

Infrastructural Landscape: Strategies for Post-Industrial Reuse

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Abstract

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This thesis examines the regional challenges facing the Great Lakes and proposes a series of simultaneous multiscale strategies to address them. The proposal activates the potential, in the greater number and area, of small cities within the region to improve water quality and water consumption. Reusing post-industrial sites is the strategy for applying the theoretical frameworks and research on the region. The concept of Landscape Infrastructure informs the project's approach of creating multifunctional infrastructure systems. When considering the creation of new infrastructure through the lens of Landscape Infrastructure that infrastructure must meet social, ecological, and economic goals while performing its desired function. Strategies are proposed at the scale of the Great Lakes, Lake Erie, and Erie, PA. Those strategies are then applied through design at the former GAF Shingle manufacturing site.





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A view of the smoke stacks at the former International Paper Mill that remain after the facility was demolished. Erie, Spring 2014

INTRODUCTION

Executive Summary

Our cities and urban regions have changed drastically in the post-industrial period following World War II. The cities in the Great Lakes are often held up as the examples of post-industrial decay yet they sit at the edge of resource that has not seen the height of conflict over its use. That resource is water, its one reason people settled in the area and why the potential for growth, within the watershed of the Great Lakes, is so high. In order to address the problems intensive human use, urbanization, agriculture, and industry have created regionally simultaneous, multiscale solutions are necessary. By utilizing the gaps left in urban fabric from the exodus of industry from the cities in the Great Lakes it is possible to apply strategic interventions that simultaneously address water quality, ecological diversity, social resilience, and business growth. While the intervention differs at each scale it is crucial to note that they are all rooted in solving common issues relating to water quality and water consumption.

At the scale of the Great Lakes as a region it is most crucial to decrease demand for potable water and improve the quality of water in the hydrological system. Though management of consumptive use in a way that allows for social, business, and ecological success a more sustainable region will emerge. Recognizing the essential value, at both the political and individual levels, which healthy lakes provide for drinking water, tourism, and commercial fishing will facilitate conversion to better practices. After residents or industry have used the water of the Great Lakes the condition it is discharged in needs to improve from current standards. Improving municipal wastewater quality and treating surface runoff before it reaches the lakes is one method to increase water quality. At the regional scale, binding policy changes that require adherence to stricter standards on consumptive use and water quality are needed to protect the Great Lakes.

For Lake Erie and its watershed it is imperative that we address excess nutrients from agricultural runoff and pollutants from electricity production. Creating water treatment approaches that address sediment and nutrient runoff from agriculture in the tributaries of Lake Erie can help lessen the formation of algal blooms. In addition to treating water from agricultural use before it reaches Lake Erie the nutrients could be used to cultivate algae for fuel sources. Diversifying the regional supply for electricity



is important in decreasing the amount of mercury released and bound to lake sediments. A focus on wind power would provide a new, consistent electricity source that could be a force for creating jobs in education, manufacturing, installation, operation, and maintenance of these facilities.

The City of Erie needs to address the flows of food and economic growth necessary to maintain or improve quality of life. At the scale of the City of Erie it is crucial to reevaluate what the best practices are for a city this size with declining growth patterns. Encouraging new growth within urbanized areas and creating urban spaces that encourage public life is crucial to make denser living attractive. Creating a local food system, that helps meet needs with less input from traditional agriculture will help improve resident quality of life, the economy, and the ecology in the region. By using space in the city that has been discarded or is under used it is possible to create a decentralized network that addresses the flows of the city. At the city level fostering a sense of engagement and stewardship with environmental quality will help improve the local tourism economy.

At the former GAF manufacturing site each of the previous goals can be applied, tested, and improved. Creating a built fabric that include water capture, separation, and reuse systems will reduce water consumption and increase water quality. Rethinking parking infrastructure as an element that is included in each structure, rather than one dissonant part, will help unify the urban fabric and meet demand. A cohesive, long-term vision for the entire Downtown Waterfront is crucial to redevelopment of these post-industrial sites. Connecting people with the unique, beautiful resource that is Presque Isle bay improves the potential for economic generation creates opportunities for partnerships between business, non-profits, and social improvement. Giving residents at grade access to the water allows them to interact with the bay in a way that is found nowhere else in Downtown Erie.



At each of these scales changes to policy, zoning, development practice, social values, and individual behaviors will need to change. The incentive for improving the region's relationship with water will be discussed from economic, social, and ecological perspectives in this thesis.

Why This Topic?

The need to consider fresh water access, responsible city planning, and sustainable regional development, while leveraging the greatest positive public impacts in tight economic conditions were the driving factors in choosing this topic. Theoretical discourse in the fields of Landscape Architecture, Urban Planning and Urban Design, as well as regional and site analysis, shaped project approaches and goals. In order to solve global, regional, and local challenges, it is necessary to look for intervention opportunities at multiple scales simultaneously. Through the distillation of regional concerns into conceptual approaches curative interventions are formulated. Those interventions are applied regionally, locally, and tested at a site scale. The GAF site proposal illustrates how a single site can embody multiple strategies while testing the implementation of the curative interventions. This approach allows Erie to create and test a case example for other cities in the region. The concepts tested and the lessons learned at the site and local levels can then be applied to the region as a whole to assist addressing water quality, water consumption, economic, social and environmental concerns.

ANALYSIS

Regional Overview & Relevance

The Great Lakes Region holds nearly 21% of the world's surface fresh water resources and 84% of North American fresh surface water resources. Yet, less than 1% of the water in the Great Lakes is annually renewable.¹ The region, which houses more than 30 Million people, impacts both the United States and Canada. Approximately one third of the region's population resides in the Lake Erie Watershed.² Nearly 11 Million residents are served with drinking water that comes from Lake Erie.³ The City of Erie is the smallest of 18 population centers in the Great Lakes Region.⁴ While the large urban centers like Chicago or Toronto have an ample application of critical thought, small (or shrinking) cities like Erie do not have as many proposals for change. This is an interdisciplinary proposal to address the large number of smaller cities as a means to create regional change.

Analyzing a region, at a scale that transgresses national and state boundaries, and proposing changes at a local scale is challenging in both the scope and depth of information. Relevant theoretical literature, current regional proposals, and case examples will help in the narrowing of focus and proposal of real-world solutions. The Chicago office of Skidmore, Owings, and Merrill (SOM) has identified the need for visioning for the Great Lakes. Their office has produced regional planning and visioning documents for the next 100 years and continues to work in this context.⁵ In order to address the challenges in this topic this thesis will build off the goals and visions identified by SOM and focusing its approach through the lens of theory. The theoretical literature relating to Landscape Architecture, Urban Planning, and Urban Design provide useful approaches in addressing a region this large. Specifically, the principle of Landscape Infrastructure and its relation to Landscape Urbanism were foundational in selecting the focus criteria.

1 <http://www.epa.gov/greatlakes/solec/sogl2009/7056waterwithdrawals.pdf>

2 <http://www.epa.gov/glnpo/lakeerie/index.html>

3 Ibid.

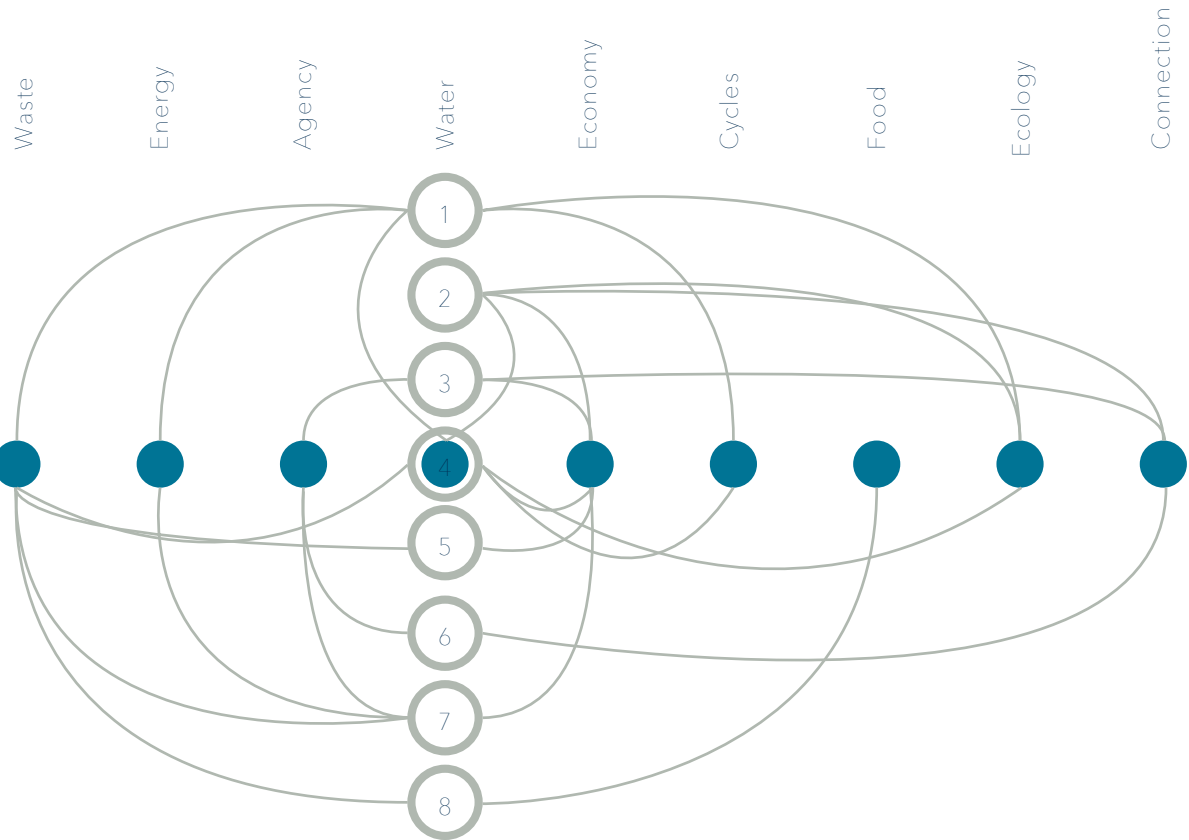
4 http://en.wikipedia.org/wiki/Great_Lakes_region_%28North_America%29

5 SOM Report, <http://thegreatlakescenturyblog.som.com/> , and <http://www.asla.org/2013awards/488.html>

The Great Lakes Century
Vision Elements

Areas of Focus

- 1 Green Cities And Great Lakes
- 2 Bigger Than A National Park
- 3 Great Minds & Great Lakes
- 4 Blue Is The New Green
- 5 Tapping Renewable Energy
- 6 Achieving Mobility
- 7 Leaders In New Economies
- 8 Commitment To Local Food



This project will provide a proposal for the former GAF Shingle Manufacturing Site⁶ that creates a new urban waterfront district that honors the history of the city, leverages future growth, and improves the economy and ecology of the area. The goal of the proposal is two fold; to create an opportunity for dialogue by illustrating the potential for the site and to propose a pilot project that can prove these concepts for the Great Lakes Region as a whole. Moving beyond a single site or city application there is great potential for this initial site to be a pilot project, testing technology and collaborations. After the proof of concept is achieved in Erie, other cities in the region could then adopt practices and policies that meet their needs. By proving and distilling my findings in Erie, I hope other small cities in the region will apply this type of intervention in their city. This project seeks to shift the integrated thought found in large metropolitan areas into these more numerous, smaller cities and apply it. Capitalizing on the greater number and larger surface area of these small cities is a way to compound impact and create a greater overall impact.

⁶ The site of the former GAF Shingle manufacturing plant, near the Erie County Convention Center is the proposed single site intervention for applying these regional interventions. It is located in Erie, PA at the foot of Sassafras Street in the Downtown Bayfront.

Analysis

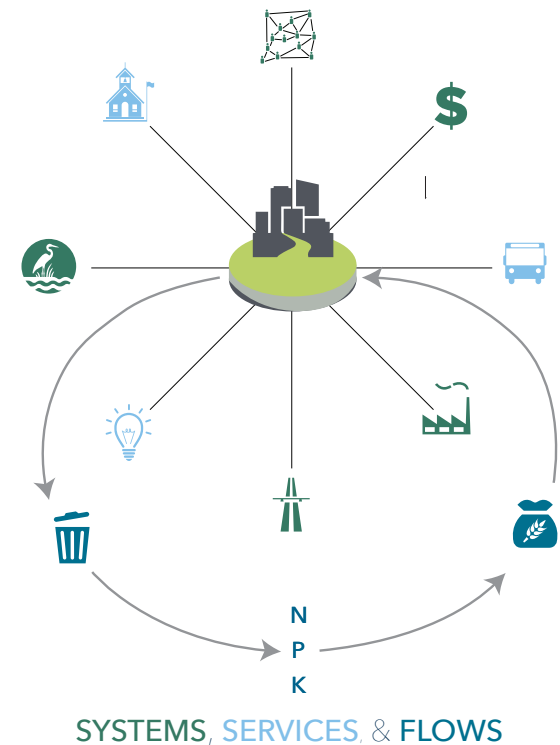
Literature and Theory

There are a multitude of sources dealing with post-industrial, contaminated, and wasted land in discourse on Landscape Architecture, Urban Planning, and Urban Design. In reviewing the literature I have found the positions presented in theoretical discussion regarding Landscape Urbanism, Drossscape, Creating Shared Value, Formerly Urban and Shrinking Cities, and Landscape Infrastructure informative to my topic area. These theoretical positions range from widely discussed and cited texts to recently published doctoral dissertations yet each speaks to the conditions found in the region and the site. This section will address each of these approaches, how they relate to the project, and identify the central elements that are applied. Additionally, the relationship between Landscape Urbanism and Landscape Infrastructure is explored as it is essential to the premise of the proposal.

LANDSCAPE URBANISM

The concept of Landscape Urbanism was introduced at a symposium of the same title in 1997. Landscape Urbanism uses interdisciplinarity to capitalize on landscape as both the lens for viewing cities and medium. Landscape then becomes the organizational field, which unifies all the elements of urban fabric. Landscape Urbanism also views cities as a system of interrelated dynamic forces, physical, social, and environmental, which change over time. Given the complexity and dynamics of cities, the processes of landscape urbanism provide crucial flexibility that allows for uncertainty. Through that flexibility time and change can be incorporated into design. Additionally,

Landscape infrastructure is a multifunctional set of



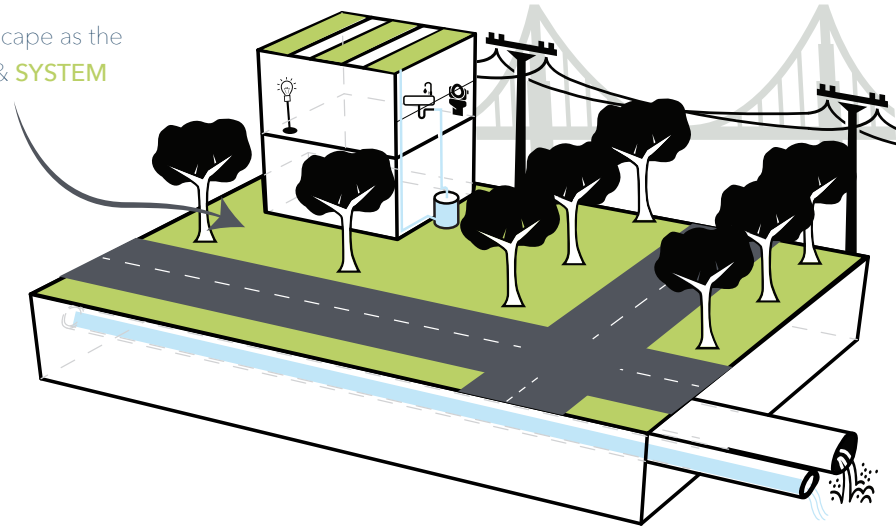
operating at multiple **SCALES** simultaneously.

INFRASTRUCTURE



LANDSCAPE INFRASTRUCTURE

Landscape as the
SITE & SYSTEM



the focus of Landscape Urbanism on indeterminacy, openness, and cross-disciplinary practice allows it to apply ecology as a methodology to understand urban conditions. Landscape has been positioned by many writing about the field as not only a model for contemporary urbanism but also a model for process and understanding.⁷

Landscape Urbanism has been written about by multiple authors to varying degrees of illustrative detail. The vague descriptions make reaching a concrete definition of Landscape Urbanism challenging at times. One of the main proponents of the theory, James Corner, tends to use vague language as a methodology to spark dialogue about the approach. However, many elements of his writing on the topic are helpful to discuss. His identification of five general themes within the approach helps to frame this analysis and comparison. The five themes are horizontality, infrastructures, forms of process, techniques, and ecology⁸. Another of Corner's explorations that is relevant to this discussion is his contrast of the term *landschaft* with *landskip* and *landschap*⁹. In contrasting the meaning of *landschaft* as an active, working or productive environment, residents included, against the pastoral image of the land he highlights the potential for how we consider landscape. Through this juxtaposition we can begin to view the ground plane as the element that organizes activity and use while shaping the processes and events that occur on it.

Charles Waldheim presents the history and evolution of the concepts that underpin landscape urbanism in multiple texts, including the Landscape Urbanism Reader. In that text, Waldheim claims that the advantages of Landscape Urbanism are "the conflation, integration, and fluid exchange between (natural) environmental and (engineered) infrastructural systems".¹⁰ The horizontal organizational tactics of landscape also apply directly to the methods needed in the organization of the city. In contrast, the vertical organizational tactics of architecture fail to help structure cities. It is interesting to note that Waldheim, as well as others, recognizes Landscape Urbanism as the approach best suited to addressing the complexity of derelict industrial sites in cities. He also states, "Landscape urbanism describes a disciplinary realignment currently underway, in which landscape is usurping

7 Allen, Stan. (2002) *Mat Urbanism: The Thick 2D*. p. 125; Corner, *Terra Fluxus in Landscape Urbanism* p.1-34; Waldheim, *Landscape Urbanism* p.14

8 Corner, James in *The Landscape Urbanism Reader*.

9 Corner, James. *Recovering Landscape*. p. 153-154

10 Waldheim, Charles. *The Landscape Urbanism Reader*. p. 171 43

architecture's historical role as the basic building block of city making."¹¹ Waldheim's description of realignment correlates with the action of positioning landscape, both in practice and approach, as an agent in design proposals. The expansion of disciplinary relevance is seen in the proposals regarding landscape infrastructure as well.

Stan Allen also discusses multiple strengths of the landscape which are referenced by Waldheim his essays on Landscape Urbanism. One concept that is particularly interesting is that of the 'thick 2D'¹². Allen talks about landscape in relation to the concept of mat building. Particularly striking is his description of the characteristics of mat building. Mat building is a proposition of a 'loose scaffolding based on systematic organization of the parts' in which not all parts are controllable by the architect.¹³ Allen compares the 'thick 2D' of landscape to an articulated section in which the fundamental work of the landscape is preformed.¹⁴ This thickened horizontality differs from the discrete, stacked elements of architecture. The 'thick 2D' weaves, warps, knots, and folds the disparate elements together. Allen also discusses the concept of the 'thick 2D' in his lecture at the 2008 symposium on landscape infrastructure.

Despite the florid prose and the somewhat indirect language used to describe Landscape Urbanism Richard Weller provides a quick synopsis of his interpretation of what the approach claims to do. Weller provides seven elements distilled from literature on the subject.¹⁵ The first is that all the elements within the landscape become the purview of design. This includes the infrastructure and built elements and extends across scales to bridge gaps between design, ecology, and planning. His second distillation asserts the synthesis that landscape provides brings creativity to planning and rationality to design. Thirdly, Landscape Urbanism conceptualizes and directly engages with the hybridized, natural, chaotic ecology of the city. Next, he emphasizes ecology's temporal and creative agency in urban life instead of positing the two as antithetical elements. Fifth, the focus shifts from the

11 Waldheim, Charles. "Landscape Urbanism: A Genealogy". P. 10

12 By considering landscape as a thickening of the surface of the ground plane we can conceptualize the processes and forces that occur within. The thick 2D is a way to acknowledge the system of connectivity linking the elements on and in that plane. In the Thick 2d elements are woven together to create a cohesive whole rather than simply stacking discrete parts.

13 Allen, Stan. (2002) Mat Urbanism: The Thick 2D. p. 122

14 Ibid. p. 125

15 Weller, Richard. "Landscape (sub)urbanism in Theory and Practice." Landscape Journal. p. 256

aesthetic qualities of things to an understanding of the forces acting on cities so those forces can be manipulated. Penultimate is the act of understanding and making visible landscape systems so they can influence forms, processes, and patterns in the urban condition. Lastly, Weller notes the preference for open-ended strategies over highly formalized master plans.

LANDSCAPE INFRASTRUCTURE

The discourse, writing, and projects surrounding Landscape Infrastructure began in 2008 with a symposium on the topic and have grown most recently to include the publishing of Belanger's PhD dissertation on the subject.¹⁶ SWA, led primarily by their Los Angeles office, compiled a book of their completed projects that represent the potential for Landscape Infrastructure. The first symposia, held in 2008 at the University of Toronto, challenges the ascendance of urban planning and civil engineering in shaping the urban context through the creation of infrastructure. The second symposia, hosted by Harvard's the Graduate School of Design in 2012, continued to address the topic and presented a continuation of Landscape Infrastructure frameworks. It has also provided real world examples of projects and methods of professional practice. Interestingly, Pierre Belanger has been a common element at both symposia and this topic appears to be his operative stance on how the profession should proceed.

Those supporting Landscape Infrastructure, particularly Belanger, assert that the creation of infrastructure, an element that deeply shapes the urban conditions in which we live, has been the sole purview of civil engineers. This is problematic, in part, because civil engineering is a discipline that lacks the critical and theoretical discourse found in design disciplines. Belanger proposes that we view infrastructure as the "glue of urbanization" and use it as a tool in urban design. Exemplar projects of Landscape Infrastructure encompass five major infrastructural categories; waste, water, transportation, energy, and food, to address economic and ecological flows in urban regions.

In 2011, SWA's LA office published the first book on landscape infrastructure. The book stemmed from the conference in Toronto and centers around example projects completed by the office. In SWA's Landscape Infrastructure, Ying-Yu Hung states, "Landscape becomes the medium through which to formulate and articulate solutions for the integration of infrastructure with

16 A book of the same title as his dissertation, *Landscape Infrastructure: Urbanism Beyond Engineering* will be available in 2014 from MIT press.

viable programming that can address the pressing issues facing many cities around the world.”¹⁷ Moving beyond a definition of landscape in this context she discusses the evolution of landscape infrastructure from the conference in Toronto in 2008. The views presented at the symposium position landscape as essential to complex systems that are part of contemporary urban economies. These systems include essential services, resources, and the processes of urbanism. In Landscape Infrastructure landscape acts as a ‘performative hybrid infrastructure that is as much about culture as about engineering’.¹⁸ The act of defining infrastructure in relation to the approach is her next step. Hung argues that, ‘as an integral part of our daily regimen, infrastructure must be reimagined’.¹⁹ Her position regarding the reinvisioning of infrastructure is bipartite and revolves around the goals of advancing culture, nature, and our ways of living, now and in the future.

Pierre Belanger’s definition of Landscape Infrastructure highlights the centrality of the ecological within the approach. In his doctoral dissertation he proposes that, “Live, ecological systems can be designed as infrastructures that shape contemporary urban economies.”²⁰ Belanger also states that Landscape Infrastructure will encompass an operating system capable of representing ‘the full complexity of biodynamic processes and resources’ while deploying them over the urbanized area in conjunction with the life cycles of infrastructure.²¹ This definition of Landscape Infrastructure seeks to fabricate a new mode of practice in which landscape architecture, civil engineering, and urban planning work together in a new model focused on ecological process, function and flow. This represents a significant departure from the scientific and rationalist approaches, influenced by Fordist and Taylorist principles, traditionally found in current civil engineering and planning practice. Landscape Infrastructure moves away from the restraints of Euclidean planning and uses ‘ecology as the agent of urban renewal and expansion.’²² In this model design serves to integrate multiple scales of intervention at once. In Landscape Infrastructure, the boundaries that define the scope of projects should not be human imposed boundaries, instead they should be boundaries defined by the processes that occur on site. Watersheds are one example of a boundary that extends beyond a superimposed human boundary. Landscape Infrastructure proposes the

17 Hung, Ying-Yu. Landscape Infrastructure: Case Studies by SWA. p. 7

18 Ibid p.7

19 Ibid p.7

20 Bélanger, Pierre. Landscape Infrastructure: Urbanism Beyond Engineering. p.8

21 Belanger, Pierre. in Pollalis, Spiro N. Infrastructure Sustainability and Design book p. 290

22 Ibid p. 290

synthesis of different spatial and biophysical conditions with social and economic conditions. These amalgams are then applied on multiple scales considering the local, regional, and global flows that interact with them. Essential to the approach of Landscape Infrastructure is the transformation of 'mono-functional structures into poly-functional infrastructures'.²³ Belanger proposes that this transformation will occur through the activation of flows and processes inherent in the methodological approach of landscape infrastructure. The success of landscape infrastructure will be measured by how essential urban services are envisioned as living landscapes, responding to the factors that influence cities. Belanger outlines these services as, 'water resources and waste cycling, energy generation and food cultivation, mass mobility and network communications', their pairings representing the infrastructures of urbanity.²⁴

RELATIONSHIP BETWEEN LANDSCAPE URBANISM AND LANDSCAPE INFRASTRUCTURE

The commonalities between Landscape Urbanism and Landscape Infrastructure indicate the analogous theoretical root they share. Given the overlap of these elements and the evolutionary timeline of each theory it can be argued that Landscape Infrastructure is a corollary of Landscape Urbanism. There are numerous shared elements between the two theories. The commonalities are a flow-centric, process based approach; a central focus on infrastructure; a systemic and ecological approach, envisioning ecology as an agent of change; a focus on contextually responsive urban interventions; a call for interdisciplinarity of practice; an inclusion of time as a fourth dimension in design; a desire to increase the relevance of Landscape Architecture; and a criticality of Urban Planning and Civil Engineering.

Each of these commonalities is important to the structuring of its respective theoretical approach but they can be grouped for the sake of discussion. The recombinant categories are systemic process for design, contextually responsive urban systems and infrastructure, and interdisciplinarity and criticality of practice. The shared characteristics of these recombinant categories will be discussed followed by a presentation of the theoretical approaches to representation.

Systemic Process for Design

23 Bélanger, Pierre. *Landscape Infrastructure: Urbanism Beyond Engineering*. p. 37

24 Belanger, Pierre. in Pollalis, Spiro N. *Infrastructure Sustainability and Design* book p. 284

Landscape Urbanism proposes a landscape-process based approach to Urban Design. The approach involves the flows critical to cities, such as 'economic, socio-political, and ecological processes'.²⁵ The awareness of process supersedes the desire to create singularly aesthetic solutions. Weller relates the desire to create a "utopia of process" as discussed by James Corner and David Harvey.²⁶ This ecological, flow-centric response is likely a reaction to the scientific rationality and efficiency focused Fordist and Taylorist models. This model also positions Landscape Urbanism as the canonical approach to the drosscapes of current urban conditions created by decentralization and decreasing density.

The defining elements of Landscape Infrastructure encompass a similar systemic approach to urban design, moving towards a systems based network approach for planning and design. A few of the flows acknowledged in the approach are waste, water, energy, food, and capital. By centering the approach on the flows needed by the city urban design can transcend the superimposed human boundaries and scale design to urban demands. Belanger argues, 'the static boundaries of political jurisdictions now stand in sharp contrast to the fluid, dynamic patterns of urban growth whereby the flows of water, waste, energy, and food transcend geopolitical borders.'²⁷ Belanger also writes directly to the Fordist and Taylorist systems as they influence Landscape Infrastructure.

Contextually Responsive Urban Systems and Infrastructure

Richard Weller presents compelling arguments in his piece "An Art of Instrumentality". This work begins to frame Landscape Urbanism's interest in context and infrastructure. Weller writes, 'Landscape Urbanism is therefore not just about high-density urban areas and civic spaces, it is about the entire landscape off which the contemporary global metropolis feeds'.²⁸ This scalar apprehension of the city, coupled with the focus on flows, drives the practitioners of Landscape Urbanism to begin to craft contextually responsive projects. Charles Waldheim relates us back to the connection of early landscape practice with infrastructure and poses that modern practice requires the use of infrastructure to shape urbanity.²⁹ Early in the discussion of

25 Weller, Richard. "Landscape (sub)urbanism in Theory and Practice." *Landscape Journal*. p. 261

26 Ibid.

27 Belanger, Pierre. in Pollalis, Spiro N. *Infrastructure Sustainability and Design* book p. 282

28 Weller, Richard. "Landscape (sub)urbanism in Theory and Practice." *Landscape Journal*. p. 75

29 Rather, contemporary landscape urbanism practices recommend the use of infrastructural systems and the public landscapes they

Landscape Urbanism, Elizabeth Mossop identified 'infrastructure as the most important generative public landscape' and discussed the need to move from infrastructure (and spaces) developed solely on technical criteria to those that meet the same standards as other elements of public space.³⁰ Mohsen Mostafavi echoes this sentiment as well.³¹ Weller's piece also provides a generative node connecting it to landscape infrastructure. His assertion that 'landscape urbanist sensibilities apprehend as a hybridization of natural and cultural systems on a globally interconnected scale,' ties categorically into Belanger's approach to landscape infrastructure.³²

In Belanger's writing on Landscape Infrastructure, he seeks to 'redefine the conventional notion of urban infrastructure and expand it as a landscape of systems, services, scales, resources, flows, processes, and dynamics, which support and cultivate urban economies.'³³ Infrastructure is obviously a crucial piece of this evolutionary approach. He argues that 'infrastructure is the interface by which we interact with the biological and technological world.'³⁴ In focusing on the systems that feed cities the theory demands that traditionally mono-functional infrastructures become multi-functional urban resources. Landscape infrastructure is critical of current disconnect between infrastructure and its surroundings. Beyond the focus on the physical infrastructure that shapes urban spaces, the theory recognizes regional urbanization or horizontal urbanism that occurs in current conditions of the city.

Interdisciplinarity and Criticality of Practice

While the Landscape Urbanist position argues the advantage of the field of landscape architecture in exchanges between the built and natural systems it also asserts the failure of urban planning in proposing physical change. While the ascendancy of landscape is touted, the need for interdisciplinary practice is central to theory. Designing to accommodate the ecological and flow based

engender as the very ordering mechanisms of the urban field itself, shaping and shifting the organization of urban settlement and its inevitably indeterminate economic, political, and social futures. Charles Waldheim, *Landscape Urbanism*, p.39

30 Waldheim, Charles. *The Landscape Urbanism Reader*. p. 171

31 "Reconsideration of all the material elements (physical/conceptual, permanent/ephemeral) that together provide the infrastructure of the urban...provide new opportunities for the redefinition of the public sphere." Mostafavi, p.6

32 Weller, Richard. "Landscape (sub)urbanism in Theory and Practice." *Landscape Journal*. p. 73

33 Belanger, Pierre. in Pollalis, Spiro N. *Infrastructure Sustainability and Design* book p. 276

34 *Ibid.* p. 278

processes called for in Landscape Urbanism requires collaborative teams, which should be led by landscape architects. Many, if not all of the authors writing about landscape urbanism claim it is the way to approach the current conditions of urban design. Weller makes the case that, 'landscape urbanism warrants serious discussion because it alone seems theoretically prepared and practically capable of collapsing the divide between planning and design.'³⁵ This claim helps to elevate the relevance of the field of landscape architecture while justifying the methods of its practice. Waldheim's criticality of the practices that contribute to the current state of urban design is similar to Belanger's. Waldheim calls out post modern architects, urban designers, and urban planners. In his observation post modern architects 'practiced a kind of preemptive cultural regression' by designing objects that ignore context.³⁶ His opinion of urban designers and urban planners is equally as critical. He asserts that urban designers are guilty of, 'the aggregation of architectural elements into ensembles of nostalgic urban consumption.'³⁷ Lastly, he feels urban planners" abdicated altogether, seeking refuge in the relatively ineffectual enclaves of policy, procedure, and public therapy.'³⁸ Waldheim is also aware of the role civil engineering plays in the creation of spaces. He discusses successful landscape urbanist projects that move away from 'an optimized artifact of civil engineering toward a more complex synthesis of requirements, in which neither civil engineering nor landscape dominate.'³⁹

Pierre Belanger is critical of the role urban planners and civil engineers have played in allowing infrastructure to ignore context and value only technical metrics. Landscape infrastructure seeks to move beyond valuing only the scientific, rational systems favored in Euclidean planning and current land use models. Belanger believes that 'landscape infrastructure is a contemporary field of practice that addresses the flows of urban economies and dynamics of global ecologies.'⁴⁰ His approach does not claim that engineering will become less prevalent, but it does claim that its dominance should be questioned and shared with designers. In the same vein Belanger believes that designers must work to share the leadership regarding infrastructure. He states design must 'leverage

35 Weller, Richard. "Landscape (sub)urbanism in Theory and Practice." *Landscape Journal*. p. 71

36 Waldheim, Charles. *The Landscape Urbanism Reader*. p. 38

37 Ibid. p. 39

38 Ibid. p. 39

39 Ibid p. 45

40 Belanger, Pierre. in Pollalis, Spiro N. *Infrastructure Sustainability and Design* book p. 276

disciplinary knowledge outside the formal limits of its own capacities while engaging more synergistic collaborations.⁴¹ Belanger is also conscious of the increased funding avenues for projects grounded in infrastructure in our current cultural climate.

Representational Avenues

The methods of representation in Landscape Urbanism tie into the agency of unfolding the unseen. James Corner wrote, "imaging always exercises agency, actively unfolding, generating, and actualizing emergent realities."⁴² For Corner, constructing the spaces seen as images in the mind makes visible the invisible. The role of the designer is to use images to facilitate and instigate the creation of space. This linkage of the performative, to the visual is critical to landscape urbanism. Representing time and process in images links to the theoretical importance of time in landscape urbanism. These representations show how human-to-human or human-to-nature interactions occur, in space and over time. Mapping is another important concept as it allows process to be incorporated on the site. Corner does not describe mapping as productive of form but he recognizes that mapping can help to exert formative and organizational influence. He also delineates his differentiation between tracing, the documentation of 'what is', and mapping, the documentation of 'what is and what is not yet'.⁴³

The approach in Landscape Infrastructure lends itself to mapping and illustrating flow and linkage. Belanger discusses landscape as the structural process that allows us to perceive the world differently. He states that, 'as a projective method, representation through the mapping of complex levels of information is instrumental to the design of infrastructure and ecology.'⁴⁴ He also believes that in the process of creating infrastructure the strategies of visual communication and the research supporting those images becomes essential to design practice. Representation can 'project alternative futures' and can 'be a powerful tool to counter the technocratic dominance of other forms of knowledge.'⁴⁵ Belanger highlights sectional representation as the method of representing what is hidden from view by providing linkage between the surface and subsurface. Sectional representation has evolved to include the sectional profile or cutaway section to show even more dynamic interactions on site.

41 Ibid. p. 289

42 Corner, James. *Recovering Landscape*. P. 160

43 Corner, James in Cosgrove, Denis E. *Mappings*. P. 214

44 Belanger, Pierre. in Pollalis, Spiro N. *Infrastructure Sustainability and Design* book p. 291

45 Ibid. p. 291

Points of Evolution in Landscape Infrastructure

The corollary evolution of Landscape Infrastructure is rooted in the recombinant categories previously discussed. Belanger differentiates Landscape Infrastructure from its root in Landscape Urbanism and substantiates its evolution in these key actions:

- By challenging the control of pure 'science' disciplines of planning & civil engineering and asserting that a new model of practice is necessary. This critical observation posits that efficiency and central control are not the only metrics of success for urban infrastructure. The inclusion of ecology takes metrics a step farther. Metric reevaluation highlights the lack design standards for elements that are a crucial piece of urban fabric.
- By questioning the metrics of success for urban infrastructure the redefinition of urban infrastructure is possible. This allows the theory to expand the definition of infrastructure as a landscape of systems as proposed.
- The system of landscape creates a shift in the process of creating infrastructure from inflexible, rigid systems detached from nature to systems in flux over time and accepts varied inputs. This new model is connected with context locally to globally. This flexible model allow landscape infrastructure to move beyond traditional land use and Euclidean zoning practices that ignore geography & ecology.

Through those operations, Landscape Infrastructure grows from Landscape Urbanism to become a discrete approach to Urban Design. The theoretical evolution of Landscape Infrastructure from its roots in Landscape Urbanism expands the understanding of urban infrastructure to a 'landscape of systems, services, scales, resources, flows, processes and dynamics'.⁴⁶

OTHER THEORETICAL INFLUENCE

Drosscape

Alan Berger, in both his essay and book titled *Drosscape*, discusses the potentials for disused urban space that is created by deindustrialization. His position that designers should create cities that accommodate the 'inevitable dross' into their structure and function will serve as another metric to guide my design process and iteration. *Drosscape* differentiates itself from traditional design practice through site-based intervention that works toward a regional fragmented, chaotic system. Creating an interconnected system of wasted space that improves regional landscape deficiencies in the urban realm is one way to approach my thesis.

Formerly Urban

The concept of Formerly Urban as a defining feature of Rust Belt cities (many of which fall in the Great Lakes region), is discussed in a collection of essays that present varied ways to conceptualize futures for post-industrial change. David Grahame Shane poses a key response of the approach in his attempt to define what exactly constitutes a 'formerly' urban area. He asserts that the old categories that drove industrial economies no longer function, therefore actors in this new paradigm need to adapt. Julia Czerniak questions a singular approach from definition of formerly urban as illustrating a shrinking or dying city. She poses the possibility that cities need not grow in our traditional definition. This repositioning of what 'growth' is in or modern economies will be a crucial element of my thesis. Return to what has been is not the intention, movement towards what can be is. Additionally, she acknowledges the challenge to design-driven change in these areas and cites a personal rationale for choosing this topic and site (lack of professional design expertise). Another term introduced for cities like Erie is 'weak market cities'. The definition that emerges for this term is rooted in the transition from the loss of an industrial identity and the current process of searching for an economic niche. That definition could evolve to include a more complex understanding of the future niche that moves from a solely economic base to a more sustainable model that accounts for social, ecological, and economic needs. The need for new activation and strategies to encourage urban life in the context of these cities is a concept to explore through research of precedents and design iteration.

Creating Shared Value

The concept of Creating Shared Value was proposed by Michael E. Porter and Mark R. Kramer in a series of articles and discussions beginning in 2006. The 2011 "Creating Shared Value: Redefining Capitalism and the Role of the Corporation in Society" was my first exposure to this important concept. The goal of creating shared value is an evolution of corporate social responsibility (CSR) that many of us are familiar with. Businesses working to create shared value position social issues at the core of their business model and use that lens to identify openings for profit. This model allows the application of business innovation, knowledge, and skill to larger social problems. Through this approach, business profits from creating solutions to these problems and society sees improvement in areas of concern. By directly linking community health and economic benefit, CSV moves beyond philanthropy or corporate responsibility. Kramer and Porter recommend three approaches to achieving this model. First, by reinvisioning markets and products business can tap into demand that is currently unmet in the marketplace.⁴⁷ If the business can identify the 'societal needs, benefits, and harms' to be met through their offerings, even as they change over time, they can capitalize on the opportunity, especially in new markets.⁴⁸ Secondly, recognizing opportunity within internal supply chain and improving efficiency can create shared value. The externalities of business practice often have unacknowledged cost. Diminishing the costs of energy use and logistics, resource consumption, procurement, and distribution all provide opportunity to create value. Lastly, acknowledging that businesses do not operate in a vacuum and they rely on the infrastructure and other companies around them leads us to clustering development. Local cluster development that concentrates similar firms, the support for those businesses, education in the sector, and the infrastructure to support them helps regional development as well.

Achieving this model globally would require a paradigm shift within the business world, a challenge the authors acknowledge. Despite the challenge of implementing this model on a global scale, the working principles it presents in its methodology are helpful when considering how to reuse post-industrial land in cities like Erie.

47 Creating shared Value, Kramer Porter 2011 p 7

48 Ibid. p.8

APPLICATION OF THEORY IN THIS DOCUMENT

Parts of each theoretical approach were useful in the transition from the research phase to the design exploration of my site. The theoretical research allowed me to frame my approach to city and site specific recommendations while considering their regional impacts. Using the theoretical literature to shape my approach allowed me to balance the demands of design and planning within the project. The discrete categories I have identified to include in the design approach are waste, energy, agency, water, economy, cycles, food, ecology, and connection. Within each of these categories specific metrics are proposed for collection to help quantify the success of the pilot projects.

THEORY

IMPORTANCE TO THESIS

APPLICABILITY AT EACH SCALE

Landscape Urbanism



Great Lakes Region



Lake Erie Region



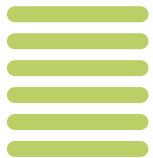
Erie Region



GAF Site



Landscape Infrastructure



Drosscape



Shrinking Cities



Creating Shared Value



Analysis

APPLICABLE SCALE

PRINCIPLES CENTRAL TO THESIS APPROACH

DESCRIPTION

Waste Energy Agency Water Economy Cycles Food Ecology Connection



Landscape Urbanism provides the framework for considering the systems that impact urban design. The approach incorporates of temporal change into the process of planning and design. This theory is novel in the field of urban design for Considering ecological function as an aspect of urban systems.



Considering the flows that feed cities and the waste they generate allows for management and sourcing decisions. In this approach ecology is tied to economy, social success is tied to physical space, and the technological is paired with the organic.



Understanding the inevitability of wasted space in urban areas and planning for that transition is the main element drawn from this theory. Acknowledging that underuse of urban space is part of the urban condition allows designers to adjust for it and harness the opportunity it provides.



The Great Lakes region holds many cities that fit this moniker. This approach provides the consideration that not all 'growth' has to follow the patterns it has historically. Creating proposals that reuse the existing urban fabric in ways that are appropriate to the patterns of the area.



Tying business success to the potential to address societal problems is a high-minded approach that can create significant benefit for both parties. This approach bridges the gap in the design theories and creates an incentive for development or business to engage in considering the flows and challenges of cities.

Case Examples

The cases presented are selected as examples of development, design, or policy choices relevant to the proposals of this document. They are intended as quick summaries with links to more information so that readers can gain basic understanding and



Analysis

explore more, if desired. These projects were chosen as examples based on personal analysis and exposure. They present a wide range of approaches and illustrate how achieving the goal of this proposal is possible.



Frozen Lake Erie Photo Credit: rabesphoto

VIA VERDE **Bronx, New York**

What is it? A model example of mixing affordable and market rate housing, prioritizing sustainable choices, and integrating healthy living into design.

Why is it here? To provide an example of how high-quality design can integrate disparate uses and solve challenges.

Exemplar approaches: Integrating income and ownership levels, passive cooling, design to improve health, green space, urban agriculture, and brownfield reuse.

Applicable Scale(s): Erie and Site



Photo Credit: Jules Antonio

Description: The project is the end result of collaboration between two architecture firms and two developers submitting their proposal for the site to a design competition held in 2006. On the 1.5 acre site it includes 222 mixed-income residential units housing 400 people, 40,000 square feet of green roof or open space, and 7,500 square feet of retail space. Tenants in the retail space include a clinic extension of Montefiore hospital and a pharmacy. The green roofs, building orientation and design for maximized solar gain and building width are all elements that help reduce energy needs on site while improving resident's quality of life.

Links: <http://uli.org/case-study/uli-case-studies-via-verde/> <http://www.viaverdenyc.com/>
http://www.ryerson.ca/carrotcity/board_pages/housing/via_verde.html

LUFA FARMS
Montreal, Canada

What is it? An urban, rooftop farm

Why is it here? By recognizing a need for urban food production the project improves agricultural practices leads to productive reuse of rooftop sites.

Exemplar approaches: Urban rooftop farming, nutrient management, water management, and distribution

Applicable Scale(s): Great Lakes, Lake Erie, Erie, Site



Photo Credit: Fadi Hage

Description: Lufa farms began operation of their 31,000 square foot rooftop farm to provide produce to feed growing urban populations at a time when current farming practices are proving to be unsustainable. Their response was to create a hydroponic system that recirculates all of the water they use, keeping nutrients out of the watershed and reducing their own wastewater. Locating their greenhouse on a roof allows them to capture the benefits of the building and use below, sharing heat and using the carbon dioxide expelled from the air circulation system. In addition, the urban location provides added heat because of the urban heat island effect. Lufa’s proximity to customers allows them to harvest and deliver in the same day, removing refrigeration from their production chain. From their initial prototype they are able to feed 2,000 people, with boxes starting at \$30 a week. Their interface provides access to a modern CSA with online ordering, modification options, and delivery selection as well as an online marketplace.

Links: http://www.ryerson.ca/carrotcity/board_pages/rooftops/lufa_farms.html https://lufa.com/en/science_behind_lufa

WAITANGI PARK Wellington, New Zealand

What is it? A waterfront park with filtration wetlands

Why is it here? The park addresses ecological concerns by daylighting a local stream and treating the water in linear wetlands it before discharged into the larger watershed.

Exemplar approaches: Wetland filtration to remove sediment and pollutants, creation of high-quality public space while treating water

Applicable Scale(s): Erie and Site scale



Photo Credit: Phillip Capper

Description: The design of this 6 hectare urban park reflects the nearby historical stream path and wetland systems that were irrevocably altered by an earthquake and human settlement. The park covering 30% of the Wellington waterfront is a mix of urban park, skate park, playground, and constructed wetland. Historically, the Maori used the area as a food resource, boat launch, and freshwater source. The park utilizes a series of sedimentation, separation, filtration, and treatment methods in the process of preparing the daylighted stream for discharge into the Wellington Harbor. Before the stormwater is discharged, it is circulated into cisterns used within the park for irrigation. The majority of the watershed that drains to this area is covered in impermeable surface, leading to runoff contaminated with heavy metals and polycyclic aromatic hydrocarbons (PAHs). The monitoring of filtration performance has shown a reduction in fecal coliform levels between 90-99%. Additionally, heavy metal levels have reduced to levels below the water quality limits.⁴⁹

Links: <http://www.rcaforum.org.nz/waitangi-park-wellington-2/> http://www.wellingtonwaterfront.co.nz/docs/A_100_masterplan.pdf

⁴⁹ Waterfront Stormwater Case Studies, Green Futures Lab http://greenfutures.washington.edu/pdf/wss_StormwaterPrecedent_082911.pdf
Analysis

LIVING DOCKS

West Palm Beach, Florida

What is it? A floating public space that integrates ecological function

Why is it here? The project integrates functional space with living systems in a way that improves marine habitat.

Exemplar approaches: integration of living systems and built elements to create a hybrid infrastructure, integration with waste from restaurant, natural water filtration

Applicable Scale(s): Site



Photo Credit: Fergusonta

Description: This 400-foot long dock is triple the typical width of normal docks. In the center of the overwater extension of public space are a series of depressions. Native mangroves, spartina grass, and oysters are planted or grown in the depressions. Not only is the dock an extension of public space, it serves as a tie-up area for boaters, a water taxi stop, and oyster incubator. Interestingly, the project incorporates discarded oyster shells from local restaurants as they provide an ideal growth medium for encouraging oyster colonization.

Links: http://www.wpbwaterfrontproject.com/?page_id=5 http://greensource.construction.com/features/Solutions/2010/april/1004_Hope_Floats.asp <http://dirt.asla.org/2010/04/12/west-palm-beachs-living-dock-also-an-oyster-based-water-filtration-system/>

WASTEWATER MEMBRANE BIOREACTORS Traverse City, Michigan

What is it? A wastewater treatment system retrofit to increase quality of output

Why is it here? Precedent project for membrane bioreactor filtration and Great Lakes Regional example of water management

Exemplar approaches: Membrane bioreactor wastewater treatment, community support for higher water quality

Applicable Scale(s): Great Lakes, Lake Erie, Erie, & Site



Photo Credit: Aquabio Ltd.

Description: In order to meet increasing demand without the option to expand its wastewater treatment plant Traverse City began looking for new options. Public input showed a desire to move beyond the current level of treatment and improve water quality. Membrane bioreactors were proposed as the best solution to meet increased water quality in the current wastewater treatment plant footprint. The WWTP serves more than 45,000 residents, treating wastewater from the surrounding communities. The treatment draws treated effluent into the hollow filtration tubes through suction. Backflows are automatically programmed into the system to reduce filter clogging. The operations of the plant show that outflow benchmarks are well below targeted levels, which are significantly lower than the State's treatment requirements. Total suspended solids and biochemical oxygen demand were below detectable levels in tests. Ammonia and phosphorus were reported at 0.5 mg/l. The desired standards were 1mg/L of ammonia and 0.5 mg/L phosphorus. The DEQ standards for those are 11mg/L and 1mg/L respectively.

Links: http://www.glslcities.org/TraverseCity_Treatment_Plant.pdf

LAND BRIDGE
Vancouver, Washington

What is it? A non-traditional approach in order to connect divided areas

Why is it here? A novel approach to increasing pedestrian access across a roadway

Exemplar approaches: Pedestrian access beyond the model of stairs or traditional pedestrian bridges, landscape integration

Applicable Scale(s): Site



Photo Credit: Visitor7

Description: The project was designed as part of the Confluence Project connecting the Renaissance Waterfront Trail and Fort Vancouver. Historically, the site housed the first European trading post in the Pacific Northwest. The land bridge spans 190 feet over the roadway and incorporates a 3,800 foot long trail. The bridge is 40 feet wide and includes a pedestrian and bike path, plantings, lookout spaces, and educational elements.

Links: http://aspirebridge.com/magazine/2009Summer/vancouver_land_bridge_sum09.pdf www.jonesandjones.com/work/pdf/natural/Vancouver_Land_Bridge.pdf <http://www.confluenceproject.org/project-sites/vancouver-land-bridge/>

RIVER WALK PARK

Milwaukee, Wisconsin

What is it? A park on a formerly under used site that enlivens public space

Why is it here? By transforming a parking lot into public space the project increases economic development while improving stormwater management.

Exemplar approaches: Public waterfront design, stormwater management, history reflected in design, brownfield reuse

Applicable Scale(s): Site



Photo Credit: Google Streetview

Description: This public plaza was created in 2010 and is part of the Milwaukee Riverwalk. The design team, Stoss Landscape Urbanism, was selected from a competition for the site. In addition to the stormwater management aspects of the site the project uses river water to irrigate the site plantings. The site is designed to create fishing access meeting ADA standards. The site design integrates hardscape with plantings to blend the spaces together, integrating urban with natural. The material palate, site furniture, and lighting scheme reflect the industrial character of the site. The site illustrates how economic and environmental improvement can go hand in hand.

Links:

<http://www.archdaily.com/155956/erie-street-plaza-stoss/>

<http://www.lafoundation.org/research/landscape-performance-series/case-studies/case-study/615/>

<http://www.stoss.net/projects/2/erie-street-plaza/>

SOUTHWIRE'S 12 FOR LIFE PROGRAM

Multiple Locations—Carrollton, Georgia; Florence, Alabama; Georgia Department of Corrections

What is it? An example of a business venture that creates shared value

Why is it here? By recognizing a gap and filling it, Southwire is able to improve business while creating social benefit .

Exemplar approaches: Creating Shared Value (CSV)

Applicable Scale(s): Great Lakes, Lake Erie, Erie, Site



Photo Credit: NASA

Description: Southwire was facing a shortage of eligible workers and identified that educational attainment in their area was failing. To help solve both issues the company initiated a program with the Carroll County School System. The program works with the students most at risk for not completing high school. Students attend classes and work part time for Southwire. Students not only complete school they learn valuable work and interpersonal skills. The program is also exciting because it teaches the participants the power of their own agency. The program has been well received. In the first five years of work, 420 students who were graduation risks have graduated.

Links: http://www.southwire.com/documents/new_12_brochure.pdf <http://www.southwire.com/ourcompany/sustainability/12-for-life.htm> <http://12forlife.com/results.html>

EVERGREEN BRICK WORKS

Toronto, Canada

What is it? An adaptive reuse of a post-industrial site to create a park and community amenity

Why is it here? The project reuses a former industrial site to create a public amenity and connect ecology with culture.

Exemplar approaches: post-industrial reuse, adaptive reuse, water management practices, integration of nature, culture, and community

Applicable Scale(s): Erie, Site



Photo Credit: Loozrboy

Description: This multidisciplinary project shows the potential of what industrial sites can become. Instead of razing the property, remediation and adaptive reuse have created a richer site for public use. The former brickworks is part of Toronto's Lower Don Lands. The site redevelopment focused on collaboration and environmental sustainability. The project integrates the built fabric with landscape performance and targeted LEED Platinum certification.

Links: http://www.asla.org/uploadedFiles/CMS/Advocacy/Federal_Government_Affairs/Stormwater_Case_Studies/Stormwater%20Case%20219%20Evergreen%20Brick%20Works,%20Toronto,%20Canada.pdf
http://greensource.construction.com/green_building_projects/2011/1109_Centre_for_Green_cities.asp

<http://www.sabmagazine.com/blog/2011/12/19/evergreen-brick-works/>

HARBOR BATHS, ISLANDS BRYGGE Copenhagen, Denmark

What is it? A swimming facility in a natural body of water

Why is it here? To show how commitment to using a public amenity can bring new life to former industrial waterfronts.

Exemplar approaches: creation of new types of public space, recreational swimming space

Applicable Scale(s): Site



Photo Credit: Milgrammer

Description: The most famous of the Copenhagen harbor baths is the Islands Brygge site featuring a jumping platform that looks like the bow of a ship. This transition to harbor swimming would not have been possible without the commitment from the city to reduce combined sewer overflows (CSOs). Historically, the harbor had been used for swimming but in the 1950s it was banned. Capitalizing on the improved water quality the city is now able to offer residents an urban swimming experience. The shape of the Islands Brygge baths are designed to accommodate lifeguard line of sight. The baths are constructed to allow users of all abilities to swim, socialize, and be outside.

Links: http://www.nyc.gov/html/ia/gprb/downloads/pdf/Copenhagen_Harbour%20Bath.pdf
<http://www.dac.dk/en/dac-life/copenhagen-x-gallery/cases/harbour-bath-at-islands-brygge/>

<http://www.dac.dk/en/dac-cities/sustainable-cities/all-cases/water/copenhagen-from-sewer-to-harbour-bath/>

BO01 & WESTERN HARBOR **Malmo, Sweden**

What is it? Post-industrial sustainable neighborhood redevelopment

Why is it here? A city-wide approach to sustainable development has led to new and exciting post industrial reuse

Exemplar approaches: post-industrial sustainable development, urban design

Applicable Scale(s): Erie, Site



Photo Credit: La Cita Vita

Description: The strategic redevelopment of Malmö's former industrial site shows the potential for other cities facing the same concerns. The project is designed to be 'a city for people and for the environment'. It's a striking departure from other redevelopment of former urban sites. The city also markets their approach to tourists and other cities, generating revenue from their sustainability approach. The redevelopment of Malmö's western harbor has seen former shipbuilding spaces be converted into manufacturing spaces for wind turbines and warehouses be reused as university buildings. The area of Bo01 was the first part of the project constructed, built to showcase what sustainable development can look like and what it can achieve. The buildings in this section are massed to protect visitors and residents from the strong winds that blow across the site. The project uses vacuum collection for household waste and manages stormwater on the surface. Stormwater elements are integrated into the urban fabric through parks and exposed conveyance. The district uses solar, wind, biogas, and incineration for energy production. Criticism of the project includes a lack of diversity for residents, high prices of the housing, and an inadequate parking supply. The project provides both good and bad examples of sustainable development.

Links: http://www.energy-cities.eu/IMG/pdf/BO01_EN.pdf <http://www.malmo.se/download/18.7101b483110ca54a562800010420/1383649557450/westernharbour06.pdf> <http://www.fomento.gob.es/NR/rdonlyres/9D6A5DD0-D460-4728-9882-71E4E5EDD3EF/95899/5.pdf> <http://www.urbangreenbluegrids.com/projects/bo01-city-of-tomorrow-malmo-sweden/> <http://www.symbiocity.org/en/approach/Cases-undersidor/Western-Harbour-tomorrows-here-today/>

GROWING POWER

Milwaukee, Wisconsin

What is it? An urban farming operation

Why is it here? Growing Power is an exemplar case of what urban agriculture can do in cities socially and environmentally.

Exemplar approaches: community agriculture, aquaculture, composting system

Applicable Scale(s): Erie, Site



Photo Credit: Ryan Griffis

Description: Growing Power is a community-based agriculture nonprofit in Milwaukee, WI focused around providing affordable access to healthy food. Education and community building are important components of their mission. The process of 'growing' soil is a crucial component in their success. Growing Power has expanded from a single scale urban farm to encompass a network of food production, community advocacy, and education. In their main Milwaukee site, they utilize a variety of urban agriculture systems including aquaponics, greenhouses, hoopouses, apiary, poultry cultivation, and composting and vermiculture for soil creation. The Milwaukee headquarters is the primary site for their education and engagement programs that are then replicated elsewhere. Growing Power is hoping to expand their operation at the Milwaukee headquarters through the construction of a vertical greenhouse that will allow integration of their production, education, and retail spaces within one building. The vertical greenhouse will feature the use of a bio digester, solar orientation, photovoltaic panels, and water harvesting to help close the production loop at Growing Power.

Links: <http://www.growingpower.org>
<http://www.yesmagazine.org/issues/food-for-ev-eryone/growing-power-in-an-urban-food-desert>
<http://www.growingpower.org/Press%20kit%205-20.pd>

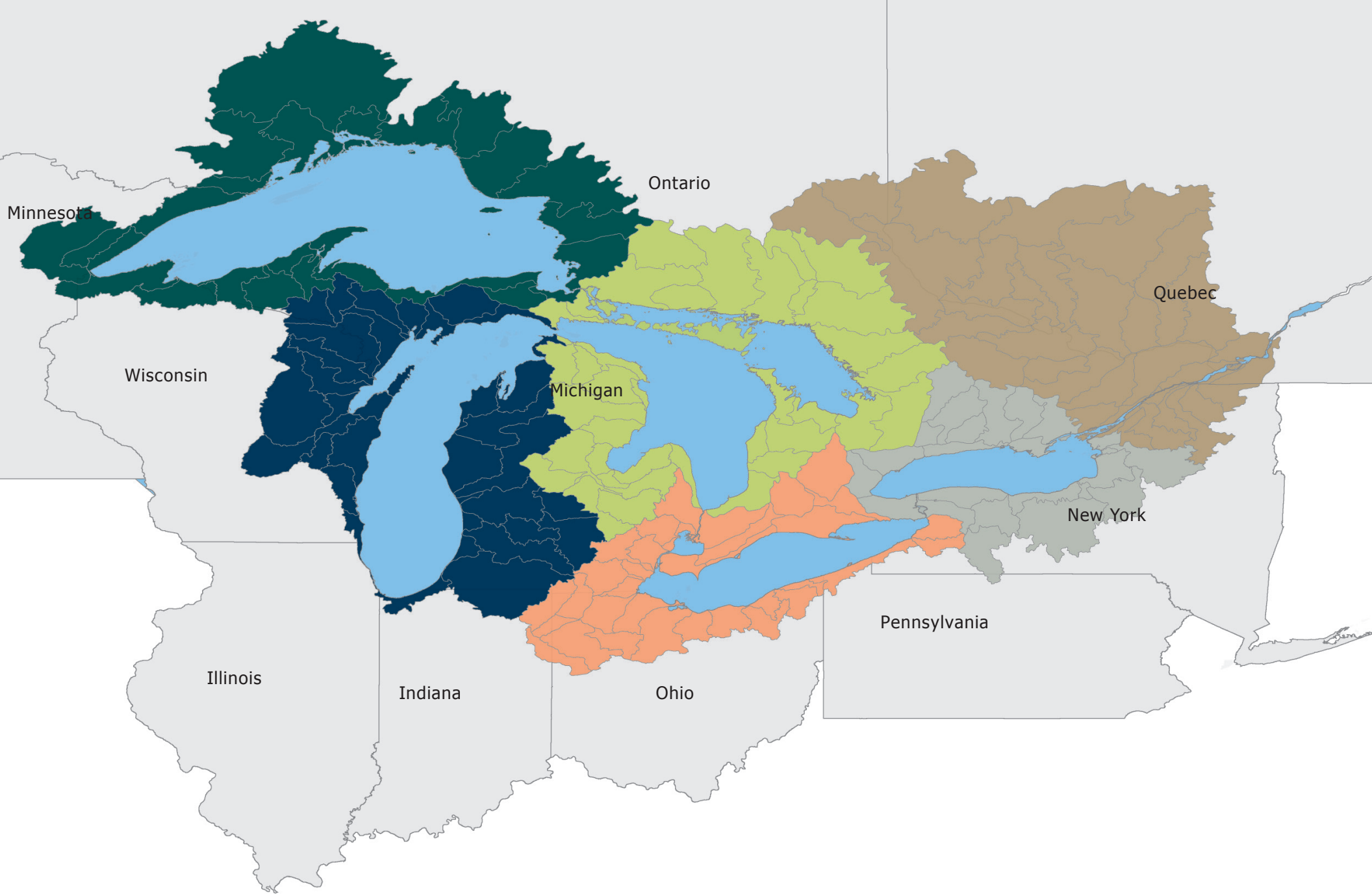


Regional Information

Cascade Creek

REGIONAL INFORMATION





Regional Information

Great Lakes Region

The study boundary that is used in this project is the extent of the watershed of the Great Lakes. The five Great Lakes are Superior, Michigan, Huron, Erie, and Ontario. The lakes border two countries, two provinces, and eight states. This region covers 94,000 square miles and contains approximately 5,500 cubic miles of water.⁵⁰ The lakes were created by glacial movement and melt and are replenished, to a small degree, by groundwater, runoff, and precipitation. Lake levels fluctuate over time and can change up to 24 inches in a single year. The lakes played a role in the historical development of the United States and Canada and continue to contribute to the development of each nation. Once European settlement began the sensitive ecosystem that developed after the glaciers receded was threatened. The Great Lakes have served as transportation routes, provided valuable resources and economic potential, and provided areas hospitable for settlement. Shipping played a role in the local economy as early as 1825 with the creation of the Erie Canal. Industrialization of the region began in the early 20th century with steel mills, paper mills, automobile production, and chemical manufacturing. A culture of resource exploitative practices like clear cutting, intensive agricultural production, overharvesting of fish and wildlife, and industrial production reliant on water caused harmful impacts on the ecosystem. The information provided in this section is a brief overview to the complex, engaging systems in the Great Lakes.

50 "About the Great Lakes | Great Lakes | US EPA." N. p., n.d. Web. 16 May 2014.



LAKE SUPERIOR

AVERAGE DEPTH: 483 ft.
MAXIMUM DEPTH: 1,332 ft.
VOLUME: 2,900 cubic miles
WATER SURFACE AREA: 31,700 sq. miles

LAKE MICHIGAN

AVERAGE DEPTH: 279 ft.
MAXIMUM DEPTH: 925 ft.
VOLUME: 1,180 cubic miles
WATER SURFACE AREA: 22,300 sq. miles

LAKE

AVERA
MAXIM
VOLUM
WATER



HURON
 AVERAGE DEPTH: 195 ft.
 MAXIMUM DEPTH: 750 ft.
 VOLUME: 850 cubic miles
 WATER SURFACE AREA: 23,000 sq. miles

LAKE ERIE
 AVERAGE DEPTH: 62 ft.
 MAXIMUM DEPTH: 210 ft.
 VOLUME: 116 cubic miles
 WATER SURFACE AREA: 9,910 sq. miles

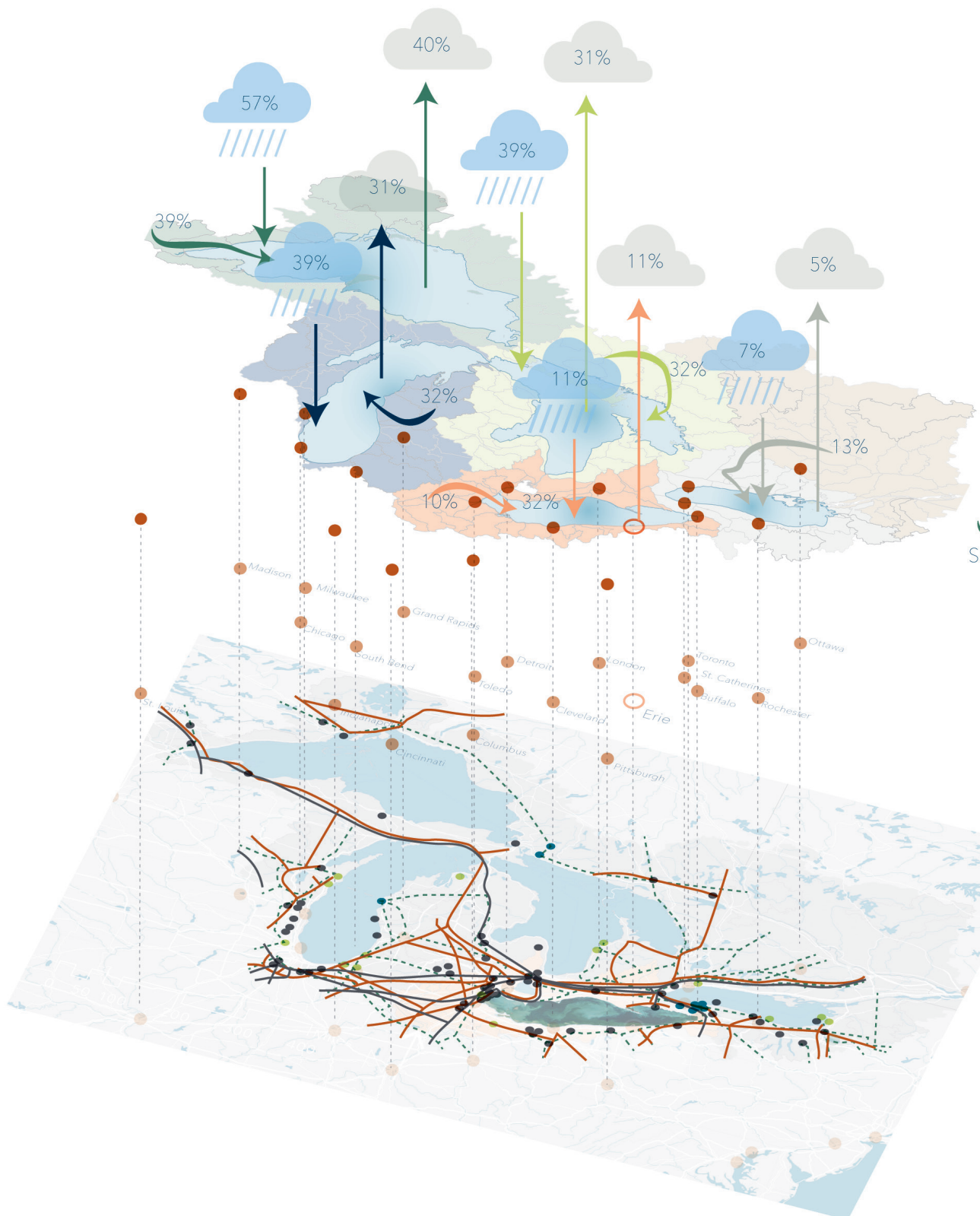
LAKE ONTARIO
 AVERAGE DEPTH: 283 ft.
 MAXIMUM DEPTH: 802 ft.
 VOLUME: 393 cubic miles
 WATER SURFACE AREA: 7,340 sq. miles

GEOGRAPHIC

The five lakes that make up this complex system vary greatly in volume, depth, miles of shoreline, and population. The lakes were created 20,000 years ago at the warming of the last ice age. The glaciers which gouged out the landform and melted to create the lakes were up to 2 miles thick. The lakes as we know them today were formed between 3,500 and 4,000 years ago. There is a total of 10,210 miles of shoreline in the great lakes, which contributes heartily to the 95,471 miles of shoreline in the United States.⁵¹ The Great Lakes holds 6.5 quadrillion gallons of water, yet less than 1% of that volume is renewed annually. The sectional profiles of the lakes illustrate an interesting variety of depth to each of the lakes. Lake Superior is by far the largest and deepest of the five lakes. Lake Erie is the smallest lake by volume and depth with a shoreline length 100 miles greater than Lake Ontario. An interesting feature of the Great Lakes system is the Niagara Escarpment, the most notable piece being Niagara Falls. Over a distance of nearly 35 miles the height of the system drops nearly 330 feet.⁵² There is a single drop of 167 feet at Niagara Falls. While all of the lakes have their own individual characteristics they form one hydrological system.

51 <http://oceanservice.noaa.gov/facts/shorelength.html>

52 http://www.canadiangeographic.ca/atlas/themes.aspx?id=watersheds&sub=watersheds_flow_thegreatlakes&lang=En



Non-Antropogenic Water Cycle



Infrastructure in the Great Lakes

- Gas Pipeline
- Oil Pipeline
- - - Power Lines
- Fossil Fuel Power Plant
- Hydroelectric
- Nuclear

DEMOGRAPHICS

An estimated 40 million people currently call the Great Lakes region home. Indigenous People arrived in the region around 10,000 years ago. There is documented use of metals and established fishing communities from six thousand years ago. Estimates for the region in the 16th century place 60,000 to 117,000 inhabiting the shores of the Great Lakes.⁵³ The early inhabitants grew corn, beans, tobacco, and squash. They settled in scattered villages that relocated as the surrounding area was exhausted, once to twice in a generation.

The first European fort was built in 1670, at the Straits of Mackinac although exploration of the region began in the early 1600's. The fort at Kingston, Ontario was the first fort in the lower Great Lakes and was built only three years after the first fort. Conflicts over the region between the French and British began in 1759 and continued between the British and Americans until 1812. After the conclusion of the War of 1812 settlement of the region began in earnest, to the disadvantage of the indigenous people.

While the region has maintained population levels it has not grown at the same rate as the national rates for the United States and Canada. Between 1970-1990 the average growth rate for both countries was 22%. In that same period the region grew less than 1%. The population trends in Canada do differ from that of the US. Ontario grew 31% between 1970-1990. The states surrounding the great lakes saw a population growth of 1.7% in that same period.

ECONOMIC

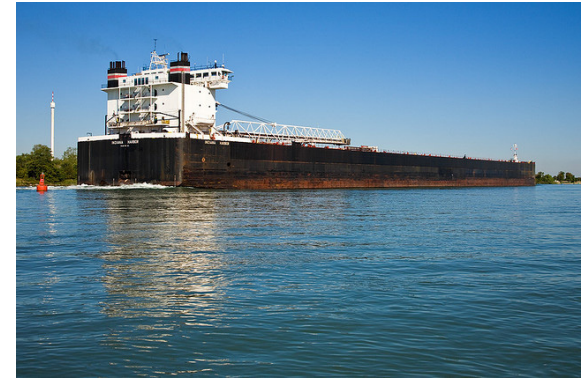
The economic power of the Great Lakes region is substantial; if it were an independent country the 4.5 trillion dollars in gross regional product would make it one of the largest in the world. A study of 2010 figures by the Marin Institute shows 226,833 jobs, generating 14.1 billion dollars in personal income, tied to maritime commerce in the Canada and the United States.⁵⁴ Businesses engaging in maritime activity on the Great Lakes & St. Lawrence Seaway generate 33.6 billion dollars in revenue. Maritime commerce generates 4.6 billion dollars at the local, state/provincial, and federal levels. Protecting the economic potential around the lakes is crucial for continued regional prosperity. Industrial use has a strong historical presence in the region, with manufacturing making up 66% of the United States industries in 2009.⁵⁵ The second largest share of the US industries was tourism and recreation, at 14%. Shipping and agriculture each played a strong role in industry in the US at 8% each. The economic health all of these categories is directly linked to the availability of water and the health of the ecosystem. The commercial fishing industry harvested on average about 19.3 million pounds annually between 2005-2009. The valuation for that harvest was 22,506,000 dollars in 2010.⁵⁶ Lake Michigan contributes the highest values for both harvest and value at 32.9% and 39.6% of the totals respectively. Lake Erie's harvest contributes the second highest values. Sport fishing contributes an estimated 4 billion dollars into the regional economy.⁵⁷

54 http://www.greatlakes-seaway.com/en/pdf/eco_impact_full.pdf

55 <http://www.miseagrant.umich.edu/downloads/economy/11-203-Great-Lakes-Jobs-report.pdf>
page 2

56 http://glmris.anl.gov/documents/docs/Commercial_Fisheries_Report.pdf p 18

57 <http://www.glerl.noaa.gov/pr/ourlakes/economy.html>



The 1,000 foot long Great Lakes Freighter Indiana Harbor on the Detroit River

Photo credit: James Marvin Phelps

Ice fishing on lake Ontario

Photo credit: Lake Central



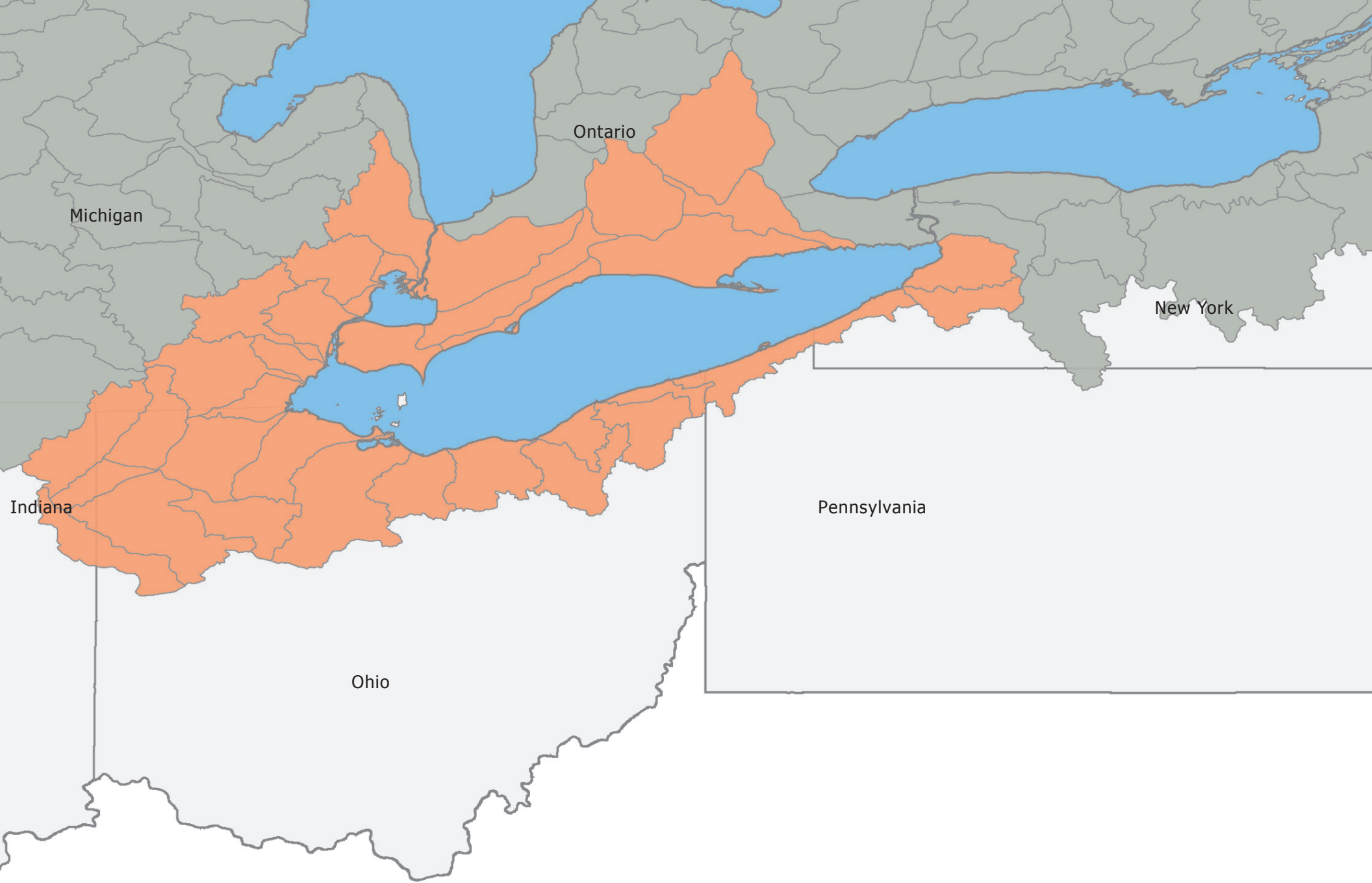
ECOLOGICAL

The Great Lakes Basin is home to more than 3,500 species and the type of ecosystem changes through the range of the lakes. The northern sections of the lakes are forested, with coniferous and hardwood forests. The southern sections of the lake are typically prairies and grasslands. Prior to human habitation the shorelines and lakeshore areas contained numerous marshes, wetlands, and dune communities. The introduction of invasive aquatic species has had a negative impact on native fish and shellfish communities. Eutrophication and oxygen depletion, from various causes is a serious concern to the health of the lakes. Hardening of shorelines and increased impervious surface has also had profound negative impacts on the regional ecosystem. Anthropogenic pollution of lake water and sediments from industrialization and pesticides causes concern with bioaccumulation and biomagnification in food webs. Pollution in the region presents issues because of the rate of system outflow, biological cycling, resuspension of sediment, and water retention time. Of the five lakes Erie is the most susceptible to the impacts of pollution from anthropogenic sources.

INTERNATIONAL AGREEMENTS

Given the complexity of a multinational, multiprovince, and multistate region agreements concerning boundaries, use, and management of the lakes have evolved over time. The Boundary Water Treaty was the first such document. The treaty establishes the International Joint Commission (IJC) to resolve disputes over water use. The process began in 1905 when the International Waterways Commission was created to advise both nations on hydropower generation. In 1909 the Boundary Waters Treaty was signed and began the IJC's relationship with studying the issues of the lakes. Water pollution was one of the first concerns addressed by the IJC in 1912. Their findings, in 1919, were that an international agreement was necessary to address pollution. The IJC continues to conduct studies and address the concerns facing the region today. The Great Lakes Fishery Commission was established in 1955 to address the concerns of invasive species impacting the fishing industry. The sea lamprey, a parasitic fish, had severely impacted fish populations as it expanded in the region. Fish stocking and restoration programs are currently part of the rehabilitation efforts led by the Great Lakes Fishery Commission. The biggest turning point in addressing the water quality issues facing the lakes came after years of abuse. Events like the 1969 Cuyahoga River fire and the massive algal blooms in near shore areas leading to fish kills in the 1960's signaled a change was necessary. In 1972 the Great Lakes Water Quality Agreement

established common objectives for the reduction of pollutants and the creation of research and monitoring programs. It was demonstrated that agricultural use and urban areas were impacting water quality. This is an important step as it identified non-point source pollution as an issue in addition to point source pollution. In 1978 another agreement was reached regarding the lakes. This agreement moved beyond the 1972 Agreement, which outlined methods to protect the lakes, and called for restoration of the lakes. The 1978 agreement addressed the challenge of persistent toxic chemicals and the impacts they had. It correlated issues in birth defect and bird reproduction as well as an increase in tumors on fish with polychlorinated biphenyls (PCB's) and pesticides. In 1985 the Great Lakes Charter established a good faith agreement between the states and provinces bordering the region. It deals with water management and use issues like diversion. Another quality agreement was not established until 1987. The 1987 Agreement worked to create Remedial Action Plans, Areas of Concern, and Lakewide Management Plans. This agreement focused on an ecosystem approach to address concerns and begin remediation. In 2001 an Annex to the Great Lakes Charter was signed to reaffirm commitment to the principles established in the 1985 Charter. Building on all of these agreements the Great Lakes Compact was signed into effect in 2008 creating a binding agreement regarding use and management of the shared resource.



Lake Erie Region Overview

While Lake Erie was one of the first to be created by glacial retreat it was the last to be discovered by European settlers. The lake is the most productive of all of the Great Lakes, the majority of fish caught for human consumption are caught in Lake Erie. The lake is the shallowest in the system of lakes and is the most densely urbanized, creating the potential for serious water quality problems. Lake Erie is the southernmost of the Great Lakes and holds nearly one third of the Great Lakes' population. Historically Lake Erie was a center for commercial fishing, paper production, and steel manufacturing. Wind can push water from one end of the lake to the other, creating height differences up to 16 feet. Similar to the rest of the Great Lakes, manufacturing, shipping, fishing, and tourism in addition to agriculture are the economic drivers of Lake Erie.

GEOGRAPHY

Lake Erie borders one province, Ontario, and four states, Michigan, Ohio, Pennsylvania, and New York. The watershed also extends into the Northeastern corner of Indiana. The Lake Erie watershed covers 30,140 square miles. Nearly all of the land in the watershed is almost completely urbanized or agricultural. It is the smallest of the Great Lakes due to its shallowness compared to the rest of the system. There are three distinct basins within Lake Erie. The western basin borders Ontario, Michigan and Ohio and contains the islands area. It extends to Cedar Point, OH and Pelee Point, Ontario. The central basin extends eastward from the islands to Long Point, Canada and Erie, PA. The eastern basin extends to Niagara Falls. The three basins increase in depth as they

LAKE ERIE

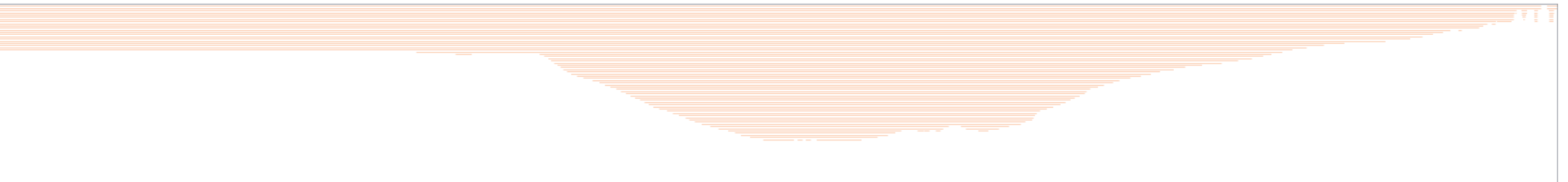
LENGTH: 241 miles

BREADTH: 57 miles

TOTAL DRAINAGE BASIN AREA: 30,140 sq. miles

REPLACEMENT TIME: 2.6 years

move eastward with the eastern basin being significantly deeper than the other two. While the deepest point in the lake is 210 feet the average depth of the lake is 62 feet. Erie's deepest point is less than half that of the average depth of lake Superior (483 feet). The shallow depth of Lake Erie means it warms the most in the summer and freezes fastest in the winter. The geological formation of Lake Erie provides the region with the agricultural, industrial, and recreational opportunities. There are 31 Lake Erie Islands and they are surrounded by an ecosystem unique in Lake Erie and the Great Lakes. Given the lake's small size water is only retained in it for about 2.6 years and volume is renewed from upstream. While the volume of the lake, 116 cubic miles is small compared to the



rest of the Great Lakes 11 million people have their drinking water supplied directly from the lake. Interestingly, combined sewer overflows dumped an estimated 8 billion gallons of sewage into the lake in 2004. There are approximately 817 miles of shoreline around Lake Erie. Predictions on the impacts daily use and of climate change vary for the region but the predictive models show a decrease is likely. The decrease in lake levels is predicted to be between 3 - 6 1/2 feet over the next 70 years. That decrease would mean shorelines move lakeward between half a mile and nearly 4 miles, creating new, natural shoreline.⁵⁸ The geographic location and the lake itself creates an environment well suited for agricultural production. Given the retreat of previous glacial lakes the soils around the lake are ideal for crop production.

DEMOGRAPHICS

The Northern coast of the lake was settled by the Attawandaron, multiple Iroquois tribes settled the Eastern portion of the lake, and The Eries settled the Southern shore of the lake. Between 1651 and 1657 the Iroquois conquered their neighboring tribes in the Beaver Wars. The lake was first discovered in the late 1600's by European settlers and exploration of the lake was limited due to conflict between the French and Iroquois. Settlement around Lake Erie was prolific due to the availability of resources, potential for industry, and temperate climate in the Great Lakes. Since the original European settlement of the Ohio Lake Erie watershed, over 90% of our Lake Erie marshlands have been filled or converted to some other use.⁵⁹ In 2010 the population for the region totaled 12.4 million residents. 1.9 million or about 15% are Canadian while the remaining 10.5 million reside in the United States. Lake Erie is the most populated lake in the Great Lakes.

58 "Lake Erie Water Levels | Indicators | MED Large Lakes Research Branch | US EPA." N. p., n.d. Web. 16 May 2014.

59 <http://lakeerie.ohio.gov/Portals/0/Reports/2008LEPRplan.pdf> p.ix
Regional Information

ECOLOGY

Lake Erie is the most biologically diverse of all of the Great Lakes. The lake is susceptible to pollutants, runoff, and water level change due to how shallow the lake is. Between 1960-1990, for every one percent increase in population, there was a corresponding five percent increase in the conversion of green space to urbanized land use.⁶⁰ It is home to 90 species of native fish and 17 introduced or invasive species. A combination of excess nutrients and invasive species is altering the native ecosystem to a dangerous level. Particularly troubling are the extensive algal blooms in the western and central basins. Coal-fired plants add mercury to the air which settles into the sediment of the lake. Nuclear plants release warm water and do not cool properly if water temperature exceeds 85 degrees Fahrenheit. Additionally, urbanized areas contribute to bacterial contamination that closes regional beaches.

60 <http://lakeerie.ohio.gov/Portals/0/Reports/2008LEPRplan.pdf> p x



American Falls and Goat Island in the Winter of 2006

Photo Credit: Daniel Mayer

Toxic Algal Blooms in the Western and Central Basins of Lake Erie, 2011

Photo Credit: NASA

Regional Information





Regional Information

Erie Region

HISTORY

The City of Erie has a long history of settlement due to the climate, resources, and natural harbor. The Erie and Seneca tribes had inhabited the area prior to European settlement. The French named the peninsula protecting the harbor Presque Isle, meaning 'almost an island'. European settlement began in 1753. Shortly afterwards conflict between the French and British began for control of the area. The British won control of the area. After the American Revolution three states vied for control of the 'Erie Triangle', with Pennsylvania being successor. Erie was founded in 1795. The War of 1812 was crucial in Erie's history. As a campaign to gain American control of the Great Lakes from the British the construction of a Naval fleet helped establish the city. Following Oliver Hazard Perry's success in the Battle of Lake Erie two ships were intentionally sunk in Misery Bay, part of the area enclosed by Presque Isle. One of those ships, the Niagara remains in Erie. The Brig Niagara is an icon of the city although only parts of the restored ship are from the original vessel. As rail transit developed the city was the site of three track gauges meeting, leading to jobs transferring the goods. Manufacturing and industrial production provided the backbone of the local economy prior to the deindustrialization of the US following WWII. As the economy transitioned Erie experienced population decline and a shift in economic base.

POPULATION

Erie is the smallest of 18 population centers in the Great Lakes Region.⁶¹ Erie is the fourth largest city in Pennsylvania. As of the 2010 census the city has a population of 101,786, the estimated population for 2013 is 100,671. The city's population density is 4,631.7 people per square mile. Seventy-five percent (75%) of the population was Caucasian as of the 2010 census. Additionally, nineteen point seven percent (19.7%) were black, six point nine percent (6.9%) were Hispanic, and one point five percent (1.5%) were of Asian descent.

ECOLOGY

Presque Isle State Park presents a unique glimpse into the diversity and types of ecosystems that existed in the area prior to European settlement. The natural peninsula contains seven ecological zones. The constant reshaping and shifting of the footprint of the peninsula with those zones provide a fantastic example of ecological succession. The park hosts over 4 million visitors annually. By area, the park contains a greater density of endangered and threatened species than any other area in Pennsylvania. The ecological diversity and access to natural shorelines is a huge draw for tourism.

61 http://en.wikipedia.org/wiki/Great_Lakes_region_%28North_America%29
Regional Information



Presque Isle Lighthouse, Photo Credit: Kathy Weaver

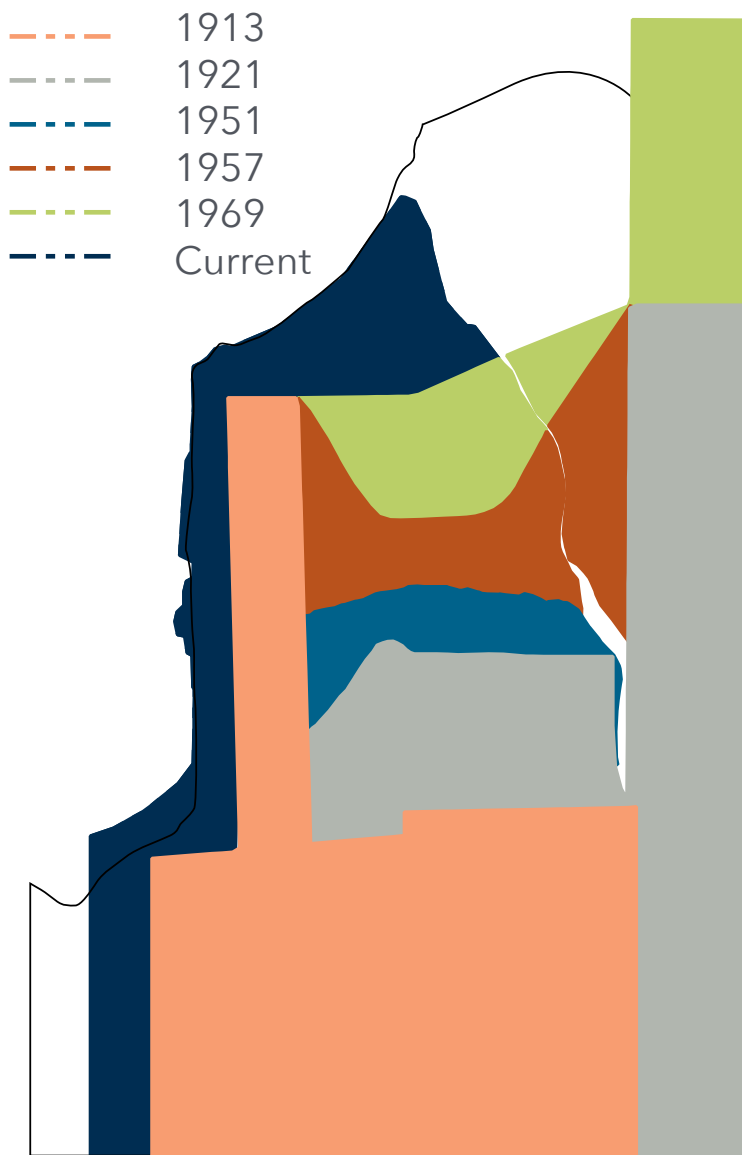


Former GAF Site Spring 2014

GAF Site History

The site in Erie chosen for intervention is located at the foot of Sassafras Street on Erie's Bayfront. The site has grown through fill over time and is separated from the downtown core by seventy-foot bluffs and the Bayfront Highway. Directly adjacent to the site is the newly constructed Erie County Convention Center. Remediation has been performed on the site and it is in the process of planning for redevelopment.

For over a century this site had been used to manufacture roofing products for residential and commercial use. The manufacturing processes on site used asbestos, tar, sand and felt to create their shingles. Over that century some of the manufacturing materials contaminated the soil and surface water. After GAF relocated in 2007 the previous structures were demolished in 2010. In December of the same year Erie County Convention Center Authority (ECCCA) acquired the property. ECCCA operates and manages the Bayfront Convention Center, which opened in 2007, on the property adjacent to the site. Due to the site contamination ECCCA started planning and remediation in 2011 and completed it in 2013. In addition to site contamination, tar boils, shingles, and tar paper were found in Presque Isle Bay and in the drainage ditch.⁶² The area of the site West of Sassafras Street that borders the Bayfront Parkway presents the highest level of exposure to harmful chemicals when in use. One serious area of concern is the presence of non-aqueous phase liquids (NAPL) under part of the site, which limits use to non-residential even after remediation.

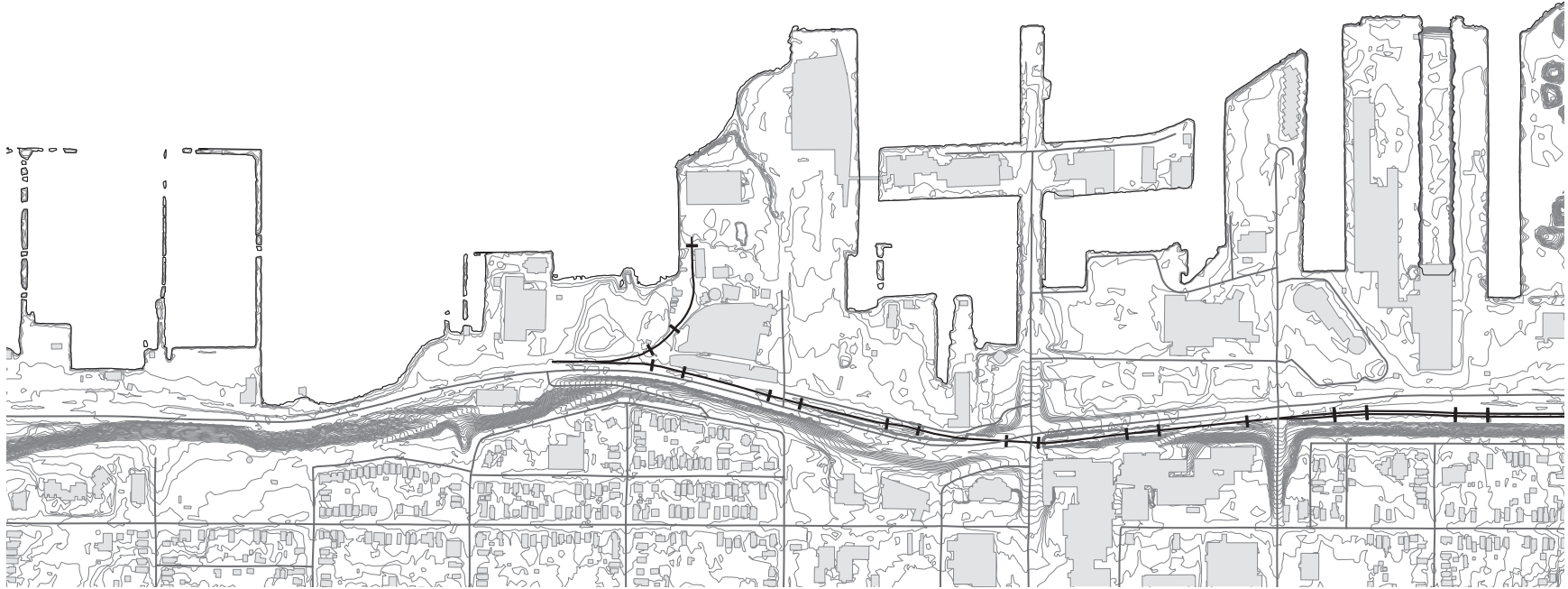


Site fill over time

Regional Information

The presentation of the concept plan, which is required for the remediation of the site, was met with mixed reaction from community members.⁶³ In response local architects (Kidder Wachter), a city councilmen and urban designer (Jay Brennan), and developer (Scott Enterprises) created their own alternatives visions for the site. Some of the public and professional criticisms of the ECCCA proposal touch on the underuse of space, a creation of an all but gated residential community, and a call for an amenity to attract visitors. Frankly, I agree with them. The concept proposal puts too high an emphasis on creating residential space for prospective affluent owners and does not create a draw for residents and tourists. Additionally, the development patterns are more suburban in form and density than the downtown, waterfront site should hold. The ECCCA proposal creates a short-term solution that fails to take part in establishing the Bayfront as a hub of activity in Erie. I feel the ECCCA proposal is unsuitable because it fails to meet its own stated goal of 'achieving the highest and best use' for the site. This proposal builds off of the professional suggestions and attempts to integrate public suggestions that compliment the mix of uses needed to create an interesting and robust development.

⁶³ "The GAF Property: What's Next? - Erie Reader." N. p., n.d. Web. 19 May 2014.



Site Context showing 2 foot contour intervals

PROBLEM STATEMENT

In the period of post-war deindustrialization Erie's population has decreased.

Most of the heavy industrial uses have left the city in the past decades. However, moderate to light industry still comprises a piece of the local economy. Creating linkages with that existing industry will be an important piece of the thesis proposal.

Given the decrease in industrial use, I see an opportunity to capitalize on the vacant, under used, and disused industrial land. My approach in this thesis will be to identify active public and industrial uses, inactive brownfield sites, and existing ecological assets to create a decentralized network of apparently discrete elements that when linked into an networked system increase ecological function, address issues like stormwater runoff, and create engaging public space. The conceptual goal of creating this Theory based network is to address an aging infrastructural system, improve the lives of residents in Erie, and re-create ecological linkages to Lake Erie all while keeping limited budgets in mind.

Critical Stance

A Landscape Infrastructure approach is a uniquely flexible Theoretical position from which to approach the re-design of urban brownfield sites in the Great Lakes region. This thesis provides a decentralized approach that improves ecological and urban systems function while increasing and improving public space. Despite the luxury of access to this fresh water the residents and leaders of the City have the duty to avoid complacency, given increasing demand on this limited resource.

In a region poised for social and economic change, I see Landscape Infrastructure as the most appropriate Theoretical lens for catalyzing change through design. This approach is flexible and appropriate given tightening budgets and limited resources. As anthropogenic change continues, it becomes necessary to approach all projects as an opportunity to lessen the impact of urban systems on fixed resources.

A crucial tenant of this thesis is the belief that interdisciplinary thinking and design is necessary to create vibrant urban spaces.

Concerted effort has been made to view the project from each lens of my education. To that end Landscape Infrastructure allows me to address the site from each discipline individually and as a combined whole. Applied interdisciplinary collaboration between designers, engineers, economists, and planners is needed to solve the problems facing modern infrastructure and urban design.

In order to achieve the ecological, social, and economic goals discussed in this thesis Erie needs to see development as a means to that end. Unplanned or uncontrolled development will yield negative results, therefore constraints that work to improve societal value are necessary. A cohesive vision for the Downtown Bayfront needs to be the driving force behind any development on GAF site.

Design is one tool Erie can use to create a destination on its waterfront. Adopting progressive policies regarding water and improving ecological conditions are another. The potential for Erie to harness the underutilized spaces in the city and reimagine them as sites for new industry, education, social interaction, business, and ecological diversity is the root of this proposal. This thesis explores the potential for this site while creating a piece of an urban network that reuses vacant industrial space to honor the history of the city while growing its future.



A pair of rainbow trout caught in Mill Creek in March of 2014



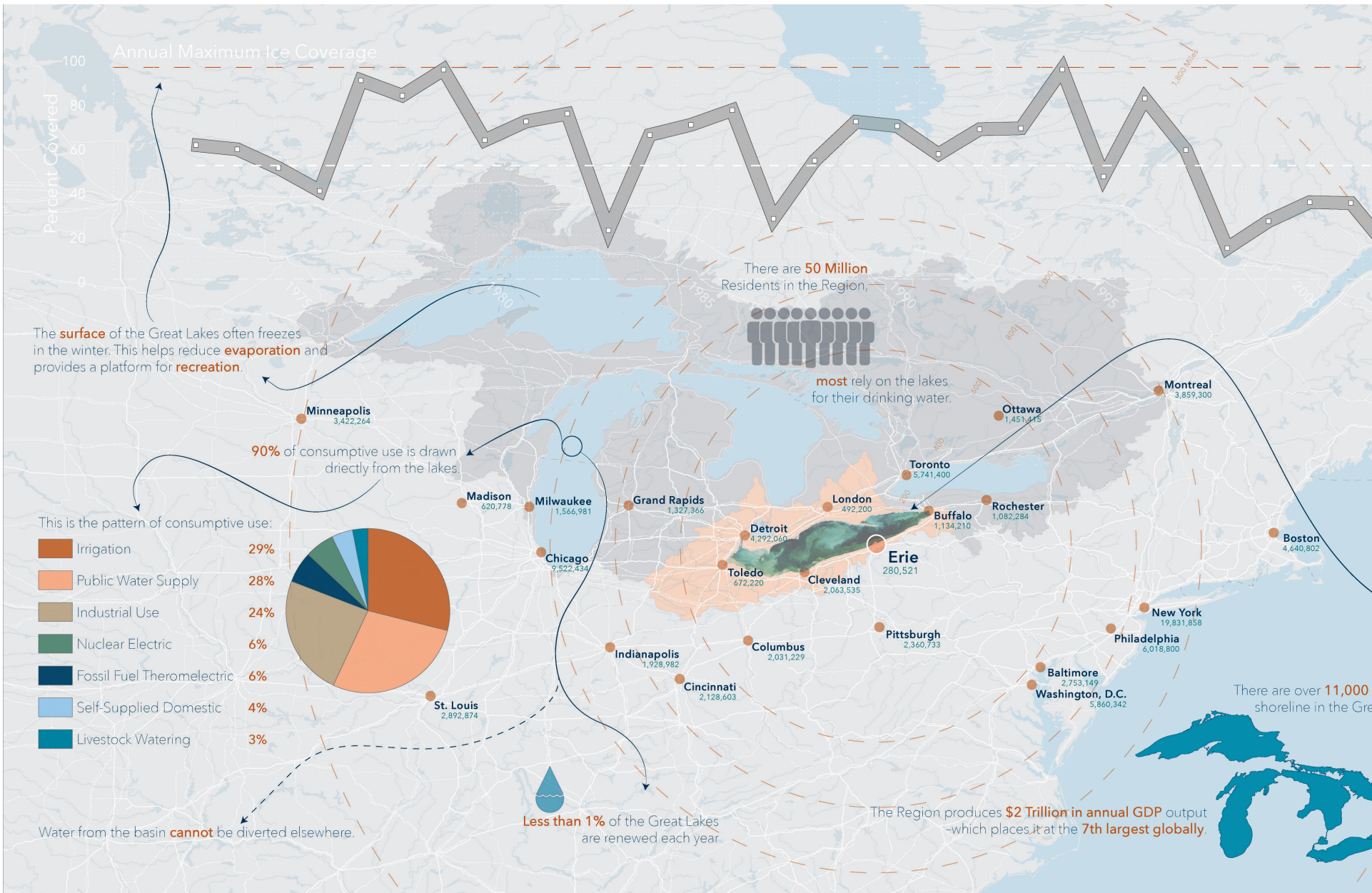
Visioning and Design Interventions

VISIONING AND DESIGN INTERVENTIONS

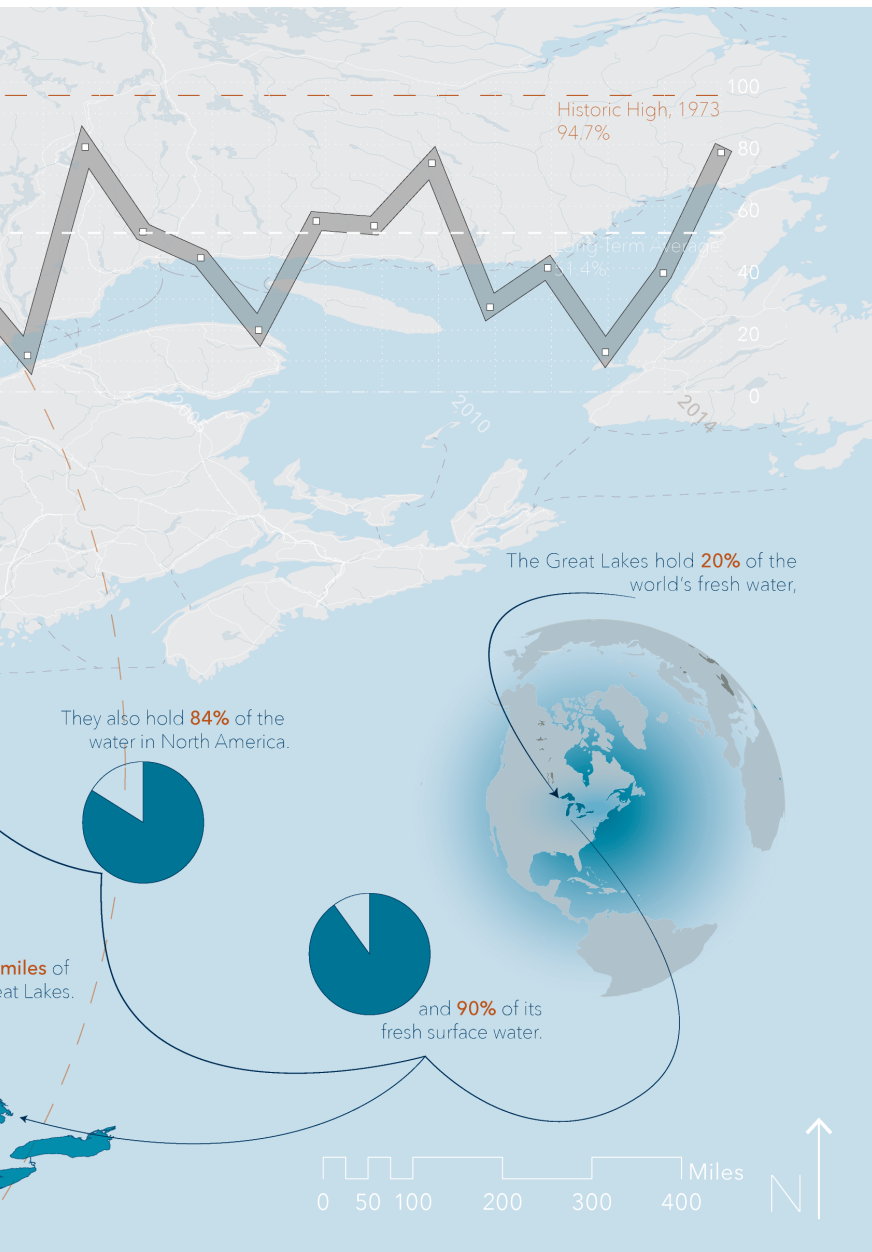
This section uses the theory, background information, and practical examples discussed previously to determine the recommendations for post-industrial reuse. By identifying the most important systems, flows, and processes that impact each scale the interventions are tailored to help accomplish it. As the scale of each focus area decreases more detail is possible in proposed interventions.



The Downtown Bayfront and GAF Site from Presque Isle



Visioning and Design Interventions



Great Lakes

Progress at protecting the Great Lakes has already begun. Through design and planning we can move from a culture of protection to one of improvement. Throughout the Great Lakes almost 90% of the population gets their drinking water directly from the lakes.⁶⁴ Maritime commerce on the Great Lakes plays a crucial role in individual and business revenue generation. A study of 2010 figures by the Marin Institute shows maritime commerce in the region generating 33.6 billion dollars in business revenue, 14.1 billion dollars in personal income, and 4.6 billion dollars in tax revenue.⁶⁵ Tourism and recreation are also important, generating 16 billion dollars in spending on boating trips and equipment.⁶⁶ The waters of the Great Lakes are crucial for sustaining life and economy in the region. The strategies for post-industrial reuse at the scale of the Great Lakes involve addressing water, agriculture, and energy resources.

⁶⁴ Protecting the Waters of the Great Lakes International Joint Commission February 2000 - <http://ijc.org/files/publications/C129.pdf>

⁶⁵ http://www.greatlakes-seaway.com/en/pdf/eco_impact_full.pdf page 5

⁶⁶ <http://www.miseagrant.umich.edu/downloads/economy/11-708-Great-Lakes-Jobs.pdf> page 1

GREAT LAKES REGION GOALS & STRATEGIES

Goals

- Reduce dependence on fossil fuels for energy & mobility
- Improve water quality
- Increase the efficiency of water consumption
- Craft smarter food systems
- Adopt a nutrient management program
- Look at wind power, geothermal, heat exchange, and co-generation potentials.
- Increase filtration & air quality standards on existing power facilities
- Remove CSO's from watershed
- Use a decentralized approach to treat runoff as it is conveyed and before it reaches to water bodies
- Separate water systems in built environment, New & retrofit
- Increase incentives for treatment and reuse of (industrial) wastewater
- Protect valuable agricultural resources
- Adopt better agricultural practices—fertilization, pesticides, monocropping, soil quality loss etc
- Harvest nutrients from wastewater/use biosolids as fertilizer
- Create regional separation and processing for waste streams; recyclable, organic, solid
- Transition to closed-loop model for resource management



A coal-fired power plant located near Cleveland, OH.

Photo credit: Ben Stephenson



Overwater Wind Farm in Sweden

Photo credit: Tomasz Sienicki

REGIONAL APPROACHES

Water

While reducing consumption for drinking or other potable uses, is unlikely with population growth there is potential to reduce demand for irrigation and industrial use. Improvements in agricultural practices can reduce demand for water and the amount of fertilizers applied. On-site treatment of industrial wastewater can simplify the municipal treatment process and target the contaminants specific to that use. Collecting rainwater and reusing graywater for irrigation and industry are two strategies to reduce consumptive demand from the lakes.

Treatment before discharge of the water used for irrigation and industry is crucial, regardless of if the water comes from municipal supply, reuse, or rainwater harvesting. How treatment and filtration can be managed is best determined based on the contaminants and discharge options. It may not be feasible to treat all water running off agricultural fields but coupling improved agricultural practice with intermediate treatment facilities in along water courses can reduce the nutrient and sediment issues before discharge into the lake. Throughout the region, the reduction of CSO's is vitally important to protect the value of tourism, fishing, recreation, and the environment.

Decentralizing stormwater management and treatment is applicable at all scales of this project. Reducing impervious surfaces, detaining runoff, and infiltrating treated stormwater can reduce the load on local treatment facilities. That load reduction will allow wastewater treatment facilities to manage more serious contaminants more efficiently. Directing surface runoff into raingardens, bioswales, and treatment wetlands are all good methods for improving the quality of water and slowing its speed in storm events. After road contaminants are managed detention and infiltration ponds are a tool to reduce peak flow volumes as well. Implicit in the Landscape Infrastructure view is that all of these methods would be integrated with other uses. Paring bioswales along roadways or integrating retention areas with public space, as with water squares, will fulfill multiple objectives simultaneously.

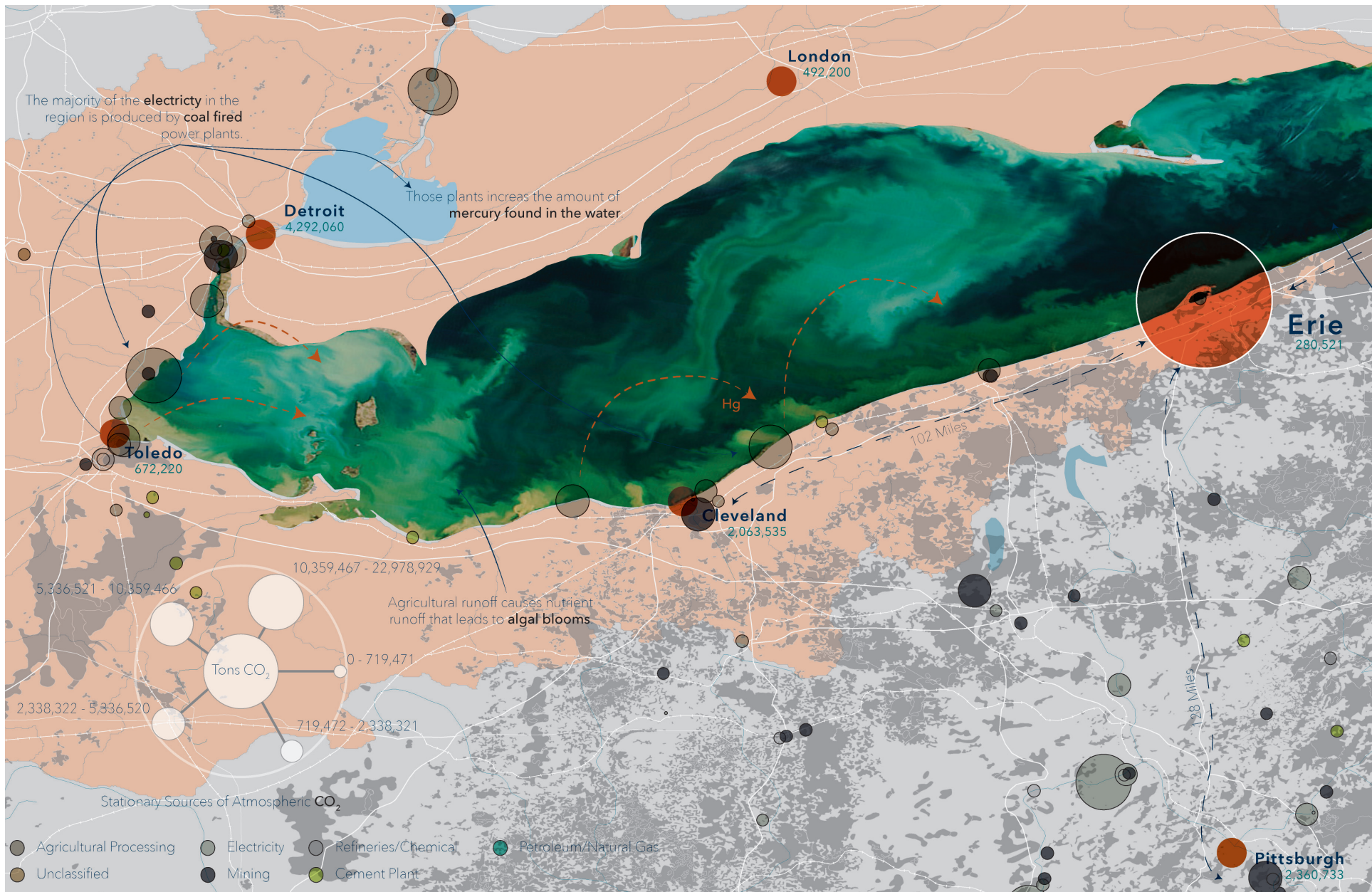
Improvements in wastewater treatment technology are allowing for greater treatment capability and the ability to recapture valuable nutrients. Revising the relationship with waste and how biosolids can be reused as fertilizer is a crucial way to recapture nutrients that otherwise harm the watershed of the Great Lakes. In order to do this most efficiently separating waste streams into blackwater, greywater, and yellow water from the household to the treatment plant is ideal.

Agriculture

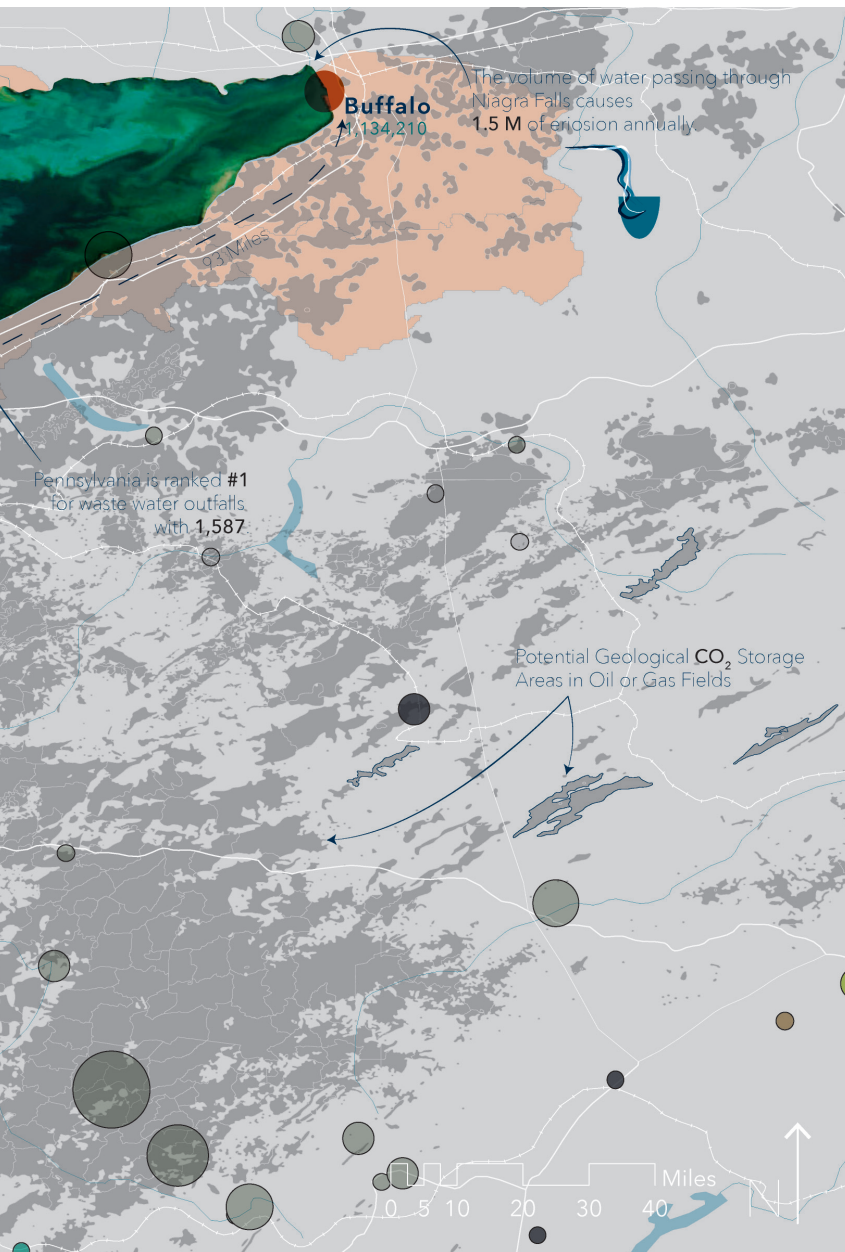
Feeding the residents of urban areas is important and protecting the land that is used to grow food are equally important. We can continue to feed cities and improve the ecosystem by modifying agricultural practice. Additionally, cities can recognize the impacts of transporting food and begin to grow delicate, high-cost crops within their own boundaries. Diversifying the food system to accommodate large and small-scale growth patterns will be a helpful tool in feeding growing populations. Large-scale agricultural production needs to reevaluate wasteful irrigation and fertilization practices.

Energy

Investing in new energy technology to replace the numerous coal fired electricity generation plants in the region will help to reduce the amount of mercury introduced into the Great Lakes and its ecosystem. The potential for power generated from wind in the region has been analyzed. Now it needs to be implemented. Beyond wind power, the potential for geothermal heat exchange is another underutilized alternative for the region. Incinerating, with proper air filtration, waste streams that cannot be reused again can also be used for energy generation. Pairing an incineration system, which produces carbon dioxide with a bioreactor producing algae for biofuel, is one way to combine compatible use to maximize production and minimize impact.



Visioning and Design Interventions



Lake Erie

The importance of managing agricultural runoff and pollution is most pressing in Lake Erie. Within the system of the Great Lakes Erie is most susceptible to algal blooms and has the highest harvest to volume ratio for commercial fishing in the Great Lakes. The geologic differences between Lake Erie and the rest of the Great Lakes cause both of those conditions. The low volume and shallow depth of the lake present ecological opportunity but when inundated with excess nutrients and sediments those characteristics lead to algal blooms. With approximately 63% of the watershed in use for agricultural production this issue must be addressed before it's economic impacts are irreversible. Managing agricultural runoff, especially in the Western Basin and Central Basin of the lake, should be of the highest priority. The geological structure of most of the lake provides for another opportunity. Most of Lake Erie is ideal for the generation of energy from wind power. The presence of multiple coal fired power plants along the South shore of the lake leads to the high mercury levels found in sediments and the food chain. Moving away from this inefficient, polluting energy source will help improve the quality of life around Lake Erie. Cities in the region that size the opportunity to design, manufacture, assemble, and ship wind turbines will benefit from the diversification of energy source. Given the geology of the lake coupled with the density of population the approaches in the region center around water quality improvement and alternative energy generation.

LAKE ERIE REGION GOALS & STRATEGIES

Goals

- Identify and maximize regional assets while protecting valuable regional resources
- Shift from a resource extractive economy to a resource efficient economy
- Create shared value for all in the region; socially, ecologically, and economically.

Strategies

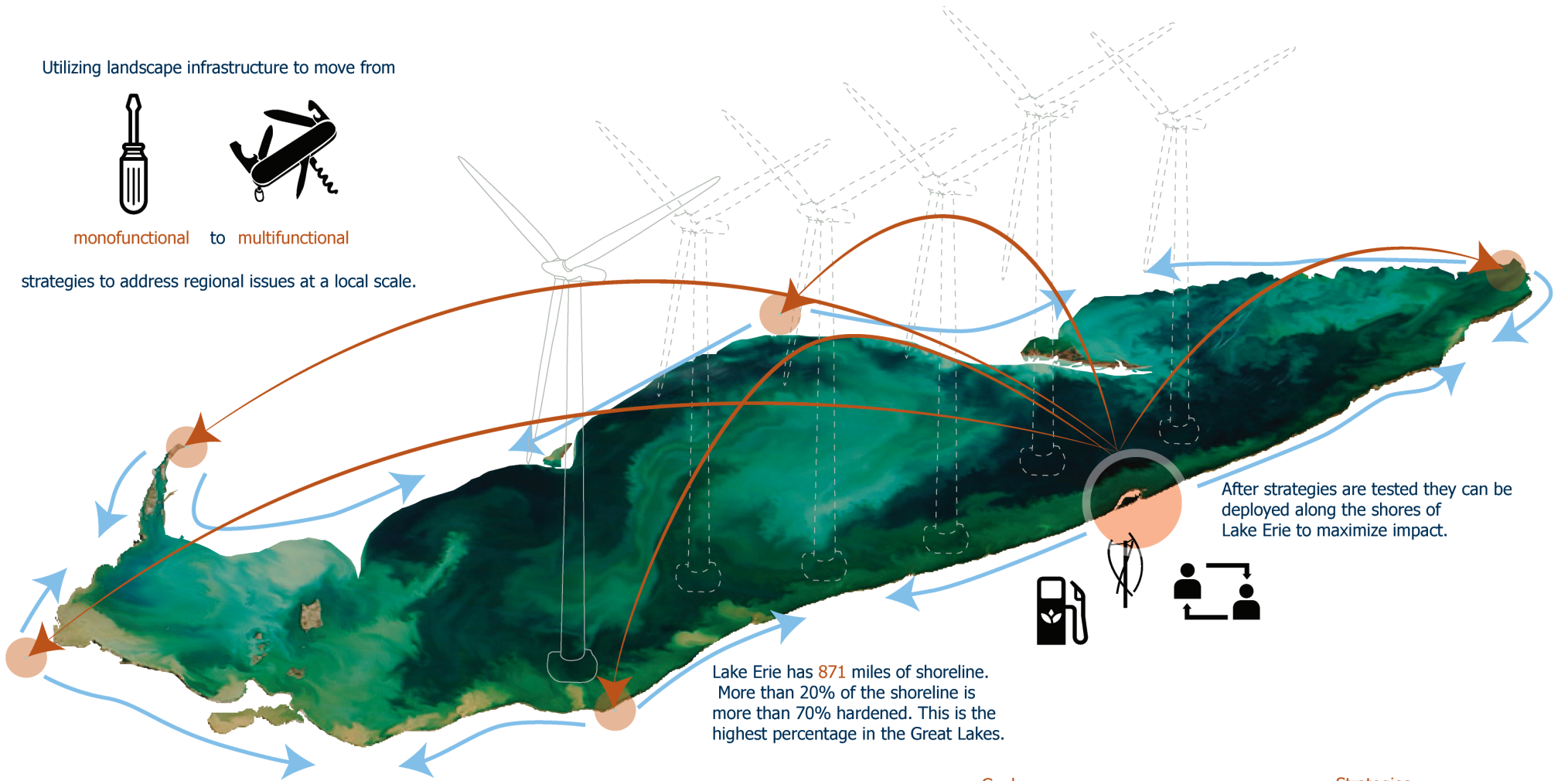
- Transition from coal power to wind power
- Harness algal growth potential for biofuels
- Eliminate CSO's in Lake Erie watershed
- Protect/create/restore shoreline as water level changes
- Improve native and stocked fish populations
- Focus on incubating a green manufacturing hub
- Use infrastructure to build social strength

Utilizing landscape infrastructure to move from



monofunctional to multifunctional

strategies to address regional issues at a local scale.



After strategies are tested they can be deployed along the shores of Lake Erie to maximize impact.

Lake Erie has 871 miles of shoreline. More than 20% of the shoreline is more than 70% hardened. This is the highest percentage in the Great Lakes.

The shallowness of the lake, relative to the rest of the Great Lakes, is both an asset and a challenge. The potential for capturing wind energy is one element that could be implemented in most of Lake Erie. The majority of the lake, excluding the eastern basin, is less than 30 M. deep. The depth of the lake also compounds issues with sedimentation and nutrient runoff. Toxic algal blooms are increasingly being caused by excess nutrients coming primarily from human waste and agricultural runoff.

Goals

Maximize the regional assets while protecting the valuable regional resources.

Shifting from a resource extractive economy to a resource efficient economy.

Creating shared value in for all in the region, socially, ecologically, and economically.

Strategies

Transition from coal power to wind power.

Harness algal growth potential for biofuels.

Focus on incubating a green manufacturing hub.

Use infrastructure to build social strength.

REGIONAL APPROACHES

Water Quality Improvement

Lake Erie's algal blooms have been increasing enough in severity and frequency to cause alarm beyond academics and environmentalists. Predictions for the summer of 2014 indicate this year will be similar to the previous years. Green, smelly, slimy algae will bloom and kill fish and the tourism economy. Implementing policy changes limiting the type of fertilizer, the amount, and the application method need to be made to protect the lake. Farmers need to have better resources for education on agricultural practices that won't harm the lake. Shifting when fertilizers are applied, from fall to during the growing season, while reducing the amount between March and the end of June is one way to reduce phosphorous load in Lake Erie.

Installing treatment areas along the tributaries draining into Lake Erie allow for two positive outcomes; water quality can be improved before it reaches the lake and nutrients can be harvested for reuse. The installation of conveyance and treatment swales adjacent to agricultural fields could be used to lessen the nutrients flowing into lake tributaries as well. The solutions to fixing the excess nutrient loads are complex but the reason to do so is growing.

Alternative Energy Generation

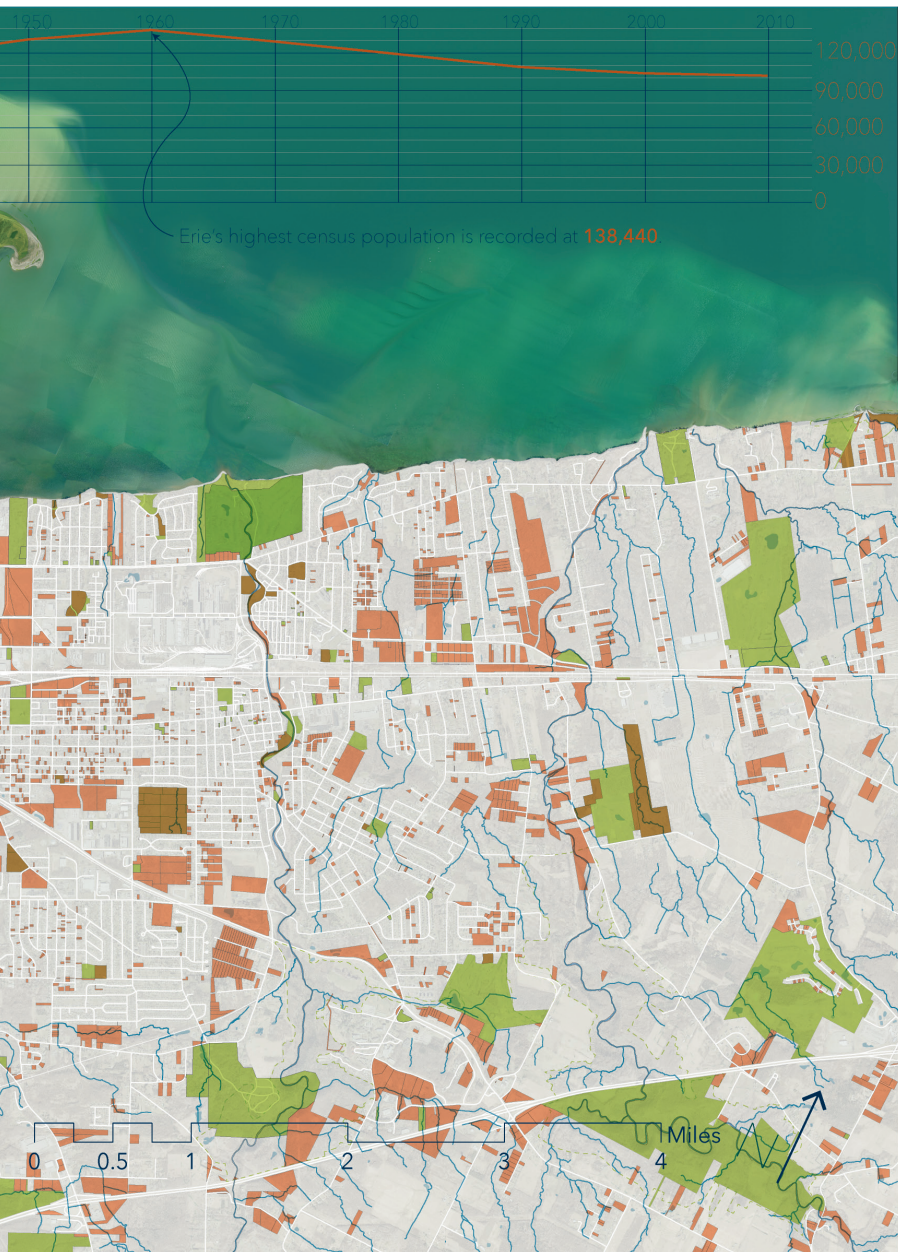
The potential wind power generation in the western and central basins is ideal for regrouping the regional electric demand to a sustainable source. The creation of large wind farms in the lake itself is a controversial one. However, integrating methods to capture wind into the built fabric of cities in ways that doesn't disturb residents or harm wildlife has great potential. Wind could be utilized to pump water used in geothermal or other heat exchange systems. Wind could also be used to lift water then have that water turn turbines to generate electricity. Finding alternative ways to use consistent wind power in situations where electrical generation isn't ideal will allow for greater diversity of energy sources.

While it is hopefully a short-term problem an additional source of energy could be derived from the algae blooming in the lake. Finding a way to harvest the algae from the lake and leave the water could allow for nutrient and energy recapture. Harvesting could take place on the lake itself, converting vessels to pump water into filtration systems, separate the biological components

and return the water to the lake. This could also have shore side applications doing similar processes. The land-based approaches would be more limited and would likely be more complex. Algae could also be cultivated and harvested for biofuel production. Potentially, over-water farms could be sited near the outlets of the tributaries with the highest concentrations to take advantage of the available nutrients. This could occur on land as well, integrating 'treatment' of runoff and water bodies with productive use.



Visioning and Design Interventions



Erie

The current conditions in Erie present an opportunity to implement a series of projects to form a network of Landscape Infrastructure interventions. After conducting site observations, mapping analysis, and reading the visioning literature for the city multiple needs and approaches became apparent. The challenges presented include suburban development patterns, declining population, a transition away from historical economic generation, no public recreation space near the urban core, and a lack of tax-revenue generating waterfront property. The opportunities in Erie are the availability of prime waterfront property for redevelopment, the potential for grant funding and public-private collaboration, a mixture of under used and vacant space in key locations, strong linkages via rail and road infrastructure, a unique resource in Presque Isle, and a community that is ready to see positive changes in Erie.

As a member of Great Lakes and St. Lawrence Cities Initiative (GLSLCI) Erie has taken steps in the process of improving the condition of the lakes. In the spirit of that collaboration Erie can strive to be an exemplar case of adapting to post-industrial economies, shifting populations, and greater environmental awareness. Erie's greatest potential lies in redefining/focusing itself as a hub for sustainable technological manufacturing, innovation, design, and education.

ERIE REGION GOALS & STRATEGIES

Goals

- Become an exemplar case of sustainable post-industrial reuse
- Create an economic cluster development around green technology and innovation
- Harness the potential of Erie's location and use it to attract and leverage intelligent growth.
- Let water availability influence development patterns.

Strategies

- Meet and exceed GLSLCI initiatives and best practices
- Use centralized and decentralized infrastructure to create change
- Pair industry with education in the green tech industries in research, development, manufacturing, construction, and installation.
- Reuse suitable post-industrial sites as incubators for this cluster
- Adopt strong countywide policy protecting agricultural and greenfield sites
- Push for change in policy, social attitudes, and economic drivers away from a suburban development model.
- Invest in creating livable, desirable urban space in key locations
- Craft partnerships between the public, private business, government, and non-profit groups to solve these challenges.
- Keep growth within the Lake Erie Watershed

CITY APPROACHES

Food System

At the city scale creating a denser network for local food growth, processing, and use is a primary goal. There are multiple sites that could be ideal locations for urban agriculture. The West Erie Plaza, a commercial development extending between 12th St. and 8th St. along Pittsburgh Ave. could be started as the hub for urban agricultural production in Erie. The site provides ample surface area, multiple under used commercial spaces, and easy access to the highway. In this four block long complex a dozen storefronts sit vacant.⁶⁷ Many of the remaining commercial uses in the plaza are food or health related. Portions of the extensive surface parking could be used to create surface beds with hoop houses, similar to Growing Power's approach and would extend growing seasons. The larger commercial spaces like the former Halle's/Gabriel Brother's store could be retrofitted for indoor aquaponic, aeroponic, or hydroponic growing. The strip of commercial buildings could house more smaller scale indoor growing or be utilized as processing and preparation spaces. If structurally capable, the low strip of commercial buildings could be retrofitted with rooftop greenhouses to create more growing space. If the structures do not support full rooftop reuse the roofs could be retrofitted with green roofs used to capture water on site and use it in production. The adjacency this site has to a channelized section of Cascade Creek could be another opportunity to ameliorate sediment and nutrient problems before it reaches the bay or lake. Creating a series of filtration wetlands would allow for treatment and the creation of public park space. Another adjacency to capitalize on is the proximity to the K-12 educational institutions that back the site. Partnering with Villa Maria's Elementary and High school academies would create opportunities for students to learn about how food is cultivated, how the food system works, and gain hands on growing experience.

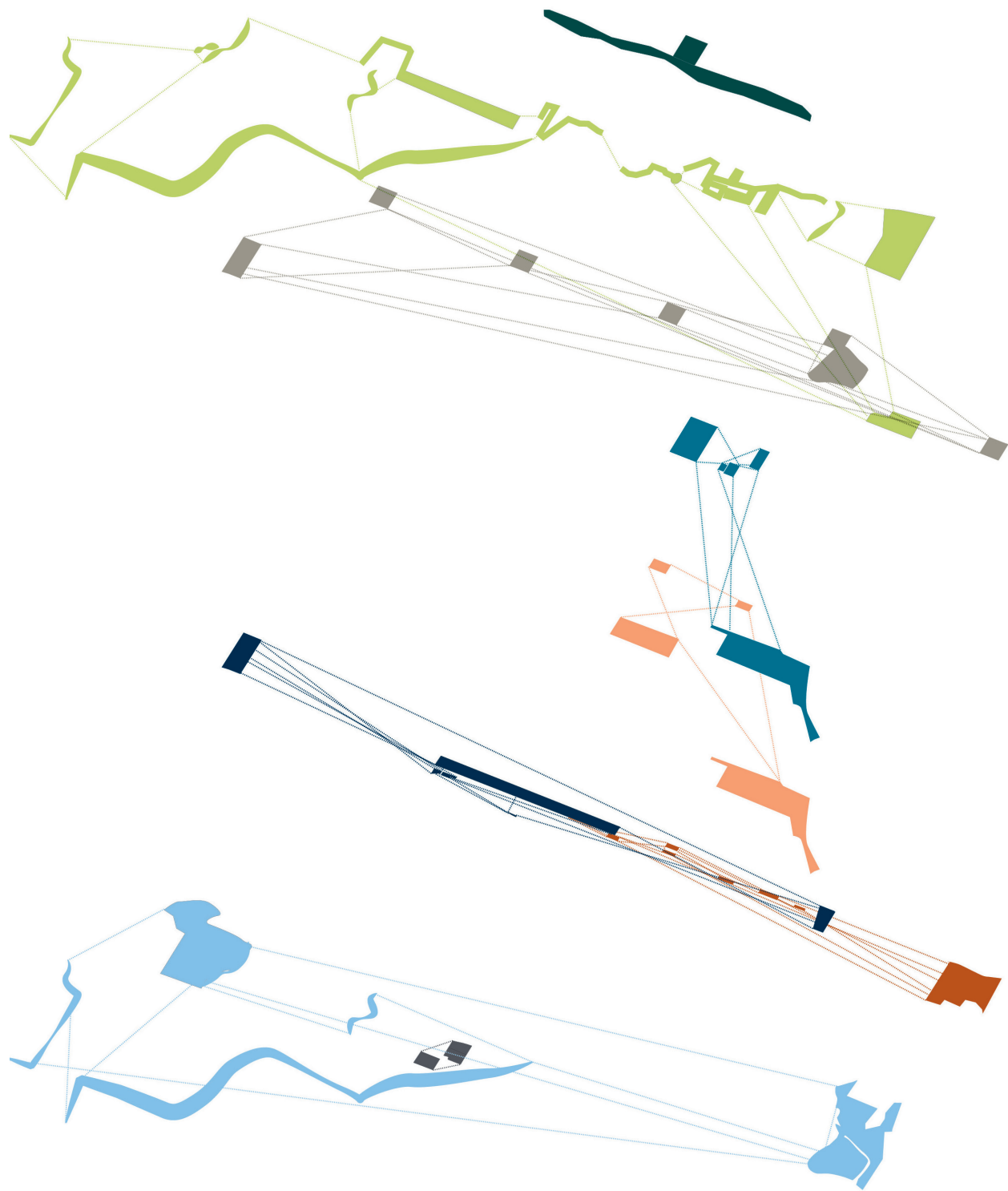
Adaptive reuse of currently vacant industrial buildings in Erie for indoor growing of food products will utilize the large area, high floor load capacities, and adjacency to transportation corridors. If the buildings were designed to accommodate construction of additional floors they are candidates for adding rooftop greenhouses. There are a variety of adaptive reuse projects that

67 ("West Erie Plaza on Methodical Comeback Trail | GoErie.com/Erie Times-News")



Mapping of Landscape Infrastructure interventions and axonometric view of layered interventions

Visioning and Design Interventions



Connections

Ecology

Nutrients

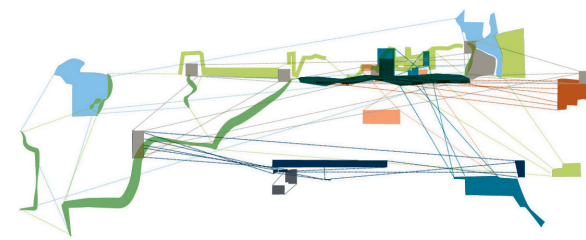
Economy

Knowledge

Food

Energy

Water

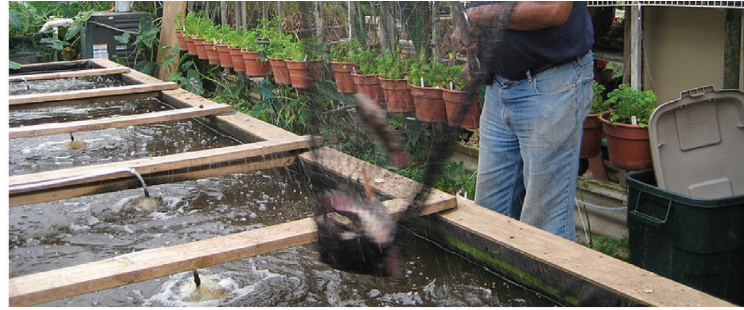




Organic Waste Collection and Processing

Collecting both household and commercial waste. County and region would allow for greater economies of scale. Reuse of derelict and under used surface parking throughout the city as volume dictates. Cycling the nutrient rich compost or vermicompost into regional agriculture, sales to local residents, and diverting large streams of organic waste from landfills.

Precedent: Growing Power's composting operation



Multiscalar Urban Agriculture

A range of urban agriculture interventions that work to augment the food system needs of the city. Soil based growth paired with aquaponics raising yellow perch indigenous to the Great Lakes. Indoor hydroponic and aeroponic growth reusing large interior spaces to grow plants year-round. Rooftop greenhouses installed on existing flat roof buildings or integrated with new design.

Precedents: Growing Power, the Plant Chicago, and Lufa Farms,



Surface and Subsurface Processing of Pipe

Creating an opportunity to capture a large amount of sediment and debris entering Lake Erie from the city. These at each stream, as a treatment outlet to help regulate temperatures.

Precedent: Waitangi Park



Surface Wetland and Streams

...ty to reduce the
...nd excess nutrients
...m it's watershed
...urces. Deploying
...sewer, or water
...lp normalize water

...ark, Wellington, NZ.



Bluff Connections to Waterfront

While the bluffs provide fantastic opportunity to view the waterfront they severely limit access. Deploying multiple interventions like a land bridge, terraced bluff parks, and pedestrian overpasses to maintain traffic flow and views while improving connection.

Precedent: Land Bridge, Vancouver, BC



Biofuels Production

Primarily utilizing post-industrial spaces to house algal bioreactors growing fuel for the nearby biofuel plant. Large scale contained growth schemes can include vertical stacking, angled growth cells, or more traditional horizontal growth. Using a closed system allows for greatest efficiency for water use, increasing surface area for light absorption, and controlling quality.

Precedent: Klotze, Germany; MIT Cogeneration Plant; IGV Biotech, Germany; BIQ, Hamburg, GR

incorporate urban agriculture. The Plant in Chicago grows vegetables in an aquaponic systems using artificial light, mushrooms in their interior space on waste products, and in an outdoor yard converted into an outdoor farm. The number of strategies for reusing space for agriculture are as varied as the cities and buildings they occur in.

New Energy Systems

As the region, country, and world begin to shift from fossil fuel based energy sources to more renewable sources the demand for the technology, skills to manufacture and install it, and education to increase efficiency in the field will grow. A potential for the future of the city is to recognize this and encourage a cluster of development surrounding green technology. One of the strongest potentials is to use the former Hammermill site in a way that compliments the biofuels plant next to it. By constructing an algae bioreactor to grow fuel for the plant this proposal takes advantage of proximity to water and reduces the distance for transport to the next step in the processing chain. The structure of the bioreactors would conform the most efficient methods given any corresponding use on site but there are a variety of suitable options. Algae can be grown in suspension using vertical stacking, angled growth cells, or horizontal growth. In order to control contamination, increase surface area for growing, and use water efficiently a closed system is proposed. Combining the bioreactors for growing with a use that produces carbon dioxide is helpful to give the algae a consistent source to increase their growth. Large scale closed systems can be constructed of horizontal tubes, sandwiching plates, or vertical bubbling systems. In Klotze, Germany Algomed grows large quantities of algae in bioreactors. A corollary use on-site would be a district scale waste combustion plant that produces large amounts of carbon dioxide in the process of creating energy.

Improved relationship with water

Although Erie has made great strides towards better water quality practices the urban relationship with water is challenging. Many of the best practices published on the website for the GLSLCI provide a solid foundation for creating city goals that will improve the region. Erie's relationship with water, including wastewater, runoff, and potable water is one area that could see improvement.

Stormwater management at the city scale is crucial for improving the quality of water we send into Lake Erie and Presque Isle Bay. Additionally, land development patterns surrounding streams is another area where improvements can be made. By capturing

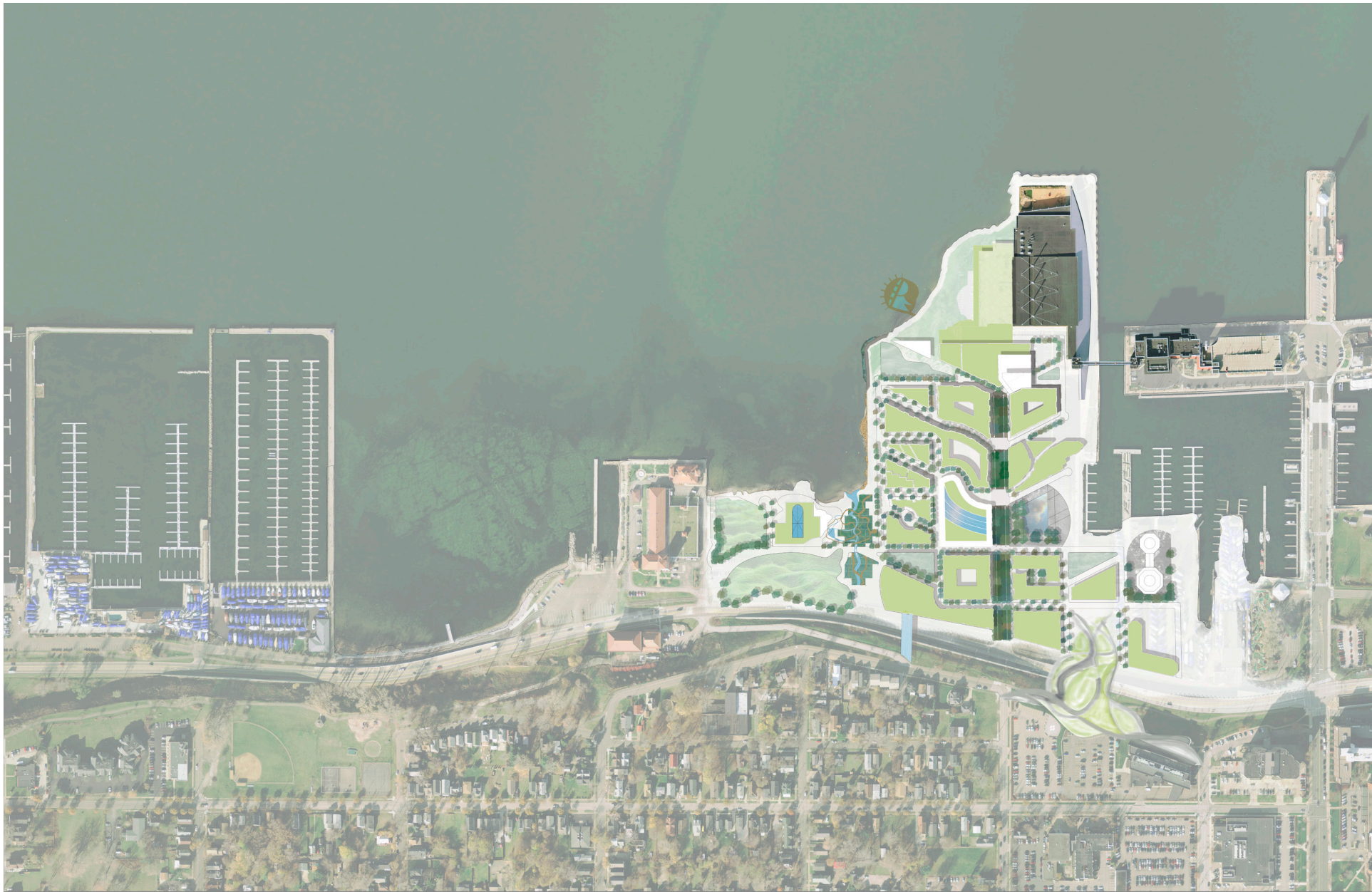
road runoff into filtration swales non-point source pollution from vehicles can be reduced. Installation of permeable pavement to encourage infiltration of water back into the ground is another way to reduce surface pollutants in the water cycle. Updating land use policy and building codes to reflect development patterns that don't cause serious damage in sensitive areas is an important step. At the scale of the city rainwater collection and reuse is one way to reduce demand on withdrawals from Lake Erie. Successful examples of better water practices include the installation of Membrane Bioreactors for wastewater treatment in Traverse City, MI or landfill gas harvesting in Milwaukee, WI that can be applied in Erie.⁶⁸ Following the best practices for water conservation published by GLSLCI is one step for reducing the quantity of water needed in Erie. Combining increased treatment of wastewater with the separation and onsite treatment of blackwater, greywater, and rainwater in new development and retrofits of current buildings could also produce marked decreases in demand for water.

Creating Shared Value

In order to increase the potential for economic growth and future viability for the city it is important to encourage growth that improves quality of life, increases educational opportunity, and creates jobs that pay living wages. Identifying gaps in workforce training with local business and forming a partnership to close that gap is one example of creating shared value. The Georgia based Southwire Company created a project that improves community futures and meets the needs of business. The project, 12 for Life, helps at-risk students with job skills while completing their education.⁶⁹ Students attend classes, work, and get paid wages, allowing them to earn a degree while earning income. This model is similar to the model employed by vocational technical schools in the area. By partnering with local businesses and colleges non-traditional sectors for real world and skill-based education can be identified and expanded. Education related to bioreactor agricultural production, wind turbine design and manufacturing, or urban agricultural skills could be areas that evolve out of other sections of this proposal.

⁶⁸ Green Pipeline to Fuel Water Reclamation Facility and Wastewater Treatment Plant Conversion from <http://www.glslcities.org/best-practices/water-quality.cfm> ("Great Lakes and St. Lawrence Cities Initiative")

⁶⁹ "12 For Life." N. p., n.d. Web. 19 May 2014. <http://www.12forlife.com/>



Visioning and Design Interventions



Site

This site has an industrial history and is located in the central core of Erie's downtown waterfront. There are multiple visions for the site driven by community interest and dissatisfaction with accepting the first and cheapest solution for this parcel. The redevelopment of the former GAF Materials Corporation site and the adjacent properties can set the tone for how the rest of the post-industrial waterfront in Erie is handled.

Site Plan depicting massing, connections, building orientation and public space

MY WORKING PROJECT ASSUMPTIONS:

- Parking and structures cannot be subsurface because of how high the water table is on filled land.
- It is important to include the uses requested by the general public and create visions for how a space that includes them looks.
- Water quality in Presque Isle Bay will remain constant or improve.
- Looking beyond the boundaries of the GAF site provides greater opportunity to show the potential for the waterfront as a whole.
- The public should retain access to the waterfront and use on site should be mixed.
- Residential development will include a mix of unit types, including market rate, subsidized, rental, and owned.
- Surface parking is avoided; parking needs should be met through structured parking.
- Sharing space between vehicles, pedestrians, and bikes is a feasible alternative for Erie.
- Erie's growth should occur within its urbanized areas as well as within the Lake Erie Watershed boundary.

GOALS & STRATEGIES FOR THE SITE SCALE

Goals

- Create a pilot project for district scale infrastructure
- Reimagine parking on the waterfront, mix it, layer it
- Create an extension of the urban core
- Link economy, ecology, and culture
- Meet the needs/demands of a diverse group of stakeholders

Strategies

- Separate waste streams--water into black, grey, roof, runoff; household into organic, recyclable, solid
- Capitalize on co-generation and energy harvesting potentials
- Treat wastewater on site, harvest energy, create power for site
- Use wind funnels, incorporated into built fabric, to generate power on site
- Practice intelligent site design for solar orientation, creating usable public space, and capturing potential resources
- Shift priority of public space away from cars and back to people and public life.
- Wrap, raise, and mix uses with parking to meet demand
- Develop the site at a human scale while meeting demands for tax base and neighboring use
- Keep waterfront access in the public realm, craft public space that responds to the negatives of the site and the positives
- Layer public use on top of parking and adjacent to commercial use.
- Create a node for local food distribution

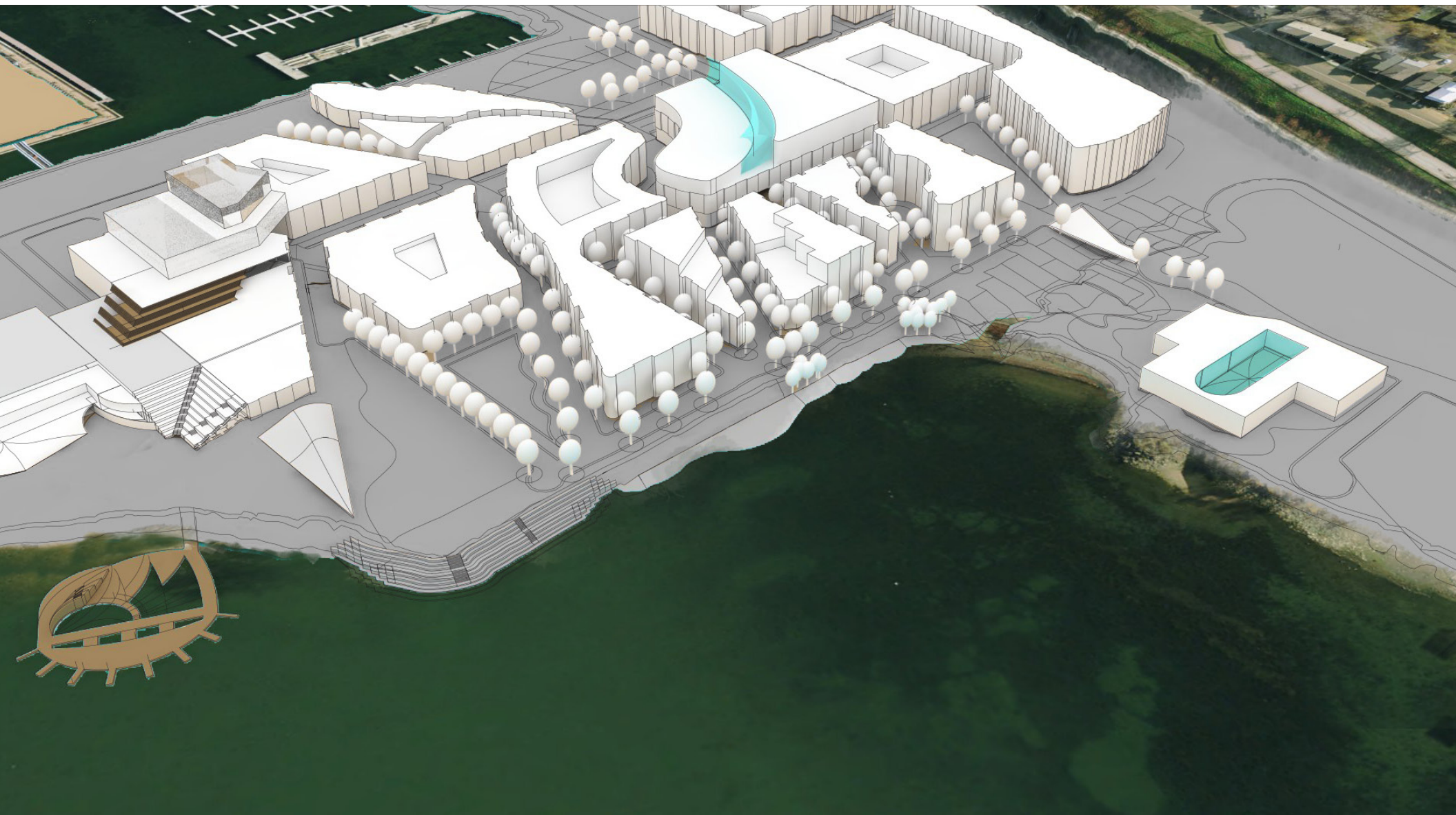


Illustration showing building massing, street orientation, and public space

SITE APPROACHES

Site Overview

The proposal for this site moves from the current position in which development, economic growth, social benefit, and ecological benefit are mutually exclusive and asserts that those four items are in fact intrinsically linked. My exploration of site potentials to create the highest and best use, including government, business, and resident demands, used the theoretical areas of focus and the landscape infrastructure operations for the city as a whole as framing devices.

Proposing this site as an example of sustainable urban development allows me to address all of the areas of focus, in varying degrees. While all of the strategic approaches are applied on site there are five that define the core of approach on site. The five crucial approaches are economy, knowledge, ecology, water, and energy. Layering the application of strategic approaches while identifying and targeting the best opportunities to create engaging public space shaped the design of a distinct waterfront urban area.

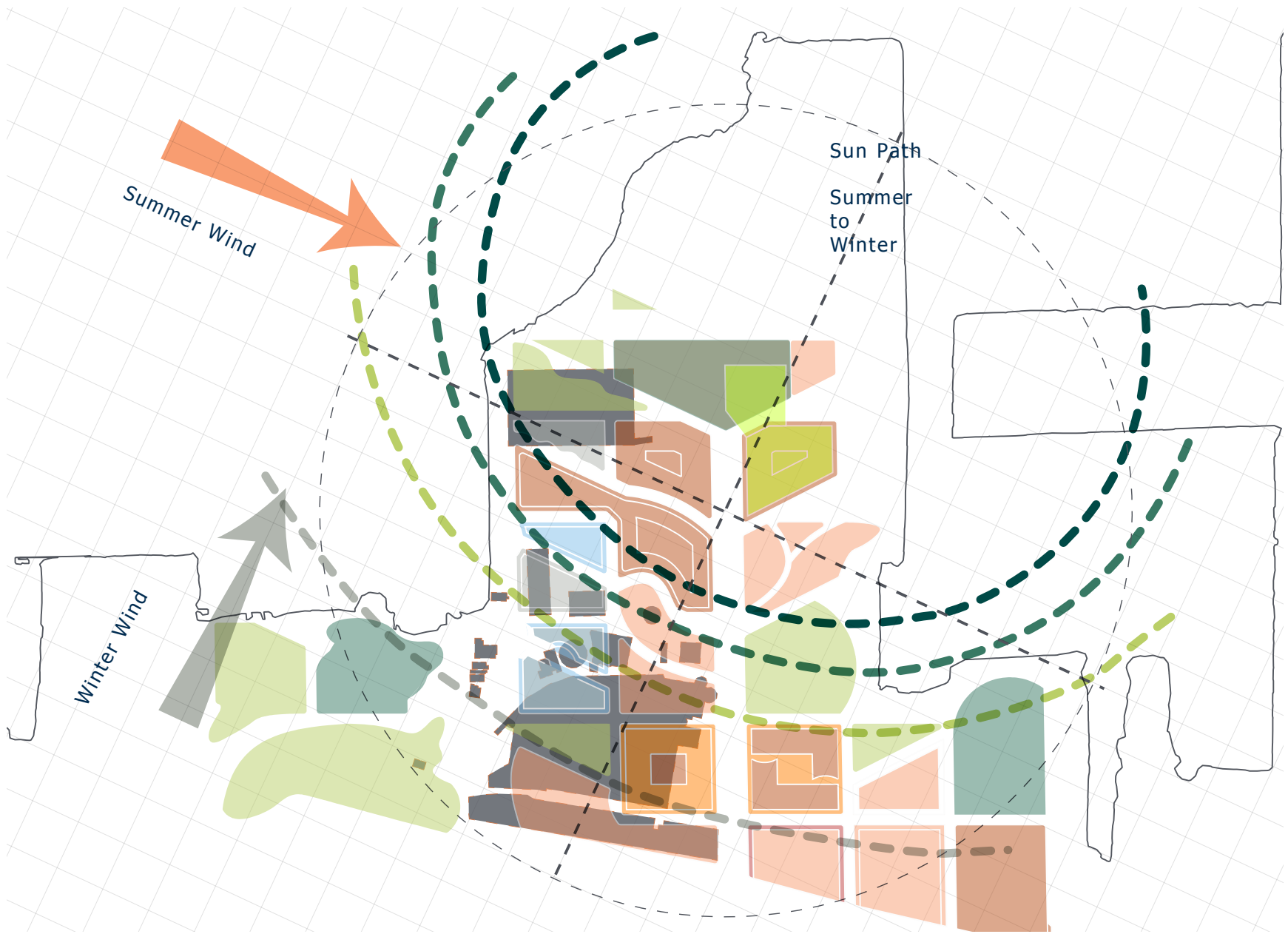
Exploring how to meet the desired characteristics for the site while creating a base for increased tax revenue led me to discover other proposals for the site that don't push the boundaries for what Erie can be. From those proposals, I was able to draw out minimums for new development and establish baseline amounts for the parking needed. In order to achieve the other goals and improve economic potential higher-density, mixed-use development that incorporates structured parking into the built fabric is the suggested. The proposed uses for the site include retail, leisure, townhomes, and multifamily housing. The residential uses would be targeted toward a mix of owner occupied and rental units. Integrating market rate units with subsidized units, through tax incentives, in the rental properties is part of the proposal.

Designing a new, human scale urban fabric that encourages public use and prioritizes the demands of many stakeholders was challenging. Determining the proposed grid began with analyzing the climatic exposures on site, specifically seasonal wind speed and direction as well as solar orientation. Strong wind comes from the South, or Southwest at times when it is most important to minimize it's impacts. Building massing is proposed to minimize wind travelling across the site, reduce wind tunnels, and create an

opportunity for capturing wind energy in building-integrated wind funnels. Adding thermal mass and photovoltaic solar screening, in the correct locations will allow for greater winter heat gain and summer energy production. Orienting buildings to protect and create microclimates allows residents and visitors to extend the season of use for outdoor and public space.

Providing adequate parking infrastructure that meets the needs for the neighboring convention center and remains at a human scale was addressed by incorporating structured parking into nearly every proposed building. The exterior of parking levels in each building should be designed and detailed at a level that creates a pleasing human experience. Typically, ground level edges on buildings will have a buffer of use other than parking to activate the space. Wrapping other use, stacking parking, integrating infrastructural systems, and layering use above parking structures are the operations used to move beyond the creation of typical parking structures.

Site analysis diagram showing sun path, wind direction, and proposed use



Commercial Uses

A central retail street is proposed running parallel to Sassafras St. The largest retail structure will accommodate 3-4 floors of parking and serve as the anchor for retail uses. The street level uses are proposed as smaller, boutique style spaces. A potential is to use a portion of the storefronts as incubator spaces for upcoming local artists and craftspeople. Similar models have been used in the redevelopment of Granville Island in Vancouver, BC. While these spaces do not generate the highest revenue streams they generate human use and activate space in a way traditional retail does not.

Food access, education and growth are elements that can be embodied in the use on site. Restaurants, cafes, and small commercial storefronts will be part of the fabric of the entire proposal. A larger space for food retail is needed to serve both the proposed growth in this development as well as the surrounding neighborhoods. The form this food retail space must take is not prescribed in this proposal, however it could be accomplished through ensuring a diversity of food available year-round, at a reasonable price, at the market house. The need could also be met with a traditional grocery store integrated into a mixed-use structure.

Hotel Use

In other proposals for the site prime waterfront space is used for a hotel. Given the desire for the new proposed hotel to be less expensive and the close proximity of another hotel directly on the waterfront the hotel in this scheme moves toward the center of the site. The hotel will be linked to the largest parking structure as well as sit above a portion of that structure to give some waterfront views. The hotel will also have private outdoor space above the garage, overlooking the uses below. While these two uses are common in combination, the last layering of use is to use the topmost surface of the parking structure as public space. Additionally, the westward side of the structure will include terraced public space that connects the public access at the waters edge to the space above. This structure is sited to take advantage of summer sun exposure and create sunset vantage points. The goal in this situation is create 'topographical' change by structuring parking underneath public space to create multifunctional infrastructure and Sunset Park.

Residential Use

Integrating housing on site is an important piece of developing this site into a new neighborhood for Erie. To create a rich diversity within the residents a mix of rented and owned units is proposed. Multifamily apartment and condominium buildings will make up the bulk of residential units with some townhomes incorporated into the scheme as well. All of the proposed complexes will have shared outdoor space available, some will include private outdoor space as well. The buildings are massed so that units have exposure on two sides and can be cross-ventilated in the warmer summer months. This also increases the depth light will penetrate and reduces the amount of energy needed to produce artificial light. Parking in these residential spaces will be sited on the lowest floors and the top of the structures will be used to create shared space. The shared space proposed includes courtyards, atriums, common kitchens with gathering spaces, or fitness areas. For the townhome projects the housing will be elevated above the parking and the units will have both shared outdoor space and private outdoor space. Integrating affordable housing units with market rate units should be encouraged through policy and tax incentives.



Steam and boat cleats at Presque Isle



Public Space

Crafting a variety of public space experiences that have multi-season functionality is integral to the proposition. The tone of the neighborhood is set by the transition from the central separated car-bike-pedestrian circulation system to a network of woonerfs elsewhere on site. This design decision was an intentional choice to redefine the streets in this neighborhood as shared public space. It is an intentional departure from prioritizing the speed and comfort of only vehicular traffic. Instead, all modes of locomotion, pedestrian, bike, or motorized vehicle negotiate to share the space. This model requires increased engagement and improved attentiveness to surroundings for all users. In both the separated and shared circulation systems street trees are planted to improve air quality, capture carbon dioxide, provide shade, and increase aesthetic value.

A series of surface and subsurface treatment wetlands are sited on the western edge of the site. Currently, a piped stream has an outlet into Presque Isle Bay in that location. The piped outfall that runs through the center of the site could also be diverted for filtration before discharge. This public space amenity will also serve ecological goals by helping reduce sediment, nutrient, and pollutant levels dispersed into the bay. Adjacent to the filtration wetlands is where the aquarium, hatchery, and educational center is proposed. The wetlands are intended to compliment the process of hatching and raising fish to stock the lake. Increasing the size of the current S.O.N.S. of Lake Erie hatchery and linking it with educational uses, will allow for an increase in the number of fry released. Incorporating native fish stocking and education is a way to create engagement across age groups and educate visitors about the importance of these fish to the economy and ecosystem. Siting the aquarium at the shoreline with the bay and next to an outlet into the bay allows for a design that integrates the building, exhibits, and landscape into a holistic system for education, economic generation, and increased ecological performance. Focusing on the local, freshwater ecosystem at the aquarium will showcase the flora and fauna of the region.



Visioning and Design Intervent



Visualization showing the potential use of the Sea Organ

Running along the Western shoreline of the site is an area that provides a variety of ways to access the water. This is a crucial addition to Erie's downtown waterfront experience. There is currently no other at grade access points for the public to interact with the water. The character of the shoreline transitions from a more natural shoreline at the treatment wetlands and outlet to a structured urban edge where Sunset Park meets a pier extension into the bay. At the northern terminus of the park, where the pier extends out, is an opportunity to create a sea organ, as proposed by local residents. This area receives consistent wind from the south and west and the waves produced could be used to activate a sea organ. Instead of using only the corrugated iron cribs typically used on Erie's waterfront this section of the waterfront park establishes a new design language for the site. Honoring the industrial heritage of the area but modernizing access to the water itself are crucial components to the approach. This new interface extends out beyond the shoreline and onto a multi-function pier that provides connection for the water taxi and boats. The pier could incorporate habitat sites for native freshwater mussels, or unionids, to help reestablish populations and filter water. An example of this type of integration is the Living Docks in West Palm Beach, Florida. The pier would also provide access to and protect a floating pool and hot tubs. This floating swimming area could resemble the model used with Copenhagen's harbor baths. The constructed platforms capture some of the water they float above into contained pools that is warmed with sun exposure. Additional solar heating systems could be devised to warm water for hot tubs. Shallow pools and children's areas with playful water features would be contained and warmed while deeper pools could connect directly with the bay.

At the northern end of the site is where Sunset Park is located. By draping public space above structured parking and using surrounding building mass to protect it a stunning view shed created. Visitors can overlook the swimming pier to the sun setting over Presque Isle. At ground level mounds and undulating built structures blend together to create outdoor rooms and space for play or sunbathing. The park ascends the side of the underlying structure as an amphitheater and terraced surfaces orient westwards. North of the parking structure, the loading and staging area for the convention center is enclosed and covered with an intensive green roof. While this roof is inaccessible to the public it provides stormwater management and improves aesthetics for

park users and hotel guests. This space is an extension of the attractions around it, increasing the experiential quality for the users and adding a unique amenity for local residents as well.

Along Erie's inner harbor, at the Eastern edge of the site, a large multifunctional plaza helps to store water, activate the area in all seasons, and provide an overflow space for the nearby market house. The plaza has two sections, an outer ring with trees and structures for supporting use and small commercial stalls. The inner core of the site can be used as a wading pond and sprayground (in the warm months), skating rink (in the cold months), or as an open-air market and gathering space (any season). The proposal integrates site furniture to create this space as an extension of the residential uses on site yet balances the experience to welcome tourists and convention goers. Underneath the plaza space reservoirs hold the captured stormwater, greywater, and yellow water to be treated and reused on site. The plaza acts as a node connecting the land bridge over the Bayfront Parkway and the new urban core.

Visioning and Design Interventions





Visualization showing the multiseason use of the inner harbor wading pool and skating rink.

Site Connections

The bluff that runs parallel to Erie's waterfront is a product of the glaciers that created the Great Lakes. While it provides great opportunities for viewing the Bayfront, it creates a significant barrier to interacting with it. In order to address these connection issues, two pedestrian and bike connections are proposed. The more significant of the two, a land bridge sited between Sassafras Street and Peach Street links the terminus of the two roads into the new urban core. The undulating form passes over the Bayfront Parkway and allows users to enter into the site between the plaza and market house. It provides easy connection to the Convention Center. This would also create improved access from the Bayfront linear park into the site. A series of sinuous paths that slope onto the site would be intermixed with grassed seating and observation spaces.

The second connection into the site would be in the form of a more traditional pedestrian bridge connecting from West Front Street between Myrtle Street and Sassafras Street. The bridge would connect to a building holding parking, site infrastructure, and commercial use. Users could descend to grade level by foot or in elevators.

On-Site Waste Separation

Separating multiple waste streams is one way to maximize the sustainability of the project. Designing the development and buildings to support separated wastewater streams is essential to reducing consumption and protecting the watershed. Storm water, or water that falls on rooftops, can be captured and used for non-potable use after treatment. Surface runoff, typically any water that contacts ground surfaces vehicles use, can be captured and treated before use or dispersal into the watershed. Grey water, such as water from showers, sinks, or laundry facilities is produced in high volume but does not have contaminant levels that make it prohibitive for reuse. Yellow water, or separated urine, contains a high percentage of nutrients that can be recaptured in a moderate volume of water. Black water is the traditional sewage we are accustomed to and requires the highest treatment because of pathogen content. Each of these water streams can be used in a way to help minimize ecological impact and improve economic conditions. The following table shows how reuse for each is proposed on site.

In addition to separating wastewater streams, it is important to separate household and personal waste. In order to reduce heavy vehicle traffic and decrease barriers to stream separation a pneumatic collection system is proposed. These systems are in use in Europe, Asia, and are now coming online in the US. By keeping organic material, recyclable material, and hazardous material out of landfills we increase their useable lives and lessen environmental impacts. Organic waste, such as food scraps and other biodegradable items can be separated at the household level and collected to create compost. That separation of organic material for compost will divert volume from landfills and be used to create a tangible product for sale. Continuing to separate recyclable materials, as Erie is already doing is important. Educating users about how to dispose of potentially hazardous materials like paint or nail polish is also part of the process. Waste that cannot be composted or recycled can be collected into it's own stream. From that point, it can be used at the district scale for waste-to-energy power production or disposed of in landfills.

Cogeneration Options

Integrating energy generation into the infrastructure of the site is part of creating an efficient system. Some of the greatest opportunities come from the nearly year-round winds in Erie. By utilizing the south facing building facades for integration with wind funnel technology energy can be generated without large turbines. Other, smaller, more appropriate wind capture technologies can also be used throughout the development for pumping water or energy generation. By separating black water from other wastewaters the organic material in it can be dewatered and used for biogas or biomass digestion to produce energy. Lastly, all wastewater can go through the process of heat exchange to recapture energy.

Visioning and Design Intervention





Visualization depicting the treatment wetlands at sunset



The mouth of Cascade Creek

Take Away's and Distillable Framework

TAKE AWAY'S AND DISTILLABLE FRAMEWORK

All of the scales that were part of this proposal are posed with the same core challenges, yet at each scale the solution is much different. For example, addressing water quality issues is paramount to the success of the region. For the Great Lakes Region this is reflected in higher standards for water discharge and better monitoring of system wide conditions. At the scale of Lake Erie addressing agricultural runoff is the key approach to improve water quality. For the City of Erie increasing treatment before streams and drains reach the lake and bay are most important. At the scale of the GAF site water quality management moves beyond treatment to involve education and create a public amenity. The scalar transitions all work to solve the overarching regional issue but begin to have more diversified application as scale decreases.

Policy Changes

Regionally, there are already documents packed with well-researched recommendations for the changes that need to be made to address water quality improvements and to reduce consumption. The goals and best management practices the Great Lakes and St. Lawrence Cities Initiative has available on their website reflect the policy shifts that need to occur to improve the conditions of Lake Erie. The ratification of the Great Lakes Compact reflect the changes that have been made since the Great Lakes Water Quality Agreement yet there is substantial progress to be made.

The International Joint Commission recently published "A Balanced Diet for Lake Erie, Reducing Phosphorus Loadings and Harmful Algal Blooms" which provides examples of best management practices for agriculture and urban areas. Additionally, it provides recommended levels for phosphorus levels lakewide. The stormwater management practices discussed throughout this proposal are echoed in the Joint Commission's report as a method to reduce non-point sources of phosphorous. It cites bio-retention facilities like rain gardens, filter basins, or planted infiltration ponds, as the most effective at the removal of phosphorous. When installing these devices attention should be paid to correct design, soils, and plant selection, as they are part integral to successful

reduction. The second most effective way to remove phosphorus is through constructed wetlands. The success rates of the two approaches are 82% for bio-retention facilities and 75% for wetlands.

<http://www.betterfarming.com/sites/default/files/2014%20IJC%20LEEP%20REPORT-1.pdf>

The Alliance for the Great Lakes published "Great Lakes/St. Lawrence River Water Conservation Model Policies & Measures, State/ Provincial Model Public Water Utility Model" to address the changes need to reduce consumptive use. One of the approaches I find most interesting is the creation of a 'water budget' based on the inflow and withdrawals in the watershed. While the document recommends that states and provinces adopt all of the policies that are 'environmentally sound and economically feasible' it is important to keep in mind the cost of poor water management on the economy of the region. Additionally, it would be prudent to educate consumers on the true cost of water in the region and to move towards pricing schemes that reflect it's cost.

<http://www.greatlakes.org/Document.Doc?id=939>

Common to both documents are the suggestion of using green infrastructure or low impact development practices. In order to achieve the highest implementation of these types of projects policy will need to shift. The current policy climate is often prohibitive of these development patterns and completing projects using these techniques requires additional effort from the designer or client. Shifting policy to require new development, infrastructure, and any government retrofit to use these techniques would see the greatest impact and reduce barriers. If requiring the implementation is too strong a tactic then policy change coupled with incentives are the next proposed method of implementing green infrastructure projects.

Infrastructure Changes

Our relationship with and expectations for infrastructure projects must evolve as we move into an era of even tighter budgets and higher standards. Infrastructure, as we think of it traditionally, must move beyond a single level of service and become multifunctional. Expanding how we define infrastructure instead of just roads, pipes, or bridges needs to happen concurrently with the transition to multifunctionality. By thinking of the challenges the complex systems that feed cities pose and using the strategies we know (roads, bioswales, bridges, or decomposition) to solve them, we reach our new understanding of infrastructure. The public relationship with consumptive goods and waste needs to be addressed as a crucial element that can be changed in the design of infrastructure and through education.

Urban Design Elements

As the project moved into a smaller scale it became apparent that the potential for the site being redeveloped in a suburban pattern was very likely. Developing small, semi-detached residential units and one large structure is not the highest and best use for a parcel that is in a central urban core. It was important to propose a use continuing the cues of the existing urban fabric but that adapted to the challenges of the site. Extending Sassafras Street as the central spine of the design and then orienting the cross streets to protect against wind was an essential piece of the urban design. Small block sizes, numerous street trees, well-articulated building facades, and ample public space are all elements that are used to design urban fabric that is enjoyable to inhabit. Connection to the city is a concern given the Bayfront Parkway and seventy foot bluffs. Incorporating a land bridge as a tool to give at grade pedestrian access as well as a traditional pedestrian overpass gives users increased access to the site.

WRAP UP

Next Steps

The potential next steps for this project are vast, like the potential for this project. If unlimited time and resources were available a more thorough mapping and analysis of the utilities infrastructure in the City of Erie would be my first step. That layer of information will be crucial in addressing the details of how the city can create decentralized systems to manage water, waste, and energy while still utilizing central hubs in the most appropriate way. Another potential is to consider the master plan for all of Erie's downtown waterfront from the perspectives this site used. Looking into the possible ways to extend the importance of public space and sustainable practices while creating tax revenue for the city. The next site I would consider for developing multifunctional infrastructures on is the former Hammermill/International Paper site. It's adjacency to the biofuels refinery and the potential for large scale industrial reuse, with direct lake access make it an ideal site for reuse. Beyond that addressing wastewater and stormwater, city and countywide would be a design priority. Improving the quality of the water and ecosystem in Erie could lead to more tourism revenue and more fishing revenue. Overall, I hope this document serves as an example of what Erie can strive to achieve. Goals like this create a city that pairs supportive business with driven education and passionate residents with unique ecologies to make itself an example of post-industrial redevelopment.

Conclusions

The implications of cities in the Great Lakes not making progressive changes in their relationship with water are staggering. Yet the opportunities that exist in change are equally amazing. The quality of water discharged into the lakes needs to take a higher priority at the municipal level to create regional improvement. Linking the health and levels of the lakes to economic incentives is crucial for accomplishing this. As the region is poised to continue to grow, smaller cities need to adapt their thinking to attract growth. As water becomes scarce worldwide all of the communities within the Great Lakes have an advantage. Yet, with that advantage they have a duty to protect the resource and a responsibility to leave it better than they found it. Proximity to the lakes, and with it access to water, should not be an element that is taken for granted in policy or daily life.

As Erie begins to make changes that will impact the city for generations to come crucial and demanding choices will be made. Erie has the potential to adopt a set of views and practices that protect the value of the ecosystem while growing economic potential and quality of life. There is a great potential for the city to leverage the proximity to water and potential sources of renewable energy in order to create intelligent growth patterns. Equally possible is the potential to use suburban land development patterns on our greatest opportunities. This proposal for reinvigorating the waterfront is an example of how we can begin to change our thought process from meeting the minimum requirements and shifting to development choices that position the city to reach beyond it's previous success. While other cities and projects have shown these approaches work, the crucial element of Erie's success will be the concurrent application of multiple approaches. By showing the residents of Erie the precedents for change and visualizing how that change would impact their city, I hope more is expected from the GAF redevelopment. While many residents of the Great Lakes become accustomed to the beauty and unique opportunity that the lakes provide I hope Erie's residents will see their opportunity to appreciate and protect the gifts that make life in Erie so special.

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