

GREEN FUTURES

Scenario Planning in Cincinnati's East End Neighborhood

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ABOUT THE PROJECT

This project is the product of a University of Cincinnati class titled, Urban Landscape III: Infrastructure, taught through the Niehoff Urban Studio. It was organized in a seminar format, with a design component.

The semester was initiated by a three-day long planning workshop called the Vacant Lots Charrette. During this weekend, landscape architecture, horticulture, and planning students worked together to address how communities could turn vacant lots from eyesores into opportunities. Students were able to meet with community members to learn about the neighborhood as well as visit the community in person. The workshop ended with a presentation about the future vision for the East End made to local stakeholders.

The team of students spent many weeks reading and discussing urban infrastructure issues and interventions including specific topics related to climate change and resiliency planning. These topics ranged from the urban heat island effect to stormwater management to everyday

urbanism and urban agriculture. These topics were not location specific to Cincinnati but included examples from around the world. This helped to provide a foundation on which to apply the local Cincinnati context and plan for infrastructure interventions.

Concurrently, the team researched the local conditions of the East End neighborhood to better understand the area. This included an analysis of its demographics, land use, vacancies, city-owned property, transportation network, vegetation, water quality, flooding conditions, and recreational opportunities.

The next step involved a case study exercise where the team researched and analyzed best practice topics that might be beneficial to the community. This included: climate change, bank stabilization, slope stabilization, phytoremediation, green affordable housing, and eco villages and recreation.

Finally, the team synthesized this knowledge into four specific interventions applied to the East End neighborhood.

ABOUT THE TEAM

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EXECUTIVE SUMMARY

The East End currently faces issues of vacancy and risk of flooding, while also experiencing some commercial and residential growth. The neighborhood seeks to confront these conflicting realities through development strategies that are tailored to the area's natural environment. Located along the Ohio River, much of the neighborhood lies within a floodplain which poses major problems for maintaining and redeveloping the area. However, its proximity to downtown, the Ohio and Little Miami Rivers, nature, and the future Oasis rail line all make the East End a potential desirable place to live. But, how does one mitigate the effects of climate change and extreme weather in a floodplain while still planning for a successful future?

During the Vacant Lots Charrette, the team crafted a vision statement and goals for the East End neighborhood as follows:

Vision: The East End coexists and interacts with nature to build community and provide a regional destination.

1. Coexist with Nature
2. Interact with Nature
3. Build Community
4. Make a Mark Regionally

Through the process of this project, the team shifted its thinking to consider other possibilities for the future of the East End. In order to plan interventions for the community, it was important to think about what the future might look like. With this idea, the team envisioned two scenarios, or frameworks, for the neighborhood. In the first, the East End would become more industrial, focusing on green industry and harnessing the river as a means for transporting goods. In the second framework, the neighborhood would become a recreation destination, linking multiple activities, such as the biking, kayaking, boating, and other sports. These

frameworks each come with their own assumptions. It is against these scenarios and their respective assumptions that the team applies their infrastructure interventions. These interventions of bank stabilization, slope stabilization, brownfield remediation, and eco-housing are solvent in both scenarios but differ depending on the scenario to which they are applied.

Scenarios are a helpful tool for planning more than one future. It is the hope that the East End community will begin to think critically about ways to respond to potential problems such as flooding, landslides, and brownfield contamination. No matter the future, if an intervention is applied in the correct way, it would both protect the East End from greater harm, while allowing it to continue to thrive.

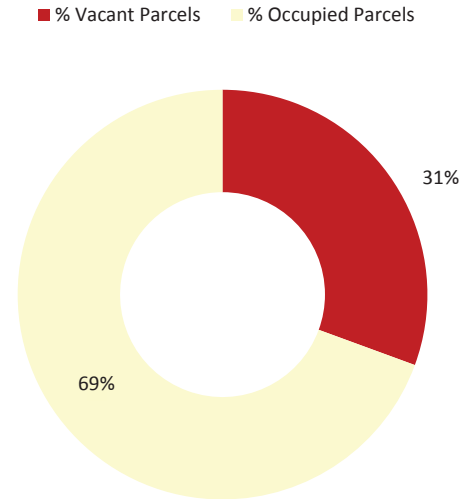
CONTEXT

Vacancy

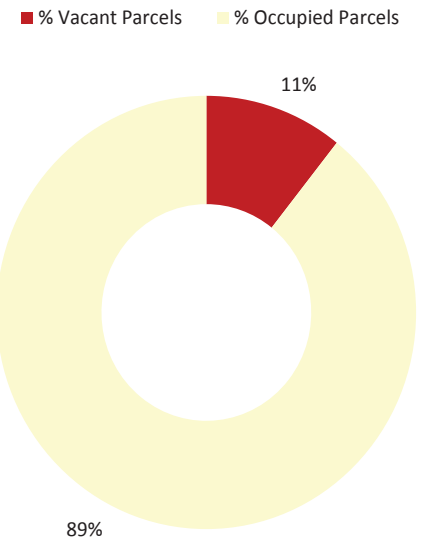
Vacancy is quite high in the East End neighborhood. The map below shows vacant parcels in red with all other, presumably occupied or public right-of-way parcels in beige. Vacant parcels tend to be either along Columbia Parkway to the north or along the Ohio River on the south. The land area in the East End totals about 2.75 square miles. Of that, 2.46 square miles of the parcels are occupied or roughly 89%. That leaves about 0.29 square miles or 11% of the total land that are vacant. The chart to the right, titled Vacancy by Percentage of Land Use, shows the share of vacancy based on the area of parcels.

The chart titled, Vacancy by Number of Parcels, on the other hand, shows the percentage of vacant parcels based on the number of parcels. There are 3,093 parcels in the East End; of them, 2,147 are occupied and 946 are vacant, or 69% and 31% respectively. This means that even though only 11% of the total area is vacant, the number of vacant parcels are disproportionately higher, consuming 31% of the total number of parcels. This also increases the likelihood that there are more property owners to contend with in the East End and that land assemblage would involve multiple players.

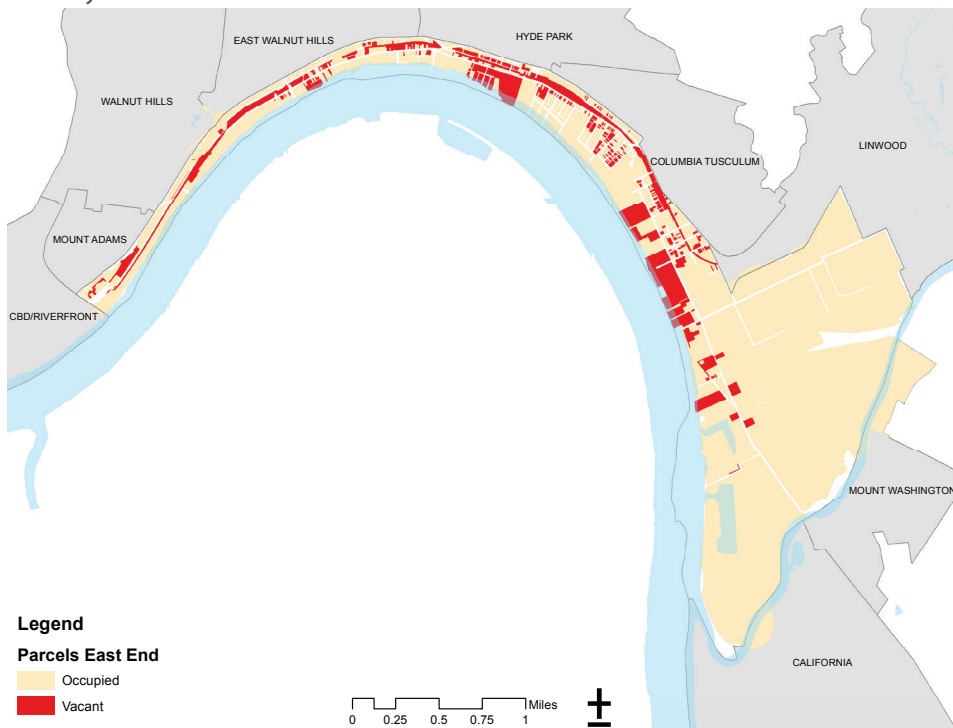
Vacancy by Number of Parcels



Vacancy by Percentage of Land Use



Vacancy in the East End



Data via CAGIS, 2014.

CONTEXT

Demographics

HISTORY

Cincinnati's East End neighborhood now stretches seven miles along the Ohio River, to the east of downtown. The current area is actually an accumulation of several historic neighborhoods [1]. Early development was influenced by industry and railroad construction along the river. When streets and railroad lines were reconfigured in the mid to late-1800s to better connect the neighborhood to downtown Cincinnati, more people began to settle in the area [1]. The population continued to grow as industry in the area boomed, and became one of Cincinnati's characteristically working-class neighborhoods. However, reduced residential investment and increased building deterioration discouraged growth from the mid-20th century on [1]. After peaking in the 1950s at about 12,000 people, the population has steadily declined since [1]. In 2010, 1,518 people resided in the East End of Cincinnati (down from 1,692 people in 2000 and 2,415 people in 1990). Numbers aside, the community's priorities from the 1992 Plan are a telling demographic factor: they first seek to provide affordable low-income housing, yet do not want to become a "low-income ghetto," [1].

POPULATION DENSITY

In 2010, the East End had 1,518 people per square mile, whereas it had 1,170.6 people per square mile in 2000. Compared to the rest of Cincinnati, the neighborhood is significantly less dense than the center city, but more so than the hillier western side of the city and than the eastern Little Miami River valley region. The East End is also less dense than the other eastern neighborhoods of Cincinnati, like Hyde Park, Mount Lookout, and Columbia-Tusculum. This may partially be explained through the narrow development pattern of the neighborhood, the proportion of single-family homes in the area, and the numbers of vacant housing units (see Housing section).



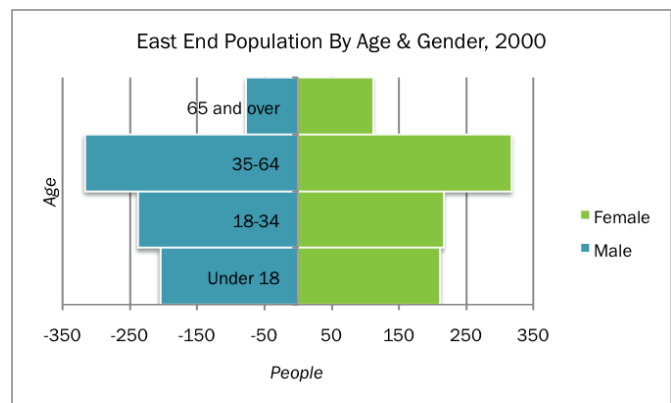
Population Density, in comparison to Cincinnati. (Census 2010)

AGE, GENDER, & RACE

In 2000, the median age of East End residents was 38.4 in Tract 43 and 33.2 in Tract 44. The largest concentration of East End residents is in the age 35-64 category. If these residents have remained in the East End over the past ten-plus years, this has significant implications for neighborhood services needed to handle the aging population.

In both 2000 and 2010, there were more females than males living in the East End, although only by a minimal number.

The East End has been predominately composed of white residents for the past twenty years. In 2000, the area was 81.3% white, and was 86% white in 2010. The percentage of African-Americans living in the area dropped from 18.7% in 2000 to 11% in 2010. However, American Indians, Asians, and other races were represented in 2010 (each 2% or below) [3], whereas they were not in 2000 [4].



Census Designation	Male		Female	
	Tract 43	Tract 44	Tract 43	Tract 44
Under 18	42	163	48	163
18-34	54	184	52	164
35-64	87	230	82	235
65 and over	29	48	36	75

East End Age Distribution (Census 2000)

HOUSEHOLD TYPES

Household Type	Tract 266
Married-couple Family	33%
Single-father Family	5%
Single-mother Family	12%
Non-Family	50%

East End Household Types (Census 2010)

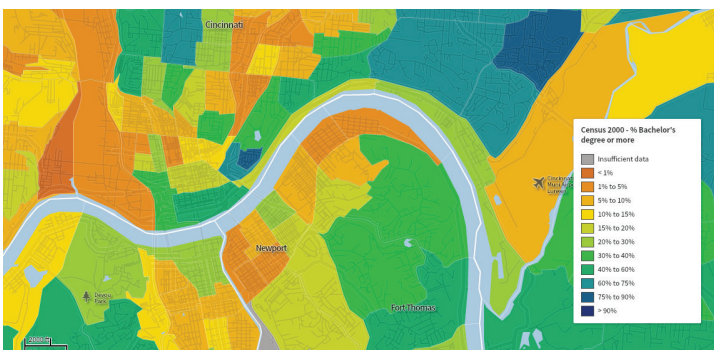
Notes: Certain census data was only available for the year 2000. Prior to the 2010 Census, the East End was divided into two census tracts (Tract 43 and Tract 44). Tract 43 had a smaller population than Tract 44, as demonstrated by Census 2000 figures (the tracts having 430 and 1,262 residents, respectively). Beginning with the 2010 Census, the area was consolidated into Tract 266. This redrawing of boundaries may account for some of the drop in the East End's population from 2000 to 2010, as certain areas from Tract 44 are no longer included in Tract 266. Even so, as the 1992 Plan points out, the population has been declining since the mid-20th century.

EDUCATION

The East End does not have the highest educational attainment rates within Cincinnati—especially when compared to the more affluent neighborhoods directly to the north (see below). However, in 2000, the majority of residents over age 25 had graduated high school, and between 16 and 20% had graduated with at least a Bachelor’s degree.

Educational Attainment (25 & Over)	Census Tract 43 (2000)	Census Tract 44 (2000)
Less than High School	25%	49%
High School	75%	51%
Bachelor’s Degree	16%	20%
Master’s Degree	3%	11%
Professional School Degree	0%	5%
Doctorate Degree	0%	<1%

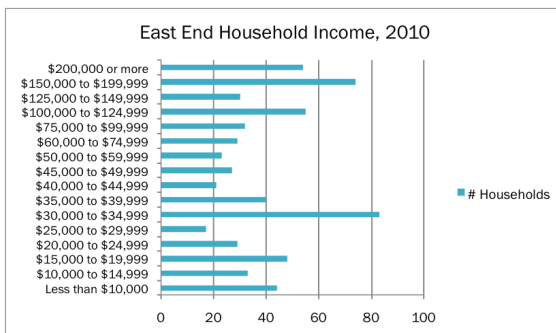
East End Educational Attainment (Census 2000)



Percent population with Bachelor’s degree or more, Cincinnati. (Census 2010)

EMPLOYMENT

East End household income is not normally distributed—this almost bi-modal distribution indicates socioeconomic disparity between East End residents. The 2000 median income for East End households was \$40,982 in Tract 43, and \$33,098 in Tract 44, and increased to \$45,592 in 2010. 73% of households in Tract 43 had wage or salary income in 2000, as did 82% of Tract 44 households. 33% and 23% of households (respectively) had social security income. As of 2000, 6% of residents in Tract 43 and 8% of residents in Tract 44 were unemployed. 324 individuals in 2010 (roughly 21% of the population) were classified as living in poverty. 102 people had earned an income below poverty level in the past 12 months (2009-2010).



Sources:

- [1] City Planning Department. 1992. East End Riverfront: Community Development Plan and Guidelines. Cincinnati, OH.
- [2] Community Design Center. 2014. East End Garden District Study: An Urban Design Menu: Exhilarate Activate Savor. Cincinnati, OH.
- [3] Department of Planning and Buildings. 2012. East End Statistical Neighborhood Approximation. Cincinnati, OH. Accessed February 16, 2014. <http://www.cincinnati-oh.gov/planning/link-servid/B4ABFF98-EC1B-9A36-D291C3F90AA55325/showMeta/0>.
- [4] U.S. Census Bureau. U.S. Demography 1970 to Present. Prepared by Social Explorer. Accessed February 16, 2014. <http://www.socialexplorer.com/89AACD3A4F1E4E1/explore>.

HOUSING

The East End had 851 total housing units in 2000 (median year built =1939). Of the units, 89 were renter-occupied in Tract 43 and 282 were renter-occupied in Tract 44. The average gross rent for renter-occupied units was \$771 in Tract 43 and \$578 in Tract 44. 96 and 264 units (in Tracts 43 and 44, respectively) were owner-occupied, with a little over 50% of housing in both tracts being single-family (1 unit) dwellings. Tract 43 was the only tract in Cincinnati to have mobile homes in 2000. Furthermore, Census Tract 44 was the only tract in the city to have boats, RVs, or vans as an owner-occupied primary housing unit.

In 2010, the number of vacant housing units rose from 120 (Census 2000) to 139. While there were more vacant units for rent than for sale in 2000, that reversed in 2010, when there were 33 vacant units for rent, 48 for sale, and 29 classified as “other vacant.” While the rates are not as high as some more western parts of the city, they still leave visible markers of the neighborhood’s declining population.

TRANSPORTATION

Transport Type	Tract 266
Car, truck, van	78%
Public Transportation	5%
Bike	1%
Walk	5%

East End Transportation to Work (Census 2010)

SUMMARY

Census data available from 2000-2010 suggests that Cincinnati’s East End neighborhood is changing in several ways: decreasing in absolute population, shifting in racial composition, and decreasing in economic stability. Moving forward with development, the community should consider the large percentage of people living in poverty (21%), and how this contrasts with the large segment of residents with incomes above \$100,000. Awareness of this socioeconomic disparity will help determine the best courses of development in order to avoid isolating certain groups. The community will have to determine how to attract newcomers to the area, while preserving affordable spaces for current residents.

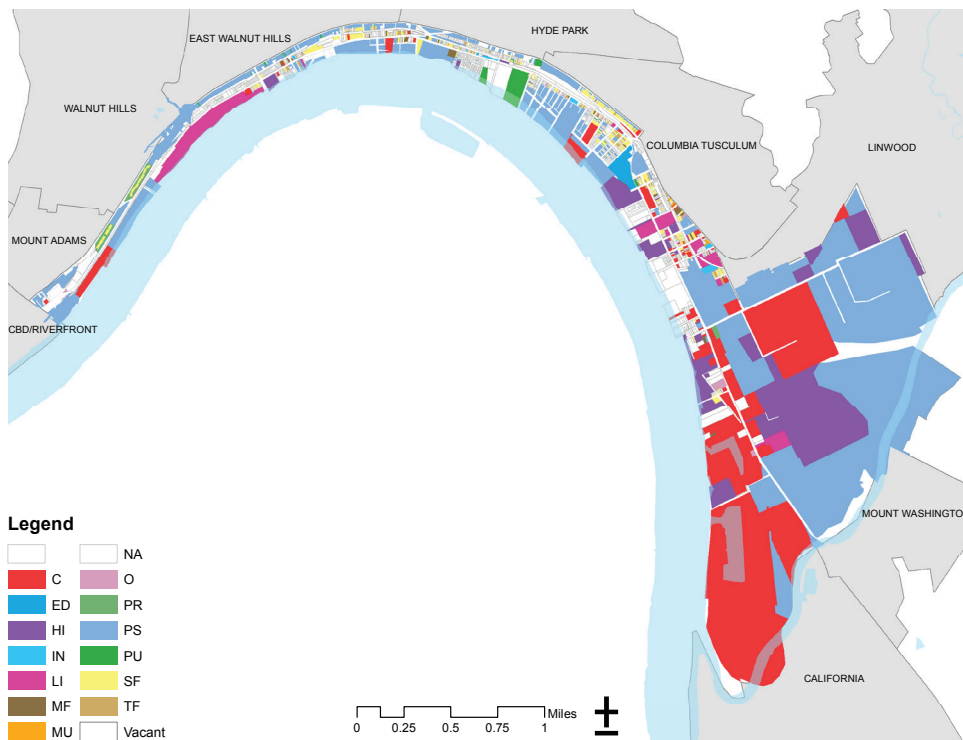
CONTEXT

Land Use

Land Use in the East End is varied between residential, commercial, industrial, and public service uses. The map, Land Use in the East End, below shows the land uses mapped out by parcel. It is easy to infer that the Lunken Airport constitutes a large amount of the public service land use in the southeast portion of the map. In fact, from the chart below, Share of Land Use by Type, public services comprise 42.9% of the total land use. Light industrial occupies much of the land along the Ohio River to the west, with heavy industrial located in the eastern part of the neighborhood. Single-family, two-family, and multi-family residential parcels are mostly located away from the Ohio River along River Road. Commercial parcels are scattered but primarily located in the southeast section of the neighborhood.

Beyond public service, the most prominent land use in the East End is commercial, making up 26.4% of the neighborhood, followed by heavy industrial with 12.2%, and vacant parcels with 10.7%. All other land use types are less than 3% each. Residential is only a small component of land use type with single-family at 1.4%, twofamily at 0.3%, and multi-family at 0.3%. Even added together, residential parcels only comprise just less than 3% of total land area. This shows that commercial and industry dominate the neighborhood, along with the Lunken Airport as a public service. When considering redevelopment opportunities, these predominant land uses should be considered and kept in mind.

Land Use in the East End



Share of Land Use by Type

Type	Square Feet	Percentage
Commercial	20,265,188	26.4%
Education	437,077	0.6%
Heavy Industrial	9,401,542	12.2%
Institutional	146,105	0.2%
Light Industrial	2,247,513	2.9%
Multi-Family	206,098	0.3%
Multi-Use	36,912	0.0%
Not Applicable	53,151	0.1%
Office	142,818	0.2%
Parks and Rec	289,504	0.4%
Public Service	32,928,398	42.9%
Planned Unit	628,407	0.8%
Single-Family	1,103,121	1.4%
Two-Family	261,265	0.3%
Vacant	8,198,912	10.7%
Unknown	408,093	0.5%
Total	76,754,104	

Data via CAGIS, 2014.

CONTEXT

City-Owned Property

Of the East End's 2,601 acres, just over half is city-owned or operated at 57.4%. The rest of the land is assumed to be privately-owned, and includes vacant space as well.

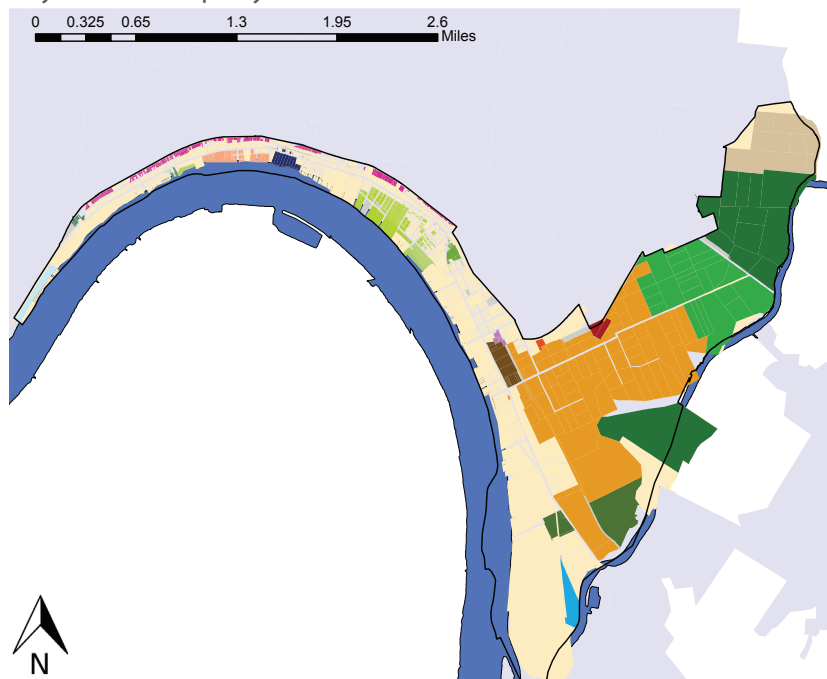
While some of the uses of this city-owned property (as can be seen in the map below) are clear, such as the Lunken Airport, others have much smaller impacts on the neighborhood, including street right of ways and vaguely labeled parcels of "recreation maintenance." Because some city property is so small and cannot be easily discerned in a map, these parcels are collapsed into the "other" category.

In the map below, major city properties or uses are highlighted. Similar uses are collapsed; for instance, parcels labeled "Lunken Airport," "Lunken Airport Hangar," and "Lunken Airport Office" are all captured under the label Lunken Airport. City-owned property is overlaid on privately owned land.

Nearly all of the northeast portion of the neighborhood is owned by the City in the form of the Lunken Airport, the Lunken Airport "playfields" that includes a golf course and tennis court, and the Little Miami River Scenic Park and an accompanying sports complex.

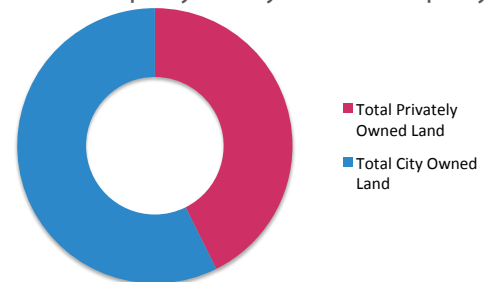
When collapsed even further, the two main city-owned property types become obvious. In the chart below, titled City-Owned Property Breakdown, all greenspace, parks, and outdoor recreation facilities are collected under the broad term of "greenspace." Viewed this way, it is clear that the Lunken Airport is still a large city service, but now it can be seen that outdoor recreation space takes up over half of the city-owned property. This should be taken into consideration as the East End continues to define its identity and role in the city of Cincinnati.

City-Owned Property in the East End

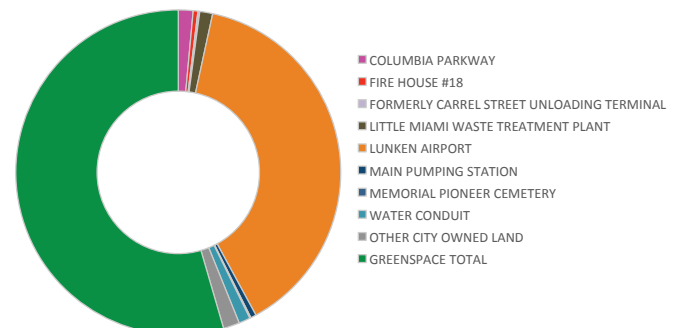


Data via CAGIS, 2014.

Private Property vs City-Owned Property



City-Owned Property Breakdown



CONTEXT

Existing Businesses + Services

The East End has a unique physical character: the boundary is unusually long, thin, for the most part, is in close proximity to the Ohio River, and much of the land is in the floodplain. The East End also has ample access to the river, much more than most neighborhoods. These characteristics do much to both guide and limit commercial development and available services.

Lunken Airport. One of the primary businesses for the East End, as far as land consumption, is the city-owned Cincinnati Lunken Municipal Airport. This airport covers over 500 acres, which is 22% of the entire East End land cover, and has three runways.¹

Industrial. Historically, the East End was heavily industrial and the western tip of the neighborhood in particular still has active light industry. Light industry along the waterfront includes Queen City Forging and Hyde Park Painting and Carpentry.

Commercial / Retail. The East End's envisioned "garden district" includes Eli's Barbecue as an anchor for this area that the neighborhood hopes to turn into an entertainment district. BrewRiver GastroPub is another burgeoning destination restaurant/bar that may continue to attract further restaurant and retail development.

Other. The rest of the neighborhood has different business options. The Rivertowne Marina and accompanying businesses (such as the Four Seasons Yacht Club and Sea Ray of Cincinnati) dominate the riverside and southern portion of the East End. Other businesses in the south area of East End are used car sales and several auto parts dealers, like Jack's Used Auto Parts, Cohen Auto Parts, Bobs Used Auto Parts.

A smattering of most business types appear in the neighborhood. There are small accounting and law firms, wholesalers and warehouses (Johnson Electric Supply), creative firms (Round Pixel), antique malls, a dog training academy, and others.

Community. A surprising range of community places serve the East End. The most notable is perhaps the Riverview East Academy, a K-12 school raised several feet off the ground as a preventative measure against flooding. This is a community school that attracts from nearby neighborhoods including the East End. The East End also has an active Montessori school for preschool children. Other notable community spaces are the Le Blond Community Center and St. Rose (or Rosa) Church, which is on the US National Register of Historic Places.

St. Rose Church

Lunken Airport Aerial



Google Maps, 2014. googlemaps.com



Queen City Tour, 2011. queencitytour.blogspot.com

¹ City of Cincinnati, Transportation and Engineering. About Lunken Airport. 2014.

CONTEXT

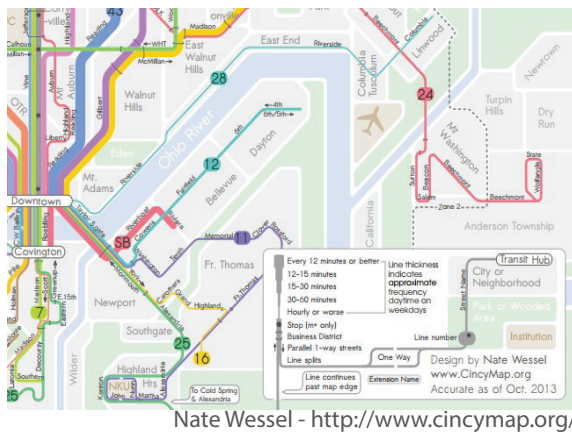
Transportation Network

The Street Network map displays the limited accessibility in the East End due to few external access points, limited intersections, and numerous cul-de-sacs. This map also shows the street hierarchy of the East End, which primarily consists of local roads, and one principle and minor arterial. As one can observe from the map there is one main access road into the East End from the East, four from the North, and one from West. The existing rail line is also displayed to show the potential Oasis Commuter Rail Line, which is currently undergoing a Tier 2 National Environmental Policy Act (NEPA) study, and preliminary engineering by OKI. This commuter rail line would provide a much needed mobility option for the East End residents.

Street Network



Bus Network



Nate Wessel - <http://www.cincymap.org/>

The East End is served by one bus route as shown in the frequency map to the left. The single line, route 28, is insufficient to support the entire community and operates on an average frequency of every hour. Route 28 travels from Milford to the Fountain Square Transit Station. The average time it takes to get from Eli's Barbeque to the Fountain Square station is approximately 21 minutes, based on Google maps. Bus routes 24 and 30 are also accessed by the community, but the stops are in Columbia Tusculum.

Internal Connectivity - 23 intersections per sq. mile
External Connectivity - 2.19 access points per sq. mile
Number of Cul-de-sacs - 34

Oasis Commuter Rail Line



OKI - Eastern Corridor

The Oasis line is planned to be 17 miles long and is expected to serve 3,240 people per day on an average weekday. The proposed stations within the East End will include the Boathouse, East End area (near Torrence Parkway), and Lunken Airport (along Wilmer Avenue).

CONTEXT

Plant Types

The East End Neighborhood supports a large percentage of land with vegetative cover. This vegetation serves as a buffer along the riverfront, and also provides recreational opportunities. The land can be categorized as floodplain, wet field and prairie, wet wood, and wetlands. Because of this, many of the trees, shrubs, grasses and flowers found in the East End Neighborhood are moisture tolerant and can withstand having their roots submerged in water.

Trees such as Eastern Cottonwood, Swamp White Oak, American Sycamore, and Black Willow grow in the forested floodplains along the Ohio River and in the East End Neighborhood. The area also sustains a variety of long grasses such as sedge.

The Eastern Corridor Land Use Vision Plan is helpful in assessing the current plant conditions in the East End Neighborhood. The document, which was compiled by Meisner + Associates and the Hamilton County Regional Planning Commission, completed assessments in a study area which includes the East End Neighborhood.

The East End, like many parts of Ohio, suffers at the hand of several invasive species, particularly Amur, Morrow and Tatarian honeysuckles. The honeysuckle prefers to live along marshes or in the understory of woodland, making the East End Neighborhood ideal. Other invasive species that can be found in the East End Neighborhood are Garlic Mustard, which grows in floodplain forests, Purple Loosestrife, which grows in wetlands, and common reed grass, which colonizes quickly and flourishes in wetlands (Invasive).

Sources:

Clermont County. 2002. Eastern Corridor Land Use Vision Plan: Final Report. Accessed February 18, 2014. <http://www.hamiltoncountyohio.gov/hcrpc/pdf/ECLUVPReport.pdf>

Invasive Plant Fact Sheet: Amur, Morrow and Tatarian Honeysuckle. Ohio Department of Natural Resources. Accessed February 18, 2014. <http://www.dnr.state.oh.us/dnap/invasive/1amurhoneysuck/tabid/1996/Default.aspx>.

Bush Honeysuckle



Kenneth R. Robertson INHS <http://www.inhs.illinois.edu/research/vmg/bhnysock/>

Garlic Mustard



Glenda Denniston. http://lakeshorepreserve.wisc.edu/landscape/spring_phenology.htm

Purple Loosestrife



<http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/purple-loosestrife.aspx>

CONTEXT

Water + Flooding

Water quality remains a high concern for not only the East End Neighborhood, but also Cincinnati, and the Ohio River Watershed as a whole, as the Ohio River Basin is occupied by over 25 million people and provides drinking water for more than five million people (Ecology 2010). Three major issues plague the Ohio River: combined sewage overflow (CSO); nonpoint source pollution (including acid mine drainage (AMD), agricultural runoff and urban runoff); and industrial pollution.

The Lock and Dam System. "Over 230 million tons of cargo are transported on the Ohio River each year. Coal and other energy products make up approximately 70 percent of the commerce traveling by barge. The US Army Corps of Engineers installed a system of locks and navigation dams along the river, which include 21 sets of locks and dams. Now, the river functions as sets of pools. Each pool has similar ecological conditions, but environmental factors have created differences between them as well. Cincinnati borders the Ohio river along the Mendahl pool, and is located between the Captain Anthony Meldahl Locks and Dam and The Markland locks and dam, located at river miles 436.2, and 531.5, respectively. Because of these interventions to the river, the natural flow of water along the Ohio River has been halted. This has isolated and aggravated natural ecosystems, and has quickened the collection of pollutants.

Sources:

Ecology: The River and Its Watershed. Ohio River Foundation. Accessed February 18, 2014. http://www.ohioriverfdn.org/about_the_river/ecology/index.html.

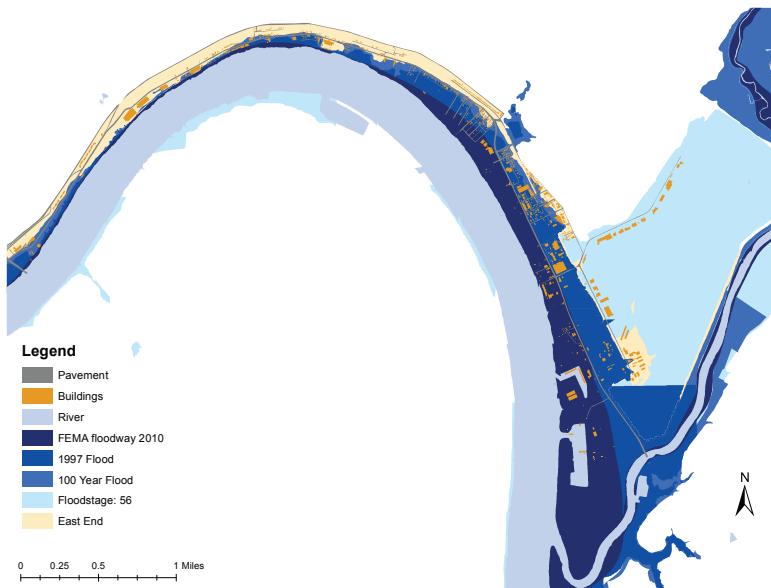
Available Data. Ohio River Valley Water Sanitation Commission. Accessed February 18, 2014. <http://www.orsanco.org/data-main>.

Turer, Dilek, J. Barry Maynard, and J. John Sansalone. 2001. "Heavy Metal Contamination in Soils of Urban Highways Comparison Between Runoff and Soil Concentrations at Cincinnati, Ohio." *Water, Air, and Soil Pollution* 132, no. 4 (December): 293-314.

Ecology • About the River • Ohio River Foundation www.ohioriverfdn.org

Flooding

Flood Conditions



The Flood Conditions map displays the variety of flood stages that occurred in the East End of Cincinnati. The layers are in order from darkest to lightest showing the FEMA floodway, the flood of 1997, the 100 year flood mark, and the amount of flooding in a moderate floodstage. As you can see the East End is extremely low lying, has seen severe flooding in the past, and will continue to see flooding in the future. The most recent major flood in the East End occurred in 1997 when the Ohio River crest to 64.70 feet. Based on historical crests of the Ohio River over the past 114 years the East End has experienced at least a moderate stage flood or greater 37 times. According to these figures the East End has a 32% chance of experiencing a moderate stage flood or greater.

1884



1907



1913



1937



1997



<http://www.cincinnativiews.net/floods.htm>

CONTEXT

Recreational Opportunities

The community of the East End offers a wide range of recreational opportunities, from high end boating, Recreation facilities, recreational ball fields, to basic walking trails. The river front section of the community is limited by the existing infrastructure. The northeastern portion and central areas of the community represent the optimal locations for recreational opportunities, with the Lunken Complex, Schmidt Recreation complex, and Otto Armleder being among several of the existing opportunities already in existence in the East End.

Leblond Recreation Center

The Leblond recreation Center is the Head Quarters for The Cincinnati Recreation Commission's Division of Therapeutic Recreation and serves people of all ages with a wide variety of disabling conditions

Reeves Golf Course

This Golf Course is located within the Lunken Airport complex. With Golf attracting a more affluent level of clientele, the people that utilize this facility also come from all over the city, introducing many different people to the community (CRC Golf Courses, 2014).

Ohio Erie Bike Trail

The Ohio to Erie Trail runs the entire length of the state of Ohio from Cincinnati to Cleveland. The connection of this trail system comes from the north via the Little Miami Scenic bike trail to Otto Armleder Park. Right now the trails in the East End run all the way to International Friendship Park and downtown (The Ohio to Erie Trail, 2014).

Four Seasons Marina

Four Seasons Marina is similar in nature to the Ohio River Launch Club, in that it is a large marina that houses berths for more high-end boats. This represents a very high end of clientele that are being drawn into the area (Four Seasons Marina, 2014).

Leblond Recreation Center



<http://cincyrec.org/search/facility.aspx?id=37>

Ohio River Trail



<http://www.ohioriverpaddlefest.org/ohio-river-trail/>

Four Seasons Marina



<http://www.yelp.com/biz/four-seasons-marina-cincinnati>

CONTEXT

Projected Land Use

The projected land use for the East End community can be gleaned by observing the zoning that would affect any property that applies to change its use or is left vacant for more than one year. The map below, Zoning in the East End, shows that almost all of the land along the Ohio River and Little Miami has been zoned to Riverfront. Three classes of Riverfront districts exist: Residential/Recreational, Commercial, and Manufacturing. Riverfront districts are described in Title XIV, the Zoning Code of the City of Cincinnati as follows:

§ 1415-03. Specific Purposes of the Riverfront Subdistricts.

(a) RF-R Riverfront Residential/Recreational District. To optimize the scenic beauty of the riverfront while mixing residential uses into current public and semi-public land uses and to enhance the stability and revitalization of adjoining neighborhoods.

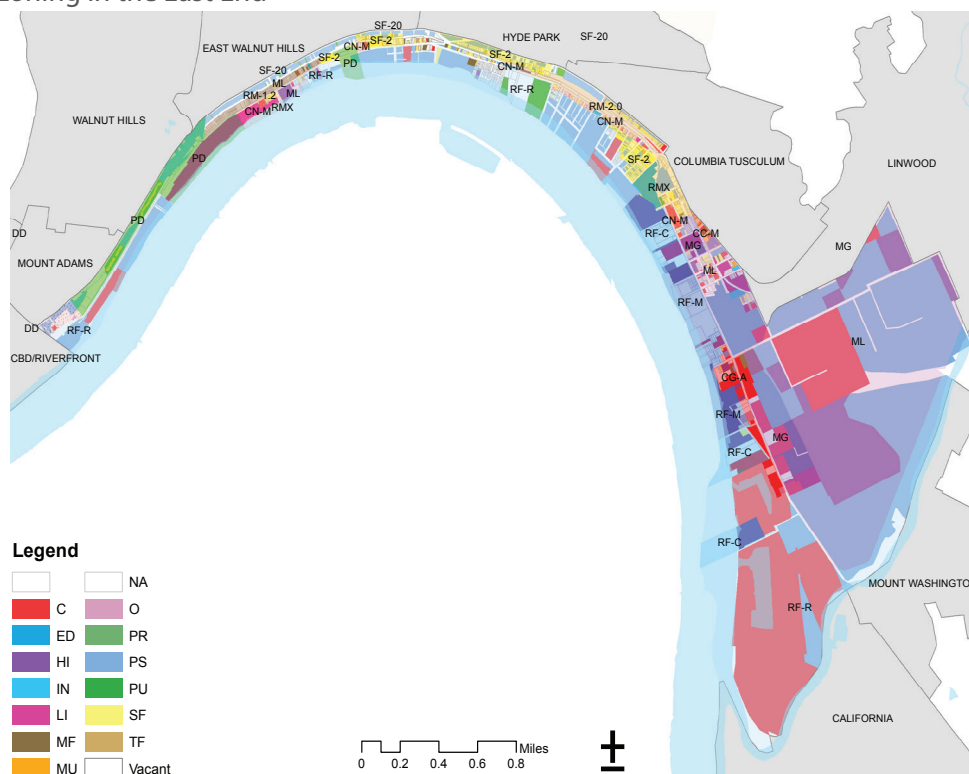
(b) RF-C Riverfront Commercial District. To provide sites for commercial and manufacturing uses that require river access and to provide a buffer between the high

intensity RF-M riverfront industrial and the more mixed-use RF-R areas, while providing needed services for both areas and protecting adjoining residential neighborhoods, public parks and recreation facilities from the effects of more intense commercial and industrial uses.

(c) RF-M Riverfront Manufacturing District. To provide sites for heavy industrial uses that require river access, maintain the economic vitality of the industrial riverfront and minimize any adverse impacts resulting from such activity on residential, park, recreation and commercial recreation facilities.

Residential uses are then clustered along River Road and Columbia Parkway and the Lunken Airport site is zoned for Light Manufacturing. On the western edge of the neighborhood, the manufacturing site is currently zoned for a Planned Development, but current plans plan to keep the property as manufacturing.

Zoning in the East End



Data via CAGIS, 2014.

CASE STUDIES

Introduction

After collecting background information on the East End, the team shifted focus to other cities dealing with resiliency and sustainability issues. Our goal was to determine best practices for landscape interventions that addressed climate change and supported the natural environment.

We completed the following six case studies:

- 1 Climate Change Mitigation
- 2 Green Affordable Housing
- 3 Eco-Villages & Recreation
- 4 Bank Stabilization
- 5 Slope Stabilization
- 6 Brownfield Remediation

CASE STUDY

Climate Change

Overview

In order to understand how to plan best for Cincinnati, especially its riverfront communities like the East End, it is necessary to understand how the climate is predicted to change over the next century. It is accepted within the scientific community that humans are affecting the climate through the burning of fossil fuels, emissions of greenhouse gases, and unsustainable practices. These changes to the earth are not predicted to affect all locations in the same way. Therefore, the two case studies used here were conducted at Xavier University and the Pew Center to project more accurately how climate change will affect the Cincinnati region. Specifically, how will temperature, heat, precipitation, and vegetation change as the climate does.

Temperature

Two models, developed at the Canadian Centre for Climate Modeling and Analysis were used to project climate change in the next century. During the 20th century, the average temperature for the Ohio winter season December – February was 29.25 degrees Fahrenheit. The average temperature for the winter season has been increasing at a rate of .15 degrees per decade. The CGCM2 model projects an increase in temperature within the next 30 years of 2.5 degrees for the winter, 2.6 degrees for the spring, 1.3 for the summer, and 1.3 for the fall months. This model predicts that within the next 100 years, temperatures will increase between 6.7 and 11.4 degrees Fahrenheit. Using the CGCM1 simulation, the spring and autumn months show higher temperature increases, with winter being higher than summer averages. It predicts an increase over the next century of between 7.4 and 10.4 degrees Fahrenheit.¹

What this means for Cincinnati: the climate of the future would resemble that of Louisiana's today

Heat

Heatwaves can cause large scale negative effects on human health, with populations in the Midwest at an increased risk for heat-related illness or even death. Heatwaves can affect humans in varying ways from heat cramps to heat exhaustion to heat stroke to death. Those most at risk are aging adults and younger children, as well as those with pre-existing medical conditions, including obesity. Usually, urban populations are more at-risk for heat-related illnesses and death since buildings and asphalt absorb more heat during the day and taking longer to cool at night. In addition, urban areas lack vegetation to naturally cool people and buildings. Statistically, lower socio-economic classes are disproportionately negatively affected by heatwaves as are those who live alone.²

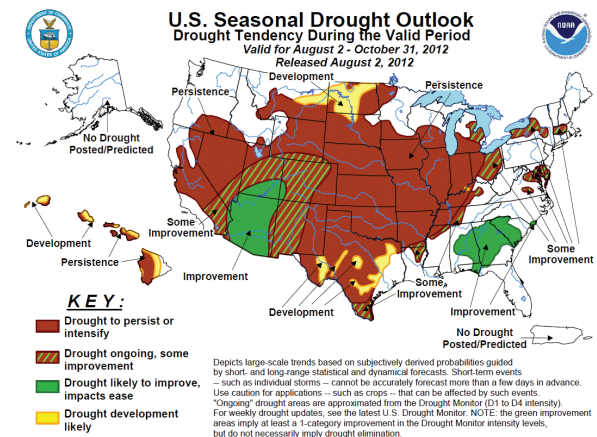
According to a study with the National Center for Atmospheric Research/Department of Energy Parallel Climate Model, the intensity and number of heatwaves will continue to increase in

View of Cincinnati and the Ohio River from the West



Source: Wikimedia Commons, 2006. Author: ansketh17. Cincinnati, OH taken from Mt. Echo Park, winter 06. http://commons.wikimedia.org/wiki/File%3AWinter_Cincinnati.JPG

U.S. Drought Conditions August-October 2012



Source: Wikimedia Commons, 2012. Author: National Oceanic and Atmospheric Administration Climate Prediction Center. A map of the United States Drought Outlook for August-October 2012. http://commons.wikimedia.org/wiki/File%3ANOAA_drought_map_2012.gif

the 21st century. Heatwaves are projected to increase in severity specifically on the Eastern Seaboard, the southern and upper Midwest, and the southwestern United States. The study looked at three Midwestern cities – Chicago, St. Louis, and Cincinnati – and used three criteria to define heatwaves:

1. Maximum temperature exceeding the 97.5th percentile for at least three days
2. Average minimum temperature above the 97.5th percentile for at least three days
3. Maximum temperature above the 81st percentile for the entire period

For Cincinnati, the model projected that the average frequency would increase from 1.4 to 2.1 heatwaves per year, and the average duration of a heatwave from 8.8 to 10.7 days.

Precipitation

CGCM2 predicts a slight decrease for precipitation in the winter, an increase in the spring, a decrease in the summer, and slight increase in the fall. CGCM1 projects an increase in the winter, an increase in the spring, a decrease in the summer, and a slight increase in the fall. Other modeling predicts that there may be an increase in precipitation in the winter months and a decrease in the summer months.

Soil Moisture: The change in precipitation and temperature will have a negative effect on soil moisture. **Within the next century, soil moisture may decrease up to 25%, due to evaporation caused by increased temperatures.**

Vegetation

Agriculture: The agriculture of southwestern Ohio would benefit from the increased temperatures of climate change. Crops like corn, wheat, and soybeans whose yields have risen steadily, would be expected to continue rising. Farmers may be able to “double crop” and gain two yields of a crop in a season whereas now they only yield one. The rising temperatures would have a negative effect on the proliferation of weeds overtaking crops.

Natural vegetation: Natural vegetation in the Cincinnati region has been steadily blooming earlier in the year. Certain pests like the Eastern Tent Caterpillar (pictured top right) are also appearing earlier in the growing season. Research shows that trees will expand northward in Cincinnati’s deciduous forests, though that may be stifled by human development. The table at the right shows the expected changes in Midwest and Eastern forest species. The Maple/Beech/Birch trees are Ohio’s most common species and are expected to decrease significantly.

Current Local Policies

To assess Cincinnati’s current stance on mitigating or adapting to climate change, one ought to look no further than the Green Cincinnati Plan, recently updated in 2013. It includes numerous strategies to reduce Greenhouse Gases (GHGs), become a better environmental steward, use land and resources more wisely, and adapt to climate change in the 21st century.³ The plan breaks its recommendations into the following categories:

Specific to climate adaptation, the City is proposing some of the following strategies:

- Deal with Prolonged heat – Review City’s emergency plan and incorporate language for heat emergencies.
- Change recommended plant species in landscape ordinance.
- Improve infrastructure to withstand Stormier Weather
- Complete vulnerability assessment
- Mitigate Urban heat islands – incorporate requirements for cool/green roofs, landscaping into zoning and subdivision regulations

The Eastern Tent Caterpillar is Appearing Earlier



Source: Wikimedia Commons, 2009. Author: Esc861. Eastern Tent Caterpillar Tent http://commons.wikimedia.org/wiki/File%3AEast_tent_caterpillar_tent.jpg

Projected Change in Ohio’s Forests¹

Major Forest Type	Project Change in Amount of Land Covered
White/Red Pine	~ 0
Spruce/Fir	- 50,000 km2
Oak/Pine	+ 1,000,000 km2
Oak/Hickory	+ 700,000 km2
Maple/Beech/Birch	- 480,000 to - 600,000 km2
Aspen/Birch	- 100,000 km2
Change	950000

Planning for Climate Change Chicago, IL

When officials in Chicago, IL learned that climate change would alter their weather to be more similar to Baton Rouge, Louisiana, the City began undertaking measures to mitigate the effects of a new climate. By 2070, Chicago would experience 35% more precipitation in the winter and spring but 20% less in the summer, and heat waves would increase in frequency and intensity. The City reacted by upgrading its infrastructure now to be tolerant to future weather. They replaced concrete alleys with permeable pavers and have planted drought resistant plants. As for tree plantings, the City now plants trees that will be resilient in future years like swamp white oaks and bald cypress instead of ash and maple trees, which are susceptible to plagues and warmer climates.⁴

SOURCES:

¹ Farnsworth, George, Kimberly Lears, Annette Stowasser, et al. 2007. Climate Change in Cincinnati: Proceedings of the 2007 Environmental Studies Seminar at Xavier University.
² Ebi, Kristie L. and Gerald A. Meehl. 2007. The Heat is On: Climate Change & Heatwaves in the Midwest. Regional Impacts of climate change: Four Case Studies in the United States. The Pew Center on Global Climate Change. December, pgs 8-21.
³ Green Cincinnati Plan. 2013. City of Cincinnati. Office of Environment & Sustainability.
⁴ Kaufman, Leslie. 2011. A City Prepares for a Warm Long-Term Forecast. May 22. http://www.nytimes.com/2011/05/23/science/earth/23adaptation.html?pagewanted=all&_r=0

CASE STUDY

Green Affordable Housing



Current East End Study Area

Photo by Ellen Deatrlick

Cincinnati's East End Neighborhood has prioritized protecting both its **natural environment** and **affordable housing** stock. Eco-friendly affordable housing development can address both these aims through green building practices that build community, promote healthy living, and enhance overall neighborhood sustainability.

OVERVIEW

Eco-friendly affordable housing makes sense from a financial, as well as environmental, perspective. Communities and individual homeowners and renters both benefit from the environmentally-conscious building and cost-saving techniques. National leaders like the U.S. Department of Energy and the Natural Resources Defense Council recognize this, and have committed to providing neighborhoods with needed funds to build new green affordable housing and to retrofit old housing stock for a more sustainable future. A review of prototypes and case studies in Louisiana, Pennsylvania, Massachusetts, and Oregon reveals one key theme—eco-friendly affordable housing development succeeds where an overarching organization is coordinating building activities with community participation. In the case of the East End, such an organization would be particularly useful in acquiring the technical expertise needed for building in a floodplain.

COMMUNITY BENEFITS

Better Investment

Huge energy savings lower the developments' risk profile, making it a safer investment than other affordable housing projects. This, in turn, attracts private investment to buy Low Income Housing Tax Credits—a primary means for funding American affordable housing.

Preserve Natural Resources

Innovative building practices reduce the amount of lumber needed, protecting natural forests. Water resources are protected by systems that encourage re-use and cut daily consumption.

Slow Run-Off & Pollution

Greater attention to permeable surfaces and other stormwater management practices reduces both water contamination and the risk of combined sewer overflow events.

Lower Carbon Footprint

Residents contribute to an overall lower environmental impact.

COMMON STANDARDS OF SUSTAINABILITY

LEED
RATINGS

ENERGY
STAR

HERS
INDEX

LIFE
CYCLE

R-VALUE
EQUATION



Make It Right Green Affordable Housing

Image via Flickr: joevare, no changes made

INDIVIDUAL BENEFITS

Lower Energy Use & Spending

Better insulation and energy sourcing, together with energy-efficient appliances, can dramatically reduce energy use by an estimated 30% or greater. This helps decrease the burden of rising energy costs.

Lower Water Consumption

Updated water fixtures and recycling techniques can lower water consumption by an estimated 50%, reducing water bills while improving site functionality.

Healthier Living

Quality, yet affordable, materials reduce the risk of asthma, lead-poisoning, and other health risks associated with older home construction and outdated practices. Quality of life is improved through greater thermal comfort in warm and cold seasons.

Increased Accessibility

A more integrative approach to housing development facilitates proximity to needed services, resources, and jobs.

CASE STUDY

Green Affordable Housing

PROTOTYPE

Make It Right New Orleans, LA

Relevance to East End: Floodplain construction; community-focus

The Make it Right organization builds LEED-certified affordable homes and promotes community engagement in New Orleans's Lower 9th Ward neighborhood, where many others would not reinvest after Katrina. They are able to build in the floodplain through innovation in green building techniques. Their best practices employed in foundation, elevation, and advanced



Make It Right Green Affordable Housing

Image via Flickr: joevare, no changes made

CASE STUDIES

56th & Walnut Philadelphia, PA

Relevance to East End: Mixed-humid climate considerations

This 2012 green retrofit improved insulation and moisture control for a 32 multi-family apartment complex in an urban environment. Upgrading ductwork, ventilation, and exterior insulation, together with installing a new furnace, water heater, lighting, and appliances, contributed to an overall 47% annual energy savings. The building team focused on improvements that would ensure long-term affordability, even if that meant greater up-front capital improvement costs.

Wisdom Way Solar Village Greenfield, MA

Relevance to East End: Emphasis on natural setting

This project, which ultimately created an affordable community of 20 highly-efficient units, sought to foster a vibrant neighborhood with space for recreation and gardening. Double-walled insulation and photovoltaic panels kept natural gas usage to a minimum, making residents' energy bills about one-fourth of the typical New England heating bill.

Lincoln Woods Portland, OR

Relevance to East End: Preserve original environment & diversity

In 2006, the 70-unit Lincoln Woods housing development was completed, with both green residential and community space. The project leaders were able to maintain the wooded area around the housing, as well as the diversity of population living in the area. This study highlights the importance of testing new technologies for functionality before residents move in, and then every year after. Additionally, green technology and life-style education is essential for maintaining the space long-term.

REFERENCES

- [1] [Makeitright.org](http://makeitright.org)
- [2] NRDC.org/cities/building/fhousing.asp
- [3] Carb-swa.com/Collateral/Documents/CARB-SWA/Profiles/wisdom_way_community.pdf
- [4] Carb-swa.com/Collateral/Documents/CARB-SWA/Profiles/56th_and_Walnut_Case_Study.pdf
- [5] Enterprisecommunity.com/resources/ResourceDetails?ID=66601.pdf#
- [6] <http://www.enterprisecommunity.com>
- [7] U.S. Department of Housing and Urban Development, Multifamily Accelerated Processing (MAP) Guide, Chapter 9: Environmental Review

FLOODPLAIN REGULATIONS

If any significant part of a project is located within 100-year-floodplain, it must be discussed with U.S. Department of Housing & Urban Development (HUD) at the pre-application phase. Any construction in 100-year-floodplain is strongly discouraged (extended to 500-year-floodplain for any housing construction or rehabilitation that is intended to serve people with mobility disabilities). HUD may analyze sites further if there is any evidence of past flooding (even if not technically within the 100-year-floodplain). An 8-Step Review Process is required for any housing construction proposals in a floodplain. Any floodplain development that is accepted (after the 8-step process) is required to have flood insurance.



Affordable Ecological Village

Image via Flickr: harry_nl, no changes made

NEXT STEPS

For the East End to move forward with eco-friendly affordable housing development, neighborhood leaders should begin to build a team of committed community members and professionals, and seek the assistance of a larger non-profit with proven experience in the field. A variety of online resources and tool kits are available to help guide discussion, and evaluate specific needs of the community.

Report Prepared by: Ellen Deatrick

For more information please email: deatree@mail.uc.edu

Online Resources & Tool Kits

Make It Right Library & Laboratory

makeitright.org/what-we-know

Enterprise Green Communities

enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities

Consortium for Advanced Residential Buildings (CARB)

carb-swa.com/building-america-research.htm

Smart Communities Network

smartcommunities.ncat.org/buildings/affhousing.shtml

CASE STUDY

Eco Villages & Recreation

Buffalo Bayou Promenade

Overview

The Buffalo Bayou had long been a polluted, underutilized, eye sore until the City of Houston initiated one of the largest public park investment in its history. The \$15 million investment improved river access and water quality through slope naturalization, native vegetation plantings, and increased the channel's ability to withstand stormwater velocity (shear stress) by 400%. The investment created the Buffalo Bayou Promenade (Sabine-to-Baby), a 23 acre urban park which created over twenty miles of recreational paths, enhanced community interaction and events, and created significant economic benefit.

Process

The Sabine-to-Bagby flood control and recreational improvement project required a multi-organizational effort to be accomplished. This section of the bayou proved difficult to drum up support because it's location directly below Interstate 45, which led to long term pollution and abandonment. As with many public infrastructure projects throughout the nation this intensive infrastructure improvement was created through public-private partnerships.

Public Involvement



- Buffalo Bayou Partnership
- Harris Count Flood Control
- Texas Department of Transportation
- Houston Parks and Recreation
- Houston City Planning and Development

Private Involvement



- Downtown Businesses
- Residential Population
- Lee and Joe Jamail

Buffalo Bayou Partnership

The Buffalo Bayou Partnership was critical in the success of the Sabine-to-Bagby Promenade and was created in response to the Buffalo Bayou Master plan, developed in 1986. The plan outlined the need for renovating the 10 miles of the bayou in order to make it more productive environmentally, economically, and socially. "The BBP is a coalition of civic, environmental, governmental and business representatives whose director nominees are confirmed by the Mayor of Houston and Harris County Judge." The ultimate goal is to develop a 150 mile recreational trail network along all of Houston's historic bayous.



Figure 1: Rod Jones Photography

Performance Benefits

Environmental:

- Planted 641 trees - sequesters 29.74 tons of CO2 and absorbs 337,411 gallons of stormwater runoff annually
- Gabion Sacks - improve ability to withstand stormwater
- Soil Excavation - increase flood storage capacity of the Bayou

Social:

- Provides recreational, educational, and community events
 - Receives 22,500 visitors per year through events
- Increases outdoor activity for 88% of the survey respondents
- Installed 188 lighting fixtures

Economic:

Two developed areas (downtown & midtown) adjacent to the Buffalo Bayou Promenade experienced a significant increase in employment, retail, and office and residential units.

Conclusion

The Buffalo Bayou Promenade has seen tremendous environmental, social, and economic success, and has served as a catalyst for future green infrastructure improvements. Houston has chosen to invest in greenways because of the measurable benefits highlighted above. One of the most important benefits from this project is the community interaction through recreation. The once polluted space is now being used for a yearly Regatta boat race, concerts, art events, and educational opportunities. This greenway has helped Houston become a more active city by providing more interaction with the natural environment, and will likely attract residents.

Eco-Village at Ithaca, NY

OVERVIEW

The 176 acre Eco-Village at Ithaca is located just outside of Cornell University and currently includes two 30-home co-housing neighborhoods and 175 residents - with a third neighborhood nearly finished. Like any eco-village, success is dependent upon community, which is why the neighborhoods are designed in tight knit clusters allowing for more community interaction. These tight knit clusters also allow for over 80% of the land to remain green space. The main goal of the eco-village is to create cohabitation with nature, "by integrating ecological, economic, social, and cultural dimensions of sustainability to regenerate social and natural environments" (GEN).

Process

The Eco-village at Ithaca was developed in 1991 through the Eco-village at Ithaca, Inc. a non-profit developed to purchase the 176 acre parcel and improve the way communities are built. The land was then immediately split up and divided into a non-profit education center, Community supported Agriculture (CSA) to provide food, and "FROG," their first residential group. The education center enables the group to teach the public about successful methods to live in a community and preserve open space.

Typical CSA



Figure 3: New Leaf CSA

The CSA provides all local fruits and vegetables for the eco-village to purchase a "share" at the beginning of the season. Residents can either pay for the "share" or agree to work 60 hours during the harvest.

Eco-village example in London



Figure 2: Tom Chance

Performance Benefits

Community:

Community interaction and sharing is vital to the success of an eco-village. Although sharing is optional in the village, most residents take advantage of the ability to share meals, transportation, clothes, toys, videos, books, and more.

Homes:

Homes are sustainable in the village and include passive solar design, triple pane windows, and super-insulation. Homes are constructed vertically to reduce ground cover and share hot water and heating facilities. Through the addition of new neighborhoods homes continuously improve and the newest neighborhood will include homes with no drafts and walls a foot deep. These homes virtually heat themselves by the occupants body heat.

Energy:

Solar panels generate over half of the electricity needs as all homes have solar panels on the roofs or a larger array in front.

Ecological Impact

According to a study performed by a PHD student from Rutgers University, Eco-village at Ithaca residents have an ecological footprint that is 70% less than a typical American. This means that through community collaboration, efficient living conditions, and the ability to live among the land the 175 residents use as many resources as a community with 52 residents. The Ithaca Eco-village serves as a great case study to display the benefits communities can have on people and the planet.

CASE STUDY

Bank Stabilization



GROUNDWORK
Cincinnati
Mill Creek



www.groundworkcincinnati.org

Caldwell Seymour Greenway Project

OVERVIEW

Groundwork Cincinnati - Mill Creek (formerly the Mill Creek Restoration Project) successfully completed several ecological restoration projects within the Caldwell Nature Preserve, Caldwell Recreation Park and Seymour Nature Preserve with funding from the Clean Ohio Conservation Fund (COCF) and in partnership with the Cincinnati Park Board, Cincinnati Recreation Commission, and the Metropolitan Sewer District. This project was in conjunction with the larger Mill Creek Greenway Program framework. Final work was completed in the Fall of 2004.



Image Taken from Groundwork Cincinnati - Mill Creek's Digital Database

Origins

The Mill Creek is the backbone of Cincinnati and was the location for the majority of the factories and pollution associated with the industrial revolution. The effects that this and the development of housing and further industry along the Mill Creek and its tributaries has caused a great deal of problems in the entire Mill Creek watershed. With the erosion of the stream banks, water quality deteriorating, and native species losing their foothold, action was required. These issues were being affected by a combination of factors along the Mill Creek and its tributaries in and around Caldwell Nature Preserve, Caldwell Recreation Park and Seymour Nature Preserve. Through stream and flood plain restoration, stabilization of eroded banks, wetland restoration, and soil bioengineering and stabilization a solution presented itself.

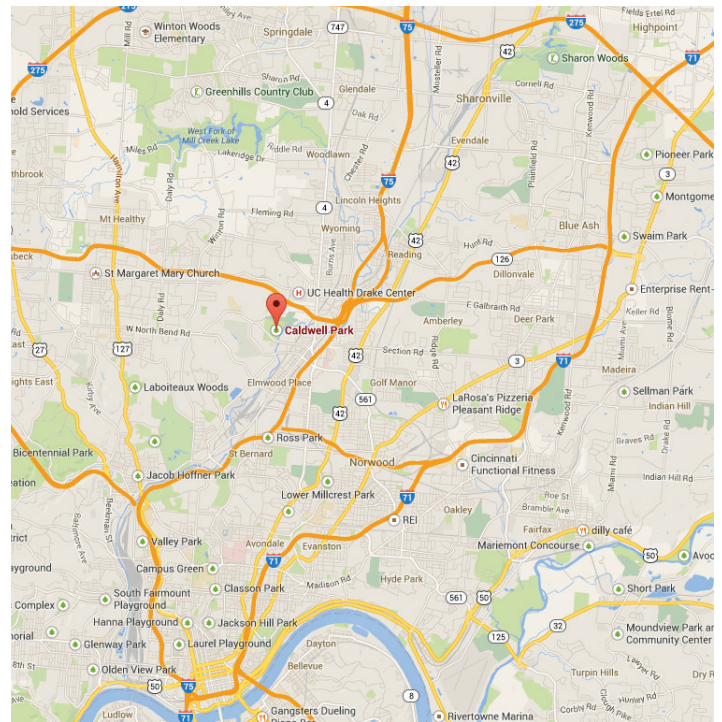


Image Taken from Google Maps

Plan

The study area includes the Mill Creek and Seymour Creek located in between Ronald Reagan Highway and the Norwood lateral. These areas were further broken down into three sections, Streambank Restoration in Mill Creek, Reach 1: Caldwell Park/North Bend Road to Seymour Avenue Bridge, Caldwell Seymour Wetland Restoration, Streambank Restoration: Seymour Avenue Bridge to Center Hill. These different sections of the project were covered by 5 million dollars that was raised through the different grants and partners of the project. The plan was for the reduction in sediment loads and increase in water quality, while also repairing damage done to the local ecosystems from invasive plant species and human action.

Caldwell Seymour Wetland and Floodplain Restoration

Groundwork Cincinnati's conducted wetland restoration (totaling 0.2 acres) in two Seymour Preserve locations, including removal of amur honeysuckle, placement of logs to enhance water collection and planting native trees, shrubs and herbaceous materials.

They also completed the restoration of nine acres of floodplain land along Caldwell Preserve and the Caldwell Recreation Park, including removal of honeysuckle and aggressive invasive winter creeper that covered trees and carpeted the ground. Once the invasives were eradicated, MCRP replaced them with native Ohio trees, shrubs and herbaceous materials. By recreating the natural floodplain, the natural occurrence of flooding will have a larger area to spread out and slow down, reducing its destructive force.



Before

After

Streambank Restoration in Mill Creek, Reach 1: Caldwell Park/North Bend Road to Seymour Avenue Bridge

Soil bioengineering design and stabilization of 175 linear feet of severely eroded streambanks along the Caldwell Recreation Park, just upstream from the North Bend Road bridge. The work included two 25-foot vegetated reinforced soil slope (VRSS) sections, two 50-foot fill bank sections protected with woven coir and direct woody plantings, and a 12.5-foot tie-in on the upstream and downstream end of streambank work area. By completing this project, the increase in the amount of soil sediment affecting water quality has been lowered to more normal levels, and natural wildlife has had the chance to reassert itself.



Before

After

Streambank Restoration: Seymour Avenue Bridge to Center Hill

This section of the project included stabilization of a 200-foot reach immediately downstream of the Streambank restoration site, installing five rock vanes for grade control along the left descending bank.

Again the stabilization and increase in native vegetation has allowed for an increase in the water quality while also stopping the erosion that was occurring here previously.



Before

After

Conclusion

This project has shown what the restoration of riparian zones along eroded waterways can achieve. This project addressed the issues of flood mitigation, erosion, water quality, projected changes in the flow of the waterway, and the plant communities that are affected during these issues. With Soil Bioengineering and streambank stabilization taking the lead on this project, the incorporation of native plants into the plan helps restore the native ecosystem to its once healthy and vibrant self.

All Images Taken from Groundwork Cincinnati - Mill Creek's Digital Database

CASE STUDY

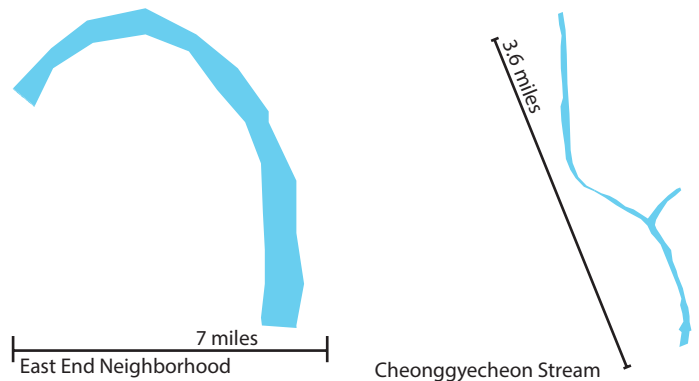
Slope Stabilization



Courtesy of Marc (mental.masala)

OVERVIEW

The bank along Riverside Drive in the East End Neighborhood of Cincinnati provides both opportunities and challenges. While it is an asset to the community for several reasons, including serving as wildlife habitat, the area may also require some modification. In order to make the space more aesthetically pleasing, as well as functional, a variety of bank and slope stabilization techniques may be used to prevent erosion and to control stormwater runoff. Some relevant techniques include terracing, live planting techniques, hard armoring, and bioengineering solutions. The case study of the Cheonggyecheon Stream Restoration project has been examined as an example of a project similar in scale to that of the East End.



THE CHEONGGYEcheon STREAM RESTORATION PROJECT

In recent years, the City of Seoul has undertaken a number of large and small scale projects to revitalize natural ecosystems in the city and to increase the quality of life for the citizens of Seoul by providing access to nature and recreation opportunities. The Cheonggyecheon Stream Restoration project accomplished this by revitalizing a 3.6 mile stream corridor located in the center of the city. To accomplish this, an elevated freeway which stood above the section of stream was demolished, and a variety of landscaping techniques were used to create a recreation area and walking paths. Of most interest to the East End Neighborhood, the project utilized terraced vertical walls to create a stable slope, areas for plantings, and habitable spaces.



Courtesy of civ33



Courtesy of Estelle Pizer

CONCERNS

Cost

The total cost for the project was ~\$380 million USD. Approximately \$120 million USD of that was for the landscape portion.

Transportation

"The aging elevated freeway and concrete deck covering the Cheonggyecheon stream posed safety risks and needed to be repaired or removed."

Transportation experts were concerned that removing the elevated highway would increase traffic congestion and chaos in the northern end of the city since it carried 169,000 vehicles per day."

SOLUTIONS & PROPOSALS

Cost

To simply repair the existing freeway, which was in disrepair, would have cost \$90 million USD.

Transportation

With the freeway removed, the project added 22 bridges (12 pedestrian, 10 for automobiles and pedestrians), connections with 5 nearby subway lines, and 18 bus lines serving the neighborhood.

According to the Landscape Architecture Foundation, the project contributed to 15.1% increase in bus ridership and 3.3% in subway ridership in Seoul between 2003 and the end of 2008.

POSITIVE OUTCOMES

Property Values Increases with Proximity to Stream

The project increased the price of land by 30-50% for properties within 50 meters, which is double the rate of property increases in other areas of Seoul. It also increased the number of businesses by 3.5% in Cheonggyecheon area during 2002-2003. This rate is double the rate of business growth in downtown Seoul. This increase in businesses also led to an increase in the number of working people in the Cheonggyecheon area. The number of working people increased by 0.8%. In comparison, there was a 2.6% decrease in downtown Seoul during this time. In downtown Seoul of 2.6%.



Courtesy of Joe Coyle



639% Percentage of increased overall biodiversity

64,000 people visit the stream daily

ACQUIRED KNOWLEDGE:

Lessons Learned Post Construction

Studies conducted after the project was completed in 2005 led project developers to believe that, ecologically, the project may have been more successful if they had replaced the granite walls with vegetated low-flow revetment to increase habitat area. They would have also designed vegetated filter strips along the roadways and motor-bridges to reduce contaminants entering the stream from motorway runoff. The project also did not consider issues of accessibility. The later addition of elevators for wheelchair accessibility was costly. These costs could have been lower had these elevators been incorporated into the initial design and construction.



Courtesy of civ33, via Flickr Creative Commons

COMPARISONS

The bank along Riverside Drive in the East End Neighborhood of Cincinnati has the opportunity to become an irreplaceable asset to the community. As the Cheonggyecheon Stream Restoration project has shown, the scale of the bank and slope stabilization that occurs along Riverside Drive can manifest itself in many different ways. To slow storm water runoff and erosion, the bank and slope could be stabilized using methods as simple as adding strategic types of plants to the slope which will anchor soil and slow the flow of water down the slope. Moving upward in scale, the bank and slope could also incorporate bioengineering techniques such as vegetated geo-grids or tree revetments

for remediation. On an increasingly larger scale, both in cost and construction, the bank and slope could also be stabilized using armoring techniques, which could lend themselves to an engineered slope project such as that of the Cheonggyecheon Stream Restoration project. This option, while costly, also provides the benefit of creating additional recreational areas for the East End Neighborhood. The project would also contribute aesthetically to the neighborhood, as well as by providing additional ecological zones and habitats for plants and wildlife to thrive.

Source: Landscape Architecture Foundation, Case Study Briefs, & Rivers by Design

COMPARISONS: TRADITIONAL SLOPE STABILIZATION METHODS

More commonly found in the United States are more traditional methods of slope stabilization such as the implementation of soil nails and turf reinforcement. The Kadish Park slope restoration project in Milwaukee, Wisconsin (pictured right) was completed in 2012. The project removed invasive species from the slope and replanted the slope with prairie-grasses and other native species. Source: City of Milwaukee Department of Public Works



Courtesy of Aaron Volkening

CASE STUDY

Brownfield Remediation

Dow Chemical Company in Ontario, Canada

OVERVIEW

The Dow Chemical Company in Sarnia, Ontario, Canada created a large-scale (approximately two acres) phytoremediation project on top of a site that is no longer operating. The Dow Sarnia facility had been in operation for over 60 years, and as the company transitioned away from the site, efforts were made to replace the existing pump and groundwater treatment system with a phytoremediation system. 1,300 poplar and willow trees were planted to take over the uptake of groundwater. This is just one of 15 sites (both pilot and full scale) operated by Dow in remediation efforts.

PROCESS

The gray groundwater management system involved pumping water via carbon beds, extracting the water, and transferring the groundwater to a treatment center. Trees (poplar and willow, two popular types for phytoremediation because of their many, deep roots) essentially act as a “solar pump” and contain groundwater, and subsequently contain contamination. This site has been “fully implemented” for two years, and four growing seasons are required for the system to prove capable.

Certain concerns were kept in mind when developing the phytoremediation site. For instance, the timing of transitioning the system is important as it takes several years for trees to become productive. Further, because of the contamination of the site, it is important that the trees do not create a significant wildlife habitat. Along with this, other processes surrounding trees must be monitored more closely such as where leaves and pollen from trees are going and if they contain contaminants.

BENEFITS

By replacing the traditional recovery and treatment system, the Dow Chemical Company can have a cost-effective system for remediation that ultimately minimizes the long-run cost of managing the site (gray infrastructure may need to be replaced or maintained). Although initial costs and early maintenance for the phytoremediation are high, over time the project becomes more cost efficient. Specifically, Dow notes these cost benefits:

- Transportation of water off site is not required
- Electricity not required
- Carbon system does not need to be replaced
- Operation does not need to be 24/7

IMPORTANT LESSONS

Certain aspects of gray infrastructure make it a more feasible option depending on circumstance:

- It is quick to implement if a critical situation arises suddenly (whereas trees have to grow);
- it handles certain stressors that would be problematic for trees (consider a natural disaster such as a tornado)
- it can be implemented on any site easily (see next case

PROJECT COMPONENT EXAMPLES

Poplar trees are a common species for phytoremediation



Source: geograph.org.uk, 2007. Author: Brian Green
http://commons.wikimedia.org/wiki/File:Plantation_of_Poplar_trees_-_geograph.org.uk_-_529927.jpg

Willows are not only beautiful, they are excellent at taking up metal from contaminated soil



Source: Wikimedia Commons, 2009. Author: TwoWings
http://commons.wikimedia.org/wiki/File:Willow_tree.jpg

study for the importance of choosing the right species for phytoremediation) and;

- gray infrastructure is predictable and easier to control.

However, trees provide a better long-term solution, can be more cost efficient, and perform multiple functions (storage and treatment), and is not affected by stressors such as power outages or mechanical malfunctions.

Reference:

Nature.org. June 2013. “Green Infrastructure Case Studies.” <http://www.nature.org/about-us/working-with-companies/case-studies-for-green-infrastructure.pdf>

Chicago - Calumet Region



Source: Wikimedia Commons, 1940. Author: Charles W. Cushman
http://commons.wikimedia.org/wiki/File:The_fireboat_Joseph_Medill_and_3_stacks_of_Youngstown_S_%2B_T_-_South_Chicago.jpg

OVERVIEW

The Calumet region is part of South Chicago, and includes the coast of Lake Michigan. Typical of a rustbelt neighborhood, the neighborhood is dotted with brownfields that interweave with incompatible land uses - notably active industry and natural areas that provide both wildlife habitat and recreational space. A contaminated landfill serves as a pilot for Lynne Westphal and J.G. Isebrands of the USDA Forest Service in programming robust phytoremediation.

PROCESS

The Calumet pilot is meant to test an in-depth process for determining the appropriate vegetation for site remediation. Plant choice cannot be broad brush, and best choices vary by site location (climate, landscape, topography, etc.) as well as by contaminants to deal with (for instance, some groundwater contaminants can only be reached by very deep-reaching roots).

The four phases of the plan are as follows: Phase I, experimental screening of plants in a controlled environment at the site to evaluate plant growth and mortality and contaminant uptake. This involves moving amounts of soil into containers. Note that this requires significant research prior to Phase I of the contaminants in the site and corresponding plant biology.

A comparable landfill site in the United Kingdom



Source: geograph.org.uk 2007. Author: Tim Heaton
http://commons.wikimedia.org/wiki/File:Weldon_Landfill_Site_III_borehole_-_geograph.org.uk_-_324381.jpg

In Phase II, the choice of plants from Phase I is narrowed and refined. For Phase III, the plants from Phase II are tested at a demonstration level on the actual site. And finally, in Phase IV, if the other phases have been successful, the project from Phase III will be scaled up to the site level.

COMMUNITY CONSIDERATIONS

According to Westphal and Isebrands, vegetation, especially trees, can have a huge impact when used for brownfield remediation. The change from desolate, polluted, brown field to green, natural, trees can be dramatic, and have a positive effect on residents, particularly in poor neighborhoods.

Trees provide health and aesthetic value to neighborhoods



Source: Wikimedia Commons, 2009. Author: Unimatic1140
http://commons.wikimedia.org/wiki/File:More_Elms2.jpg

Effects range from increased home values to decreased depression rates in residents. However, an important consideration is that when planted for brownfield remediation, trees may also need to be removed. Tree removal can be a very emotional event, and residents need to be educated on the possibility before remediation begins, which would be the case in the Calumet region. Further, when contamination levels are high enough, care must be taken to clarify that the vegetation is not for recreational purpose.

INITIAL RESULTS AND NEXT STEPS

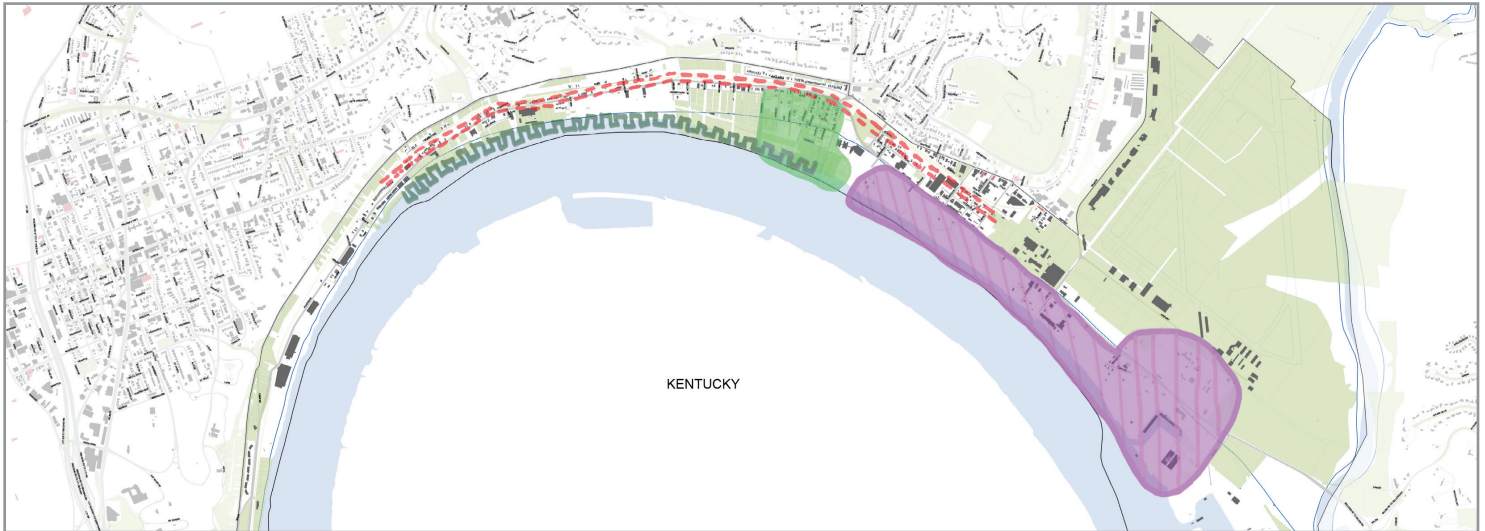
Phase I is in progress using native tree species cottonwood and black willow. Several metals and organic compounds that are above Illinois' safe threshold are the contaminants being tested. The authors are monitoring survival and growth rates of the trees as well as water and contaminant uptake. If the results are positive, planning for future phases will commence. If the trees experience high mortality or poor uptake, new species may be selected.

Reference:

Westphal, Lynne and J.G Isebrands. 2002. "Phytoremediation of Chicago's Brownfields: Consideration of Ecological Approaches and Social Issues." <http://naturalsystems.uchicago.edu/urbanecosystems/calumet/cdrom/problem%20solving/Westphal%20and%20Isebrands%202001.pdf>

DESIGN PROPOSALS

& Conceptual Frameworks



The map above identifies the neighborhood areas targeted for design interventions: bank stabilization is represented by the green line, brownfield remediation will take place within the purple overlay, slope stabilization is shown with the red dotted line, and eco-friendly development will occur within the green overlay.

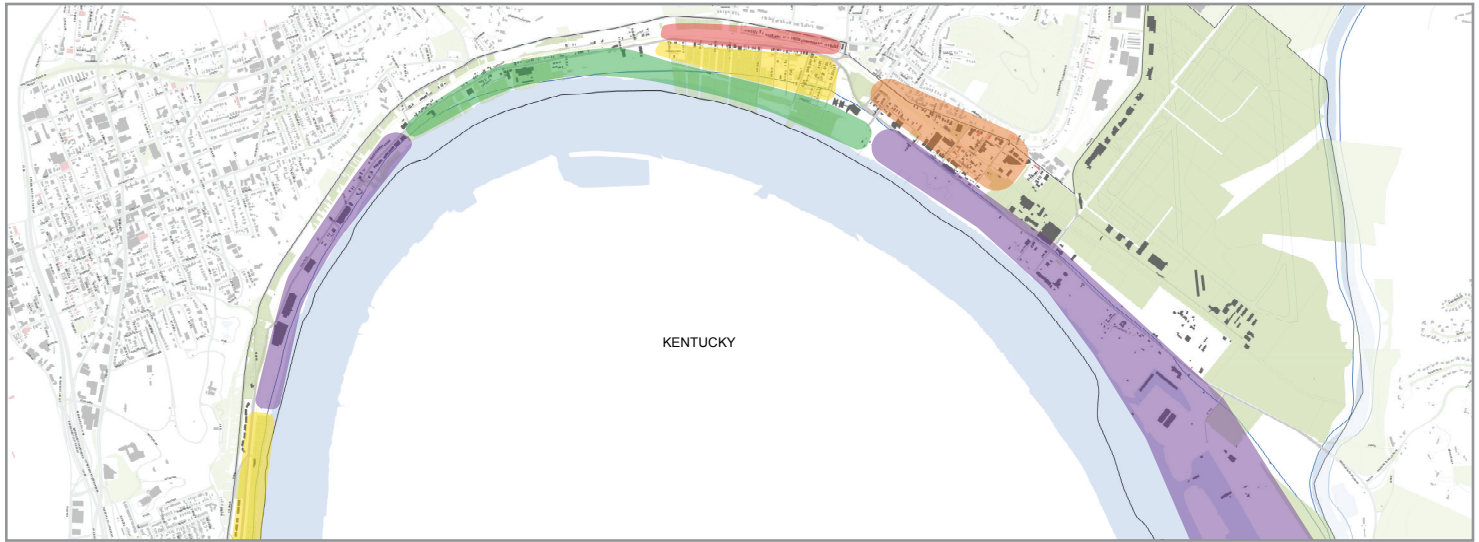
Based on research on the community's current profile and conditions and an exploration of case studies of green infrastructure best practices, the team determined two possible scenarios for the future of the East End:

- A** In Framework A, the East End capitalizes on industrial assets like its flat topography and proximity to the river, rail lines, and road networks to become an ideal location for green industry.
- B** In Framework B, the East End capitalizes on its proximity to the Ohio and Little Miami Rivers, and to the national bicycle route that will eventually cross through the neighborhood, to become a recreational destination.

Under both frameworks, the neighborhood can take steps to mitigate the effects of flooding, severe weather events, and climate change. We propose four landscape design interventions that, with slight variation, will prepare the East End for a spectrum of future growth opportunities.

CONCEPTUAL FRAMEWORK A

Green Industrial Growth



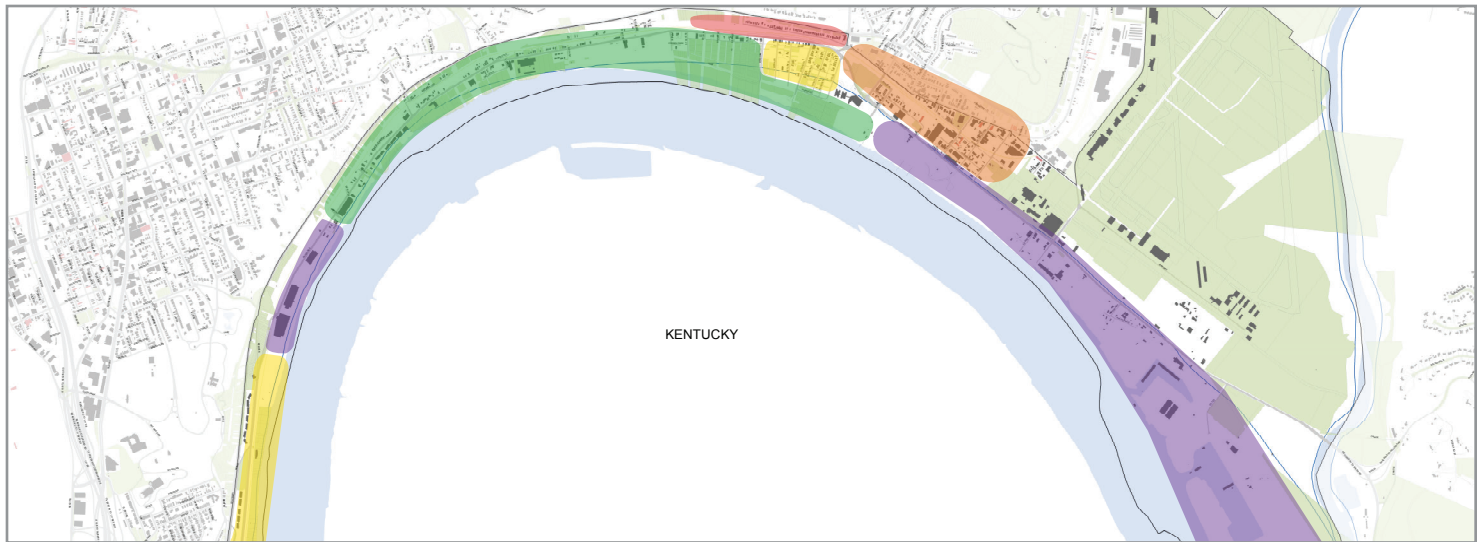
The map above shows the general concept of Framework A. Purple areas designate industrial land uses, yellow signifies residential, red shows commercial, orange shows mixed-use, and green areas are those set aside for open space and/or environmental stabilization.

ASSUMPTIONS

- The East End will see green industrial growth. Businesses seeking to participate in green industrial practices will locate in the neighborhood, increasing the amount of land use devoted to industry.
- With the expansion of industry, the shipping sector will also grow, requiring more riverfront space.
- Employment will increase in the area to fill positions needed by the new industries.
- The demand for public transit will increase, as workers will want a way to easily access jobs.
- Limited mixed-use residential development will follow the increase in industry, as some workers will want and/or need to live in close proximity to work.
- Overall competition for physical space increases with greater demand for industrial land use, as well as for residential land use for industry employees.
- Recreational opportunities will become more limited, as green space and riverfront space are taken over by business.

CONCEPTUAL FRAMEWORK B

Recreational Destination



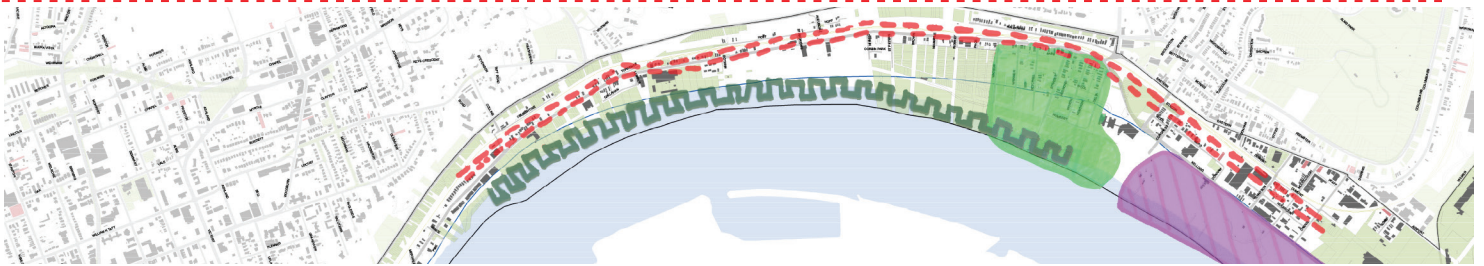
The map above shows the general concept of Framework B. Purple areas designate industrial land uses, yellow signifies residential, red shows commercial, orange shows mixed-use, and green areas are those set aside for open space and/or environmental stabilization.

ASSUMPTIONS

- The East End will have increased environmental improvement opportunities.
- The neighborhood's population will grow, as people seek to live in an environmentally-rich place close to the city.
- Industry in the East End will experience a slight decrease, as land use will turn over to recreational uses.
- The demand for public transit will increase, as residents will want easy access to the city, and visitors will want to easily access the natural amenities in the East End.
- Bike trails will bring visitors and tourists to the area, and will provide a viable commuting option for East End residents.
- An entertainment district will follow transit-oriented development along the Oasis Line and bike trails.
- Recreational opportunities will increase, as the neighborhood will prioritize open green space and riverfront space.
- Climate change mitigation strategies will be imperative to preserve the natural environment of the East End.

INTERVENTION

Bank Stabilization

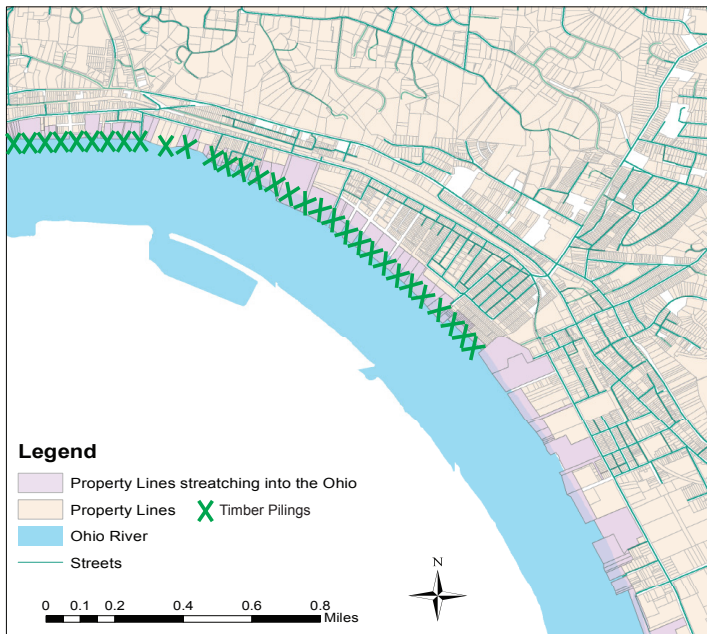


A

How will bank stabilization along the Ohio River be accommodated with the increase in Green Industrial growth and demand for shipping?

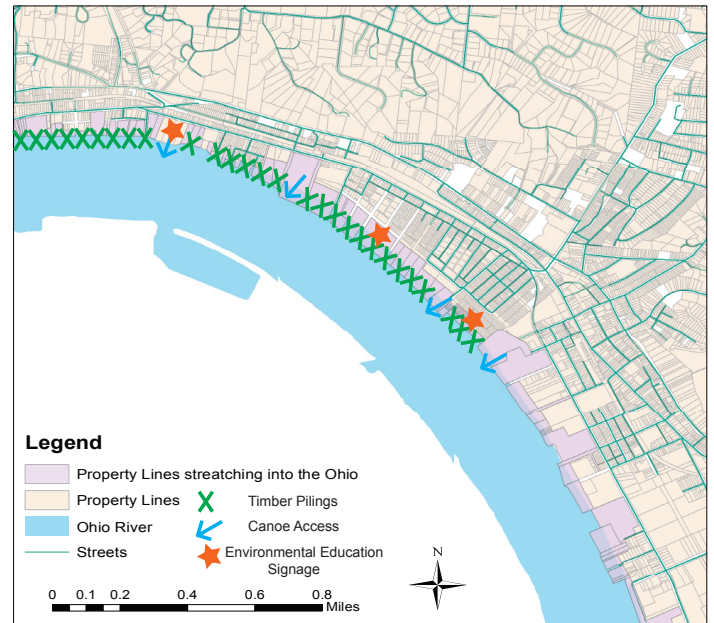
B

How will bank stabilization along the Ohio River be accommodated with the increased use of the river as recreational asset?



Because of the increase in green industry and shipping on the Ohio River, the application of bioengineered bank stabilization techniques are needed to assure protection for the land based industries and unloading facilities. Timber Pilings will provide an increased amount of roughness along the portions of the riverbank not utilized by Industry or shipping, slowing down the water along the bank and then promoting the depositing of sediment and the establishment of vegetation as well as wildlife habitat. This then helps with further stabilization of these endangered areas.

Bank Stabilization techniques utilized:
Timber Pilings



Due to the increased use of the Ohio River as a recreational asset, the application of bioengineered bank stabilization techniques are needed to assure protection of the banks. Timber Pilings will provide an increased amount of protection as well as increasing the vegetation wildlife habitat. With canoe access points being installed in conjunction with the pilings, as well as educational signage, the recreators will have ample opportunity to view and learn about the rehabing riparian zone along the Ohio River.

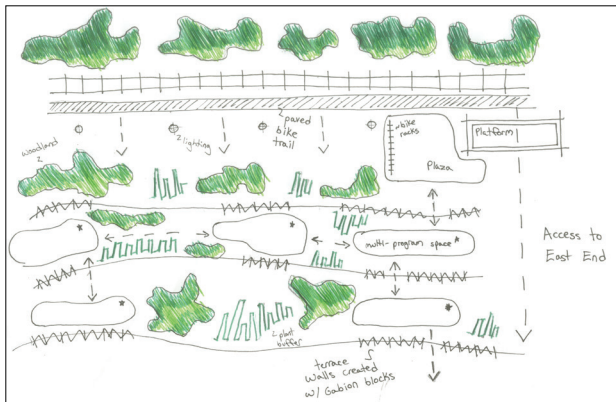
Bank Stabilization techniques utilized:
Timber Pilings

INTERVENTION

Slope Stabilization: Riverside Drive



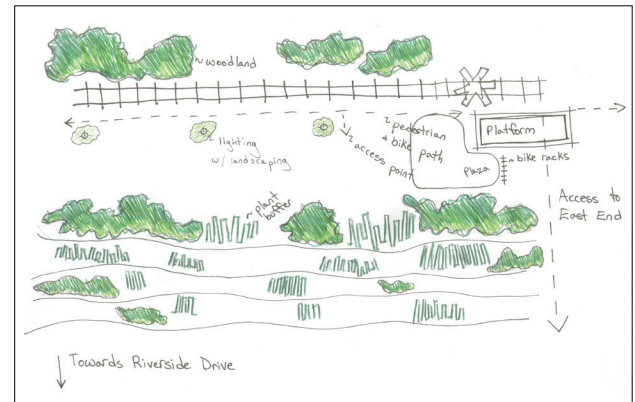
A How will the slope along Riverside Drive be affected by the increased use of the rail transit line as green industrial growth occurs?



Because of the increase in rail and pedestrian traffic at the crest of the hillside bordering Riverside Drive, the slope will require the application of engineered slope stabilization methods. Gabion walls and terracing will allow for the utilization of sections of the slope as public space and landscaping opportunities. These methods will prevent erosion as well as mitigate the increased quantity of contaminated stormwater runoff caused by the increase in development and transit.

Slope Stabilization techniques utilized:
Gabion walls & Terracing

B How will the slope along Riverside Drive be affected by the increased use of the rail transit line as recreational opportunities increase?



In order to prevent further erosion of the slope bordering Riverside Drive, landscaping interventions will occur at the crest of the slope bordering the rail line. The intelligent use of vegetation will mitigate the effects of stormwater runoff, and create a more stable ecosystem on the slope. By utilizing less invasive methods of slope stabilization, the natural character of the slope will be maintained, thus adding to the recreational character of the East End Neighborhood.

Slope Stabilization techniques utilized:
Varied Plantings & Vegetated Geogrids

INTERVENTION

Brownfield Remediation



A

If green industry continues to grow, what strategies can the East End use to mitigate current and future pollution?

While full remediation may not be an option if green industry prospers in the East End, steps can be taken to ensure environmental health and safety. A particular concern for this neighborhood is proximity to the river, as chemicals and pollutants can either run off or enter the Ohio River through groundwater. In order to mitigate this concern, certain plants may be used to slow the movement of water from these sites.

TCE, found in 50% of Superfund National Priority List sites, is a common industrial contaminant, and difficult to remove due to its physical properties. However, some studies show popular trees to be incredibly effective at not only removing TCE, but depressing the water table and making it difficult for water, and thus, contaminants, to move. Because of their excellent hydraulic control capabilities, poplars make an excellent barrier plant between the river and industrial sites.

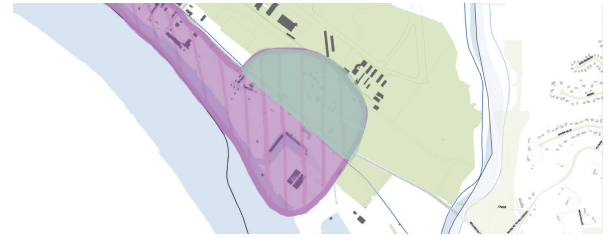
A row of poplars



Wikimedia Commons, 2009. Author: Steve F. http://commons.wikimedia.org/wiki/File:Poplar_trees_all_in_a_row_-_geograph.org.uk_-_1301682.jpg

References:

1. Lay, Jillian Donovan. 1999. "Phytoremediation of Trichloroethylene (TCE): Restoration and Reclamation Review." <http://conservancy.umn.edu/bitstream/59470/1/5.4.Lay.pdf>.
2. The Remediation Technologies Development Forum. "Evaluation of Phytoremediation for Management of Chlorinated Solvents in Soil and Groundwater." Environmental Protection Agency. http://www.rtdf.org/public/phyto/chlor_solv_management.pdf
3. Lasat, Mitch. "The Use of Plants for the Removal of Toxic Metals from Contaminated Soil." http://www.plantstress.com/articles/toxicity_m/phytoremed.pdf



B

How can former industrial sites be made safe and usable for recreational growth in the East End?

Contaminants from previous industrial uses can make the land unsafe, especially for the uses envisioned for the East End in this scenario. Phytoremediation can be used to remove some or all of this contamination.

If industrial use is to decline, there is a good chance the prevalent salvage yards will be among the first to go. Especially those south of the airport, junkyards are sprawling, have excellent visibility from the road (good for future development, bad for current conditions), do little to spur commercial or recreational development, and are very aesthetically displeasing. Research shows these salvage yards can be remediated using a variety of hyperaccumulator plants that take up heavy metals, a major type of contaminant found in salvage yards. Heavy metals can be expensive to remediate, at a cost of up to \$250/yd³. Phytoremediation is much more cost effective at ~\$80/yd³.

Alpine Penny-cress is known to colonize heavy metal-rich soils



Nodding Thistle has superior lead-uptake compared to most plants



Indian Mustard is currently being researched for its uptake potential



Sources clockwise from top left:

Wikimedia Commons, 2009. Author: Andrew Curtis. [http://commons.wikimedia.org/wiki/File:Alpine_penny-cress_\(Thlaspi_alpestre\)_-geograph.org.uk_-_1222085.jpg](http://commons.wikimedia.org/wiki/File:Alpine_penny-cress_(Thlaspi_alpestre)_-geograph.org.uk_-_1222085.jpg),

Wikimedia Commons, 2010. Author: Lmmahood. [http://commons.wikimedia.org/wiki/File:Nodding_thistle_\(Carduus_nutans\).JPG](http://commons.wikimedia.org/wiki/File:Nodding_thistle_(Carduus_nutans).JPG)

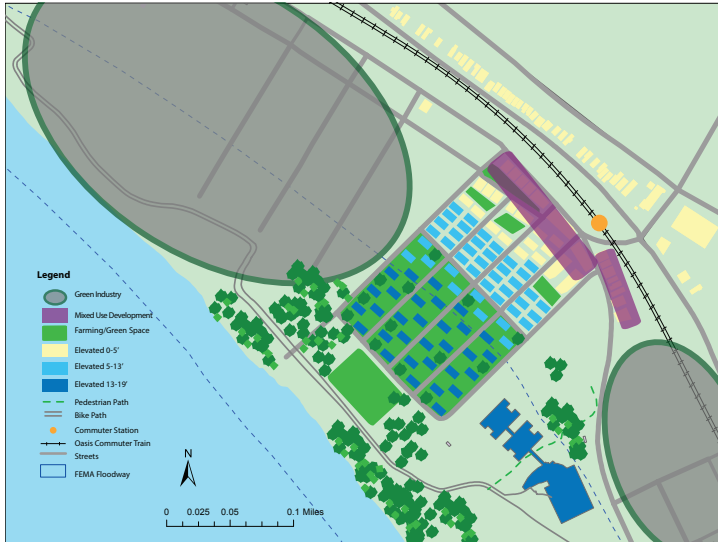
Wikimedia Commons, 2008. Author: Indiaphotoblog. http://commons.wikimedia.org/wiki/File:Yellow_mustard_flower.jpg

INTERVENTION

Eco-Housing

A In the case of limited land availability, recreational opportunities, and mixed-use residential development how will the demand for housing change?

Sustainable & Flood Resistant Homes



If the East End were to experience more green industrial growth and shipping opportunities, the ability to live in the garden district would be limited. The cost of property and thus housing in the garden district would be more expensive and fewer people would live there because of the limited space and close proximity to industry. The Oasis Transit station would primarily serve the commuting population from outside of the East End and there could be a small mixed use development close to the transit station. There would be limited ability to mitigate flooding due to the lack of green space, but the planting of trees and flood resistant plants could help.

Flood Resistant Building

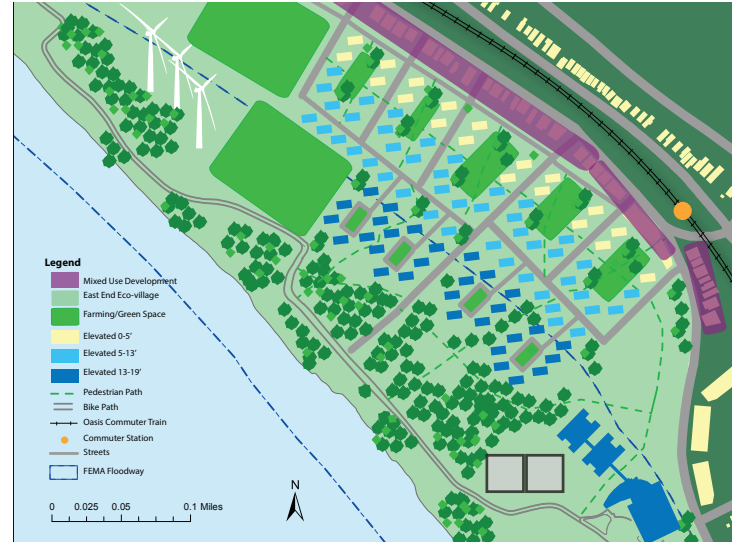


<http://inhabitat.com/the-f9-flood-proof-house-stands-tall-above-rising-tides/>

This is a state of the art sustainable flood resistant home that includes solar panels, rainwater harvest system, passive solar opportunities and is made out of durable reused materials.

B How will the demand for housing change in response to increased population, recreational and environmental opportunities, and public transit demand?

East End Eco-Development

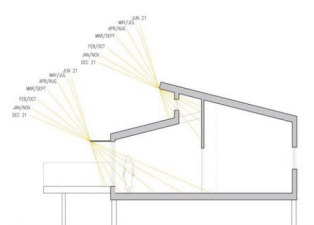


The East end could develop a Transit-Oriented Eco-development to accommodate a mix of land uses and incomes, increased population, climate mitigation, and low impact development. This eco-development would include sustainable flood resistant homes, open space for gardening and flood mitigation, trails and recreational opportunities, and renewable energy sources. The eco-development would be unique with the fact residents would not need a personal vehicle given the Oasis Transit Station would be across the street. A similar mixed income TOD Eco-development can be found in Cleveland, OH which now has 6,000 residents and 400 super efficient homes that heat and cool for \$400 annually.

Eco-Home



The East End Eco-development includes a low impact development site plan, as the houses are clustered to conserve green space. The homes are oriented along an east west axis for optimum passive solar energy as seen in the example home. These newly constructed homes must be elevated due to flooding.



http://ny.curbed.com/archives/2013/10/07/elevated_flood-proof_resilient_house_headed_for_rockaways.php

CONCLUSION

A Green Future

Despite declining population and large rates of vacancy, the East End has a wealth of environmental resources and natural opportunities to become a destination neighborhood. Whether or not the neighborhood follows either trajectory of the two frameworks outlined here—green industrial growth or recreational growth—the community should prioritize protecting and supporting its natural environment.

The Ohio River banks should be stabilized to ensure productive and recreational use of the waterfront, as well as ecological health of the landscape. On the other side of the narrow neighborhood, the slopes along River Road should be stabilized to prepare for the expansion of transportation modes, and other future development along the main arterial. Brownfield remediation will proactively place the neighborhood in a position that welcomes future land uses suitable for human interaction.

Finally, it will be necessary to consider eco-friendly flood-resistant residential development moving forward, as the risk of flooding and national floodplain regulations will severely restrict what can and cannot develop on sites closer to the river. Planning for a green future will make the East End an attractive and viable place for residents, businesses, and visitors alike.

NEXT STEPS

- Use Frameworks A & B to guide a community discussion about potential neighborhood futures, and how they are related to environmental resiliency and sustainability.
- Form an East End task force to prioritize design interventions in a timeline.
- Seek the aid of local non-profits and student groups to lend expertise in economic impact, financing, grant writing, and engineering feasibility.
- Invite city leaders and officials to a round-table to advocate for investment in the East End, using case studies to demonstrate parallels with other cities' projects.

