996*. The origins of the urban crisis race and inequality in postwar Detroit.* Princeton studies in American politics. Princeton, N.J.: Princeton University Press.

7 Melosi, Martin V. 2000. *The sanitary city: urban infrastructure in America from colonial times to the present*. Creating the North American landscape. Baltimore: Johns Hopkins University Press.

8 Dorothea Engel. 1937. *History of the BOWC*. Wayne State University, Detroit, Michigan.

9 Hubbell, Clarence W. 1916. *Preliminary report on sewage disposal for the city of Detroit, made to George H. Fenkell, commissioner of public works,*. Detroit, Mich.,.

10 City of Detroit, Detroit Stormwater Management Plan 2007 http://www.detroitmi.gov/DepartmentsandAgencies/DepartmentofEnvironmentalAffairs/StormWaterManagement.aspx (accessed 01/28/2011).

11 DWSD fact sheet. www.dwsd.org (accessed September 4, 2011).

12 Baricco, Alessandro. 1999. *Ocean sea*. Oceano mare.English. New York: Knopf. http://hdl.handle.net/2027/[u]: mdp.39015039908523.

13 David Foster Wallace, "This is Water," Adapted from the commencement speech given to a graduating class at Kenyon College, Ohio, 2008.

14 Jerry O. Wolff and Charles J. Krebs, "Hypothesis testing and the scientific method revisited," in *Acta Zoologica Sinica*, vol. 54, no. 2 (2007): 383-386.

15 Kate Bickert, Jeff Ciabotti, Nancy Krupiarz, Hugh Morris, Darren Smith, "Greenways Initiative: Planning for Detroit's Rail-Trails, Abandoned Rail Corridor Inventory and Assessment," prepared by rails-to-trails concervancy for the greenways initiative, (2002) www.railstrails.

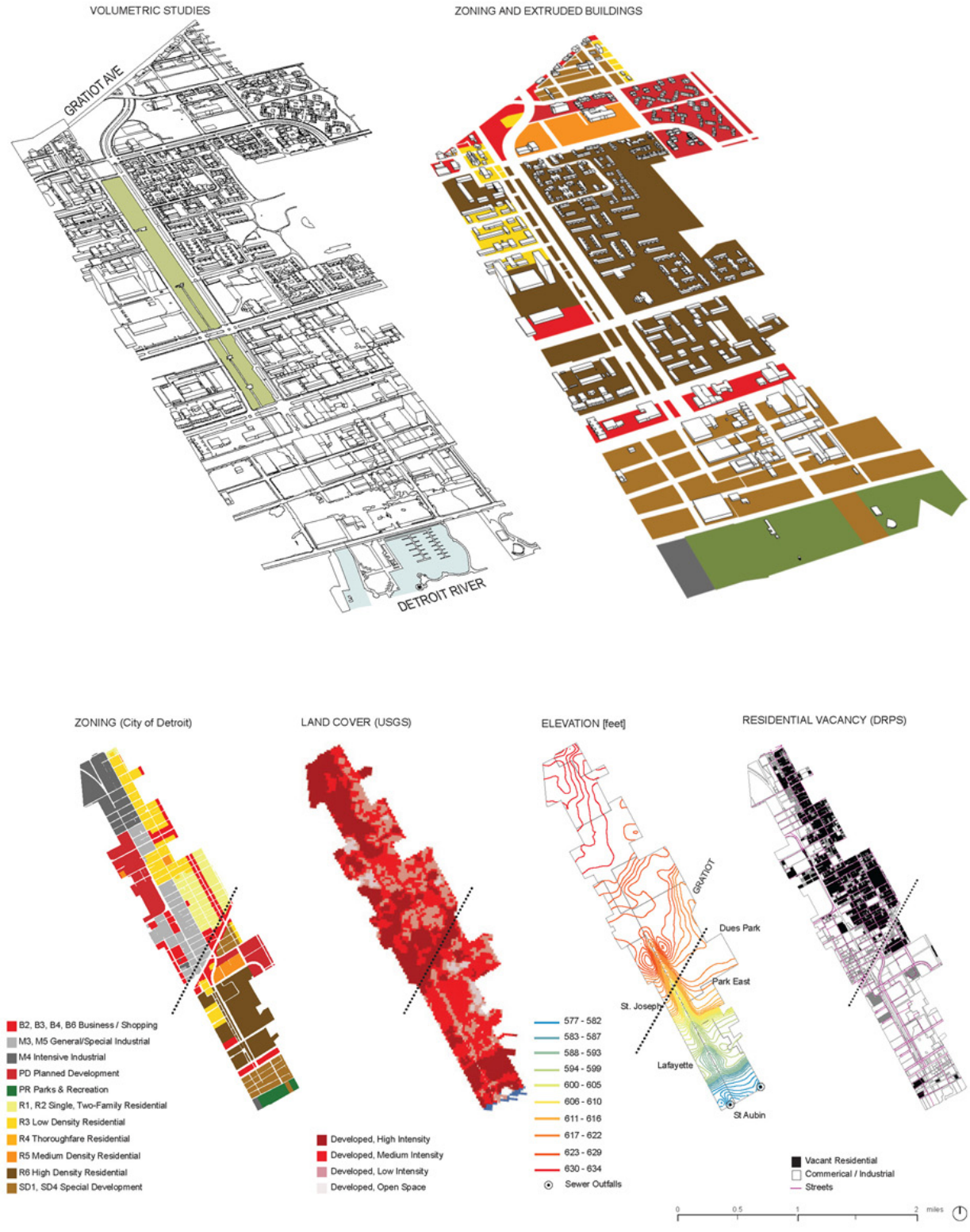

Figure 3. Analysis of the Dequindre Cut

Figure 4. Diagramming the fundamental considerations within the Dequindre Cut