



Urban Land **New York**
Institute

Technical **Assistance Panels**

GOWANUS, BROOKLYN

**A Vision for a Greener,
Healthier, Cooler Gowanus:
Strategies to Mitigate
Urban Heat Island Effect**

JANUARY 2018

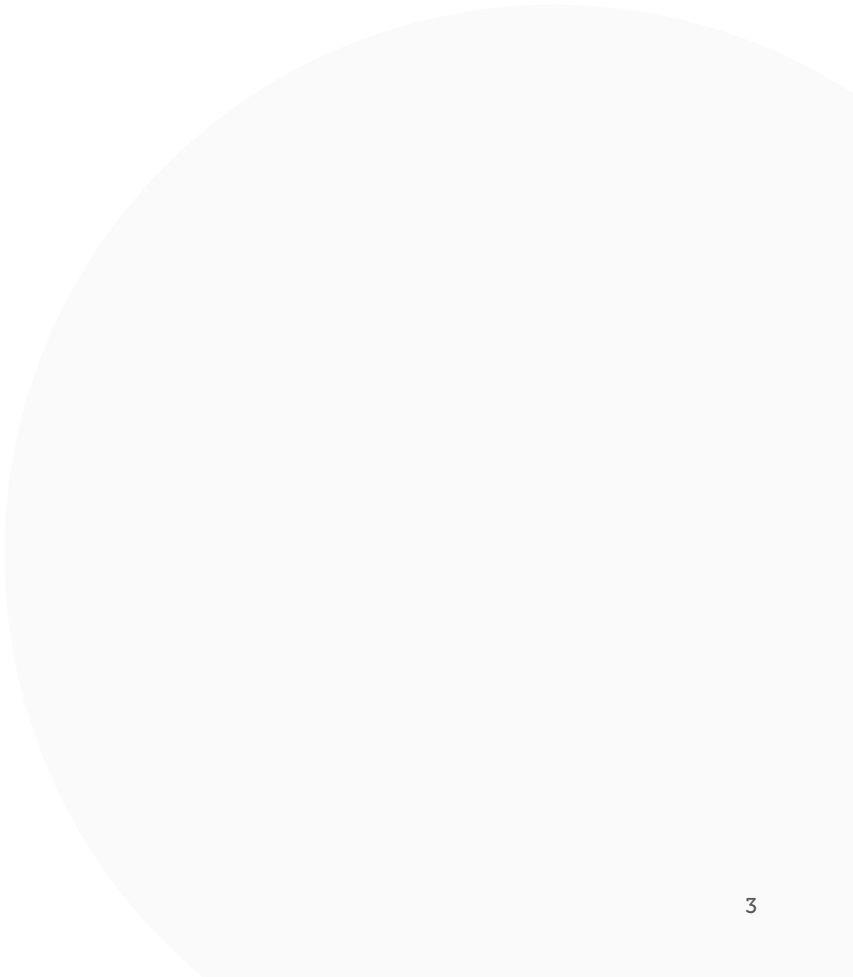
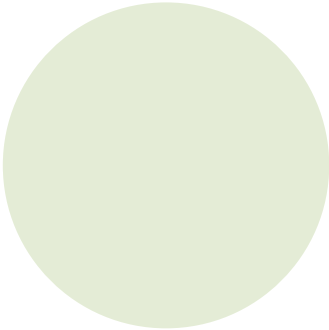


Table of Contents

1 Acknowledgments	3
2 Urban Land Institute and the TAP program.....	5
3 Gowanus TAP Panelists, Stakeholders, Sponsor, and Process	7
4 Introduction.....	11
5 Study Area.....	15
• Location and Boundaries	
• Description and Land Uses	
• Demographics and UHI's Impact on Gowanus's Low-Income Population	
6 New Challenges for Gowanus.....	21
7 Key Observations and Findings	23
8 Recommendations for a Greener, Healthier, and Cooler Gowanus.....	27
9 Funding, Incentives and Implementation	39
10 Conclusion	49
11 Appendix	51

Acknowledgments

The Gowanus Urban Heat Island Mitigation Technical Assistance Panel—and this report, which springs from it—were made possible through generous funding from the New York Community Trust. The Urban Land Institute’s New York District Council and the Fifth Avenue Committee, Inc. are grateful for the support and the opportunity to explore this pressing issue.



Urban Land Institute and the TAP program

Founded in 1936, the Urban Land Institute (ULI) is a 501 (c)(3) nonprofit research and education organization whose mission is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI has more than 40,000 members worldwide representing the entire spectrum of land use and real estate development disciplines working in private enterprise and public service. As the preeminent multidisciplinary real estate forum, ULI facilitates the open exchange of ideas, information, and experience among local, national, and international industry leaders and policy makers dedicated to creating better places.

The ULI's New York District Council (ULI New York) covers most of New York State and has more than 2,300 members, including real estate developers, investors, property owners, brokers, architects, planners, public officials, engineers, and students. ULI New York

embraces the best practices in leadership development, community service, and enhancement of land-use policy and practice at the local level.

ULI New York convenes Technical Assistance Panels (TAPs) at the request of public officials, community stakeholders, and nonprofit organizations facing complex land-use challenges. TAPs provide objective, unbiased recommendations from a panel of diverse experts from ULI New York's membership who are assembled specifically for their expertise in the issues identified by the TAP sponsor. Typically, the TAP panelists spend one to two days visiting the study area and analyzing existing conditions, exploring specific planning and development issues, and formulating realistic and actionable recommendations to move initiatives forward in a way that is consistent with the sponsor's goals and objectives.



Technical Assistance Panels

3 |

Gowanus TAP Panelists, Stakeholders, Sponsor, and Process

TAP Panel Members and Support Staff

As organizer of the Gowanus Urban Heat Island (UHI) Mitigation Technical Assistance Panel (TAP), ULI New York convened a panel of volunteer members representing disciplines including development, transportation engineering, landscape architecture, engineering, architecture, urban and environmental planning, and healthcare. Panel members were selected who possess professional expertise relevant to the objectives for this TAP.

The following individuals served as TAP panelists:

James Lima

President, James Lima Planning + Development (TAP Chair)

Matthew Brian

Executive Vice President of Development, Omni New York LLC

Nancy Choi

Senior Environmental Engineer, ARUP

Bret Collazzi

Principal, HR&A Advisors

John Imbiano

Principal/Partner, IQ Landscape Architects, PC

Aviva Laurenti, P.E., PTOE

Deputy Director of Traffic Engineering and Associate, Sam Schwartz Engineering

Matthew Payne

Vice President of Built Ecology, WSP

Jeffrey Raven

Principal, RAVEN Architecture + Urban Design, LLC
Director and Associate Professor of the Graduate Program in Urban + Regional Design, New York Institute of Technology

Rupal Sanghvi

Founder, HealthxDesign

Donna Walcavage

Principal and Landscape Architect, Stantec

Maud Fouquerand and Anna Dai, master's degree students at New York Institute of Technology, provided on-site research support.

Felix Ciampa, Executive Director of ULI New York, and Kathryn Dionne, a Manager for ULI New York, along with Katharine Burgess, Senior Director of Urban Resilience at ULI, provided organizational and technical support in preparation for and during the TAP process.

TAP Stakeholders

The TAP benefited from the participation of a diverse group of stakeholders who met with the panelists and shared information, ideas, and opinions on a range of issues relevant to Gowanus and UHI. These stakeholders represented local non-profit and advocacy organizations, neighborhood institutions, New York City government (including New York City Housing Authority and New York

Members of the ULI panel and Fifth Avenue Committee pictured at the Gowanus Canal.

Credit: Steve Lipofsky





The ULI panel touring the study area.

Credit: Steve Lipofsky

City Department of Environmental Protection), the Mayor's Office of Recovery & Resiliency, public officials and their staff, residents of Gowanus, and local developers.

Sponsor: Fifth Avenue Committee

Founded in 1978, the Fifth Avenue Committee, Inc. (FAC) is a community-based non-profit organization in South Brooklyn that, in its own words, "advances economic and social justice by building vibrant, diverse communities where residents have genuine opportunities to achieve their goals, as well as the power to shape the community's future." FAC's goal is "to transform the lives of over 5,500 low- and moderate-income New Yorkers annually so that we can all live and work with dignity and respect while making our community more equitable, sustainable, inclusive and just."

After Hurricane Sandy in 2012—during which the Gowanus Canal overtopped its banks, causing severe flooding—FAC broadened its scope to include work

on environmental issues, initiating its Turning the Tide (T3) program. The organization's interest in UHI is an expression of that new area of focus. FAC seeks to leverage activities happening now and in the near future—including environmental remediation and an anticipated rezoning that will likely permit higher density, mixed-use development—to mitigate UHI in Gowanus and secure meaningful benefits for low-income residents and the community at large as part of advancing climate and environmental justice (EJ).

The U.S. Environmental Protection Agency (EPA) defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

FAC joins with EJ groups in efforts to ensure that no community should bare the disproportionate burden of impacts due to environmental, planning and political decisions and policies.

In its briefing materials for the panel members, FAC posed a series of questions that helped shape the way panel members approached the assignment. Those questions were as follows:

1. **What can property owners, property managers, NYC Housing Authority (NYCHA), NYC Parks, NYC Department of Transportation (NYCDOT) and others responsible for the public and private realm do to reduce UHI effect without compromising industrial, manufacturing, commercial and mixed uses in Gowanus?**
 - How can these adaptation/mitigation strategies tie into planned large-scale remediation and sustainability projects that are part of the Gowanus Superfund cleanup?
2. **In the context of all the neighborhood's environmental problems—particularly UHI and combined sewer overflows—what types of land-use actions, design standards and other frameworks could be put in place through special districts, measures, and/or development standards as part of the expected Gowanus rezoning?**



- How can these measures address the neighborhood's long-term sustainability in anticipation of additional growth and increasing climate related impacts?

3. What have been key components of successful environmental improvement special districts nationally? What is the precedent nationally for a local environmental infrastructure fund that could support a range of green infrastructure, including maintenance of UHI-offsetting measures, and green workforce development efforts?

4. Since Thomas Greene Park, Gowanus's only public park, will be taken offline for many years, where could a temporary park and swimming pool be located and how could their design showcase UHI-offsetting measures?

- What are some UHI-offsetting measures that should be considered as part of any Thomas Greene Park re-design effort?

Michelle de la Uz, FAC's Executive Director, and Sabine Aronowsky, its South Brooklyn Accountable Development Coordinator, led FAC's preparation for the TAP, with support from FAC colleagues and partners at the Pratt Center for Community Development.

TAP Process

The Gowanus UHI TAP was held April 24-25, 2017, and was based at Fairfield Inn & Suites by Marriott New York Brooklyn, on Third Avenue in Gowanus. Panelists came primed for the assignment, having reviewed the briefing materials from FAC in advance. On the morning of April 24, after Michelle de la Uz and Sabine Aronowsky (both of FAC) gave a brief presentation to the group, the panelists toured the study area on foot and by bus. Following the tour, the panelists interviewed stakeholders to gain a better understanding of the issues, dynamics, challenges, and opportunities in the area.

TAP panelists, who formed groups reflecting their expertise, then worked to formulate recommendations. Some took time to head out into the neighborhood again to check their recommendations against on-the-ground conditions.

The panelists presented their recommendations to FAC at the end of the day on April 25. This report recaps and elaborates on that presentation.



4 |

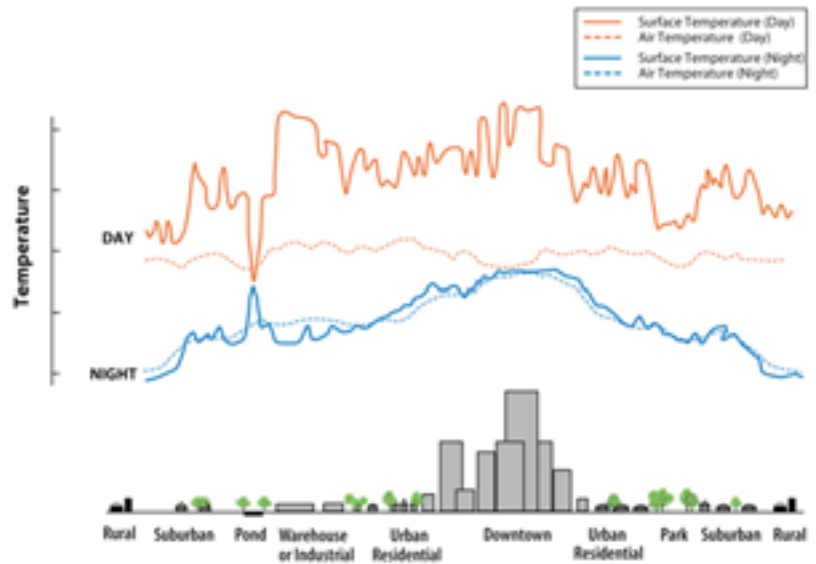
Introduction

Buildings. Cement and asphalt paving. Such things give us places to live and work in and sidewalks and streets to walk and drive on. But they also sit baking in the sun, absorbing—and re-radiating—heat.

That’s why cities, with a preponderance of buildings and paved areas, can be hotter than less-developed nearby areas, particularly at night. This phenomenon is referred to as the Urban Heat Island (UHI) effect. Per the U.S. Environmental Protection Agency (EPA), the annual mean air temperature of a city with a population of 1 million or more can be 1.8 to 5.4 degrees Fahrenheit hotter than its surroundings. In addition to causing higher daytime temperatures, urban heat islands keep cities and their residents from cooling off at night. In the evening, cities can be as much as *22 degrees Fahrenheit hotter* than neighboring areas.

This phenomenon is a serious concern. Extreme heat increases peak energy demand, air conditioning use and costs, air pollution, and greenhouse gas emissions. It also affects water quality—and, importantly, it affects our health. Extreme heat can exacerbate chronic conditions, particularly for vulnerable populations such as children and the elderly. And it causes more deaths than any other weather-related hazard, including hurricanes, tornadoes, and flooding, according to *“Climate Change and Extreme Heat: What You Can Do to Prepare,”* a guide published by the EPA and the Centers for Disease Control and Prevention (CDC). The guide indicates that each summer, more than 65,000 Americans on average visit an emergency room for acute heat illness. Between 2006 and 2015, a total of 1,130 people died from the heat.

Urban Heat Islands are a threat to public health, but they disproportionately impact environmental justice communities that suffer the cumulative impacts of environmental burdens. The policies and planning decisions have left EJ communities living in substandard housing conditions in highly polluted areas, with significantly less tree coverage and lack of parks and open space in their neighborhoods. In addition, EJ communities often suffer from obesity and cardiovascular disease, with lack of access to affordable, healthy foods. The result is a population highly vulnerable to UHI impacts, with studies showing



heat-associated mortality impacting low-income and environmental justice communities. As one of the densest cities in the world, New York City is particularly susceptible to the risks related to UHI. With climate change, the health dangers for New Yorkers are likely to grow. According to the New York City Panel on Climate Change (NPCC), temperatures associated with climate change will rise by 4.1 to 5.7 degrees Fahrenheit by 2050. This rise in overall temperature will be coupled with more frequent and prolonged heat waves. According to the *New York Times*, in July 2006 a heat wave in New York resulted in 140 deaths. The NPCC has predicted that by 2050, there will be 500 heat-related deaths in the city per year.

While the City of New York has acknowledged the seriousness of UHI—the Mayor’s Office of Recovery & Resiliency has an Urban Heat Island Task Force and launched the Cool Neighborhoods NYC program in June 2017—the topic has not received the level of funding or attention that other climate-related concerns, such as coastal protection, have. That is perhaps not surprising given that heat rarely produces extreme events as singularly destructive as a major storm like Hurricane Sandy, which struck the New York region in 2012. And in some parts of the city, the heat is mitigated by cooling ocean breezes (for example in Rockaway, Queens) or by expansive green space (such as the many neighborhoods with leafy, tree-lined streets and long-established parks with lush, mature plantings). However, other areas don’t have such advantages.

According to the United States Environmental Protection Agency (EPA), the term “heat island” describes built up areas that are hotter than nearby rural areas – as exhibited by the above graphic which shows the day and night temperature differentials between downtown areas compared to rural and suburban areas.

Credit: Jeffrey Raven

One of these areas is Gowanus, in South Brooklyn. Originally a salt marsh that was filled in, then an industrial powerhouse that relied on the Gowanus Canal to transport goods, the area developed without the abundance of shade trees and other greenery that beautify, and cool, other longtime residential communities. According to neighborhood residents and visitors who were interviewed over the course of the TAP, summer days in Gowanus can be brutal. In fact, “A

NYC Panel on Climate Change (NPCC) – Summary of Heat Stats

Released in 2015, “*Building the Knowledge for Climate Resiliency*” is a New York City Panel on Climate Change (NPCC) publication that provides temperature projections through the year 2100. The report discusses key climate change-related issues and their impacts on the citizens of the New York metropolitan region. Topics addressed include flood risk, increased precipitation, and increased heat—and the associated public health impacts.

Extreme heat is a key focus of the publication. Climate change will lead to increased temperatures, which will be exacerbated in urban settings such as New York City due to the Urban Heat Island (UHI) effect, the phenomenon of urbanized areas having higher temperatures than surrounding areas. Increased temperatures lead to an increased need for cooling, which can cause an increase in energy consumption as well as financial and health burdens. Heat-related health impacts are most likely to affect the elderly, people with chronic diseases, outdoor workers, and low-income households, including those without air conditioning. Health impacts can include exhaustion, heat stroke, respiratory problems, compromised mental health, and heat-related mortality.

Between 1900 and 2013, the mean annual temperature in New York City increased by 0.3F per decade—a total of 3.4F. However, the future mean annual temperatures are projected to increase at an even faster rate. By 2050, the mean annual temperature is estimated to increase by 4.1F to 5.7F, and, by 2080, the estimated

increase is 5.3F to 8.8F. During this time, heat waves (defined as three or more consecutive days with maximum temperatures at or above 90F) will potentially triple in frequency. By 2080, the number of days that will reach 90F or more is estimated to be between 44 and 76, and the number of days that will reach 100F or more is estimated to be between 4 and 14.

On average, heat has been the largest weather-related cause of death since 1988 and disproportionately affects socioeconomically disadvantaged populations. Mortality due to extreme heat is also higher among residents in areas of New York City with higher summer daytime surface temperature and lower among residents who live in areas with green space. However, mortality due to extreme heat is strongly correlated with a lack of air conditioning. Eleven percent of New York City homes lack air conditioning, and the residents who do not have it most often cite cost as the impediment.

Although New York City has already put programs in place to adapt to more frequent and intense climatic events, “*Building the Knowledge for Climate Resiliency*” cites gaps in the capacity for preparedness to mitigate negative impacts on residents’ health.

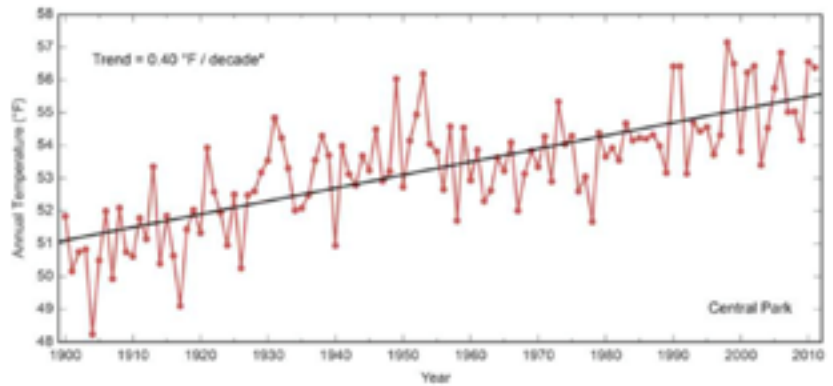
For more information, visit <http://www1.nyc.gov/site/orr/challenges/nyc-panel-on-climate-change.page>

	Baseline (1991-2007)	2020	2050
Number of heat waves per year	2	3-4	5-7
Duration of heat waves (days)	4	5	5-6
Number of days with max T° above 90°F	18	26-31	39-52

The number of heat waves and heat-related deaths per year in New York City will continue to rise due to climate change. The NPCC projects that there will be an additional 500 heat-related deaths in New York City by 2050.

Case-Only Study of Vulnerability to Heat Wave-Related Mortality in New York City (2000-2011)” shows that the entire length of the eastern Gowanus corridor has a “higher composite vulnerability heat index” compared with neighboring Park Slope and Carroll Gardens. Furthermore, Gowanus has a higher proportion of poor and underserved residents—residents who may not be able to afford air conditioning and who live in public housing—and studies have shown that the health risks associated with UHI disproportionately affect those populations. Rates of heat-associated mortality are unevenly distributed in New York City and are associated with poverty and poor housing quality.

And just as things are heating up because of a changing climate, the neighborhood is expected to experience *more* development, due to an anticipated rezoning of Gowanus. The New York City Department of City Planning (NYC DCP) has initiated a PLACES (Planning for Livability, Affordability, Community, Economic Opportunity and Sustainability) study for Gowanus in support of Mayor de Blasio’s housing plan, *Housing New York: A Five-Borough, Ten-Year Plan*, and to help



accommodate the growing population of the city. The NYC DCP study is expected to result in rezoning for greater density in the area.

On the face of it, the anticipated rezoning will put Gowanus at *an even greater risk for UHI*. However, while development is likely to create additional stresses on the neighborhood—which already contends with a host of challenges including flooding, combined sewer overflows, and traffic problems—it could also, if harnessed in ways that mitigate heat, yield benefits for

The graphic above shows the mean annual temperature in NYC from 1900 through 2010. According to the New York City Panel on Climate Change (NPCC), the city’s future mean temperatures are projected to increase at an even faster rate.

Credit: NYC Panel on Climate Change.

PLACES and Gowanus

PLACES (Planning for Livability, Affordability, Community, Economic Opportunity, and Sustainability) is a de Blasio administration initiative that seeks to foster diverse, mixed-income neighborhoods with supporting services. Part of the Housing New York, PLACES studies key planning and zoning issues in neighborhoods and then formulates recommendations on land-use strategy and investment. The initiative has included a series of place-based studies led by the Department of City Planning, addressing land use as well as related issues such as affordable housing preservation, community support services, infrastructure priorities, and economic development. A new \$1 billion Neighborhood Development Fund is dedicated to increasing the capacity of the infrastructure and facilities in neighborhoods that PLACES studies.

Gowanus is one of several neighborhoods in Brooklyn that have been under study. Engagement

has included a planning study, a workshop, and a pilot community-engagement platform called Plan Gowanus. The PLACES work sought to build from past planning efforts, such as Bridging Gowanus, and engaged government agencies, stakeholders, community groups, and local elected officials.

The neighborhood is likely to be rezoned as a result of the PLACES process. Fifth Avenue Committee and partner organizations—such as Families United for Racial and Economic Equality (FUREE), the Gowanus Alliance, Southwest Brooklyn Industrial Development Corporation, the Gowanus Canal Conservancy, and five organizations associated with local NYCHA developments—have formed a Gowanus Neighborhood Coalition for Justice to advocate for a rezoning that will benefit longtime residents and consider racial and economic equity. The Technical Assistance Panel in Gowanus explored specific strategies for the rezoning to address the Urban Heat Island effect, which will impact the health and quality of life of Gowanus residents, particularly low-income residents.

the community as a whole. The desire to leverage the planned rezoning for the benefit of the community was the impetus for the partnership between ULI New York and the Fifth Avenue Committee—and for the TAP.

Clearly, Gowanus needs a strategy for localized cooling, and the TAP was convened to inform that strategy—which is presented in this report. The recommendations

contained here include the creation of a new network of green spaces and the implementation of measures that will encourage human-powered transportation. Together they will make Gowanus not only a safer and healthier place, but also a more comfortable and pleasant one. And they will yield a reduction in energy use that will benefit local residents, tenants, building owners, and manufacturers—as well as the planet.

Study Area

Location and Boundaries

Gowanus is in South Brooklyn, sandwiched between the more affluent neighborhoods of Park Slope and Carroll Gardens. All three of these communities are part of Community Board 6, along with Columbia Waterfront, Cobble Hill, and Red Hook.

The TAP study area, as identified by the sponsor, is a long, narrow portion of the neighborhood centered on Third Avenue, stretching from Bergen Street on the north to the Gowanus and Prospect Expressways on the south. Between Butler and Sackett streets, the study area widens, extending west to the Gowanus Canal; that portion includes Thomas Greene Park.



The study area, located in the Gowanus neighborhood of Brooklyn, extends from Third Avenue from Bergen Street to the north to the Gowanus and Prospect Expressways on the south. The study area also includes Thomas Greene Park.

Credit: Pratt Center for Community Development

Gowanus Heat Island Study Area

Urban Heat Island Study Area



data: DCP & Pratt Center

Description and Land Uses

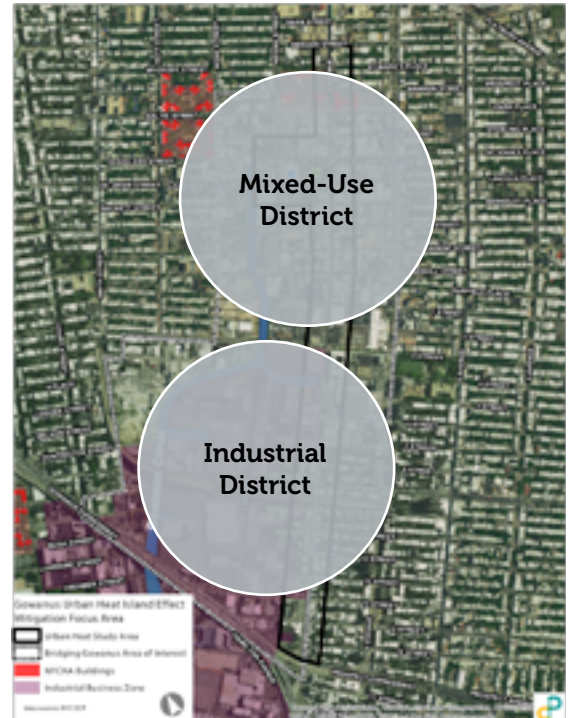
Although the study area is largely zoned for industrial use—and there is a small but committed group of industrial businesses, especially in the Industrial Business Zone (IBZ)—it is quite diverse, also containing commercial and residential uses. Commercial enterprises include co-working sites, business incubators, and arts-related facilities. In recent years, a number of hotels have opened, and the nightlife scene is growing. There is a small but vibrant residential community.

North of Third Street, the area tends to be more mixed in uses and is increasingly seeing residential development. South of Third Street is more industrial.

Running through it all is Third Avenue, the spine of the study area, a highly trafficked six-lane thoroughfare with vehicles of all types—18-wheelers, small delivery trucks, cars, and cabs—and an intersection at 15th Street that is dangerous. The avenue is flanked by narrow sidewalks and, generally, low-lying buildings.

The Gowanus Canal runs roughly parallel to the study area. Although most of the canal lies to the west of the study area and not technically within it—with the exception of the canal’s Fourth Street Basin, which branches towards Third Avenue—it is impossible to think comprehensively about the study area without taking into account this significant waterway.

Historically, the canal was not only a critical transportation route for the area, it was also a dumping ground for industry due to years of lax environmental regulation. In 2010, the EPA placed the Gowanus Canal on the National Priorities List, designating it a Superfund site. The EPA is in charge of the site’s cleanup, which will involve dredging the canal. Some of the work has



The study area and its diverse land uses.

Credit: Pratt Center for Community Development

started, but continued funding is needed to carry out the full plan.

Surrounding the canal were three manufactured gas plants (MGPs) that are believed to be sources of polycyclic aromatic carbon (PAH), which contribute to coal tar contamination in the canal. These former sites, too, are scheduled for cleanup, which will reduce health and environmental risks and prepare land for redevelopment. The New York State Department of Environmental Conservation is in charge of that project, with input from the EPA.

Another major investment in the area comes in the form of sewer and water upgrades. Sewage backup has been a chronic problem in Gowanus, causing sewage overflow into the canal and flooding streets. To help alleviate this issue, nearly three miles of high-level storm sewers are being installed throughout the neighborhood. While the new storm sewers will significantly address flooding, the process of installing the new sewer lines has resulted in the removal of some of the neighborhood’s mature trees. The new trees that have been planted are still

The Douglass-Degraw Pool that adjoins the Thomas Greene Playground.

Credit: Steve Lipofsky





Environmental Interest Areas

- New York City Housing Authority (NYCHA) Owned Buildings
- Gowanus Study Area

Environmental Hazards

- Gowanus Canal Superfund Site
- Gowanus Brownfield Opportunity Areas (BOA's)
- Manufactured Gas Plant (MGP) Sites

Industrial Zones

- Industrial Zoned Areas
- Industrial Business Zone

Source: Manufactured Gas Plant and Brownfield Opportunity Areas data is provided from the New York State Department of Environmental Conservation. Superfund sites derived from the Environmental Protection Agency.



Environmental Interest Areas in Gowanus.

Credit: Pratt Center for Community Development

young, and not yet able to provide shade and relief from the sun.

Thomas Greene Park—notably, the only public park in the area—is a modest 2.25 acres. It contains an outdoor swimming pool called the Douglass and DeGraw Pool, commonly referred to as the Double D Pool, as well as a toddler pool. The park is a crucial resource for the community, with the pool functioning not only as a recreational outlet but also as a summer cooling center—important to combat the impact of UHI on neighborhood residents. A recently refurbished part of the park borders Third Avenue and features a playground and mature trees with lush leafing. That portion of the park is only about a third of its footprint; the remainder is paved or built area, including the pool.

However, large portions of this popular—and important—park are expected to be taken offline for several years, due to the remains of an old manufactured gas plant, located on the western two-thirds of the park, which contains underground coal tar waste that is leeching into the Gowanus Canal. The site must be remediated as part of the Superfund cleanup. Furthermore, the EPA has plans to site an 8-million-gallon raw sewage and stormwater retention tank, to be built by the New York City Department of Environmental Protection

(NYC DEP), across from the park—a project that will result in the disturbance of as much as two-thirds of the park for excavation operations. The EPA, which is in charge of the cleanup, has said that a temporary park will be established while Thomas Greene is offline, and community members have suggested that the corner lot owned by Con Edison, on Nevins Street between Baltic and Butler streets, be considered for the temporary park.

In the vicinity of the existing park, there are a number of private recreational facilities offering indoor tennis, fencing, rock climbing, and other sports. However, these new recreational facilities are costly and unaffordable to much of the Gowanus population—neighborhood residents rely on the park.

Some of the low income residents of the community live in the three New York City Housing Authority (NYCHA) properties in Gowanus. One of them, NYCHA's Wyckoff Gardens, is within the study area and consists of three 21-story white-brick buildings containing 527 apartments. NYCHA is opening some of its campuses to private development as part of its NextGeneration NYCHA program, and the agency has selected Wyckoff Gardens as one of the first sites where it will allow private developers to build on public-housing land. NYCHA has proposed a small parking lot in a grove of

large, leafy, mature trees as the future site of this new development, to be comprised of 50 percent market-rate units and 50 percent affordable units.

Meanwhile, private market-rate housing is being developed—on their tour of the neighborhood, panel members saw a construction site for a new development across the street from Wyckoff Gardens. While residents in public housing might be paying \$500 a month in rent, panel members were told that some older townhouses in the area are selling for as much as \$2 million. A tenant leader at Wyckoff Gardens who met the group on its walking tour bemoaned the loss of a block of stores—including a pharmacy, a grocery store, and a 99-cent store—to the aforementioned construction project. All were businesses NYCHA tenants, and others in the area, have long relied on.

What's Happening in Gowanus: A Post-TAP Update

The New York City Department of Environmental Protection's (NYC DEP) application for 'Gowanus Canal CSO Facilities' to acquire the three privately owned parcels on the head of the Gowanus Canal was certified by the New York City Department of City Planning in September of 2017 to begin the formal public review process. Additionally, NYC DEP presented their design and massing of the 8 million gallon CSO retention tank and head house for the site to the Public Design Commission in August of 2017 and highlighted the goal of providing publicly accessible open space on 2/3 of the site on top of the CSO tank. To learn more, visit NYC.gov.

Demographics and UHI's Impact on Gowanus's Low-Income Population

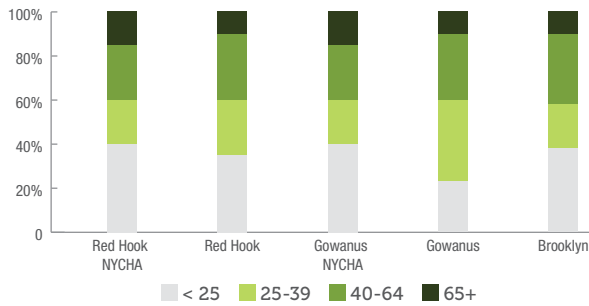
FAC provided comprehensive demographic data for Gowanus and its surrounding neighborhoods in the briefing book, in order for the panelists to familiarize themselves with the residents who call Gowanus home.

Population & Household Characteristics (2010)

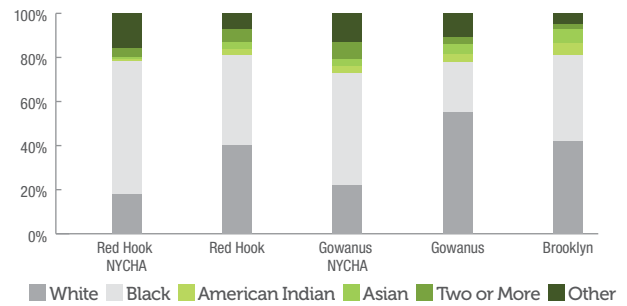
	Population	Housing Unites	Households	Average Household Size
Brooklyn	2,504,700	1,000,293	916,856	2.69
Red Hook	12,399	5,604	5,302	2.33
Red Hook Houses	6,948	2,846	2,829	2.46
Gowanus	14,728	6,727	6,185	2.36
Gowanus Houses	5,209	1,900	1,860	2.67

Source: [1] "Demographic Overview | D.A.R.E.S. aka Turning the Tide (T3) Report". HR&A Advisors, Inc. February 24, 2015.

Age Distribution (2010)

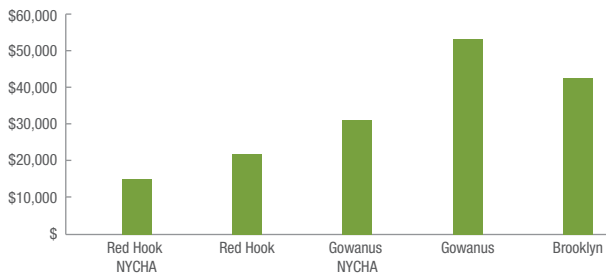


Race (2010)

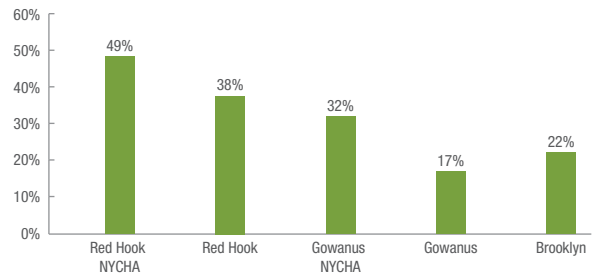


Source: [1] "Demographic Overview| D.A.R.E.S. aka Turning the Tide (T3) Report". HR&A Advisors, Inc. February 24, 2015.

Median Household Income (2008-2012)



Rate of Poverty (2008-2012)



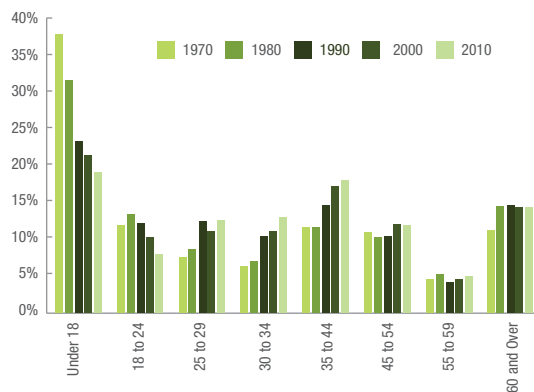
Source: [1] "Demographic Overview| D.A.R.E.S. aka Turning the Tide (T3) Report". HR&A Advisors, Inc. February 24, 2015.

Among these residents are 4,000 public housing tenants, and these tenants tend to be lower-income and older than the population at large. NYCHA residents also tend to have higher rates of asthma and other chronic diseases. According to U.S. Census data, as much as 10 to 25 percent of the Gowanus population lives below the poverty line; and in Wyckoff Gardens, 25 to 50 percent of residents live below the poverty line.

where paved surfaces are unrelieved by shading and greenery of any type. These include gas stations and parking lots. Also included are bare warehouse walls that re-radiate heat, increasing air temperatures—

UHI is a particular concern for Gowanus’s poor and underserved population because UHI disproportionately affects such vulnerable populations. Hotter nighttime temperatures are especially dangerous during extreme heat events. Residents are often unable to recover from the daytime heat, and most do not have air conditioning units due to the cost of the units themselves and associated fees imposed by NYCHA. As a result, they become more vulnerable to heat-related health problems in subsequent days.

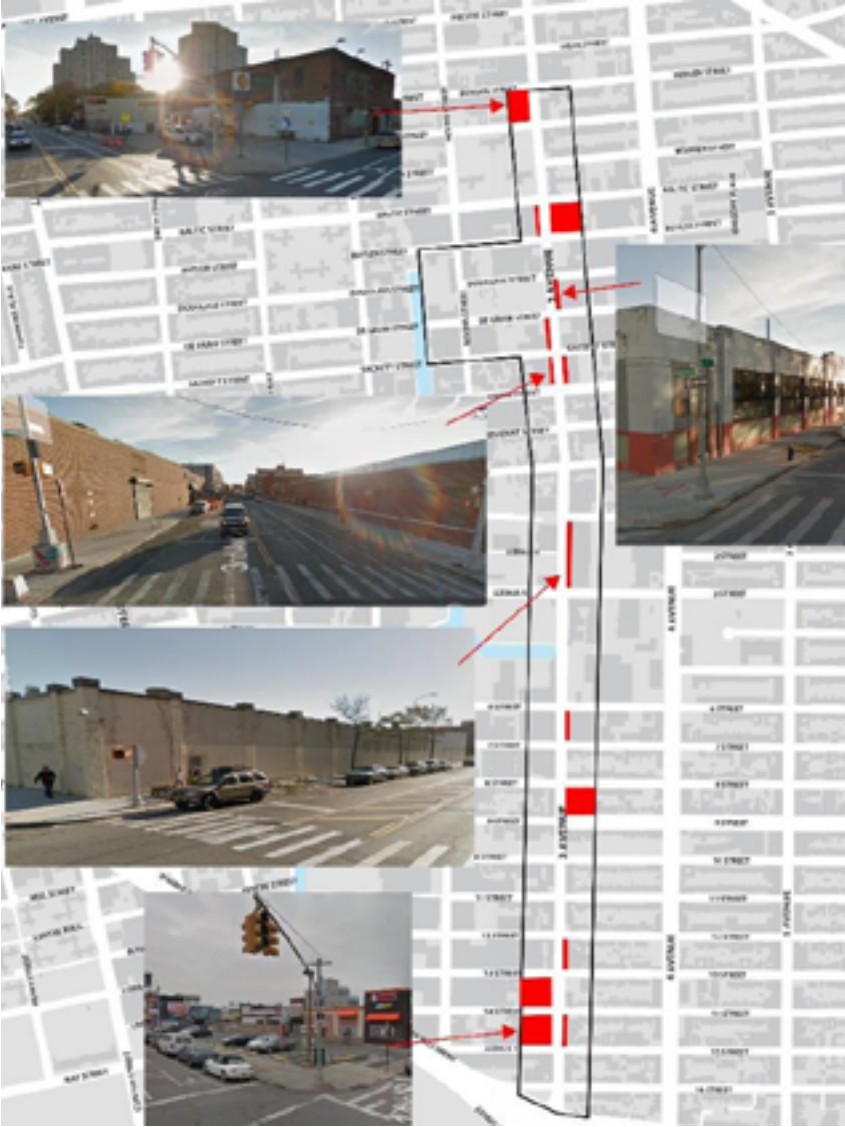
Age Distribution of Gowanus as Percentage of Total Population, 1970-2010



According to U.S. Census Bureau statistics, the age distribution in Gowanus has skewed older in recent years. Older populations are more vulnerable to UHI.

Furthermore, there are specific places in the study area that could be described as “urban heat deserts”—areas

Source: U.S. Census Bureau (1970-2010 Decennial Census). Accessed through Minnesota Population Center. National Historical Geographic Information System (NHGIS), www.nhgis.org



Urban heat deserts identified in the study area.

Credit: Fifth Avenue Committee

and creating not only a hot environment but an inhospitable one.

Studies in New York City have found that areas with high levels of heat-related mortality tend to be in census tracts with high proportions of low-income and minority residents. As mentioned earlier, one study showed that the entire length of the eastern Gowanus corridor has a “higher composite vulnerability heat index” compared with neighboring Park Slope and Carroll Gardens. Furthermore, the study found that “heat-associated mortality” of seniors in New York City was correlated with “a prevalence of poor housing conditions, poverty, hypertension, impervious land cover, and high land surface temperature.” The study concluded that adaptation strategies are most usefully conceptualized at a local level.

6 |

New Challenges for Gowanus

Gowanus clearly is already burdened with significant challenges: poverty, Superfund toxicity, lack of parks and open space, heavy traffic and a lack of pedestrian safety, poor air and water quality, high asthma rates, poor access to services and pharmacies, and hospital and health center closures leading to increased emergency room visits. Now climate change—and additional challenges—lie ahead. These challenges are explored in this chapter.

Scarce Park and Green Space at Risk

Gowanus already has a dearth of park and green space, and what little is there is currently at risk. In the near future, a portion of the only park in the area—Thomas Greene Park—will likely be taken offline due to cleanup of an old manufactured gas plant, located on the western two-thirds of the park, which is leeching coal tar waste into the Gowanus Canal, and the siting of an 8-million-gallon raw sewage and storm water retention tank that will reduce the amount of raw sewage that enters the canal. In addition, the community will lose mature trees if NYCHA allows the infill development at Wyckoff Gardens to be built on the tree-shaded area of the Wyckoff campus that it has identified as the site for the new development. The installation of new sewers in the community—while hugely important—has meant the loss of some of the community’s mature trees, and the new ones that have been planted are not yet big enough to provide shade.

Third Avenue, in particular, is open, exposed, and *hot*. There are some blocks where, walking along, all one sees are the solid sidewalls of buildings. Those solid walls radiate heat—adding to UHI—and they also project unfriendliness. Not only is Third Avenue a hot zone, in places it is an inhospitable one.

However, adding green space to the community is more complicated than simply planting a lot of trees—and this is aside from the fact that there is not an abundance of tree pits to begin with. For one thing, manufacturers and businesses in the area have mixed feelings about street trees. They have concerns about trees blocking the

areas in front of their warehouses and shops, possibly affecting parking, pickups, and deliveries that are crucial to the efficiency of their businesses.

There are other reasons tree planting must be managed with care. Flooding in Gowanus is not only a matter of the canal overflowing its banks—it also relates to the fact that this former salt marsh has creeks running underground, resulting in a high water table that causes groundwater seepage. This can make it difficult for trees to take root. Furthermore, because of the widespread contamination in the area, there can be issues with soil contamination and with digging deep for tree planting.

The Social Repercussions of a Changing Climate for Gowanus

With its increased temperatures and more frequent and prolonged heat waves, climate change will only intensify UHI in Gowanus. If all else does not change, the health risks for local residents and workers will increase, especially those who are elderly or have chronic health conditions or are at risk for developing such conditions. In addition, it will be more difficult for people to stay outdoors for an extended length of time in the decades ahead. Today, when it’s such a long, hot slog to get from place to place in summer, the elderly, people with disabilities, and others might already be inclined to just stay home. More heat will lead to further isolation, declining social cohesion, and, with that, the potential for certain chronic illnesses to worsen.

The Implications of the Proposed Rezoning

Panel members heard from stakeholders that the anticipated Gowanus rezoning would likely not affect the Industrial Business Zone in the southern portion of Gowanus, as part of the effort to preserve industrial jobs. The focus is expected to be north of Third Street. There, the rezoning will likely permit higher density, particularly for residential uses.

Gowanus Neighborhood Planning Study Context Map, produced by New York City's Department of City Planning. The anticipated rezoning plan will likely permit higher density and mixed-use development, while simultaneously prioritizing preservation of industrial jobs within the IBZ.

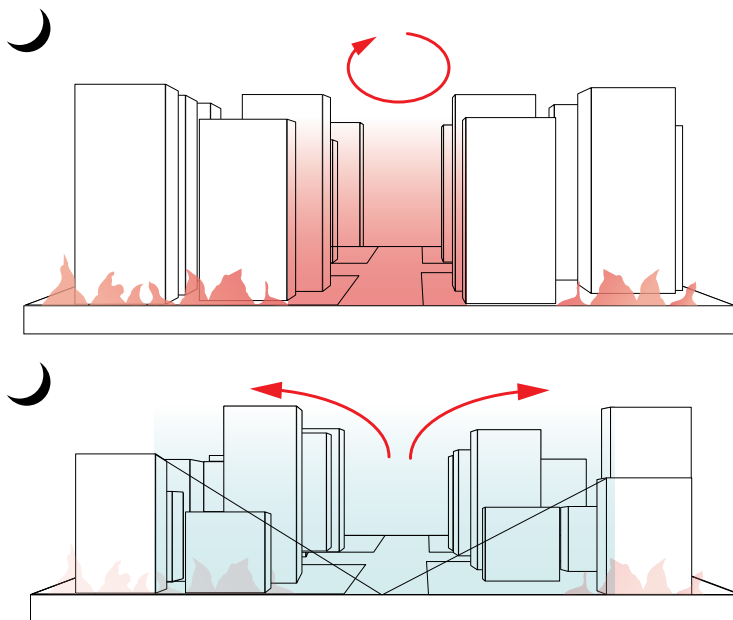
Credit: NYC DCP



Figure 6 NYC DCP Study Area, Gowanus Rezoning
 SOURCE: (1) Gowanus Neighborhood Planning Study, Context Map, New York City Department of City Planning (DCP), Feb 2018. File: gowanus_context_map.pdf

The graphic below demonstrates how higher buildings prevent streets from cooling at night leading to the intensification of UHI in neighborhoods of higher densities. The top illustration demonstrates heat being trapped at night in an area with higher buildings, whereas the bottom illustration demonstrates heat dissipating at night in an area with shorter buildings.

Credit: Jeffrey Raven



Although it is not known exactly what form the rezoning will take, maximum building height and Floor Area Ratio (FAR) are likely to increase in portions of the district, resulting in an overall increase in height and bulk. This would have huge implications for UHI because tall buildings prevent the streets that are at the base of the canyons they create from easily releasing their heat at night. Coupled with increasing temperatures and heat waves projected for the city, the heat could build up for days before being released into the night sky. Clearly, if the City proceeds with a rezoning for higher density, counter-balancing measures to mitigate UHI should be incorporated in the new zoning.

Furthermore, by rezoning, the City will be creating significant new development value by permitting more valuable residential uses, which are currently restricted. One order-of-magnitude analysis by members of the panel estimated that, if one-quarter of significantly underbuilt sites within the rezoning study area north of Third Street were developed as a result of the rezoning, the resulting value of land transactions would be \$600 million higher than if they occurred today¹. Some of that value could be captured to improve the area and mitigate the effects of the new development. The City, for its part, has said that it is making a funding commitment to neighborhoods that are being rezoned. Some of those public funds might be used to address UHI in Gowanus.

In short, the rezoning presents an opportunity to leverage the potentially extraordinary value generated to address the complex and pressing challenge of UHI. Approaching the rezoning with proposals for specific tools and investments to mitigate UHI could improve the likelihood of implementation of such measures and, as a result, have a meaningful, positive impact on the neighborhood level. This report introduces a number of types of tools, investments and development strategies that could be effective for mitigating UHI in Gowanus.

¹ The panel's analysis identified approximately 3,000,000 square feet of land area that would be significantly underdeveloped under a rezoning scenario, and assumed one-quarter of sites would be developed as a result of the rezoning. It also assumed a future residential FAR of 6.0, an existing FAR of 2.0, and an average land value for residential uses of \$200 per buildable square foot.

Key Observations and Findings

How to convert many of the challenges Gowanus is facing into opportunities? How to leverage the investment in the neighborhood to address UHI at the building and district scales? How to develop funding and delivery structures, particularly for UHI-vulnerable populations? In casting about for answers, the panel members drew on their own experience and expertise—and on-site research—to come up with the following observations and findings:

Urban Climate Factors

A new book called *Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network*, contains a framework that panelists found helpful for thinking about Gowanus and UHI. The book describes four factors that contribute to the urban climate, all of which should be considered for mitigation opportunities in Gowanus:

1. Efficiency of urban systems:

Reducing waste heat that goes into the atmosphere, including from buildings and transportation, and also reducing emissions from air conditioners, automobiles, factories, and industry.

2. Form and layout:

Whether the three-dimensional form of a district allows for wind to flow through it and for hot air to escape at night—meaning the area can cool itself off.

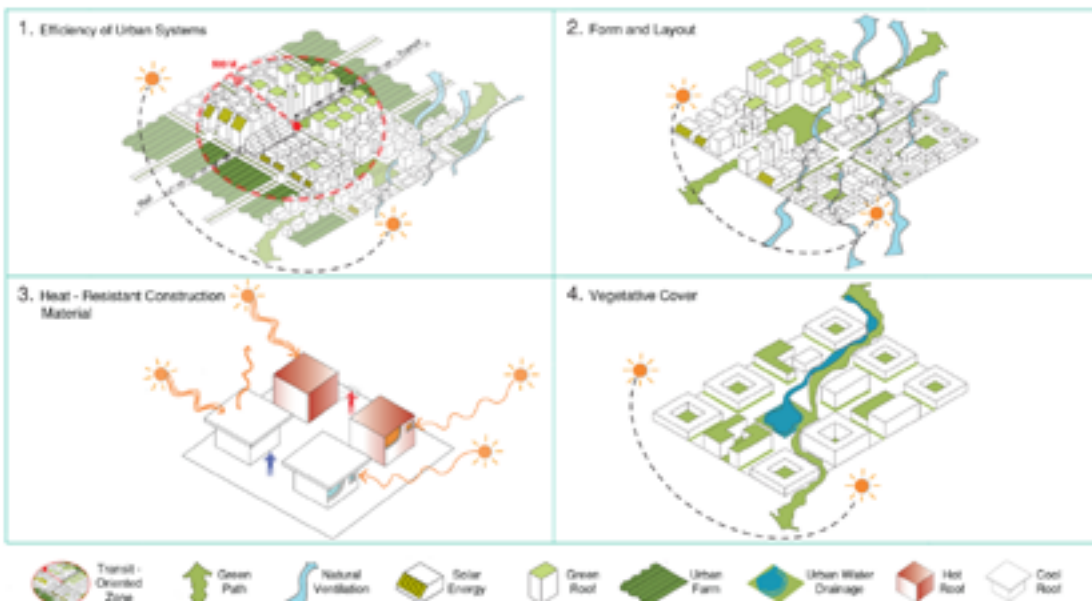
3. Building mass, construction materials, and surface characteristics:

Such as whether walls and roofs prevent the re-radiation of heat from the sun.

4. Vegetative coverage:

Which provides shading and evapo-transpiration, and does not store and re-radiate heat as much as built surfaces do.

Giving further support to the value of vegetative coverage mentioned above is a 2011 study entitled “Realising a green scenario: Sustainable urban design under a changing climate in Manchester, UK.” In this study of Manchester, England, the baseline vegetative coverage was 15 percent. The study laid out three development scenarios in the context of climate change. In the first scenario, in which vegetative cover ratios remained the same, it was projected that climate change would



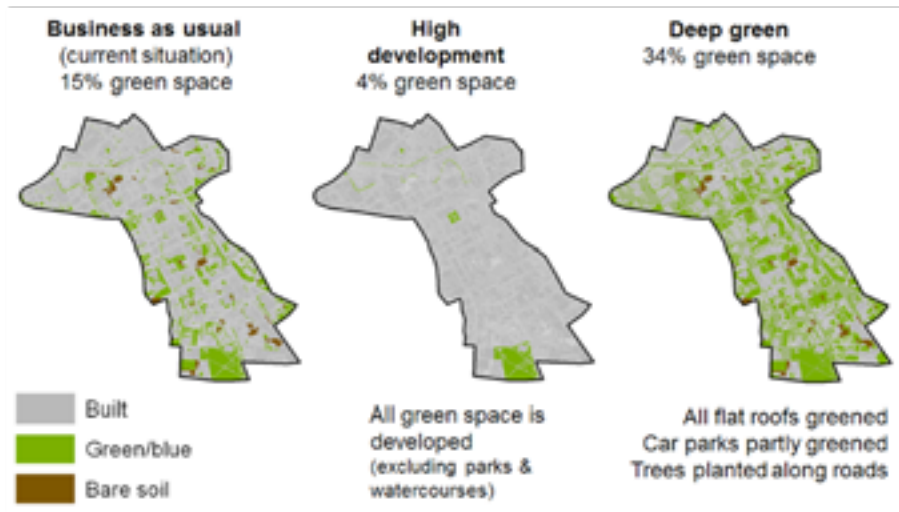
The framework in which the ULI panel based their UHI mitigation recommendations on includes addressing the efficiency of urban systems; form and layout; building mass, construction materials, and surface characteristics; and, vegetative coverage.

Credit: Jeffrey Raven

Vegetation drives urban microclimate through direct shading, evapo-transpiration, and storing and re-radiating less heat than built surfaces. A study conducted in Manchester, UK demonstrates the importance of vegetative coverage as it can decrease average surface temperatures.

Methods

Three development scenarios were proposed:



Simulated development scenarios from aerial photograph interpretation. Base map is © Crown Copyright / database right 2015. An Ordnance Survey/ EDINA supplied service.

Climate change impacts to New York City in 2017 and projected for 2050. By 2050, New York City will experience more days that will cause extreme heat stress.

Credit: Jeffrey Raven

increase maximum surface temperatures by 1 to 3.7 degrees Centigrade (33.98 to 38.55 degrees Fahrenheit). In the second scenario, in which development would increase, with green space falling to 4 percent coverage, projected surface temperatures jumped 5 degrees Centigrade (41 degrees Fahrenheit). But in a "Deep Green" scenario, in which vegetative coverage was increased to 34 percent coverage, the projected surface

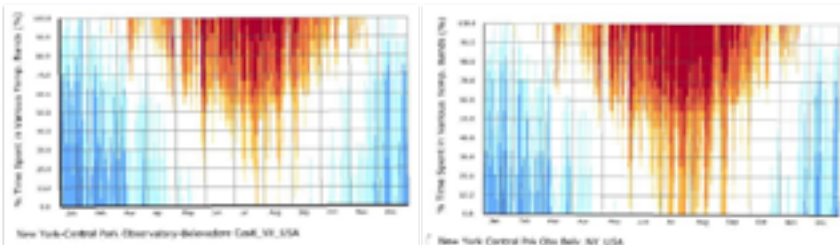
temperatures fell 6 degrees Centigrade (42.8 degrees Fahrenheit). These findings underscore the importance of vegetative coverage in mitigating heat.

Human Comfort Factors

As most know, human comfort depends on more than just air temperature. In fact, there are four "human comfort factors"—summarized in the Universal Thermal Climate Index (UTCI)—that affect the way we feel in an environment: air temperature, solar radiation, wind speed, and humidity. Because there are four factors that contribute to our comfort level, there are multiple ways to address UHI that target each comfort factor.

2017

2050



Comfort based on air temperature, solar radiation, wind speed and water vapour pressure



The Cooling Potential of Gowanus's Hidden Creeks and Prevailing Winds

A researcher named Eymund Diegel has been mapping the hidden underground streams in Brooklyn, and panelists discussed whether the hidden stream system in Gowanus could be harnessed for a cooling effect. Likewise, data on wind direction and force led the panel to explore whether there was a way of opening up the study area to the prevailing winds to ventilate and cool the area. Panelists also discussed the idea of the canal and the public promenade that is to be developed along it as part of a larger cooling system.

Potential Health Benefits of UHI-mitigation Strategies

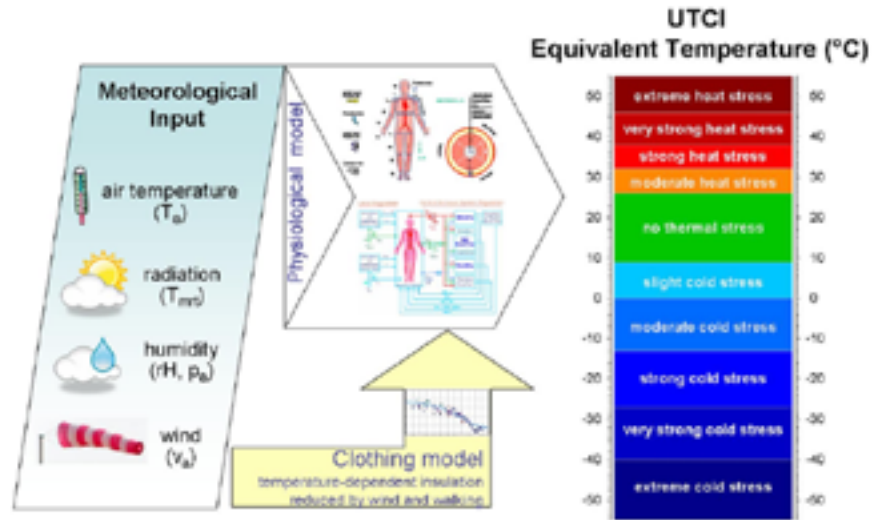
Design strategies that address UHI could significantly lower health risks for area residents. A 10 percent increase in urban surface reflectivity (as opposed to absorption) has been shown to reduce the number of deaths during heat events by 6 percent, according to the



Source: Map of local streams in Gowanus by Eymund Diegel, Gowanus Canal is in the center of the map. Mother Board, "The Hunt for Brooklyn's Hidden Creeks", August 29, 2014

Building upon local researcher Eymund Diegel's work, the ULI panel recommends taking advantage of the hidden underground stream system in Gowanus, which could be harnessed for a cooling effect.

Credit: Provided by Fifth Avenue Committee



Global Cool Cities Alliance Study, 2013. The same study said that increasing vegetative cover by 10 percent on top of increased reflectivity can reduce mortality during heat events by 7 percent. Meanwhile, according to a study appearing in *Atmospheric Environment* entitled "The Effects of Land Use in Meteorological Modeling: Implications for Assessment of Future Air Quality Scenarios," a 40 percent increase in urban tree cover in U.S. cities was found to decrease air temperatures by up to 10 degrees Fahrenheit

The Universal Thermal Climate Index (UTCI) is a metric for comfort that factors in air temperature, radiation, humidity, and wind.

Credit: Jeffrey Raven



A map showing the direction of the prevailing summer winds.

Credit: ULI Panel

Recommendations for a Greener, Healthier, and Cooler Gowanus

Perhaps not surprisingly, there is no silver-bullet solution for UHI in the study area. Furthermore, not every idea the panelists proposed is equally suitable for all parts of the area—some might be more appropriate for the more residential and mixed-use area north of Third Street and others might lend themselves to the more industrial area south of it.

However, there are many things to be done that, cumulatively, can leverage the opportunity presented by the rezoning to combat UHI and, at the same time make improvements that build on and complement the existing character of Gowanus. The following recommendations reflect the panel’s vision for the Third Avenue corridor as a pleasant public space that encourages walking and biking and serves as a connector—linking the mixed-use north with the industrial south, drawing people out of their homes and workplaces and onto the street, strengthening community bonds in the process.

Achieve 20 Percent Vegetative Coverage in Gowanus

Panel members estimated that if the area were to achieve 20 percent vegetative coverage (1,000,000 square feet) it would reduce air temperature by 3 degrees Fahrenheit. The panel explored this as a potential target, particularly given that local temperatures are also likely due to climate change. Increased vegetation would also offer stormwater retention, helping combat flooding. And, of course, it would make the public realm in Gowanus much more pleasant. Greening the study area could be achieved in the following ways:

Turn the Con Edison lot between Baltic and Butler streets into a park

To address the park needs of the community, it is crucial that a replacement park be established while Thomas Greene Park is closed, as discussed earlier in this report. Because of its size and proximity to Thomas Greene Park, the Con Edison lot between Baltic and Butler streets is a good site for a temporary park that might ultimately become a permanent second park for the community. The following features are suggested for the park:

- **A pool**, to compensate for the closure of the community’s single public pool.
- **A water play area**, with jets coming out of the ground, so children too young to swim in the pool have a place to frolic and cool off.
- **Shade-giving elements**, because there are no trees on the site. Some shade can be provided by installing seating with trellises that are planted with vines.
- **A pop-up tree nursery**, which could be used to propagate trees to be planted on Gowanus streets while doubling as a park-like green spot. This operation could be undertaken in conjunction with the Parks Department’s Native Plant Center, using stock grown from seeds collected locally—since trees with local DNA will be better adapted to conditions in the community. Not only could the nursery become a lovely community amenity—and perhaps a permanent one—it could provide jobs to local residents who could be trained in horticulture and tree care.

Redesign Thomas Greene Park

The park should be redesigned so that it has additional green space when it reopens.

- Given that the goal is to open a pool in the new park created on the Con Edison lot, the Thomas Greene Park pool should not be re-opened but rather should receive soil and plantings for additional green space.

Vines covering the side of a building.

Credit: Max Pixel



Plant trees

Trees address the need for shade, which provides cooling, as well as greenery. But on Third Avenue—where the sidewalks are narrow and businesses are wary of anything that might block access or egress—the solution must be nuanced. Trees can be a viable option where sidewalks are wider and businesses not quite as industrial.

Pilot a project exploring new detailing for planting street trees

The current details do not offer enough green cover on the streets. The pilot should explore the spacing and design of tree pits, planting medium, and species selection.

Add vines to cover the side walls of existing buildings

Vines will keep heat from re-radiating off buildings and increasing air temperature—and make it more pleasant to walk on the sidewalks of Gowanus. Vines will also help cool the buildings themselves, reducing the need for air conditioning and thus lowering energy costs and carbon emissions. Not least, they will make otherwise blank walls more attractive. Panel members noted that some buildings already had vines, such as Virginia creeper, growing on them. Of vital importance in the industrial area, vines will not impinge on business operations.

- Adding vines is a relatively straightforward matter. It simply requires cutting away the sidewalk near the building and installing drainage leading away from the building (so water does not infiltrate, and undermine, the structure).
- Similarly, window boxes can be added to building facades that have windows. The impact may be small, but window boxes can be aesthetically-pleasing and will increase vegetation throughout the neighborhood.

Add planters throughout the community

Walking through the area, panelists admired handsome square steel planters outside one local business—designs they felt were very much in keeping with the

Examples of strategies to add vegetation to the urban public realm.

Credit: ULI Panel



industrial feel of the neighborhood. Local fabricators could make planters such as those for more widespread use throughout the neighborhood.

Green Workforce Development Opportunities

The design, installation, and maintenance of green infrastructure and other green technologies present cities with an economic development opportunity. Many of the cities implementing policies promoting green infrastructure have seen associated economic benefits and have often looked to catalyze “green jobs” and skills through training programs. For example, the positive economic impact of Philadelphia’s Green City, Clean Waters plan was realized five years into the program. The green infrastructure industry catalyzed by the plan represented a \$60 million positive impact, and is estimated to sustain 430 jobs and \$1 million in tax revenue.

Green workforce development opportunities are crucial for programs like Green City, Clean Waters to continue and hire local workers with the desired skills and maintain the creation of jobs to support the demand of a growing green economy. To help meet this need, the National Association of Regional Councils (NARC), in partnership with ICF International, Monster Government Solutions, MWH Global, and Colorado Energy Group, received a Pathways Out of Poverty grant from the U.S. Department of Labor to create strategies in four regions to train and place workers in green jobs. Through this program, NARC established training programs in green trades in tandem with local community colleges that could provide credentials. More information is available here: <http://narc.org/development/workforce-development/green-jobs/>.

Explore starting a program to enlist local metalworkers to create planters for the community

Such a program could perhaps involve an apprenticeship in which local residents learn to make planters from professional metalworkers.

Preserve the leafy area at Wyckoff Gardens that has been proposed for infill development

Panelists felt strongly that this pleasant area, with its mature, shade-giving trees, should be preserved. In fact, they recommend extending the greenery there by landscaping the small parking lot amid the trees. As for the new development, it could be located on the empty parking lot on the corner of Baltic Street and Third Avenue where it won’t disturb precious existing greenery.

Require that new parking lots associated with new development in the area have trees and bioswales

Trees and bioswales will add greenery to what would otherwise be barren, paved places that would exacerbate UHI.



An overall green vision for Gowanus.

Credit: ULI Panel

Plant grass atop the sewage tank to be sited between Butler and Degraw

A grassy area here would provide a spot for passive recreation in the community.

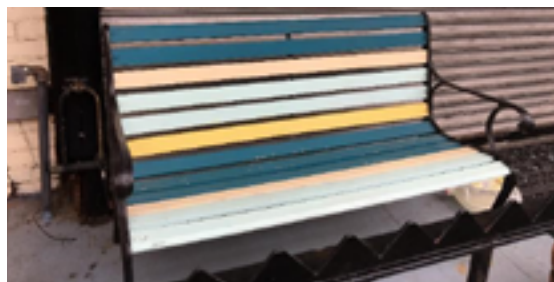
The panel recommends that additional green space is created atop the CSO tank siting area, and that other public realm improvements - such as the creation of a pedestrian corridor - are made within the study area.

Credit: ULI Panel



Create "areas of respite"

Much of the discussion during the TAP focused on how UHI can make it difficult to spend time outdoors during peak heat for the elderly, mobility impaired and others less likely to move quickly. In response, the panelists



The panel recommends creating "pathways of respite" throughout the study area.

Credit: ULI Panel

explored creating "pathways of respite" and 'areas of respite' which would provide people with pleasant, cool spaces to break up journeys through the summer heat. These small, green areas should be added throughout the community to provide spots for people to pause in the shade and for older people to sit and rest. These micro parks could be street-corner parks or even just a bench between two street trees. Such spots—especially if they are placed where there's airflow and contain seating—could help draw people out into the community and contribute to the social resiliency of Gowanus while combating UHI. These spaces would also offer an inviting amenity in the public realm at other milder points in the season.

Create "paths of respite"

Linked together, these "areas of respite" could create a "pathway of respite" which would offer relief from UHI, contribute to mitigation and improve neighborhood connectivity for pedestrians. This series of linear green spaces providing shade and vegetation should be required in the rezoning and should be designed to make the most of opportunities to mitigate UHI. These green corridors—aligned with prevailing winds and underground streams—should feature street trees, vines on blank walls, and, where possible, green roofs. Features along these corridors could be accessible to the public or not. The corridors should be established along wider east-west streets to capture the summer breeze and circulate air, allowing the neighborhood to cool off at night.

The most promising streets for this new green network are as follows (starting in the southern portion of the study area and, in some cases, spreading beyond the study area's boundaries):

- **9th Street, from the canal to Fourth Avenue** (connecting with two places of respite on the northeast and southeast corners of Third Avenue)
- **5th Street, from Third Avenue to Fourth Avenue** (thereby connecting with Washington Park)
- **3rd Street from the canal to Fourth Avenue** (again, connecting with Washington Park, but also with a place of respite on the northeast corner of Third, and, finally, with the canal)
- **Carroll Street from the canal to Fourth Avenue** (connecting with yet another place of respite, on the northeast corner of Third Avenue)

- **Douglass Street and Degraw Street from the canal to Fourth Avenue** (drawing people from Fourth Avenue to Thomas Greene Park and then, ultimately, to the new green corridor along the canal)

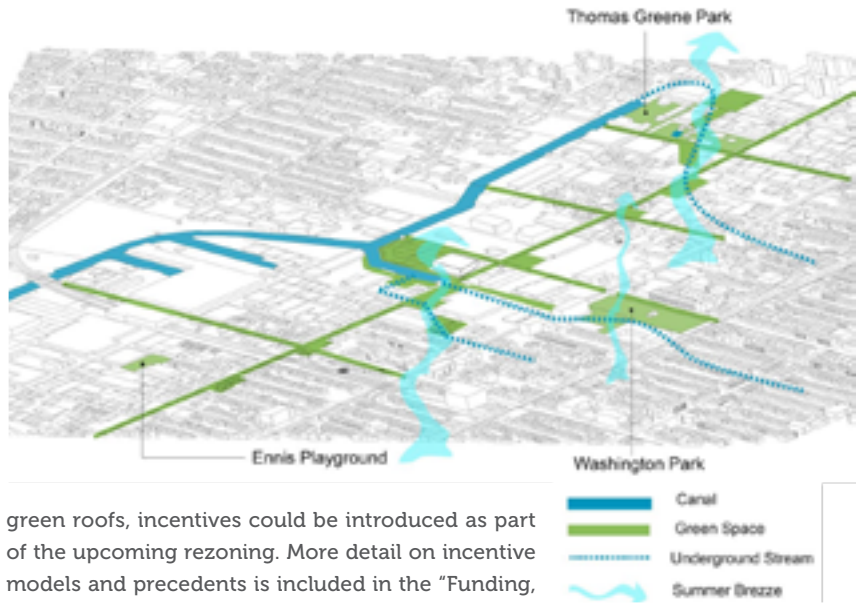


A pathway of respite that weaves through the study area. This includes enhancing Thomas Greene Park and the connection to the canal, opening areas to prevailing winds for cooling, a vegetative connection from Washington Park to the canal, creating east-west green corridors, and reconfiguring the roadway south of Carroll Street to add vegetation in the right-of-way.

Credit: ULI Panel

Introduce additional green roof incentives

The panel members estimated that the proposals above could achieve 300,000 square feet of green coverage in Gowanus. To reach 20 percent green coverage, an additional 700,000 square feet would still be required. This could be accomplished with green roofs as well as the proposed parks and green infrastructure at the street level. To encourage the implementation of these



green roofs, incentives could be introduced as part of the upcoming rezoning. More detail on incentive models and precedents is included in the “Funding, Incentives and Implementation” section of this report.

Improve the Street Environment to Better Encourage the Use of Transit and People-Powered Transportation

Such a street environment would both reduce heat exhaust that exacerbates UHI and benefit the health of the local community by providing better opportunities for walking and biking.

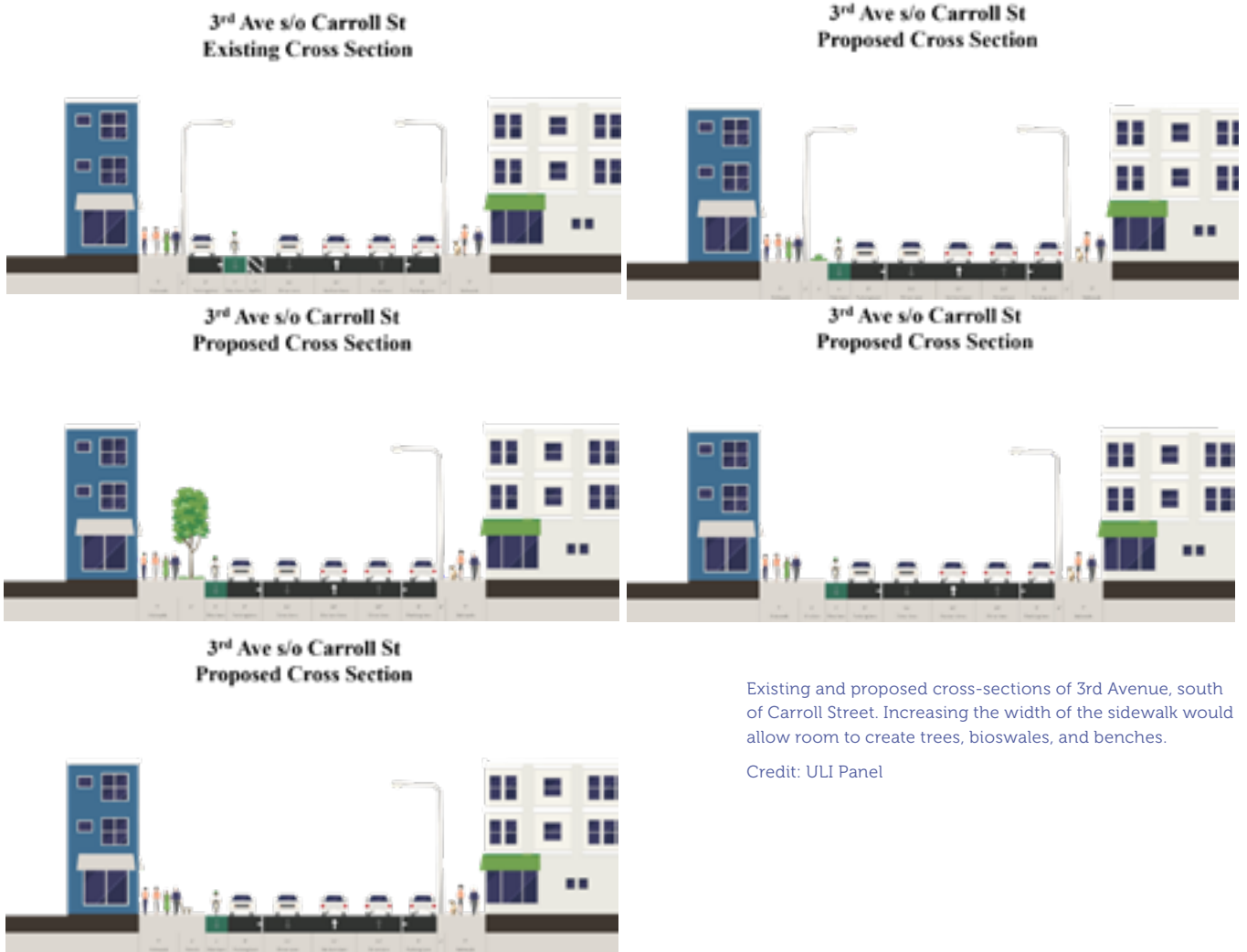
Reconfigure Third Avenue South of Carroll Street

Currently this six-lane roadway has a lane on either side devoted to parking; a bike lane; and three driving lanes. The sidewalks on either side are 11 feet wide, allowing two feet for lampposts.

Increasing the width of the sidewalk to 15 feet on the west side of the avenue by rearranging the existing bike and parking lanes would yield four feet of space for trees, bioswales, and benches. In the new configuration, the bike lane would shift to the edge of the street bordering the new vegetation, providing a safer and more pleasant ride for cyclists—and perhaps enticing more people to use bikes instead of personal vehicles, which would help to reduce heat exhaust on Third Avenue.

The “Green and Blue Strategy” for Gowanus, which knits together UHI mitigation strategies such as increasing vegetation, creating pathways of respite, creating additional public green space, while simultaneously harnessing the cooling power of underground streams and the prevailing summer winds.

Credit: ULI Panel



Existing and proposed cross-sections of 3rd Avenue, south of Carroll Street. Increasing the width of the sidewalk would allow room to create trees, bioswales, and benches.

Credit: ULI Panel

Implement safety improvements at the intersections of Third Avenue at 16th Street, and Third Avenue at Prospect and Hamilton Avenues

The panel heard from multiple stakeholders that the intersections where Third Avenue intersects with 16th

Street, and then where Third Avenue intersects with Hamilton and Prospect Avenues, are dangerous for pedestrians, bicyclists, and drivers alike. In order to implement safety improvements at this key intersection, the panel recommends replacing the stop signs with a traffic light at the intersection of Third Avenue and 16th Street, restricting traffic on 16th Street by forcing traffic to turn right onto Third Avenue to create fewer conflicts, and tying the traffic signal between the two intersections and providing a safer pedestrian crossing at the southern side of the intersection.



Proposed safety improvements to the intersections of Third Avenue and 16th Street and Third Avenue at Hamilton and Prospect Avenues.

Credit: ULI Panel

Explore bicycle parking at NYCHA sites

It is important that there is sufficient bike parking for those who currently live in NYCHA properties and want to cycle as well as those who will reside there once infill development is constructed. The provision of adequate bike parking may encourage cycling among members of the NYCHA community.

Make the Transportation System More Efficient

Making the transportation more efficient would decrease emissions that exacerbate UHI. Panel members suggest short-, medium-, and long-term strategies that can be pursued:

Short-term solutions:

Increase and improve transit service to encourage more people to take a subway or bus rather than drive or use taxis and other ride services

- Increase frequency on the B37.
- Add B103 stops on Third Avenue.
- Improve R train service.
- Consider NYCHA shuttles to key destinations.

Reduce traffic on Third Avenue

- Maintain a single travel lane in each direction during AM peak period north of Union Street.

Review parking regulations to provide more commercial loading space on Third Avenue

Reserve parking spaces for EV and hybrid vehicles



Transit routes serving the study area.

Credit: Provided by Fifth Avenue Committee

Medium-term solutions:

Increase transit connectivity

- Consider east-west bus transit routes.

Address Industrial Sector Opportunity

- Provide incentives for industrial businesses to purchase low-emission fleets.
- Consider barge delivery of goods.

Short-Term Transportation Interventions and Associated Urban Heat Island Mitigation

Transportation Intervention	Urban Heat Island Mitigation
Increase transit service B37 increased frequency More B103 stops on 3rd Avenue Better R train service Consider NYCHA shuttles to key destinations	Decreased emissions (via increased usage of multi-modal transportation)
Reduce traffic on 3rd Avenue Maintain 1 travel lane in each direction during AM peak period north of Union Street	Decreased emissions
Review parking regulations to provide more commercial loading space on 3rd Avenue Implement safety improvements at key intersections 3rd Avenue and 16th Street	Decreased emissions (via fewer stalled vehicles)
Provide more safe bicycle parking at NYCHA sites Reserve parking spaces for EV and hybrid vehicles	Decreased emissions (via increased pedestrian activity, bike use and EV/hybrid vehicle use)

Medium-Term Transportation Interventions and Associated Urban Heat Island Mitigation

Transportation Intervention	Urban Heat Island Mitigation
Increase transit connectivity Consider east-west bus transit routes	Decreased emissions (via increased usage of multi-modal transportation)
Reduce traffic impacts re: rezoning Provide parking maximums/no on-site parking Provide incentives for industrial uses to purchase low emission fleets Design for good land use mix to create walkable community Redesign 3rd Avenue between Carroll Street and 15th Street Create parking-protected southbound bike lane and reuse hatched buffer area for bioswale/greening measures	Decreased emissions (via increased usage of multi-modal transportation, increase in ped/bike travel and use of low-emission fleets)

Long-Term Transportation Interventions and Associated Urban Heat Island Mitigation

Transportation Intervention	Urban Heat Island Mitigation
Increase transit connectivity Canal-based transit to/from subway Integrate BQX into transit network	Decreased emissions (via increased usage of multi-modal transportation)
Implement pedestrian improvements New pedestrian bridge over canal (Degraw) Pedestrianize Nevins Street	Decreased emissions (via increase in ped/bike travel)
Consider new pavement designs/concrete pavement on 3rd Avenue to reduce black-top surface	Building Materials

Reduce traffic impacts from new development that will result from the rezoning

- Institute parking maximums/no on-site parking.
- Design for good land-use mix to create a walkable community.

Long-term solutions:

Increase transit connectivity

- Institute canal-based transit to and from subway.
- Integrate BQX into transit network.

Implement pedestrian improvements

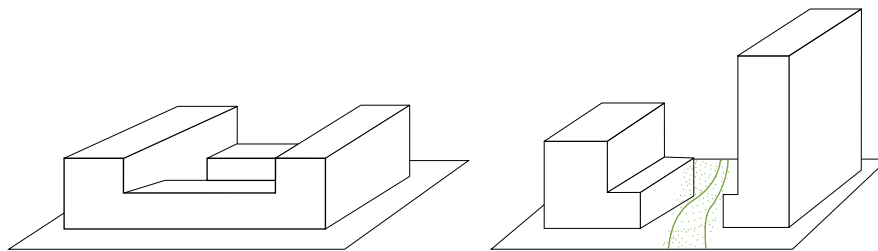
- Build new pedestrian bridge over the Gowanus Canal (at Degraw Street).
- Pedestrianize Nevins Street.
- Consider new pavement designs/concrete pavement on Third Avenue to reduce black-top surface.

Promote Efficient Building Design

Buildings can contribute to UHI in a number of ways; conversely, they can be designed to mitigate UHI. Incentives and requirements for efficient building design could be a component of the rezoning and complement requirements and incentives addressing green space in the neighborhood.

Encourage buildings that enhance airflow

The massing, or form, of a building can either block airflow or encourage airflow through the community, permitting heat to escape. Zoning should require the sort of massing that allows ventilation of the community, or it could incentivize doing so by permitting an increased FAR for such buildings. Maps of the prevailing winds should be referenced in the context of airflow, as airflow along the path of the prevailing winds will provide the most cooling and relief from UHI.



Base Case
Total FAR 4.0
Avg. Height 50ft.

Alternative Case
Total FAR 4.0
Avg. Height 100ft.

Example of massing that allows, rather than inhibits airflow through a building to promote UHI mitigation.

Credit: ULI Panel

Encourage cool and green roofs

Rooftops absorb and re-radiate heat, especially since they are typically black. On an 85-degree Fahrenheit summer day, a black roof can get as hot as 151 degrees Fahrenheit. However, a white roof—or “cool” roof—heats to just 107 degrees Fahrenheit. With a green roof the temperature drops to 89 degrees Fahrenheit, and if the green roof is thickly planted, the temperature plummets to 82 degrees Fahrenheit—lower than the air temperature. Buildings with cool or green roofs will not only contribute less heat to the atmosphere, their interiors will heat up less and require less air conditioning, thereby lowering energy costs and reducing emissions.



Construction materials matter. This graphic to the left shows the drastic surface temperature difference among different types of roofs. An intensive green roof remained a cool 82.4 degrees Fahrenheit on an 85 degrees Fahrenheit day, as compared to a traditional black roof – which reached a sizzling 151 degrees Fahrenheit.

Credit: Provided by Matthew Payne

Encourage green walls

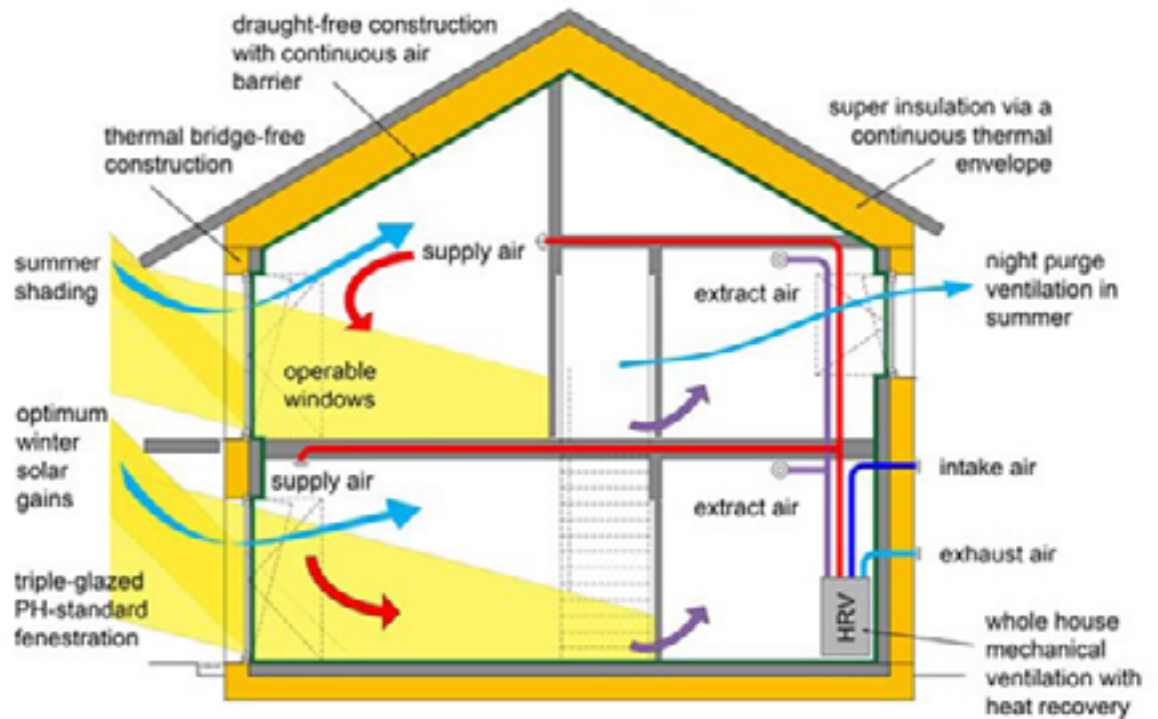
Building facades also contribute to UHI through what’s called “heat rejection”—when the building re-radiates heat from the sun. As discussed earlier, adding vines to the exterior sides of buildings—creating “green walls”—can minimize the amount of heat that radiates off them. Not only will buildings with vined walls contribute less heat to the atmosphere, their interiors will heat up less and require less air conditioning, thereby lowering energy costs and reducing emissions.

Encourage energy-saving features

Improving a building's efficiency—and thus reducing energy expenditures and emissions—can also be achieved through energy-saving features. These features include insulation and double- or triple-pane windows (to minimize energy waste through the leakage of heated or cooled air) as well as awnings (that provide shade and keep rooms from heating up so much, reducing the need for air conditioning). Breezeways can provide natural ventilation, having the same effect.

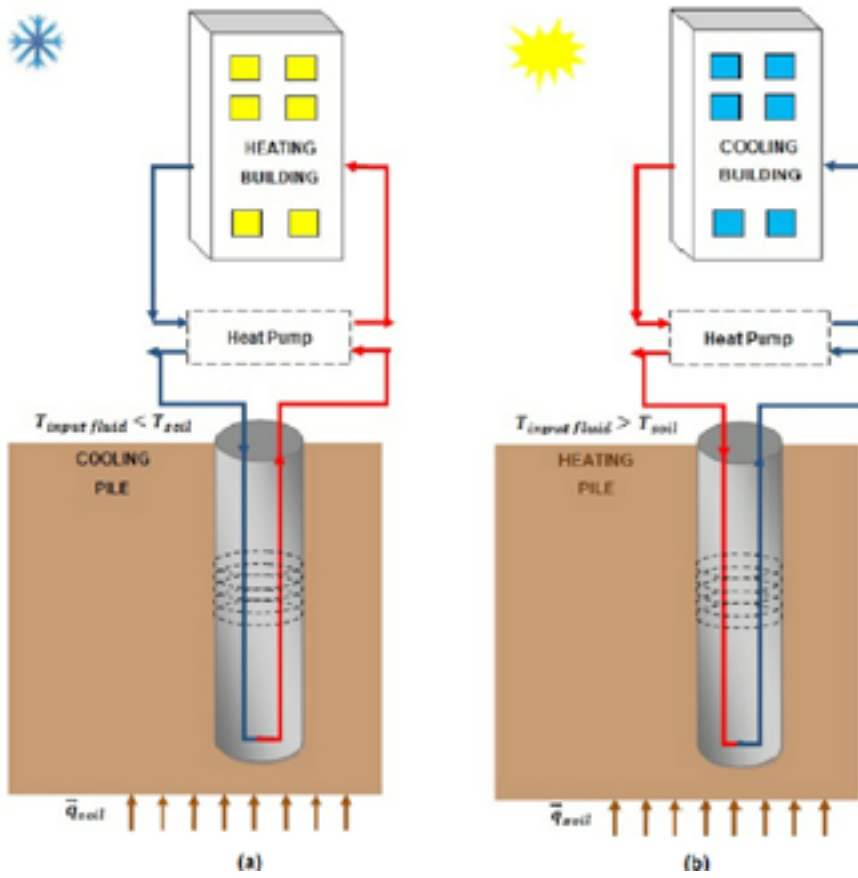
Explore the idea of re-using or re-directing solar heat

The solar heat being captured in buildings could be re-used or re-directed instead of being "wasted" (i.e., released, contributing to higher air temperatures). In the baseline "do nothing approach" the "waste" heat goes back into the atmosphere. However, waste heat can be re-directed and re-used within a building for hot-water generation, and it can also be redirected to another building (either directly, from one building to another, or indirectly, through a district heat network). It is also possible to channel heat into the ground below a building or buildings or, in Gowanus, into the canal. Clearly, some of these measures may be easier to accomplish in new buildings, with the necessary features built into them from the start.



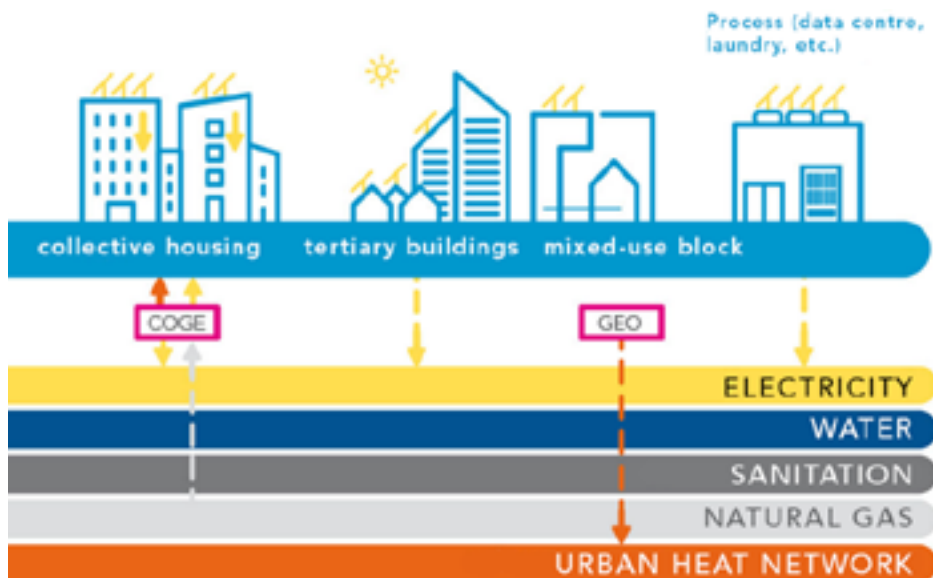
There are numerous ways to improve the efficiency of a building. For example, implementing "envelope improvements" (i.e., insulation, shading) as well as taking advantage of natural ventilation (i.e., breezeways, floor plate depths).

Credit: Provided by Matthew Payne.



Redirection of waste heat to ground or canal to improve energy efficiency of buildings.

Credit: Matthew Payne



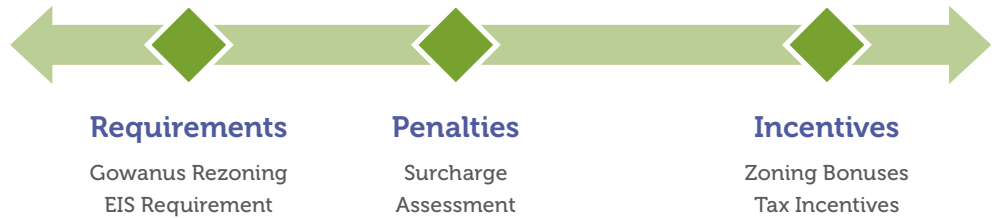
Redirection of waste heat to other buildings or uses.

Credit: Matthew Payne



Funding, Incentives and Implementation

So how does Gowanus accomplish the ambitious recommendations the panel has outlined? Panel members explored ideas for ways in which to implement UHI-mitigation measures in Gowanus, and looked to examples of how similar measures have been financed and implemented in cities across the country – which include a combination of regulatory and incentive-based strategies. These strategies would be specifically tailored for the two distinct districts in the panel’s study area – the mixed-use district north of Third Street and the industrial district south of Third Street.



efficiency measures, such as the Bronx Environmental Revolving Loan Fund (RLF), which provides zero-interest loans of up to \$100,000 to businesses and building owners to implement energy efficiency measures that improve air quality.

This “sticks vs. carrots” approach incentivizes owners, developers and tenants to make green infrastructure and energy efficiency improvements, while also placing requirements (or penalties) that also work to offset the effects of UHI.

Credit: ULI Panel

New York City’s Track Record for Incentivizing Green Building

New York City already has some of the most advanced climate action planning in the U.S., including dedicated action outlined in the OneNYC Plan and recent commitments to the Paris Climate Agreement. New York City also already has incentive programs in place to encourage sustainable and energy-efficient development. For example:

- New York City and New York State passed legislation in 2008 to provide a one-year property tax abatement (the Green Roof Tax Abatement) for property owners that install green roofs on their buildings – an abatement that is now available through March 15, 2018.
- The City Council adopted the Zone Green Text Amendment in 2012 which is a citywide zoning text amendment that removed zoning impediments to the construction and retrofitting of green buildings, allowing owners more choices for the investments they can make to save energy and money while improving environmental performance.
- Some boroughs also offer specific programs to incentivize green roofs and other energy

Harnessing Value Created by the Rezoning for UHI-Mitigation

To advance UHI-mitigation in Gowanus, specific requirements and incentives aimed at addressing UHI should be incorporated into the upcoming rezoning. Importantly, the panelists recommended that the effects of Urban Heat Island should be included in the analysis of public health impacts in the Environmental Assessment Statement (EAS) associated with the rezoning. This would set a precedent that could be followed by other areas subject to rezoning, and even by other cities searching for strategies to mitigate Urban Heat Island.

As mentioned earlier in this report, a back-of-the-envelope estimate created by the panelists envisioned that as much as \$600 million in gross land value could be realized through the Gowanus rezoning. Panelists noted that this significant value creation could be leveraged in part to address UHI. In other words, a portion of the value created could be captured to fund green infrastructure investments, such as the creation and maintenance of parks, green roofs, cool roofs, cooling centers and the “path of respite” envisioned by the panel.

The panelists agreed that there are many ways to fund the recommendations, one of which would be to incentivize developers, businesses and homeowners to pay for mitigation measures upfront and get paid back through rebates, similar to New York City's Green Roof Tax Abatement mentioned earlier. There are many examples of this type of arrangement elsewhere in the county, which include:

- In Minneapolis, Minnesota, any building that improves its storm water management—such as by installing a green roof—receives a 50 percent credit against mandated storm water usage fees paid to the City.
- In Philadelphia, Pennsylvania, businesses that implement a green roof can earn a rebate of 25 percent on costs up to \$100,000 through the Green Roof Tax Credit program.
- Seattle, Washington's RainWise Program offers rebates for rain gardens or cisterns if the property is in a targeted sewer overflow area.
- Nashville, Tennessee is promoting the installation of green roofs through a measure providing a \$10 reduction in a property's sewer fees for every square foot of vegetative roof.
- In more suburban and low-density contexts, Montgomery County, Maryland, funds the Rainscapes Rewards Program that offers rebates of up to \$10,000 to property owners to install approved storm water management controls. In Anne Arundel County, Maryland, a Stormwater Management Tax Credit provides a property tax credit of 10 percent of the cost of an approved stormwater management practice, taken per year for 5 years, to a maximum of \$10,000.

Create A Green Infrastructure Fund

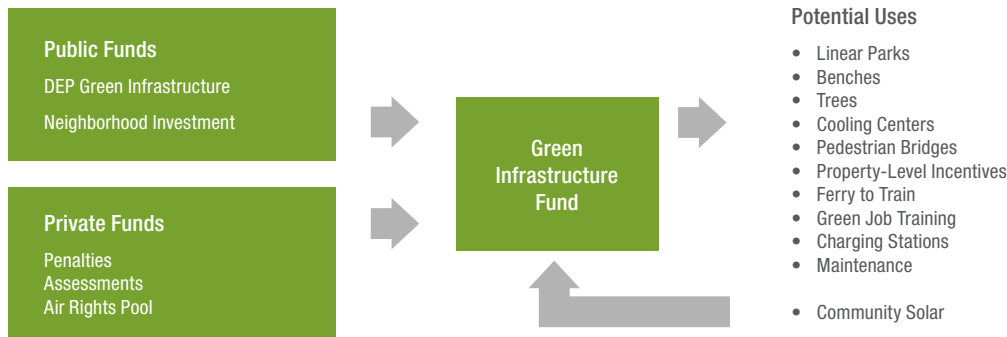
The panel recommended the creation of a Green Infrastructure Fund, funded through both public and private monies, that could then be used for green investments in Gowanus designed to offset UHI. This fund could be administered by the New York City Department of Environmental Protection (NYC DEP) to pay for a variety of UHI-mitigating measures. Private

revenue would be generated by a combination of requirements and incentives, including: assessments, penalties (for not fulfilling requirements), revenue from air rights purchases, and from a revenue pool generated from the purchase of additional FAR.

One precedent for a fund of this type is in Washington D.C., a city that boasts one of the country's oldest sewage systems and where stormwater runoff and sewage flow into the rivers and eventually into the Chesapeake Bay Estuary, which presents a significant threat to the local waterways. Because of this, D.C. is one of the many communities across the country that is required by the federal government to invest in infrastructure to address the runoff and its associated pollution from Combined Sewer Overflow.

One facet of Washington's stormwater management strategy was the launch of a Green Infrastructure Fund which included a \$1.7 million investment from Prudential Financial in joint venture with NatureVest and Encourage Capital. This fund will support the implementation of green infrastructure in response to and support of Washington's new Stormwater Retention Credit (SRC) Trading System. The SRC system provides a mechanism for developers to invest in off-site green infrastructure such as green roofs and rain gardens within the city's watershed by trading stormwater credits. This system provides developers an alternate means to reach stormwater mitigation requirements and creates an opportunity for the development of green infrastructure, and supporting installation and maintenance jobs, in underserved communities.

Washington D.C. also recently launched the first Environmental Impact Bond in the country, which was issued by D.C. Water. This tax-free bond will fund the construction of green infrastructure and stormwater management mechanisms. The bond follows the "Pay for Success" model pioneered in the social policy space, in which performance risks are shared by the public entity and investors. If green infrastructure leads to stormwater run-off reductions greater than 41.3 percent of the baseline, investors will receive an Outcome Payment from D.C. Water; conversely, if run-off is reduced by less than 18.6 percent of the measured baseline, investors will make a Risk Share Payment to D.C. Water.



A diagram showing how a Green Infrastructure Fund could work in Gowanus.

Credit: ULI Panel

Net savings from community solar can go back into the Green Infrastructure Fund.

Environmental Special District Example in Washington, D.C.

Washington, D.C. issues the first environmental impact bond in the country in September 2016. This is a tax-free bond issued by D.C.

Water for green infrastructure and stormwater management, that is modelled after Social Impact Bonds in the United Kingdom – a portion of payment to investors is dependent on an outcome of evaluations. D.C. Water will cover construction costs; performance risks are shared by D.C. Water and investors.

Source: <https://center.fuqua.duke.edu/case/2017/01/13/environmental-impact-bonds/>

	Year 1	Year 2	Year 3	Year 4	Year 5	
Financial Flows	\$25M Principal issues				\$25M principal repaid	If Green infrastructure Outperforms: Additional \$3.3M payment Performs as expected: No additional payment Underperforms: \$3.3M claw back from investors
	Interest payments @3.43%					
Core Project work (DC Water)	Flow meters inserted to develop baseline	Green infrastructure implemented (i.e., sites identified, interventions constructed)		Flow meters reinserted to measure impact	Evaluation validated to trigger payments	If Green infrastructure Outperforms: Accelerate scale/deployment Performs as expected: Continue original plan with confidence Underperforms: Scale back and deploy grey infrastructure instead

Based on diagram produced by Quantified Ventures

Requirements, Penalties and Incentives

In Gowanus, the study area's two distinct districts – mixed-use and industrial – would have a series of requirements and incentives to support a private sector response to UHI. As stated earlier, these requirements and incentives differ for the mixed-use district versus the industrial district, due to the areas' different characters and uses. The panel emphasized that it is important not to create too many or too burdensome a series of requirements and that there should be incentives in place to make it attractive for developers to implement UHI-offsetting and other environmental measures on their own.

For instance, in the mixed-use district, a building could be required to provide enough green space to meet a "green area ratio" – or the building could be penalized if it doesn't. On the other hand, incentives could be offered for publicly accessible green roofs. In the industrial district, incentives could be provided for cool roofs, green roofs, and barge delivery of goods, as well as incorporation of vines or green walls.

The requirements (or penalties if not completed) would be part of the rezoning and apply to new development and could also apply to existing properties. Penalties for not complying with the requirements would go into the Green Infrastructure Fund.

A summary of the requirements and incentives that could be used for the two districts within the study area are summarized below:

Mixed-Use District – "Area of Respite"

Requirements (Or Penalties)

- Sky View Factor
- Green Area Ratio
- Building Envelope
- Natural Ventilation
- Green space alignment with prevailing winds
- Ground-Source Heat Pump

Incentives

- Parks
- Seating and amenities in the public realm, such as benches
- Publicly Accessible Green Roofs

An Introduction to Green Area Ratios (GARs)

Green Area Ratios, or GARs, encourage the layering of stormwater management mechanisms through the use of a score-based tool to increase runoff absorption capacity and create rich, green aesthetics. GAR programs require a certain percentage of a site be covered by green infrastructure, with different point values awarded for different interventions, and provide a menu of options for developers to reach compliance based on stormwater capture requirements. Seattle is the first city in the United States to adopt a GAR, known as the Seattle Green Factor.

Development projects must include a selection of green infrastructure elements to score points, which are then weighted by size, functionality, and aesthetics. For example, features like permeable pavement, green roofs, and bioretention mechanisms score higher than shrubbery, groundcover, and green lawns. Washington, D.C.'s GAR applies to all new buildings that require a certificate of occupancy, as well as any additions or renovation costs that exceed 100% of the building value within a 1-year period. Different zones within the district have varying GAR requirements that are in line with land-use expectations. Single-family homes and some buildings with historic designations are exempt.

Industrial District

Requirements (Or Penalties)

- Emission Reduction
- Green Area Ratio
- Cool Roofs

Incentives

- Provide % of rentable space at lower rents and long-term leases
- Green Roofs
- Barge Delivery

Thinking More About Incentives

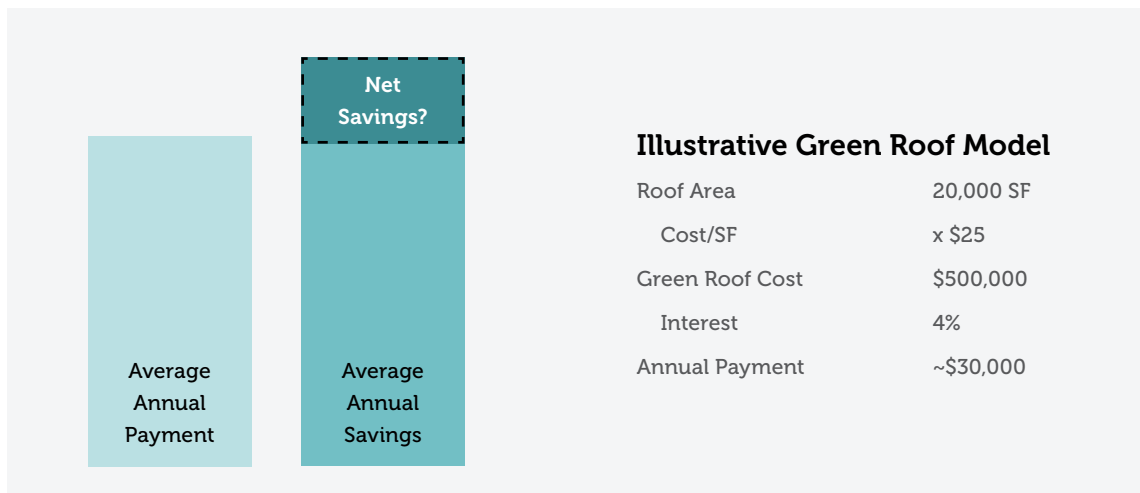
Green Roofs

In rezoning discussions, the Gowanus community could explore with DCP the possibility of introducing additional green roof incentives beyond those currently in place, such as expedited permitting or allowing greater FAR for buildings that add green roofs. Furthermore, if a building owner agrees to open its green roof fully or partially to the community—thereby increasing public green space—an even greater FAR might be available to property owners.

These incentives should also take into account the preferred locations of green spaces and corridors, including the paths of respite. Building footprints could respond to these locations, ensuring continuous green space while still developing to the same FAR.

Other cities have used incentives along these lines:

- A North American leader in green roof implementation, Chicago, Illinois offers a number of different incentives related to green roofs. The city’s zoning code offers an FAR bonus for green roofs that cover at least 50% of its area, or 2,000 square feet of contiguous roof area. Density bonuses are also available to buildings in their central business district that include green roofs. Expedited permitting programs ensure that applications with green roofs are managed within 30 days, a process that usually takes up to 3 months.
- Seattle, Washington’s original Green Streets policy offered a developer a bonus in exchange for construction of an approved streetscape. The bonus was limited to downtown Seattle.
- Portland, Oregon, gives FAR bonuses for providing “ecoroofs.”
- Austin, Texas, gives an FAR bonus for providing a green roof and an additional bonus for making them publicly accessible.



On-bill financing is a mechanism that can be used to incentivize existing owners or tenants to make improvements such as green roofs and other types of green or energy efficient investments, where the city or another entity (typically a utility) funds the energy efficiency upgrade upfront and is reimbursed over time. On-bill financing functions as a loan and the owner or tenant would pay an additional amount on their bill (e.g., utility bill) until the loan is repaid, while realizing a net savings due to increased energy efficiency.

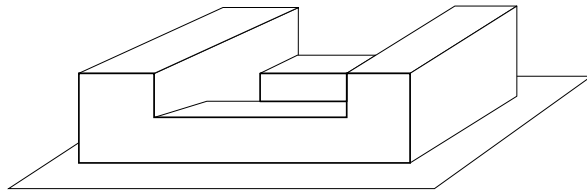
Credit: ULI Panel

Site Specific Bonus and Building Massing

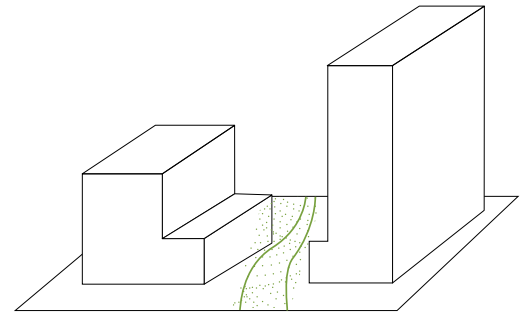
Many of the panel's recommendations for Urban Heat Island mitigation are site-specific in nature and therefore would require site-specific incentives, policies or bonuses. For example, specific sites are more suitable to the creation of a pocket park, a larger park, or the

daylighting of the streams that may run underneath the site, or green spaces along the paths of prevailing winds

The rezoning could respond to these site-specific needs with incentives or requirements related to building massing. It should be possible for buildings to achieve density and FAR goals on site while also creating more, strategically located open space on the site by utilizing greater allowed height limits.



Base Case
Total FAR 4.0
Avg. Height 50ft.



Alternative Case
Total FAR 4.0
Avg. Height 100ft.

The ULI panel recommended the creation of a site-specific zoning bonus for building massing that considers UHI mitigation, as the "alternative case" demonstrates. These illustrations indicate how two buildings with identical FAR (but allowing for a higher height) can either ignore or address UHI mitigation strategies.

Credit: ULI Panel

Assessments

Another approach to funding UHI-mitigation measures in Gowanus would be to have the City assess developers, and then use the assessment to provide certain UHI-mitigation investments or add to the Green Infrastructure Fund.

One example of this approach can be found in Chicago, Illinois, where the City of Chicago - through its Open Space Impact Fee - allocates fees that are applied to new residential developments to pay for land acquisition and park improvements in each of Chicago's 77 community areas, with the goal of creating more public open space.

Air Rights and Bonus FAR

The panel also suggested that an FAR pool be created, in which owners or developers would need to comply with

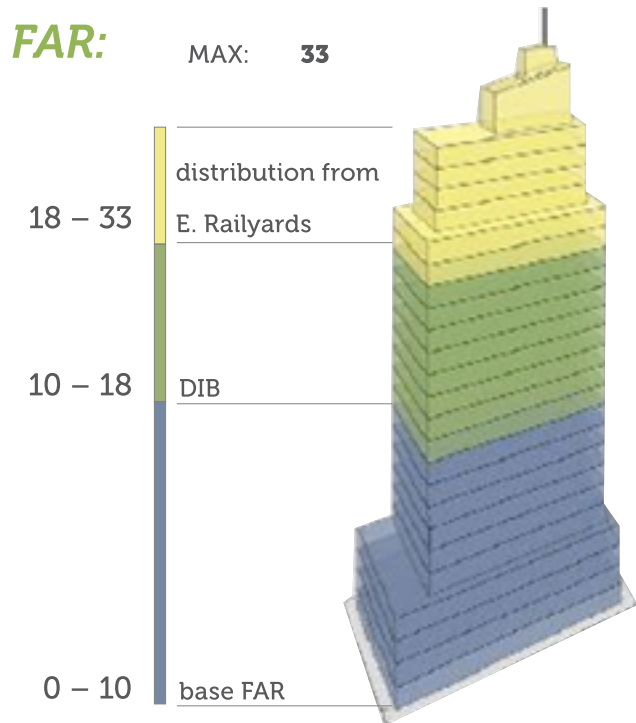
certain requirements (e.g., green infrastructure or other energy efficiency improvements) to purchase additional FAR. Revenue from the sale of this bonus FAR would be directed to the Green Infrastructure Fund. Another potential option could be to capture revenue from the sale of transferrable development rights (TDRs), also known as air rights, as another funding source.

The panel provided an illustrative example that was used in the rezoning of Hudson Yards on the West side of Manhattan, where developers of certain sites can purchase air rights from the MTA's Eastern Rail Yard, or they can receive a zoning bonus upon making a District Improvement Bonus (DIB) payment to the Hudson Yards District Improvement Fund (DIF). These revenues are used by the City to help finance infrastructure improvements in the Hudson Yards Area. The panel suggested that this could serve as a model for Gowanus, with the revenues being directed into the Green Infrastructure Fund.

Illustrative Up-zoning Regime

1 st Tranche	2.0 FAR Base
2 nd Tranche	2.0 FAR from GIB
3 rd Tranche	1.0 Far for Deeper Affordability?

Est. GIB Proceeds
~\$100,000,000



Summary of Short-, Medium-, and Long-Term Urban Heat Island Mitigation Strategies

Urban Heat Island Mitigation: Short-Term Actions (0-3 years)

Action	Party Responsible
Efficiency of Urban Systems: Transportation	
Increase transit service	MTA
Reduce traffic on 3 rd Avenue	NYCDOT
Review parking regs to provide more commercial loading space	NYCDOT
Implement safety improvements at key intersections	NYCDOT
Provide more bicycle parking	NYCHA, NYCDOT, Building owners & developers
Reserve more parking for hybrid vehicles and EV	NYCDOT, Building owners & developers

Urban Heat Island Mitigation: Short-Term Actions (0-3 years)

Action	Party Responsible
Efficiency of Urban Systems: Waste Heat & Construction Materials	
Create incentive programs for retrofitting existing buildings	NYCDEP, NYCDOB, Mayor's Office of Sustainability
Develop design guidelines for efficiency and methods of heat rejection for new buildings	NYCDEP, NYCDOB, Mayor's Office of Sustainability
Form, Layout and Vegetative Cover	
"Vining" of industrial and other walls – existing buildings	Building owners, NYC Small Business Services
"Vining" of industrial and other walls – new buildings	Building developers and owners
Implement cool roofs	NYC Small Business Services

Urban Heat Island Mitigation: Short-Term Actions (0-3 years)

Action	Party Responsible
Financing and Implementation	
Use Health Impact Framework to inform design and development decisions and consider Urban Heat Island	NYCDCP, NYCDOH, other parties involved in design and development process
Enact Gowanus Rezoning with Special Zoning District including Green Infrastructure Bonus	NYCDCP
Reboot Green Infrastructure Fund	NYCDEP
Amend CEQR process to address Urban Heat Island	Mayor's Office of Sustainability

Urban Heat Island Mitigation: Medium-Term Actions (3-7 years)

Action	Party Responsible
Efficiency of Urban Systems: Transportation	
Increase transit connectivity	MTA
Reduce traffic impacts re: rezoning including providing parking maximums, design for land use mix, provide incentives for low-emission fleets, redesign 3rd Ave	NYC DCP, NYCT DOT
Efficiency of Urban Systems: Waste Heat & Construction Materials	
Retrofit existing buildings and systems considering heat rejection and the canal	NYCDEP

Urban Heat Island Mitigation: Medium-Term Actions (3-7 years)

Action	Party Responsible
Form, Lay-out and Vegetative Cover	
Implement pop-up park and pop-up nursery	NYCDEP, NYCDPR
Implement "Paths of Respite"	NYCDOT, NYCDPR, Building developers & owners
Implement bioswales Establish training program for urban forestry/ green infrastructure maintenance	NYCDEP, NYCDPR, NYCDOT
Financing & Implementation	
Administer Green Infrastructure Fund	NYCDEP
Monitor and Implement Development Projects	NYCDOB, Building Developer and Owners

Urban Heat Island Mitigation: Medium-Term Actions (3-7 years)

Action	Party Responsible
Financing & Implementation	
Administer Green Infrastructure Fund	NYCDEP
Monitor and Implement Development Projects	NYCDOB, Building Developer and Owners

Urban Heat Island Mitigation: Long-Term Actions (7+ years)

Action	Party Responsible
Efficiency of Urban Systems: Transportation	
Increase transit connectivity, including canal-based transit	MTA
Implement pedestrian improvements such as a pedestrian bridge	NYCDOT, Army Corps, potentially with private sector contributions
Consider new pavement designs and materials	NYCDOT
Efficiency of Urban Systems: Waste Heat & Construction Materials	
Coordinate different building owners into centralized heat and cooling network	NYCDEP, Building owners

Urban Heat Island Mitigation: Long-Term Actions (7+ years)

Action	Party Responsible
Form, Lay-out & Vegetative Cover	
Transition pop-up park to permanent park recreation facility	NYCDPR
Connect street network into Gowanus public way	GCC, NYCDCP, NYCDOT
Ensure proper maintenance for street trees	NYCDPR, private entities, community groups

Conclusion

Gowanus, Brooklyn is a rapidly-changing neighborhood, home to diverse and rooted communities, including many New York City Housing Authority residents. Well-known as the home of New York City's first Superfund site, the neighborhood also has other environmental challenges beyond contamination. Notably, it is amongst the most at-risk communities in New York City to Urban Heat Island (UHI) effect, the phenomenon of urbanized areas having higher temperatures than surrounding areas. UHI leads to many health impacts particularly for at-risk populations, such as children and the elderly, and low-income households who may lack air conditioning. The Fifth Avenue Committee (FAC), a leading Brooklyn-based community organization, invited the ULI New York TAP to study how UHI could impact Gowanus and

what tools could be used to mitigate UHI and improve the local environment, health and quality of life.

Gowanus is also very likely to see increased density and development in upcoming years, due to a likely rezoning through Mayor Bill de Blasio's PLACES initiative. This rezoning presents an opportunity to leverage the potentially tremendous real estate value created to proactively address Urban Heat Island risk and incorporate strategies for mitigation. Approaching the rezoning with proposals for specific tools and investments to mitigate UHI – which are outlined in this report – could improve the likelihood of implementation of such measures and, as a result, have a meaningful, positive impact on the neighborhood level.

Appendix

"Climate Change and Extreme Heat: What You Can Do to Prepare," October 2016, U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention
<https://www.cdc.gov/climateandhealth/pubs/extreme-heat-guidebook.pdf>

"Heat Wave Was a Factor in 140 Deaths, New York Says," November 16, 2006, New York Times
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http://www.nyc.gov/html/planyc2030/downloads/pdf/npcc_climate_risk_information_2013_report.pdf

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<http://www1.nyc.gov/office-of-the-mayor/news/411-17/mayor-program-help-curb-effects-extreme-summer-heat>

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