

ESI Demonstration Project ESA

Louisville, KY, 2019

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Center For Neighborhoods

WELCOME!

We are very excited to welcome you to this year's Earth Stewardship Initiative (ESI) demonstration project in Louisville, Kentucky. ESI connects young researchers with city officials and professional scientists. The ESI Fellows represent a growing group of graduate, doctoral, and postdoctoral students from a wide range of backgrounds from schools in the U.S. and abroad. They have demonstrated curiosity and passion for a combination of ecological research, urban design, environmental equity, and social justice.

The Earth Stewardship Initiative at the 2019 Ecological Society of America (ESA) conference in Louisville is a project embedded in the ESA and supported through funding from the National Science Foundation, SESYNC, the University of Connecticut. and the University of Louisville, bringing together multiple institutions to grapple with the role of ecological science in shaping cities through ecology for the city (Felson et al. 2013). This approach builds on the concept of "Earth Stewardship" being explored among the ranks of ecologists. Chapin et al. (2011) explain that Earth Stewardship involves "shaping trajectories of social-ecological change at local-to-global scales to enhance ecosystem resilience and human wellbeing." It contends that "over the next decade or two, society has a window of opportunity to radically redefine our relationship with the planet to reduce risks of dangerous global changes that could otherwise seriously degrade Earth's life support systems." In practice, it is a new agenda the ESA is embracing by enabling ecologists to position themselves for greater positive impact in shaping modern society.

The Louisville ESI is the culmination of discussions and preparations with Louisville city officials leading up to the conference event. The 22 ESI Fellows were solicited and selected to enter into these discussions with each other and the city. During the conference, we have organized a field trip and brainstorming session with Louisville's Bureau of Environmental Services, a social event with active community members, and a workshop with ESA advisors, fellows, and city officials. These activities are embedded within the broader forum of the ESA conference, where multiple events complement the ESI program. This document serves as a reference and guide to all Louisville ESI activities. In addition to this document, members of our team will be available throughout the week to answer any and all questions as we work together.

We look forward to an exciting ESI program!

Warm regards, Alexander J. Felson University of Connecticut



Louisville, KY 1878 https://www.loc.gov/item/73693416/



Beargrass Creek watershed, Louisville, KY downloaded July 2019

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BACKGROUND ON LOUISVILLE

Influenced by both Southern and Midwestern culture, the City of Louisville is recognized for its rich history. Located on the banks of the Ohio River, Louisville has long been caught in a complicated relationship with the river. In the early 1800's as river technology began to develop more rapidly, Louisville's existence as a main river port and center of commerce was established. Traffic along the river intensified as shipping industries and various businesses noticed the possibility of success that Louisville offered. Many of the characteristics that defined Louisville in its early history can be seen today. It is a city tied to its roots bursting with opportunity and promise.

As a result of Louisville's predominately urban environment, it was one of the first cities to implement zoning and planning operations to establish and shape urban growth throughout the city. During the 20th century, the city continued to change in appearance. As did its relationship with the Ohio River. This deteriorating connection to the river impacted numerous different aspects of the City. There was a huge drop in environmental and public health. Since then, Louisville has made a substantial effort to redefine itself. With completed projects such as Waterfront Park, the City has seen the positive effects of reconnecting residents with Louisville's history and abundance of possibility.

Louisville understands that to ensure a prolific future, it must take seriously the health of its community socially, economically and environmentally. The future of local economics, wildlife and ecosystems, culture, social connectivity, and urban growth are all dependent upon a continuation of improving the overall health of Louisville. Although each of these factors bring a diverse set of difficulties, the City of Louisville is working hard to develop progressive solutions that involve the community and stimulate growth. Louisville is transforming into a place that meets challenges with the belief that they can be made better. Once recognized as a shipping port hub along the Ohio River, Louisville is now on track to become nationally recognized in its entirety.



Picnicing 1940



Greyhound Bus Terminal 1943





The Earth Stewardship Initiative (ESI) exists to create more livable and sustainable cities. ESI embraces a dynamic framework for transdisciplinary collaboration to foster the integration of ecological research in designing and managing cities. We believe that if sustainability goals are to be met, we must change the way science intersects with society. To that end, over the last three years we have collaborated with the Ecological Society of America and other organizations to create Earth Stewardship Initiative (ESI) Demonstration Projects in Portland (2017), Baltimore (2015) and Sacramento (2014). In 2016, ESI fellows and advisors attended the conference in Fort Lauderdale to present their projects. The Louisville ESI, like Baltimore, received NSF and SESYNC funding as well as funding through private funders in Louisville .

The goal of these projects is to connect communities with ecologists, urban planners, and designers, who then co-design and co-manage urban environments to promote social and ecological resilience and revitalization. In this way, ESI brings together local government, organizations, and academic institutions. ESI solicits Fellows from around the country to work with city officials, practitioners, and ESA organizers on large-scale land planning projects. Participants collaborate on an urban design process to generate sustainable design strategies, and propose ways of improving research methods for these projects through designed experiments and other adaptive management tools.

This year, ESI is collaborating with the city of Louisville in an effort to improve the connection between the local community and its surrounding ecosystems. Through ecological experiments, ESI will become involved in problems faced by Louisville that address the overall framework of the Climate Action and Resilience Plan. These experiments will aim to improve Louisville's livability and sustainability. Designed experiments are beneficial because they demonstrate how ecologists can effectively shift from studying to shaping urban ecosystems. The initiative in Louisville builds on Lessons learned from ESI projects at the 2014, 2015, and 2017 ESA conferences by becoming a program designed to "learn from the city." Louisville's environmental concerns disproportionately impact low-income and minority communities. Despite these deficits in equity throughout the city, Louisville has a lot to offer when it comes to finding ways to address goals designed to mitigate the impacts. The 2019 ESA conference in Louisville offers ESI Fellows unique opportunities to evaluate, learn more about the City of Louisville and develop four designed experiments with a team of professional ecologists, city officials, and ESA attendants.



Our goal is to explore the ways of incorporating ecological research into a collaborative planning process focusing on climate adaptation, social equity, connectivity, and water quality. The ESI team will incorporate Designed Experiments into planning projects as a framework to bridge ecology with landscape architecture and to inform urban design decisions and management for community benefit. Designed Experiments embed experiments with design projects, and methodically integrate scientific analysis into urban planning, design, and engineered systems.

Collaborating with the City of Louisville, ESI Fellows participate in real-world problem-solving scenarios that challenge them to consider how to integrate ecological information and the process of gathering relevant social and political knowledge to inform shaping cities. To support this translation, ESI Fellows assess what is needed at appropriate scales for decision making. They then use these methods to explore ways of translating science into planning and design. We use the design process (particularly the shift from site analysis to conceptual design) as a pedagogical tool to demonstrate how we move from studying to shaping and develop ecology for the city. This requires that Fellows understand diverse stakeholder interests and balance local interests with specialized and organizational knowledge and systems-thinking. To facilitate this learning experience, ESI encourages interdisciplinary collaboration through mixed teams of Fellows from design, ecology, and other disciplines. Working through city knowledge and documentation, theoretical frameworks of urban ecology, and the growing literature and data on urban ecosystems dynamics, Fellows identify relevant scientific information, projects and case studies, and explore ways of translating this data into design proposals for making Louisville more adaptable.

This year, the projects will target Louisville's land use patterns, watershed and park connectivity, urban heat island effects, public health and access, climate change, and water quality. These themes are based on a set of topics that were co-generated through discussions with city officials (see appendix). Fellows are organized into working groups around each of these themes and will use them to guide their thinking. They are described in the following sections.



Louisville ESI THEMES



Park Connectivity and Access Public Health and Contamination Flooding and Riparian Zones

Issue of flood management with waterfront parks and establishing connectivity and entry points to connect people to the water and create ecological and recreational continuity across adjacent parks. The Chickasaw Park pond has historically had issues of heavy pollutants (from rubber tanning, VOC pH, Dioxins) and there is an issue of environmental justice. The City is working with local and federal partners to plan a design to re-engineer the pond to provide better habitat quality for fish and other animals. This park is in close proxmity to two other west Louisville parks but there is no connectivity between them. Two of the parks, Chickasaw and Shawnee, are Olmsted Parks.

Fellows will seek to develop an experiment for assessing the performance and value of Louisville's existing green networks ,What specific local areas need more attention in improving watershed health, and what specific indicator(s) require the most attention? Should the frequency with which projects are sampled and measured be improved to uncover more accurate trends in health across the landscape?

Park Connectivity and Access, Public Health and Contamination, Flooding and Riparian Zones



An issue the city of Louisville faces is the problem of inequity on many fronts. For the theme of parks and connectivity, ESI is focusing on connecting all citizens to local parks and increasing access and updating conditions of local existing parks. We focues on Chickasaw Park, Shawnee Park, and Portland Wharf Park.

West Louisville Outdoor Recreation Initiative 2016



West Louisville Outdoor Recreation Initiative 2016

Louisville's urban forest including street trees provides many benefits, such as stormwater uptake, temperature regulation, and improvements in public health. Pictured here is Ladd Circle Park & Rose Garden and the surrounding wooded neighborhood.



Green infrastructure such as the Chickasaw Pond at public parks has many layered uses, providing a source for recraeation, natural beauty, and scientific research.



Olmsted Parkways Multi-use Pathway System Phase 1 Design Overview October 22, 2012 15



Urban Heat Island

Louisville is the fastest growing urban heat island in the country, with UHI effects causing a 10°F increase in air temperature in pockets throughout the city. Louisville's Urban Heat Management Study (2016) emphasizes the need for tree and vegetation plantings, energy efficiency programs, heat management strategies, and new regulatory and economic incentive programs. UHI impacts are greatest downtown and in urban residential areas, particularly those along the Ohio River and in west Louisville. The city's community forestry program aims to address UHI and has set a goal for 45% average tree cover county wide. Additional info: https://louisvilleky.gov/government/sustainability/urban-heat-island-project

This group will develop a designed experiment research project focusing on future conditions with climate change and the impacts of UHI. Some key quetsions include: How well do the indicators, rating curves and grading system used to evaluate the health of Louisville's watersheds function for communicating? Public encouragement: Should actions be graded separately from health to promote an iterative and incremental adaptive management for improvements over time? The City strives to solve problems at their source, not just their symptoms; which actions will avoid future problems?

Urban Heat Island

Focusing on the West End across selected neighborhoods including the tee canopy assessment and UHI



Dveloped designed experimental research that will better prepare Louisville for a changing climate—namely, hotter, drier summers and milder, wetter winters. Focus on actions will adapt and mitigate the Urban Heat Island effect, reduce the impacts of future drought.



The KY Division of Water continuously monitors hydrologic conditions throughout the state, including precipitation, streamflows, lake elevations and various drought indices for purposes of drought planning and response. Monitoring occurs across 15 Drought Management Regions that are based upon the Area Development Districts.





Watersheds and Water Quality, Connectivity and Recreation

Beargrass Creek is a well-loved, mostly channelized stream that runs through a large portion of the county. The community has repeatedly expressed interest in restoring the creek to its natural state where possible. The Creek's issues include: combined sewer overflow systems, tributary overflow, bacteria, invasive plants and animals, limited shade, poor signage, limited access, dangerous nearby intersections. In 1998 42% of the South Fork's 27 mi2 watershed area was impervious; estimated to be 60% more today (=67%). A 20 year restoration plan seeks to incrementally address issues. The plans do not account for climate change including heavier rainfall. Plans seek to "connect neighborhoods to the creek, improve the health of the waterway and the life it supports, and develop destination spots for people to learn about enjoy the stream." Cleaning up the Creek could also encourage development of neglected areas.

How well do the indicators, rating curves and grading system used to evaluate the health of Louisville's watersheds function for communicating? Cites strives to solve problems at their source, not just their symptoms; which actions will avoid future problems?

Watersheds and water quality, connectivity and recreation Beargrass Creek Flooding including Creason Park



Plan 2040 Public Review Draft 3/9/18 A Comprehensive Plan For Louisville Metro/Jefferson County



How can urban ecologists collect the data they need to understand how biodiversity functions in the city environment? How do city officials communicate these values to the public? How can the public become more involved in the science of urban life? Retaining functionality and expressing value through beautiful green space is a central responsibility.

Table 17. NFIF Claims by Watershea							
Watersheds	Repe	etitive Loss	Historical Claims				
	Claims	Total Paid	Claims	Total Paid			
Cedar Creek	1	\$ 128,633	18	\$ 142,750			
City/Ohio River	96	\$ 15,273,791	727	\$ 15,307,615			
Floyds Fork	7	\$ 661,223	51	\$ 806,128			
Goose Creek	11	\$ 1,176,472	70	\$ 1,801,190			
Harrods Creek	0	\$ -	43	\$ 787,814			
Middle Fork Beargrass Creek	9	\$ 738,052	35	\$ 287,481			
Mill Creek	19	\$ 386,013	359	\$ 2,239,250			
Muddy Fork Beargrass Creek	5	\$ 172,205	33	\$ 353,325			
Pennsylvania Run	0	\$ -	5	\$-			
Pond Creek	86	\$ 4,691,776	1,072	\$ 11,046,626			
South Fork Beargrass Creek	80	\$ 4,220,613	224	\$ 2,018,762			
TOTALS	314	\$ 27,448,778	2,637	\$ 34,790,942			





Hydrology Public Health and Infrastructure planning

A neighborhood plan process for the California/Victory Park neighborhood was recently completed. Neighborhood concerns include crime, lack of investment/ redevelopment, vacant properties, and environmental issues. The California neighborhood is a mix of industrial and residential uses, creating public health and environmental justice issues. The Maple Street area was part of a FEMA grant to relocate residents from this flood-prone area. The Metropolitan Sewer Distrist (MSD) currently owns the property and is looking for a community organization to take ownership and maintain the area as a community asset. Fellows in this group seek to strengthen the relationships between scientists, city officials, and the public. How can urban ecologists collect the data they need to understand how biodiversity functions in the city environment? How do city officials communicate these values to the public? How can the public become more involved in the science of urban life? Retaining functionality and expressing value through beautiful green space is a central responsibility.

The group will seek develop designed experiments that evaluate the biological (e.g. biodiversity), social (e.g. aesthetic value), and financial benefits (e.g. public money saved) of GI. City questions: Are Louisville's monitoring efforts the best method for sharing these results? What experiments or data would be most compelling, especially to the public? How should city officials and the public communicate through design, outreach and education to the community?

Hydrology, Public Health and Infrastructure Planning

California Neighborhood MSD Maple Street (FEMA grant buyout) & Victory Park



VACANT PROPERTY METRO OWNED VACANT PROPERTY MSD OWNED PROPERTY

Priority 1: Mental/Behavioral Health - Ensuring community-wide mental health and people's ability to realize their full potential, cope with stresses of life, work productively, and make meaningful contributions to Louisville

Goal	Objective
1. Promote positive early	↑ safe and stable homes for children.
childhood development	\downarrow abuse and neglect in the home
	Ensure cognitive and physical developmental benchmarks met
2. Facilitate social connectedness and	↑ social/civic engagement
community engagement across lifespan	↑ support systems
3. Provide individuals and	↑ employment rate
families with supports they need to maintain positive mental well-being	Promote early identification of mental health needs and access to quality services
	\uparrow integration of mental and behavioral health

Priority 2: Healthy Eating and Active Living - Increasing physical activity and healthy eating to reduce people's risk of chronic conditions and to reduce obsity and maintain healthy hody weight

Goal	Objective
1. Increase fitness	Encourage community design and development that supports PA
	Build a culture of active living
	\uparrow access to, and consumption of, healthy and affordable foods
2. Increase nutrition	Build a Healthy Food Culture
	↑ early childhood nutrition
	\downarrow rate of hypertension
3. Decrease rates of chronic disease	↓ type II diabetes
	↑ pre-diabetes screening
	↓ rates of hyperlipidemia
	↑ rate of diabetic patients having a A1C

Healthy Louisville 2020, February 2014



Vacant and abandonded properties (vaps) 2017 there are 5100 parcels (3600 structures)



California & Victory Park Neighborhood Plan, May 2019 21

Site Analaysis: Hazard Mitigation Plan (HMP)



The Hazard Mitigation Plan is a 5-year plan developed to meet the requirements of the Disaster Mitigation Act of 2000 and the Community Rating System. The plan covers 13 hazards likely to affect the Louisville Metro area: flood, dam/levee failure, drought, earthquake, extreme heat, hail, hazardous materials, karst/sinkholes, landslide, severe storms, severe winter storms, tornadoes, and wildfire.

Flood Related Hazards

Flood Dam/Levee Failure

Geologic Hazards

Earthquake Landslide Karst/Sinkhole

Meteorologic Hazards

Tornado Severe Winter Storm Severe Storm Hailstorm

Other Hazard Types

Hazardous Materials Drought Extreme Heat Wildfire

The Plan Approval The Plan Maintenance The Mitigation Strategy The Risk Assessment Planning Process Hazard Mitigation Plan

Louisville Hazard Mitigation Plan (HMP) 2016

Opted to Maintain the 2011 Plan Mitigation Goals including:

Minimize the loss of life and injuries that could be caused by multi-hazards.

Facilitate a sustainable economy by protecting agriculture, business, and other economic activities from multi-hazards.

Facilitate the strengthening of public emergency services, its infrastructure, facilities, equipment, and personnel to multi-hazards.

Develop a community-wide mitigation effort by building stronger partnerships between government, businesses, and the general public.

Increase public and private understanding of multi-hazard mitigation through the promotion of mitigation education and awareness of multi-hazards.

Enhance existing or design new policies and technical capabilities that will reduce the effects of multi-hazards.

Enhance existing technical and GIS data and capabilities that will reduce the effects of multi-hazards.

Hazard	Start Range	End Range	Range	Frequency	Total Losses	Probability	Average Consequences	Average Annualized Loss	Deaths
Dam Failure	1973	2015	42	1	N/A	.02	N/A	N/A	0
Flooding	1996	2015	20	127	\$ 251,915,000	6.35	\$ 1,983,583	\$ 12,595,750	2
Severe Storm	1957	2015	59	452	\$ 3,552,000	7.66	\$ 7,858	\$ 60,203	3
Severe Winter Storm	1996	2015	20	27	\$ 105,000	1.35	\$ 3,889	\$ 5,250	3
Tornado	1964	2013	50	23	\$ 5,705,000	0.46	\$ 248,043	\$ 114,100	3
HAZ/MAT	2010	2015	6	1,179	N/A	196.50	N/A	N/A	
Hail	1961	2015	55	152	\$ 20,017,000	2.76	\$ 131,691	\$ 363,945	
Karst/ Sinkhole *			1	443	N/A	N/A	N/A	N/A	
Drought	1945	2015	71	32	N/A	0.45	N/A	N/A	
Earthquake				0	N/A	N/A	N/A	N/A	
Extreme Heat	2011	2012	2	3	N/A	1.50	N/A	N/A	2
Landslide	1993	2015	23	5	N/A	0.22	N/A	N/A	
Wildfire	2000	2016	17	6	N/A	0.35	N/A	N/A	

Table 7. Louisville Metro Loss Matrix:

*Occurrences are recorded sinkholes.

Louisville Site Analysis: 5 Physiographic Regions





Karst landscape is an irregular limestone wit fissures, sinkholes, underground streams, and caverns due to eroision. A sinkhole is a natural depression in a land surface communicating with a subterranean passage, generally occurring in limestone regions and formed by solution or by collapse of a cavern roof.

4 Distinct Topographic regions in Louisville Metro

The "Flood Plain" is a strip of land The "Eastern Uplands" includes gently rolling bordering 0.5-5 miles wide along land to hilly plains to moderate to steep the Ohio River. It is gently rolling valleys (ranging from 500-800 ft). Goose with flat sloped stream beds and Creek, Harrods Creek, Floyds Fork, and the the lowest elevations in the county Beargrass Creek system drain this region. (430-440 ft) and terraces to 460 ft. IEEEERSONVILL FLOYD 22 CS101PN MATTHEW 60 FLOOD PLAIN EASTERN UPLANDS CENTRAL BASIN BIW KNOBS IRDALE 31E

The "Knobs" region includes hills that are highly dissected by stream erosion. It is the highest elevation (300-400 ft above surroundings) in the county. Side slopes of 30% to 50% are common. Numerous streams drain to Pond Creek.

The "Central Basin" is a former slackwater region of shallow soils and nearly flat terrain (450-500 ft). Improvements to the basin ditch systems have counter the lack of natural drainage.

Physiographic Regions Source: Kentucky Geological Survey

Louisville Land Use





- Single Family
- Multi-Family
- Commercial
- Industry
- Public and Semi Public
- Parks and Open Space
- Farmland
- □Vacant
- Right-Of-Way

Ohio River Watershed



Louisville's landscape is better described as being in a very wide part of the Ohio River flood plain. The Flood Plain extends from the Salt River in the southwest, north to downtown Louisville, and continues northeast to the Oldham County line.



Ohio River and Floodwall

A large portion of Louisville Metro lies within the broad floodplain of the Ohio River; however, about 17,600 acres of this floodplain, including downtown Louisville, are protected by a 28.9 mile long flood protection system. The first phase of the system, which protects the area from Beargrass Creek to just south of Rubbertown, was completed by the Army Corps of Engineers in 1957. A second phase was completed in the late 1980s to protect southwest Louisville Metro, from Rubbertown to Pond Creek. The floodwall system is built to protect Louisville Metro from floods equivalent to the historic flood event of 1937 with three feet of freeboard.

Туре	Structures in Floodplain	Total Structures	% in Floodplain
Agricultural	109	3,163	3.4%
Industrial	683	6,658	10.3%
Commercial	2,735	27,903	9.8%
Residential	14,205	357,096	4.0%
Other	983	16,768	5.9%
Total Structures	18,715	411,588	4.5%
Estimated Loss	\$1,403,820,590	\$ 40,733,526,133	3.4%

Table 14. Potential Losses from Flood



In Kentucky, the severity of a flooding event is determined by a combination of stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions and the degree of vegetative clearing. Flood currents also possess destructive power as lateral forces can demolish buildings and erosion can undermine bridge foundations and footings, leading to the collapse of structures.

Watersheds	Total	Value	Agri- culture	Resi- dential	Comm- ercial	Industrial	Other	Buildings with Basements
Cedar Creek	49	\$1,195,480	0	46	1	0	2	2
City/Ohio River	3,370	\$461,247,930	3	2,613	211	209	334	556
Floyds Fork	413	\$19,151,950	53	258	17	9	76	59
Goose Creek	150	\$18,545,360	1	109	13	0	27	39
Harrods Creek	121	\$13,459,920	4	58	19	0	40	31
Middle Fork Beargrass Creek	345	\$77,387,590	0	250	54	9	32	101
Mill Creek	2,630	\$114,818,250	0	2,396	167	5	62	463
Muddy Fork Beargrass Creek	229	\$35,118,810	0	182	20	0	27	97
Pennsylvania Run	120	\$4,736,220	2	106	0	0	12	5
Pond Creek	8,675	\$459,265,680	41	6,305	1814	354	161	479
South Fork Beargrass Creek	2,613	\$198,893,400	5	1,882	419	97	210	454
Total	18,715	\$1,403,820,590	109	14,205	2,735	683	983	2,286

Table 16. Existing Buildings in the Regulatory Floodplain and Combined Sewer Floodprone Area



Louisville's flood protection system runs a half-mile to five miles wide along the Ohio River, extending from the southwest of the county to downtown and continuing northeast along the river, including parts of Butchertown, Portland, Shawnee, Old Louisville, Shively and Valley Station.

The flood protection system includes 16 pump stations and 29 miles of walls and levees. There are also approximately 150 floodgates and 79 closures where teams would have to place sandbags or gates to stop encroaching floodwaters.

If a catastrophic river flood happened today, it could affect more than 200,000 residents and as much as \$34 billion in property, according to the Army Corps of Engineers.

This worst-case scenario threatens Louisville's energy grid, transportation, schools and hospitals. It could swamp Superfund sites and industrial chemical facilities like those in Rubbertown.

Louisville's floodwalls and levees were built three feet higher than the crest of the 1937 flood, which was a 500-year flood event. These high walls provide substantial risk reduction.

More than 4,000 feet of the city's flood walls were designed using the same technology that failed during Hurricane Katrina. These "I-walls" can be pushed over as rising water leans against them. Separate analyses found some areas of the concrete floodwall do not meet minimum safety factors, according to the Army Corps.

The sewer district has outlined a plan to spend \$4.3 billion on critical infrastructure; \$683 million of that would go to the flood protection system for repairs and upgrades. But so far, the sewer district hasn't gotten approval to raise user rates enough to fund the plan.

Form Based Code



Adopted 15 June 2000 by the Louisville and Jefferson County **Planning Commission**

PLAN 2040

PUBLIC REVIEW DRAFT 3/9/18 A COMPREHENSIVE PLAN FOR LOUISVILLE METRO/JEFFERSON COUNTY

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Plan Elements

1 S

Community Form

Guideline 1: Community Form
Guideline 2: Centers
Guideline 3: Compatibility
Guideline 4: Open Space
Guideline 5: Natural Areas & Scenic &Historic Resources



Marketplace

Guideline 6: Economic Growth.....



Mobility and Transportation

Guideline 7: Circulation
Guideline 8: Transportation Facility Design
Guideline 9: Bicycle, Pedestrian & Transit



Livability & Environment

Guideline	10: Flooding and Stormwater
Guideline	11: Water Quality
Guideline	12: Air Quality
Guideline	13: Landscape Character



Community Facilities C

Guideline	14: Infrastructure
Guideline	15: Community Facilities



Plan 2040 Chase Principles Definitions

The vision statement for Plan 2040 emphasizes five principles (CHASE) for the Louisville Metro that emerged from early public engagement activities and focused public input including 4 workshops:

Connected

Multi-modal transportation for all users. providing safe, convenient job access, housing opportunities, and regional and national transportation facilities.

Healthy

Active lifestyles promoting a state of complete physical, mental and social well-being. Equitable access to parks and open space, recreation, healthcare and healthy food across socially, economically, demographically or geographically defined populations.

Authentic

A compassionate community that recognizes its unique culture by supporting the evolution of its neighborhoods through engaging all citizens, encouraging local businesses, promoting art and culture, and recognizing important features such as buildings, parks, waterways in the built and natural environment.

Sustainable

Aresilient community that improves quality of life for all citizens by encouraging green practices to develop sustainable and high-quality development practices that provide livable, walkable communities while being harmonious with the natural environment (air, water and soil quality).

Equitable

A community that values diversity and recognizes that resources, opportunities, and outcomes must be shared. Engage all citizens in the decision-making process. Address the history of inequities and their ongoing impacts, particularly among communities of color.. Create afe neighborhoods while providing equitable access to quality education, employment and affordable housing of choice for all citizens.

Plan 2040 Public Review Draft 3/9/18 A Comprehensive Plan For Louisville Metro/Jefferson County



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LIVABILITY

Protect and enhance the natural environment and integrate it with the built environment as development occurs.

OBJECTIVES:

- Safe, accessible multi-use trails, pathways and transit options are promoted to improve air quality and increase connections throughout the community.
- Existing waterways are conserved, protected or improved to enhance water quality.
- c. Parks, public outdoor spaces and public natural areas are preserved, enhanced and accessible to all.
- Restoration of the tree canopy and integration of native species into the built environment are prioritized.
- e. The distribution of public resources addresses inequities in environmental conditions.



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West Louisville Outdoor Recreation Initiative 2016

Existing Pond Conditions Water surface area = 1.78 acres Water surface elevation = 452.67' Average depth = 1.6' Maximum depth = 4.6' 6" overflow elevation = 453.18' Bank depth = 1' Bank slope = 3H:1V Bottom slope = 5H:1V to 7H:1V Contributing drainage area = 7 -8 acres





INTRODUCTION 1.3 COMMUNITY ENGAGEMENT

WHAT YOU SAID: COMMUNITY ENGAGEMENT SUMMARY



APR

April 17 Final Public Presentation

West Louisville Outdoor Recreation Initiative 2016

Public Health



IMAGINE GREATER LOUISVILLE 2020

An Arts and Culture Vision to Transform the Region

April 2017

www.ImagineGreaterLou.org







Pregnant Workers Health Impact Assessment



The Kentucky Pregnant Workers' Rights Act (KYPWRA) (SB18) works to clarify that Kentucky law protects worten who need reasonable modifications in the workplace reasonable modifications in the workplace genarit works have equal access to safe and healthy working conditions. The Pregnant works mixed thread: Assessment works to inform doction making around the policy a measure to imprac Assessment works on inform doction making around the policy and answer to increase the access of Rentucky's pregnant workers and ther developing achieves.





MAGINE

Healthy Louisville 2020



Creating a Healthier City



Greg Fischer Mayor HealthyHometown

LaQuandra S. Nesbitt, MD, MPH Director

CASE STUDIES

These case studies provide examples of experimental research integrated within urban design.

The Parklands of Floyds Fork: Reducing Nonpoint Source Runoff

The Parklands of Floyds Fork, located in southeastern Louisville, is one of the largest current metropolitan projects. The park began its several phases of renovation in 2011, and since then has opened thousands of acres of land, an educational center, spray-ground, and even a lodge to the public. Floyds Fork is the largest watershed in Louisville and it has been at the center of rapid development. The project's design protected the habitat of several species of native plants and animals, it restored hundreds of acres of wetlands, forests, meadows, and miles of stream banks that run through the park. The renovation

of The Parklands of Floyd Fork combines beautiful trails and parks, diverse wildlife and a space that helps the community grow in ways that are sustainable,

creative, and beneficial to all those involved. Through grant а Helmslev from the Charitable Trust. an urban conservation initiative began in The Parklands. Beginning in 2015, projects bega n



throughout the park developing gardens to showcase a variety of native trees, restoration on nearly 80 acres pf

native meadows, and implementing a strategy to remove invasive plant species damaging the native plants local wildlife depend upon.

The Tornado of 1974

In the spring of 1974, a series of fatal tornados wrecked through several states in just two days. From Michigan to Georgia, hundreds of cities were destroyed and left with insurmountable complications. As the tornado moved through Louisville it nearly devastated the entire tree canopy in Cherokee and Seneca parks. As trees splintered and fell to the ground, it made way for the sunlight to reach below the canopy and allow invasive species to thrive. Plants such as honeysuckle, or Lonicera maackii, and many different species of vines began to suffocate the park. Storms again in 2008 and 2009 worsened the effects of the 1974 tornado on the parks as it began to spread into Shawnee and Iroquois. The Olmsted Parks Conservancy recognized the impacts these events were having on the environment. In 2015, the Conservancy gathered support from thousands of volunteers from around the area to clear out invasive species and substitute them with native species throughout the parks. The hopes were that these newly introduced native species would help to encourage new tree growth. These somewhat independent efforts proved the positive effects of community engagement. Without the help from native Louisvillians dedicating time to conservancy efforts, the intricate and beautiful tree system might have been lost.



The great cyclone, tornado and fire at Louisville KY 1890

Redlining Impacts on the City of Louisville

Dating back to the 1930's to 1951, West Louisville suffered as a result of the governments newly implemented HOLC, or Home Owner's Loan Corporation, which set out to guide investment in US cities. The HOLC produced a rigid grading system which categorized neighborhoods on a scale from green, yellow, blue or red. Being branded as yellow and red neighborhoods, several communities in West Louisville were impacted by this practice. Redlining refers to the practice of denying loans in certain neighborhoods because of race or socioeconomic characteristics rather than physical, design, or structural characteristics. Redlining was an explicitly discriminatory practice that led to cycles of disinvestment, racial segregation, and racial biases. To this day, many of the neighborhoods in West Louisville are continuing to battle with the lasting effects of redlining on their communities socially, economically, and environmentally.



This map shows the actual districts of Louisville that have been zoned, targteing the lower income minorties cummoties of west Louisville.

Characterizing ESI Research

A major opportunity (and challenge) of the ESA's Earth Stewardship framework is that it is open to the need for a multiplicity of people working together to create novel human-environment relationships that foster urban resilience and sustainability.

Not only are such action-oriented goals different from what a traditional ecologist may expect, but the means of working to do so are as well. In addition to ecological challenges, this work must also be carried out in contexts where there are differing views among people and institutions of the problems and possible solutions. These problems are typically multicausal and high-stakes, having no definitive answer. These problems are difficult to test and in many cases they cannot be resolved without changes among citizens and the overarching society that influence them. Thus, applying Earth Stewardship by working on real sites to explore an active role in shaping interrelated ecological and human futures involves both matters of ecology and the meanings applied to these matters and more by the people involved. This includes ecologists, scientists, designers, citizens, and all people involved and implicated.

In other words, there's no way around working with people and others' perspectives when it comes to enacting Earth Stewardship. Focusing on people's perspectives and meaning-making alongside ecological research goals provide a rich area of scholarship and practice, however, grappling with these multi-layered challenges remain new, and exposure to these real world challenges through Earth Stewardship remain limited. Given that the Earth Stewardship concept itself frames the challenge it sets out to address, we continue to embrace this concept as a driver of this evolving program. The conference presents an opportunity to assess the relatively new Earth Stewardship agenda and most importantly to explore the role ecologists can play in applying experimental research and ecological science to real world challenges.

Concluding Remarks

Perhaps the greatest benefit of partnering with Louisville on this year's Earth Stewardship Initiative has been the opportunity to work with a city that has been grappling with issues of equity and public health. In addition, the importance of parks for the city and the impact of the Olmsted park history is an opportunity to learn about regional parks and the evolving value of parkland. ESI Fellows have faced the daunting task of sifting through the extensive available information. In doing so, ESI Fellows provide an opportunity to present and discuss new ideas that build on Louisville's efforts to-date and propose exciting directions forward.

As cities like Louisville prepare for an uncertain future, there is an opportunity for ecologists to work with city officials, architects, landscape architects, urban planners, designers, and citizens to inform how cities can function ecologically, economically, and aesthetically. Adapting a city that is over 150 years old to the ecological problems of today's world is no small task.

To that end, there are a number of barriers to implementing green infrastructure and other best management practices--barriers that will certainly persist into the foreseeable future, and that this year's ESI Demonstration Project seeks to address.

Examples of these barriers include:

-Public uncertainty, lack of understanding, communication challenges and misperceptions related to green infrastructure performance, costs, and whether it is an amenity versus a necessity.

-Competition for space (i.e., development, parking, bike lanes, sidewalk widths) and Urban Form concepts that view green infrastructure

and green space as unnecessary or limiting, especially in highly urbanized areas.

-Environmental barriers such as poor-draining soils, high groundwater, soil contamination, cold weather climates, extreme storms, climate change uncertainty. -Inexperience with green infrastructure. Cities are still exploring approaches to siting, design, permitting, construction, and maintenance of green infrastructure. Green infrastructure are not a mainstream practice and may seem too experimental to some people.

In addition to overcoming these barriers, it is necessary to answer questions related to why, when, where, and how ecological strategies should best be used. In attempting to improve biodiversity, watershed health, land and air quality, and other biotic and abiotic factors, how can the City of Louisville implement practices that target site scale conditions while scaling up to system scale impacts? How can they address problems at their source, and not merely treat the symptoms? How do we improve community education, outreach, and stewardship related to GI and the health of the urban ecosystem? Through designed experiments, the efforts of ESI are an attempt to address these issues. By embedding ecological research in the urban landscape, ecologists can collect critical data that will over time help inform how the city's efforts are working, and serve as a lesson to other cities on how applied ecological approaches function as components of the physical and social fabric of cities.

KEY TERMS/GLOSSARY

ADAPTIVE MANAGEMENT

A dynamic planning and implementation process that applies scientific principles, methods and tools improve to management activities incrementally as decision makers learn from experience and better information and analytical tools become available. Involves frequent modification of planning and management strategies, goals, objectives benchmarks. Requires frequent and monitoring and analysis of the results of past actions and application of those results to current decisions.

CONCEPTUAL DESIGN (CD)

This is the first stage of the design process that is about establishing broad narratives, themes, and alternatives that guide the project team's overall approach.

DELIVERABLES

Specific artifacts (plans, drawings, maps, models, policies, analyses, etc.) that document the evolution of the project team's work in fulfillment of the scope of work and contract. These typically occur at multiple intervals in a project, such as at 30, 60, and 90 percent stages of completion, and are followed by a review between project team and client.

EARTH STEWARDSHIP

Earth Stewardship involves "shaping trajectories of social-ecological change at local-to-global scales to enhance ecosystem resilience and human wellbeing." It contends, "over the next decade or two, society has a window of opportunity to radically redefine our relationship with the planet to reduce risks of dangerous global changes that otherwise seriously could degrade Earth's life-support systems." It is a new initiative of the ESA that seeks to enable ecologists to position themselves for greater positive impact in society.

ECOROOF

Ecoroofs replace conventional roofing materials with a living, breathing vegetated roof system. An ecoroof consists of a layerof vegetation over a growing medium on top of a waterproof membrane. Ecoroofs significantly decrease stormwater runoff by detaining and evaporating stormwater on site.

ENVIRONMENTAL COMPLIANCE

This is a stage where the proposed designs are evaluated in relation to existing local, state, and/or federal Modifications regulations. to the proposed designs are made. if required, to ensure compliance with all relevant legislation. Depending on the project, it may occur earlier or later in the design process. It may be useful to consider compliance earlier given that regulations often limit the scope of what its expected and/or possible in any given project context.

EVAPOTRANSPIRATION

Loss of water from the soil by evaporation and by transpiration of the plants that grow thereon.

FLOW

The volume of water, often measured in cubic feet per second (cfs), flowing in a stream.

GREEN STREETS

Green streets are vegetated curb extensions, streetside planters, or infiltration basins (rain gardens) that collect stormwater runoff from streets. Green streets reduce stormwater flow to sewers, reduce pollutants and limit erosion in urban streams, provide wildlife habitat and neighborhood green spaces, and refresh groundwater supplies.

GROUNDWATER

Any water naturally stored underground in aquifers, or that flows through and saturates soil and rock, supplying streams, springs and wells.

HEALTHY URBAN WATERSHED

A healthy urban watershed has clean, clear streams and tributaries that flow freely,

MONITORING

Monitoring is the process of measuring the chemical, physical or biological characteristics of various environmental indicators. Monitoring can be conducted in a variety of media, such as water, air, soil or sediments.

MITIGATION

The creation, restoration or enhancement of wetland а or other natural resource to maintain the functional characteristics and processes of an area, such as its natural biological productivity, habitats and species diversity; unique water features; and water quality.

RETROFITTING

Structural stormwater management for urban watersheds measures designed to help reduce the effect of impervious areas, minimize channel pollutant erosion. reduce loads. improved promote conditions for aquatic habitat, and correct past efforts that no longer represent the best science or technology.

RIPARIAN

Of, on, or relating to the banks of a natural course of water like a stream or river.

SCHEMATIC DESIGN (SD)

This is the second stage of the design process that is about selecting particular alternatives developed in conceptual design and refining them through the creation of scaled plans, drawings, and other forms of representation.

SEDIMENTATION

The process of depositing soil or organic material.

SITE ANALYSIS

An early project stage that considers and documents past and present biological, physical, cultural, and social factors and their relationships that define the overall context of a project site.

STORMWATER RUNOFF

Water from rainfall and other precipitation that flows into drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands as well as shallow groundwater.

SUMPS

A drain which dissipates stormwater into subsurface soil. Water enters through a grate at the surface and drains into the surrounding soil through drain holes. Also known as Underground Injection Controls (UICs)

SWALE

Also known as bioswale. A long, narrow vegetated depression used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground and/or flows through the facility.

TREES

Trees protect watershed health by absorbing rain (which restores and preventing hvdroloav) erosion (which protects water quality and habitat). In this way, trees are a vital, long-term, and low-cost component of Louisville's green infrastructure for managing stormwater. Trees also clean the air, create restorative spaces, and provide cooling shade and wildlife habitat. Street trees can improve property values and slow traffic, making streets safer for pedestrians, bike riders, motorists and

WATERSHED

A watershed is a geographic area that includes a river or stream, its tributaries and the lands they drain.

CONFERENCE LOGISTICS

Schedule for ESI program at ESA Louisville 2019

May & June 2019: Pre-conference planning calls w/ Organizing Committee

June & July 2019: Pre-conference planning calls w/ Organizing Committee & ESI Fellows

11 Aug 2019: ESA WK12: Earth Stewardship Initiative Demonstration Project: Introductory Working Session for the Application of Ecological Science to Louisville, Kentucky (12p-5p)

12 Aug 2019: Workshop with Louisville Metro employees, 444 S. 5th Street (10a-12p)

13 Aug 2019: ESA FT6: Louisville's Urban Waterways: Ecology, Community Engagement, and Brownfields (led by Allison Smith) (8:30a-12p)

14 Aug 2019: Design charrette and workshop with ESI advisors, Mezzanine A, Seelbach Hilton, 500 S 4th St (12:30p-2:30p)

14 Aug 2019: Community Meeting, address (5-7)

15 Aug 2019: US Army Corps of Engineers/Three Forks Ecological Restoration Study press conference, Beargrass Flood Pumping Station, 1731 Brownsboro Road (Optional) (10:30a-11:0a)

15 Aug 2019: ESA INS15: Learning by Doing: Ecologists Jump into the Deep End to Shape Cities (3:30p-5p)

15 Aug 2019: Design working session, Gresham Smith (6-8)

16 Aug 2019: Presentations to Louisville Forward Chief Mary Ellen Wiederwohl (2:30p-3:45p)

Aug 2019: Work on white paper. Three conference calls minimum.

30 Oct 2019: White paper draft deadline and conference call.

15 Dec 2019: Submission of final paper.

WORKSHOP DETAILS

11 Aug 2019: ESA WK12: ESI Demonstration Project: Introductory Working Session for the Application of Ecological Science to Louisville, Kentucky (12p-5p)

Schedule

Introductions Alexander J. Felson, UCONN University

Welcome and City Perspective Overview: Allison Stone

University of Louisville Welcome and Perspective: Perri Eason

Louisville Project Examples: Carolyn Waters and Martha Mazur

Fellow Presentations

Park Connectivity, Access, Public Health and Contamination Urban Heat Island and Neighborhood Development Watersheds and Water Quality, Connetivity and Recreation Hydrology, Public Health and infrastructure flooding

Wrap Up, Alexander J. Felson

2:30-5:00 Bus Tour of Sites

Explore Louisville's background and issues of primary importance to the Earth Stewardship Initiative as fellows and ecologists are oriented to ESI, engage in initial discussions surrounding experimental design in Louisville, and prepare for the week's meetings with community leaders, field trip, and workshops. The Earth Stewardship Initiative (ESI) creates more livable and sustainable cities through transdisciplinary collaborations that integrate ecological research into city design and management. To meet sustainability goals we must change the way science intersects with society. To that end, ESI has collaborated with ESA and other organizations to create Demonstration Projects in Portland (2017), Baltimore (2015), and Sacramento (2014). These projects unite ecologists, urban planners, and designers through urban environmental design and management to promote social and ecological resilience and revitalization. ESI solicits Fellows nationally to work with city officials, practitioners, and ESA organizers on large-scale land planning projects using sustainable design strategies and novel research methods, including designed experiments and other adaptive management tools.

This year, ESI is collaborating with the City of Louisville in proposing designed ecological experiments that supplement Louisville's existing sustainability efforts. Designed experiments demonstrate how ecologists can effectively shift from studying to shaping urban ecosystems. Building upon lessons from past ESI projects, the Initiative in Louisville will "learn from the city." Louisville has established a city-wide green network utilizing GI design, implementation, monitoring, maintenance, and community engagement. ESI Louisville offers Fellows unique opportunities to learn about current GI design for the City and develop designed experiments with a team of professional ecologists, city managers, and ESA attendants. The program will focus on public works, city parks, planning and landscape architecture, urban forestry and green infrastructure. We will explore issues of demographics and community engagement and will address funding mechanisms, including capital projects and maintenance challenges.

SITE VISIT ITINERARTY (AUGUST 11)

- 2:30 pm Pickup at Convention Center (by bus)
- 2:45 am Portland Wharf Park
- 3:15 pm Chickasaw Park and Pond issues (drive by Shawnee Park)
- 4:00 pm West End
- 4:30 pmMaple Street in California Neighborhood (where MSD buyout took place)
- 5:00 pm For those who need to drop off at Convention Center a
- 5:15 pm Beargrass Creek at Joe Creason Park
- 5:45 pm Back at Convention Center



FIELD TRIP ITINERARTY (AUGUST 13)

Louisville's Urban Waterways: Ecology, Community Engagement, and Brownfields

8:30 am Pickup at Convention Center (by bus)
8:45 am Impound Lot
9:30 am Botanica (future Botanical Gardens)
10 am Louisville Loop
10:30 am Waterfront Park Phase I-III
11 am future Waterfront Park Phase IV
11:30 Walk back to Convention Center
12 noon Back at Convention Center

Urban areas face many environmental challenges including loss of tree canopy, air and water pollution, erosion, and the legacy of industrial sites which all have impacts on urban waterways. Despite the channelized nature of Beargrass Creek, Louisvillians consider the creek to be one of the city's biggest assets. This tributary of the Ohio River runs through much of Jefferson County and is subject to environmental stressors such as combined sewer overflows, non-point source pollution, and increased erosion and channelization due to runoff. Stream and river health are further compromised when former industrial areas are adjacent or within the watershed. How does a city repurpose these sites while ensuring water quality and stream health? And does community input shape the future of these sites? In Louisville, two former landfills have been repurposed for the public good with varying degrees of success. Limitations on what can be planted, where plantings can take place, and how they will be maintained results in challenges to restoring natural systems to provide ecological benefits. This tour will explore sites where ecological restoration has been used to enhance the water quality near former landfills, including the Waterfront Park on the Ohio River, the current police impound lot on Beargrass Creek, and a future botanical garden between the two.



APPENDIX

	Links to Websites:	Title	Links to PDFs:	Title
	https://louisvilleky.gov/government/parks/park-list/chickasaw-		https://louisvilleky.gov/sites/default/files/parks/pdfs/chickasa	
	park	About Chickasaw Park/ Park Into Campaign to Re-open Chickasaw Park's	wparkmasterplanpart2_3.pdt	Chickasaw Park Master Plan Pt.2
	https://www.olmstedparks.org/news/chickasaw-parks-clay-tennis	Clay Tennis Courts Exceeds \$5,000	https://louisvilleky.gov/sites/default/files/parks/pdfs/chickasa	
	courts-exceeds-5000-fundraising-goal/ https://www.leoweekly.com/2015/11/an-environmental-injustics	Fundraising Goal in 10 days	wparkmasterplanpart3.pdf https://louisvilleky.gov/cites/default/files/parks/pdfs/chickasa	Chickasaw Park Master Plan Pt.3
	tour-of-west-louisville/	West Louisville	w2001masterplandiagramcolor.pdf	Chickasaw Park Master Plan Diagram
	https://www.nrpa.org/parks-recreation- magazine/2019/april/louisville-echo-a-west-louisville-outdoor-	Louisville FCHO: A West Louisville	https:///puisvillaku.gov/cites/default/files/parks/pdfs/shawnee	
	recreation-initiative/	Outdoor Recreation Initiative	park uplands plan draft 1.pdf	Shawnee Park Uplands Plan 1
	https://insiderlouisville.com/government/national-grant-to-help-	National Grant to Help Re-Open a	https://louisvilleky.gov/sites/default/files/parks/pdfs/shawnee	Shawnon Back Linlands Blan 2
	https://www.globenewswire.com/news-	Polid III Chickasaw Park	park uplands plan draft 2.put	Shawnee Park Opianus Pian 2
	release/2018/10/11/1620229/0/en/Ten-U-S-Communities-	Ten US Communities Awarded A Grant		
	Awarded-Grant-Funding-to-Support-Green-Infrastructure- Projects.html	to Help With Green Infrastructure Projects	https://louisvilleky.gov/sites/detault/files/parks/pdfs/shawnee park uplands plan draft 3.pdf	Shawnee Park Uplands Plan 3
	https://www.courier-			
	journal.com/story/news/local/2016/06/11/city-plays-russian- roulette-flood-protection/84914818/	City Plays Roulette Flood Protection	https://louisvilleky.gov/sites/default/files/parks/pdfs/portland wharfparkmasterplanreportpoy2002.pdf	Portland Wharf Park Master Plan 2002
	https://louisvilleky.gov/government/parks/park-list/portland-	Portland Wharf Park	https://louisvilleky.gov/sites/default/files/parks/pdfs/portland	-
	wharf-park https://louisvilleky.gov/government/parks/park-list/shawnee-	Information/About	wharf web 0.pdf https://louisvilleky.gov/sites/default/files/parks/pdfs/shawpee	Portland Wharf Plan
	park	Shawnee Park Information/About	web.pdf	Shawnee Park Map
	https://view.joomag.com/parks-and-recreation-system-master- plan-update-2016-parks-and-recreation-system-master-plan-	Louisville Metro Parks and Recreation	http://ouisvillewaterfront.com/wp-	
	update-october-2016-final-draft/0532797001521211479	Master Plan	content/uploads/2018/10/090718-PhIV-report.pdf	Waterfront Park Phase IV Plan
1) Park Connectivity/	https://www.wiky.com/article/shawnee-parks-nearly-dollar80-	Shawnee Park's nearly \$80 million	https://louisvilleky.gov/sites/default/files/jefferson_memorial	
Public Access Flooding	https://louisvilleky.gov/government/jefferson-memorial-	West Louisville Outdoor Recreation	https://www.olmstedparks.org/wp-	west coulsville Outdoor Recreation Initiative
and Habitat	forest/west-louisville-outdoor-recreation-initiative-wlori	Initiative (WLORI)	content/uploads/2017/12/mpchapter3shawnee.pdf	Louisville Olmsted Parks: Shawnee
	https://www.courier-	Pottland Wharf Closed for Bank Soil	files/Media%20Release%20	
	journal.com/story/news/local/2017/02/28/portland-wharf-park-	Work	%20MSD%20Breaks%20Ground%20on%20Shawnee%20Park%2	MSD Breaks Ground on \$60 Million
	closed-bank-soil-work/98521436/ https://louisvilleky.gov/government/parks/portland-wharf-		OBasin.pdf https://louisvillemsd.org/sites/default/files/inline-	Underground Shawnee Park Basin
	history	Portland Wharf Park History	files/2017%20Watershed%20Master%20Plan 0.pdf	Watershed Master Plan
			https://louisvilleky.gov/sites/default/files/housing_community_	Shawnoo Neighborhood Povitalization
	https://brokensidewalk.com/2015/portland-wharf-area-basin/	Portland Wharf Area Basin	2013.pdf	Strategy Area
	https://www.wdrb.com/news/multi-million-dollar-makeover-	Multi Million Dollar Maharum Doolar	hannes (Marshall) - han statistical da Grada (Marshall) - da da sera da sera da sera da sera da sera da sera d	
	b355-27a28bd0d111.html	at Louisville 's Shawnee Park	portland neighborhood plan.pdf	Portland Vision Plan
		MSD Shawnee Park Basin is now in		
	https://www.louisvillemsd.org/news/msd-shawnee-park-basin- now-service-preventing-20-million-gallons-wastewater-pollution	service, preventing up to 20 million gallons of wastewater pollution	https://louisvilleky.gov/sites/detault/files/advanced_planning/s hawneeplan_final7_23_13.pdf	Shawnee Neighborhood Plan
	https://www.whas11.com/gallery/news/local/floodwaters-move-	8	https://louisvilleky.gov/government/louisville-loop/ohio-river-	Louisville Loop: Ohio River Valley (Shawnee
	into-area-parks-golf-course-in-w-louisville/417-523223400 https://louisvilleky.gov/government/louisville-loop/louisville-loop	Floodwaters move into area parks	valley	& Chikasaw connection)
	riverwalk-shawnee-park-trailhead	Park Trailhead		
	https://www.railstotrails.org/trailblog/2018/february/12/kentuck vs-louisville-loop/	Kentucky's Louisville Loon		
	https://www.louisville.com/content/waterfront-park-may-be-	Westward Expansion of Waterfornt		
	expanding-west-finally https://www.wbas11.com/article/news/local/105k.grapt.to	Park 19EK Grant to Improve Chickaraw Park		
	improve-chickasaw-park-pond/417-604542063	Pond		
	https://www.planning.org/cityparks/casestudies/portlandwharf.h	Portland Wharf Park Kontucky		
	<u></u>	Tortand What Furk Kentacky		
	https://louisvilleky.gov/government/sustainability/urban-heat-	Lichan Heat Island Broject	https://louisvilleky.gov/sites/default/files/sustainability/pdf_fil	Linhan Heat Management Study
	https://louisvilleky.gov/government/sustainability/urban-heat-	Excel Sheet UHI Results (bottom of	https://louisvilleky.gov/sites/default/files/louisville_forward/w	orban near management study
	island-project	page)	est louisville strategies for success august 2016.pdf	West Louisville Strategies for Success
	actions-neighborhood-data	Data	planning/californiavictory-park-neighborhood-plan	California Neighborhood Plan
	http://www.davey.com/environmental-consulting-services/urban	5	https://louisvilleky.gov/sites/default/files/community_forestry/	<u></u>
	studies/louisville-ky-urban-heat-island/	Louisville's Urban Heat Index	24march2015_draft.pdf	Tree Canopy Assessment 2015 Louisville
	https://wfpl.org/how-urban-heat-island-affects-spring-in-	Spring Comes Quickly In Louisville. Can	https://www.codotcopics.com/UTC_Viewer_Louioville/	Urban Tree Canopy Interactive View Map of
	https://wfpl.org/study-lays-out-ways-louisville-beat-urban-heat-	Can Louisville Beat the Urban Heat	https://louisvilleky.gov/sites/default/files/sustainability/sustain	Louisville
	island/	Island?	_louisville_2016_progress_report.pdf	Sustain Louisville 2016 Progress Report
	https://www.epa.gov/heat-islands	EPA Heat Island Effect	737&context=stu_hon_theses	Kentucky
	https://www.epa.gov/green-infrastructure/reduce-urban-heat-	Reduce Heat Island Effect	https://www.sciencedirect.com/science/article/pii/S019897151	The urban heat island effect and city
	Sand-errect	Const Const Torres and Ellect	https://www.epa.gov/sites/production/files/2015-	contiguity
	https://insiderlouisville.com/health/quality-of-life/green-space-	the urban heat island effect	09/documents/2 louisville urban heat island reduction mari	Louisville Metro Gov. Office of Sustainability
	https://grist.org/article/louisville-is-beating-urban-heat-with-the-	Louisville is beating urban heat with	https://insiderlouisville.com/health/green-space-dense-and-	On Reduction
	help-of-local-faith-communities/	the help of local faith communities	decentralized/	UHI, Mitigation in West Louisville
	new-trees-to-improve-air-guality/article 82f76e6c-57e5-11e9-	Chickasaw Neighborhood Getting New		
	a690-cbaf80488276.html	Trees to Improve Air Quality		
2) Urban Heat Island	https://insiderlouisville.com/amplity/louisville-grows-is-working- for-a-greener-healthier-community/	Louisville Grows is working for a greener healthier community		
Project	https://louisvilleky.gov/government/division-community-	Louisville's Urban Tree Canopy		
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Neighborhood Near Maple Street

Grant to Buyout Flood-Prone Area

Urban Hydrology MSD Executive Director Discusses Green Space in West Louisville Environmental Justice EPA

Residents Thoughts on Green Space Councilman James encourages Maple Street residents to attend an important neighborhood meeting on June 15th

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Maple Street FEMA buyout yields green space for West Louisville

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