

EXHIBIT A-EXECUTIVE SUMMARY CITY OF NEW ORLEANS

< [ExhibitAExecSummary.pdf](#) >



New Orleans is a coastal city founded on deltaic soils that has provided opportunity for generations of families. The city's location between the Gulf of Mexico and the Mississippi River is of strategic economic and cultural importance to the nation (*Att.EGraphics.pdf*, page 230, <http://bit.ly/1k4bqkr>).

The identity of the city is defined by water. The city was founded in 1718 because of its site as an accessible portage through marshlands between the Mississippi River and Lake Pontchartrain—an estuary connected to the Gulf of Mexico. New Orleans is still a city of three distinct waterfronts—the river, the lake, and the coastal wetlands that make up a third of the city's land area—and each is essential to the city's economy, ecology, safety, and culture (*Att.EGraphics.pdf*, page 230, <http://bit.ly/1k4bqkr>).

For the first two centuries of the city's existence, development was constrained to higher elevations, nestled against the river and on the natural ridges that traverse the landscape (*Att.EGraphics.pdf*, pages 232 and 240, <http://bit.ly/1k4bqkr>). When constructed in the early 20th century, canals and the pumping technology that supported them revolutionized drainage and sanitation in New Orleans and provided a model for the rest of the world (*Att.EGraphics.pdf*, pages 236-238, <http://bit.ly/1k4bqkr>). This new technology also created newly drained land for development in low-lying former cypress swamps.

The pumps and canals that drained the swamps and made possible the postwar American Dream of homeownership for many New Orleanians worked to dry the delta soils underfoot and accelerate subsidence throughout the city (*Att.EGraphics.pdf*, page 241, <http://bit.ly/1k4bqkr>). This subsidence, the compacting and sinking of soils, is most acute in low-lying neighborhoods and disproportionately impacts low income areas and communities of color (*Att.EGraphics.pdf*, page 246, <http://bit.ly/1k4bqkr>).

New Orleans shares with the overall region the physical risks of subsidence, coastal flooding, flooding from intense rainfall events (*Att.EGraphics.pdf*, pages 242-243, <http://bit.ly/1k4bqkr>), and loss of power and damage from high-speed wind events. These shocks are exacerbated by the physical stresses of coastal erosion and sea level rise which compound the risk of coastal storm surge (*Att.EGraphics.pdf*, page 235, <http://bit.ly/1k4bqkr>). However, New Orleans' resilience needs differ from much of the region in that its social stresses are more extreme. This raises the importance of connecting New Orleans' physical resilience with its social resilience by focusing on how flood risk is a matter of environmental justice and how the economic growth potential of physical adaptation can be a driver for building

income equality and employment opportunity.

Building off of the work of the city's recently released resilience strategy for the city, *Resilient New Orleans: Strategic actions to shape our future city*, as well as a decade of recovery and resilience planning (*Att.EGraphics.pdf*, page 228, <http://bit.ly/1k4bqkr>), the New Orleans approach is grounded in the belief that the positive transformation of urban social and physical networks is indelibly linked to local geography and history as a delta city. Future outcomes of improved quality of life, economic prosperity, and reduced disaster risk, particularly for vulnerable communities, will be realized through a multi-faceted and integrated approach for *Reshaping the Urban Delta* represented in the following four proposed initiatives:

1. Urban Water – transforming water from a threat into an asset in the public realm; (*Att.EGraphics.pdf*, pages 260-274 and 282-283, <http://bit.ly/1k4bqkr>)
2. Community Adaptation – adapting private property for stormwater management; (*Att.EGraphics.pdf*, pages 275-276, <http://bit.ly/1k4bqkr>)
3. Reliable Energy and Smart Systems – enhancing grid reliability and asset monitoring; (*Att.EGraphics.pdf*, pages 277-278, <http://bit.ly/1k4bqkr>)
4. Coastal Restoration – supporting coastal protection and restoration projects. (*Att.EGraphics.pdf*, pages 279-280, <http://bit.ly/1k4bqkr>)

The proposed projects begin to adapt the human environment to harmonize with the changing natural environment—transforming those areas of risk into landscapes of opportunity at various scales: region, city, district, and neighborhood (*Att.EGraphics.pdf*, page 229, <http://bit.ly/1k4bqkr>).

Adapting to a changing environment is no small task—it requires significant and integrated infrastructure investments and generational change. It is therefore critical to focus the investments possible today so as to have a transformative impact and set a replicable precedent for the investments of tomorrow. In order to develop a network of integrated solutions to social and environmental challenges, the City is geographically focusing the implementation of resilience-building activities at the scale of the

district (*Att. EGraphics.pdf*, page 254, <http://bit.ly/1k4bqkr>).

New Orleans is requesting NDR funds to implement the city's first ever Resilience District in Gentilly (*Att. EGraphics.pdf*, pages 255-259, <http://bit.ly/1k4bqkr>). The area is a prime example of 20th century urban expansion into drained cypress swamps. In many ways, Gentilly is a microcosm of New Orleans and the greater region. Its history as a place of opportunity for low- and moderate-income households and people of color, combined with its elevated environmental risks, make it an ideal place to combine interventions that build equity, reduce risk, and adapt the city to its natural environment.

The City of New Orleans is committed to working with community partners to foster widespread public engagement that facilitates community education, empowerment, and behavioral adaptation to help create a social commitment to resilience and “living with water” that is long lasting.

The four initiatives proposed within this application address the core goals of the competition—they leverage one another to realize long-term improvements in physical adaptation, economic opportunity, and social cohesion, while addressing the unmet recovery needs of the Qualifying Disaster. Together, decisive and collective action on Urban Water, Community Adaptation, Reliable Energy and Smart Systems, and Coastal Restoration will assist our most vulnerable communities to meet critical challenges around flood risk, climate change, energy interruptions, and economic wellbeing at the household, district, and citywide levels while also providing a replicable template for other districts and cities.

Attachment E: Maps and Graphics can be accessed at this link: <http://bit.ly/1k4bqkr>



**EXHIBIT B - THRESHOLD REQUIREMENTS
CITY OF NEW ORLEANS**

< ExhibitBThreshold.pdf >

Eligible Applicant – The City of New Orleans is the eligible applicant in accordance with the Program NOFA Section III.A and has been invited by HUD to apply for NDR funding in Phase 2. This is the only application from the City.

Proposed Partners to coordinate with the City to carry-out NDR projects include: New Orleans Redevelopment Authority, Sewerage and Water Board, Deltares, The Trust for Public Land and Waggoner and Ball Architects.

Resolution of Civil Rights Matters – The City of New Orleans’ city attorney has confirmed that the City does not have any of the following pending resolutions: charges, cause determination, lawsuits or letters of findings.

Eligible County - In accordance with the Program NOFA Section III.A, the City of New Orleans, which shares the same geographic boundaries and political oversight as Orleans Parish (County), is the eligible applicant. Hurricane Isaac in 2012 is the presidentially declared disaster.

Most Impacted and Distressed Target Area - In accordance with Appendix B of the NOFA, HUD has defined the MID target area as Orleans Parish. Several of the activities will benefit the entire MID area. In addition, within the MID area many of the proposed activities will primarily benefit stakeholders in a sub-area more thoroughly described in Exhibit E. As described in Phase 1 and in Exhibit D, the Parish (City) has remaining unmet recovery needs (URN) related to coastal erosion, energy supply and water management. Documentation and examples of the needs in these categories was provided in the Phase 1 application and links to the same are provided in Attachment I, MID-URN checklist, page 290. Updated information about the extent of the City’s and sub-area’s unmet recovery needs can be found in Exhibit D.

Eligible Activity – All proposed activities for NDR funding will be eligible in accordance with one of the activities listed at 24 CFR 570, subpart C and with the NOFA, Appendix A.

Resilience Incorporated – As described and documented in Exhibit G, the City of New Orleans and its partners have demonstrated the commitment to resilience through permanent actions, including recently

completed projects and ongoing programs such as the Office of Resilience and Sustainability and the Regional Planning Commission's sub-committee on Resilience.

Meet a National Objective - Each activity, other than general admin and planning, proposed with CDBG-NDR assistance will meet a CDBG-NDR national objective of Urgent Need or Benefit to LMI Persons or Households.

Overall Benefit - The City of New Orleans will ensure that at least 50 percent of the final CDBG-NDR award will benefit low-and moderate income persons.

Establish a Tie-Back- All activities proposed by the City of New Orleans with CDBG-NDR funding tie-back to the Qualified Disaster, Hurricane Isaac, by addressing demonstrated unmet recovery or resilience need. More details about how the activities "tie-back" are provided in Exhibit D.

Benefit-Cost Analysis (BCA) - The BCA for all Covered Projects, is provided in <http://bit.ly/1PNKDGt>

Applicant Certifications - City of New Orleans' application certifications are provided in Attachment C.

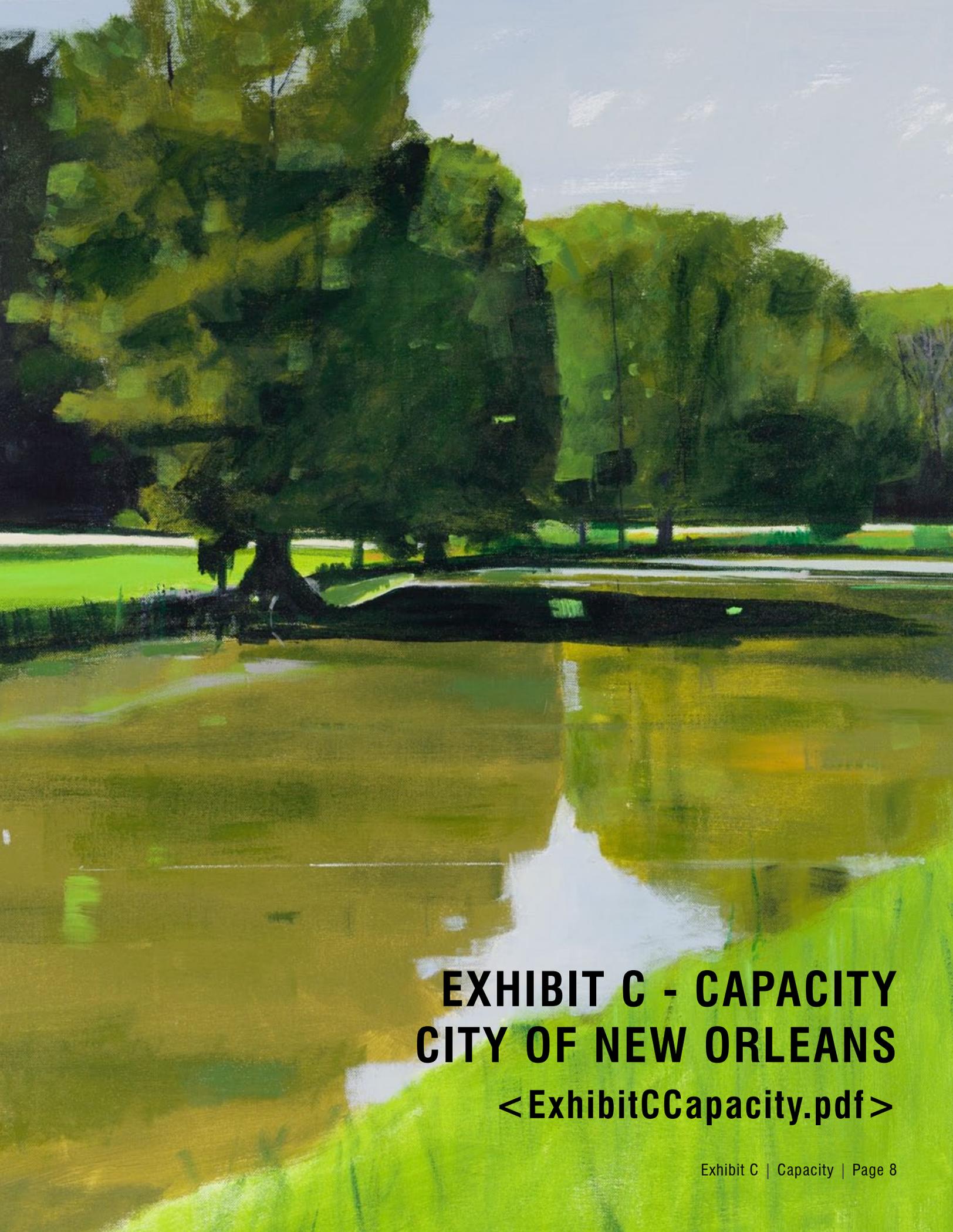
A painting of a large, leafy tree in shades of green and yellow, reflected in a body of water. The water is a mix of green and brown tones, with the tree's reflection clearly visible. The background shows more trees and a light sky.

EXHIBIT C - CAPACITY CITY OF NEW ORLEANS

<ExhibitCCapacity.pdf>

Past Experience. The City of New Orleans has demonstrated its extensive capacity to manage large-scale disaster recovery projects with federal funds and to invest strategically to build regional resilience and transform the city’s neighborhoods. New Orleans is not simply using recovery funds to rebuild housing, hospitals, facilities, and streets, but to transform historically underserved and low-income communities into places of opportunity and vitality. New Orleans proposes to build upon this success with an NDRC award, leveraging existing recovery funds to bring about outcomes that go beyond rebuilding the past to make an investment in New Orleans’ future.

While the rebuilt roads, homes, and businesses represent significant *outputs* created by New Orleans’ disaster recovery funds, the *outcomes* of these investments are the most vital results. By building storm-resilient, high-quality, energy-efficient housing in neighborhoods that suffered poor housing standards for decades, New Orleans has raised the standards of living for low-income communities. By adding bike lanes and improved pedestrian features to street rebuilding projects, New Orleans has increased mobility. By incentivizing fresh food retailers to establish locations in neighborhoods that have been underserved for 50 years, New Orleans has brought healthy food to many underserved communities. These outcomes contribute to both the physical and social dimensions of building city resilience. New Orleans continues to monitor these outcomes and their associated benefits to public health, neighborhood satisfaction, and household stability.

The following examples demonstrate New Orleans’ capacity to deliver transformative projects with multiple benefits using federal funds that convert the urban landscape of risk and disinvestment to one of safety and opportunity.

Resilience and Sustainability. In December 2013, New Orleans was selected as one of the first 32 cities for the Rockefeller Foundation’s 100 Resilient Cities Challenge after an intense application and review process. In partnership with the Rockefeller Foundation, the City hosted its Agenda Setting Workshop for building city resilience in February 2014. This facilitated workshop with invited stakeholders from across sectors was tasked with defining the resilience challenges facing New Orleans as a foundation for further research and planning. As a pilot city for defining resilience, the City participated in the *Perspectives on City Resilience* project sponsored by the Rockefeller Foundation and conducted by

Arup. This report, completed in March 2014, further helped to define the city's challenges which were analyzed and catalogued in the City's *Preliminary Resilience Assessment* published in June 2015.

In November 2014, Mayor Landrieu appointed the City's first Chief Resilience Officer and quickly assembled a team to develop a strategy for the future resilience of the city. Also in November 2014, New Orleans was the site of the inaugural Chief Resilience Officer Summit, where the city had the opportunity to showcase its progress toward resilience along with the challenges that remain. From December 2014 to July 2015, the City, in collaboration with other non-profit partners and community organizations, engaged over 350 stakeholders in developing a set of actions and recommendations to guide the city's resilience building activities (*Att.EGraphics.pdf*, page 251, <http://bit.ly/1k4bqkr>). In August 2015, New Orleans launched the first city resilience strategy in the world—a model for other cities to look to as they work toward identifying shocks and stresses of their own and opportunities to address them through strategic and visionary actions with multiple benefits. The strategy, *Resilient New Orleans*, is a foundation of this NDRC application.

In September 2015, the Mayor's Office of Resilience and Sustainability was formed to provide a central unit from which the City is managing the coordination of resilience-building activities across departments and agencies.

Capital Projects and Public Works. New Orleans is carrying out an unprecedented program of rebuilding public facilities to serve as community anchors, stimulate private investment, enhance economic development, and elevate quality of life and safety for residents. In 2014, the City completed 23 priority facilities with a total investment of over \$88.8 million. Since May 2010, the City has completed 136 capital improvement projects across New Orleans totaling \$223 million. Highlights include new fire and police stations, community centers, and parks and recreation facilities in underserved neighborhoods. New Orleans has invested over \$450 million in HUD disaster recovery funds, leveraged with FEMA Public Assistance funds, to create much greater benefits.

In 2014, the City also completed 60 roadway projects with a total funding investment of over \$47 million. This work resulted in over 24 miles of newly paved streets and an additional 14 miles of bike

lanes. Likewise, the Sewerage and Water Board of New Orleans (SWBNO) is currently implementing a \$3.3 billion capital improvement program comprised of over 600 projects that will create 25,000 construction jobs across the city. Through various revenue sources including rate fees and bonds, SWBNO's capital improvement program is fully funded for the first time in 25 years. This work is being paired with the U.S. Army Corps of Engineers' \$1.7 billion Southeast Louisiana Urban Flood Control Project to improve drainage and the City's \$1 billion recovery program repairing public facilities and streets to create one of the largest infrastructure improvement efforts in the history of New Orleans.

This extensive capital projects rebuilding campaign demonstrates New Orleans' capacity to plan and execute in collaboration with a diverse set of stakeholders. Each project is shaped through multiple stakeholder meetings and public hearings throughout the design process. New Orleans often adjusts its project designs in response to feedback from stakeholders, which often results in better design and creates compromises between competing interests. New Orleans has developed user-friendly tools such as roadwork.nola.gov to keep residents informed of the public project schedule and progress.

Housing and Economic Development. New Orleans is taking a comprehensive approach to rebuilding storm-impacted communities, transforming disinvested neighborhoods to places of opportunity with high-quality affordable housing and commercial amenities along small business corridors. Many low- and moderate-income households now have access to better housing and services. New Orleans partnered with HUD and a coalition of local housing and homelessness organizations to become the first major U.S. city to house all homeless veterans—one year ahead of schedule. The City of New Orleans and the Housing Authority of New Orleans (HANO) are working with private developers McCormick Baron Salazar and HRI, the nonprofit community services organization Urban Strategies, the Recovery School District, and Iberville public housing residents to implement a \$30.5 million Choice Neighborhood Initiative grant award to transform the Iberville public housing development and revitalize the historic Tremé neighborhood. The City's Soft-Second Mortgage Financing Program successfully invested \$52 million in CDBG-DR funds to help over 800 homebuyers purchase their first home. The City's Fresh Food Retailer Initiative, in partnership with The Food Trust, incentivizes grocers to locate new stores in food deserts, providing fresh food options where none have existed for

decades. Lastly, New Orleans created the New Orleans Business Alliance, a public-private partnership to encourage business attraction, retention, and expansion. *Prosperity NOLA*, the Business Alliance’s plan for economic development, aligns with the city’s resilience strategy, making “Equity as a Growth Strategy” a key principle.

Workforce Development. To advance our city’s social resilience, New Orleans created the Network for Economic Opportunity. An outgrowth of a HUD-DOT-EPA Sustainable Communities Planning Grant, The Network for Economic Opportunity (the Network) focuses on connecting disadvantaged job seekers and businesses to opportunities. Since launching in 2014, the Network’s key initiatives have included opportunity centers where workforce development organizations provide foundational skill development, case management, and supportive services; policy improvements such as strengthening enforcement and compliance with the disadvantaged business enterprise (DBE) and Section 3 programs and executing a local hiring initiative to employ residents; and sector-specific job training to increase opportunities through partnerships with large employers and projects including the new airport terminal, new hospitals, and the Sewerage and Water Board of New Orleans. The proposed NDRC projects will leverage this capacity to connect unemployed and at-risk jobseekers to the opportunities created by the funded projects.

The Network was born from one of the most complex and comprehensive community engagement processes with a diverse group of stakeholders the City of New Orleans has undertaken since the post-Katrina recovery planning efforts. The process demonstrated how government priorities can be re-aligned to match community priorities through thoughtful engagement. The original scope of the planning project was to examine the feasibility and economic opportunity of taking down an elevated highway that runs through historic African-American neighborhoods. The highway exacerbated disinvestment when it was built in the 1970s and its removal was imagined to have the power to reverse this effect. However, through extensive engagement, much of it led by residents, the project focus was re-prioritized from focusing on the physical environment to the social environment, especially to the employment needs of the residents.

General Administrative Capacity. In 2012, the City of New Orleans determined that it could more

efficiently and effectively manage the city's recovery and the over \$400 million in CDBG-DR funding if the Project and Fiscal Management functions were performed by City employees rather than by consultants. Through collaboration with the City's Civil Service Commission, 99 positions were created, including Documentation Specialists, Project Managers, Financial Analysts, and Schedulers. The City has created a specialized workforce that not only is skilled in project management but also thoroughly engaged and knowledgeable about the federal grant administration requirements for both FEMA and HUD.

The City of New Orleans has implemented an extensive Capital Recovery Plan which is executed by the Capital Projects Administration and the Department of Public Works (DPW) Engineering Division. Through a cooperative endeavor agreement (CEA), DPW and the Sewerage and Water Board of New Orleans (SWBNO) coordinate on the construction of all work that involves extensive rehabilitation of a street requiring the replacement of water, sewer, or drain lines. The CEA permits either DPW or SWBNO to perform work on behalf of the other entity for FEMA, state, or locally funded projects. The Project Delivery Unit is responsible for the management of the capital and infrastructure budget.

The Capital Projects Administration is responsible for managing facilities projects from the conceptual and design phases, through permitting and estimates, bidding, construction, and final occupancy. The projects vary in scope and size to cover the rehabilitation and/or construction of various City facilities, including community centers, fire and police facilities, recreational parks, pools, stadiums, libraries, and courthouses. Since 2012, the Capital Projects Administration portfolio has increased from 122 projects valued at \$360 million to 245 projects valued at \$519 million.

The Department of Public Works Engineering Division provides engineering, technical, and administrative services for planning, developing, and executing capital improvement projects involving the city's major and minor streets and off-system bridges. Since 2012, the DPW portfolio of capital projects has increased from 169 projects valued at \$312 million to 387 projects valued at \$1.1 billion. The projects range from bridges and streetscapes, bikeways and road reconstruction, to stormwater management and green infrastructure.

The Sewerage and Water Board of New Orleans (SWBNO) Engineering Division provides engineering, technical, and administrative services for planning, developing, and executing sewer, water, and drainage infrastructure systems in conjunction with the Department of Public Works major and minor streets capital improvement program. This division also provides engineering and technical services for SWBNO utility infrastructure facilities such as drainage and sewage pumping stations, water and wastewater treatment plants, large drainage canals, the electrical infrastructure system, and a major power plant. The SWBNO ten-year capital improvement plan for water, sewer, and drainage infrastructure systems is valued at \$2.6 billion.

The Project Delivery Unit (PDU) is responsible for managing all accounting and processing of financial transactions, contract and procurement routing, document controls, cost controls, external reporting, and scheduling for all construction projects in the Capital and Infrastructure budget. The PDU oversees the administration, reimbursement, and closeout for disaster and FEMA HMGP funds. Since 2012, the City's Capital Budget has increased from \$844 million to \$1.9 billion. Over the past two years, New Orleans has significantly increased efforts to focus on grant closeout. The City has successfully closed 30 of the 101 CDBG-DR Katrina projects and 849 of the 1,151 FEMA projects.

Technical Capacity. In July 2015, in anticipation of Phase II of the National Disaster Resilience Competition and to carry out integrated water management projects with FEMA Hazard Mitigation Grant Program (HMGP) funding, New Orleans substantially increased its technical capacity by selecting six teams of architecture and engineering firms through a request for qualifications. As New Orleans selects projects for implementation, the six pre-qualified firms are invited to submit responses to a request for proposals specific to each project. The six firms each carry substantial experience with designing green infrastructure projects and include technical expertise in hydraulic and hydrologic modeling, civil engineering, cost estimating, soil science, coastal science, disaster recovery, landscape architecture and urbanism, urban design, construction administration, and public engagement. The firms include Waggonner and Ball Architects, Stantec, Moffat and Nichols, CDM Smith, Spackman Mossop Michaels, and Meyer Engineers. Three firms already under contract to design HMGP projects, Waggonner and Ball, Stantec, and Moffat and Nichols, have begun to design these projects with the

enhanced features to be supported with NDR funds and will have their contracts amended to reflect this additional scope and funding if funds are awarded.

Community Engagement Capacity. For the development of integrated water management and resilience projects, community engagement is core to New Orleans' mission and will be integral to project development rather than just a step in the process. Over the course of the past decade, community capacity has grown and highly knowledgeable and passionate neighbors have emerged as ambassadors for more resilient systems and practices. In the development of this application, New Orleans hosted discussions with community members most affected by the proposed NDR projects to build awareness of water management challenges and gather input on innovative strategies to reach their friends, families, and neighbors. New Orleans used the input shared by participants to develop a more creative and inclusive approach. New Orleans invited this input from community members during a day of engagement in the focus for this application that included a tour of important water features such as canals, pumping stations, bayous, and demonstration projects and featured a lunch discussion at one of the potential project sites, Mirabeau Gardens (*Att. EGraphics.pdf*, page 253, <http://bit.ly/1k4bqkr>). The robust and creative community engagement process New Orleans proposes to use in carrying out NDR projects is further described in Exhibit E, Soundness of Approach.

To reach a broader community, the City will partner with the numerous non-profit and community-based organizations that are playing an active role in environmental awareness, education, and research. Since 2014, many of these grassroots organizations are supported by grants from SWBNO to build community awareness and demonstration projects around water and the environment. New Orleans will coordinate with local universities and schools that have integrated resilience into their curriculum, environmental and community-based non-profit organizations that carry out neighborhood-scale projects, and industry organizations that represent businesses active in the design, construction, and maintenance of integrated water management projects.

Building on a decade of unprecedented citizen involvement in recovery planning, the City created the Office of Neighborhood Engagement (ONE) to manage and organize the multi-faceted activities of engagement between the City's many departments and its citizens. Community engagement will

be integrated into the project delivery system for New Orleans' NDR-funded projects, led by the professionals at ONE. ONE uses informal gatherings as well as formal, quarterly summits to stay engaged with citizens and community leaders. ONE staff also attend neighborhood and civic association meetings throughout the city. ONE gives special attention to communities where language or cultural barriers could impede full participation, such as the Latino and Vietnamese communities, and is dedicated to overcoming hurdles that diminish involvement. ONE holds quarterly summits and monthly trainings for grassroots community leaders and has developed strong, trusting relationships with both formal and informal neighborhood leaders. ONE developed a participation plan with specific processes for the Department of Public Works to carry out proactive engagement around infrastructure projects, to bridge the department's statutory and technical duties with community engagement.

In the past year, New Orleans has taken additional steps to develop more capacity on community engagement. Recognizing the need for deep and sustained community engagement on issues of resilience, New Orleans applied for and was one of 10 cities in the country selected for the Resilience AmeriCorps program. Two AmeriCorps VISTAs will work with the Chief Resilience Officer and the staff in the Office of Resilience and Sustainability to focus entirely on community engagement around the shared risks and opportunities New Orleans' neighborhoods face. In addition, New Orleans developed an animated video for community education and awareness, supported by CDBG-DR funds, describing how integrated water management can be used to reduce flood risk and improve water quality.

Regional Coordination Capacity. The City of New Orleans recognizes that its resilience challenges are inextricably linked to the other jurisdictions in the region that share the same ecosystems, workforce, and infrastructure. New Orleans led the effort, as a member of the board of the Regional Planning Commission (RPC) the metropolitan planning organization for the New Orleans region, to create a regional Resilience Committee to integrate resilience thinking across neighboring jurisdictions into the existing work of economic development, environmental planning, and transportation planning in greater New Orleans. The Committee was established on October 13, 2015 and will serve as a key forum for all eight member parishes to convene and discuss the implementation of projects that build the region's

resilience, with a focus on critical services such as flood protection, stormwater management, and energy infrastructure (Att.DConsultation.pdf, page 216). By creating a more resilient region, which includes other NDRC applicants St. Tammany Parish, Jefferson Parish, and, within the State of Louisiana’s application, St. John the Baptist Parish and Plaquemines Parish, the committee will contribute to the region’s growth, prosperity, and sustainability. New Orleans’ approach to building resilience works within the framework developed by the State of Louisiana for its NDRC application whereby New Orleans will “retrofit” existing infrastructure, “reshape” many underutilized assets, and receive fellow Louisianans in their future “resettlement” from outside the levee protection system.

As a coastal city, New Orleans has also begun to play a larger role in supporting the implementation of the State of Louisiana’s *Comprehensive Master Plan for a Sustainable Coast* (Coastal Master Plan). In fact, New Orleans’ physical adaptation through urban water management and property interventions and preparation for the risks of climate change *is* the city’s component of the Coastal Master Plan. The Coastal Master Plan is the comprehensive approach to protecting and restoring the coast—its environment, its people, its industries, and its culture. The five-year, \$50 billion plan, managed by the Louisiana Coastal Protection and Restoration Authority (CPRA), includes hundreds of projects that use a “multiple lines of defense” approach. Marsh restoration reduces storm surge and protects vital ecosystems, earthen levees and concrete floodwalls hold back storm surge, and diversions of river water carrying sediment to replenish subsided wetlands. These interventions are all referred to by the plan as “structural” flood mitigation strategies. The lines of defense continue inside the flood protection system with the “non-structural” components that include acquisitions of property to remove households from flood risk, elevating homes and businesses, and flood-proofing structures by hardening building envelopes and raising equipment above the flood plain (Att.EGraphics.pdf, page 235, <http://bit.ly/1k4bqkr>). These are the urban adaptation strategies New Orleans intends to implement. As the CPRA prepares the 2017 plan update, New Orleans is working closely with its state government counterparts to develop its components.

Another one of New Orleans’ key regional partners is Greater New Orleans, Inc. (GNO, Inc.), which strengthens the region’s economic resilience through business attraction and retention; targeted

research, policy development, and marketing; and maintaining a strong network of regional economic development entities. GNO, Inc. administered the creation of the *Greater New Orleans Urban Water Plan*, a critical foundation to this application, which addresses regional urban water issues in a complementary fashion to the Coastal Master Plan. GNO, Inc. also leads the Coalition for Coastal Resilience and Economy and partners with local universities to provide specialized workforce training for coastal restoration. In addition, New Orleans will continue to lead and participate in the 100 Resilient Cities network, the C40 Cities Climate Leadership Group, the Urban Sustainability Directors Network, and local initiatives such as the Greater New Orleans Urban Water Collaborative, the Louisiana Water Network, and others.

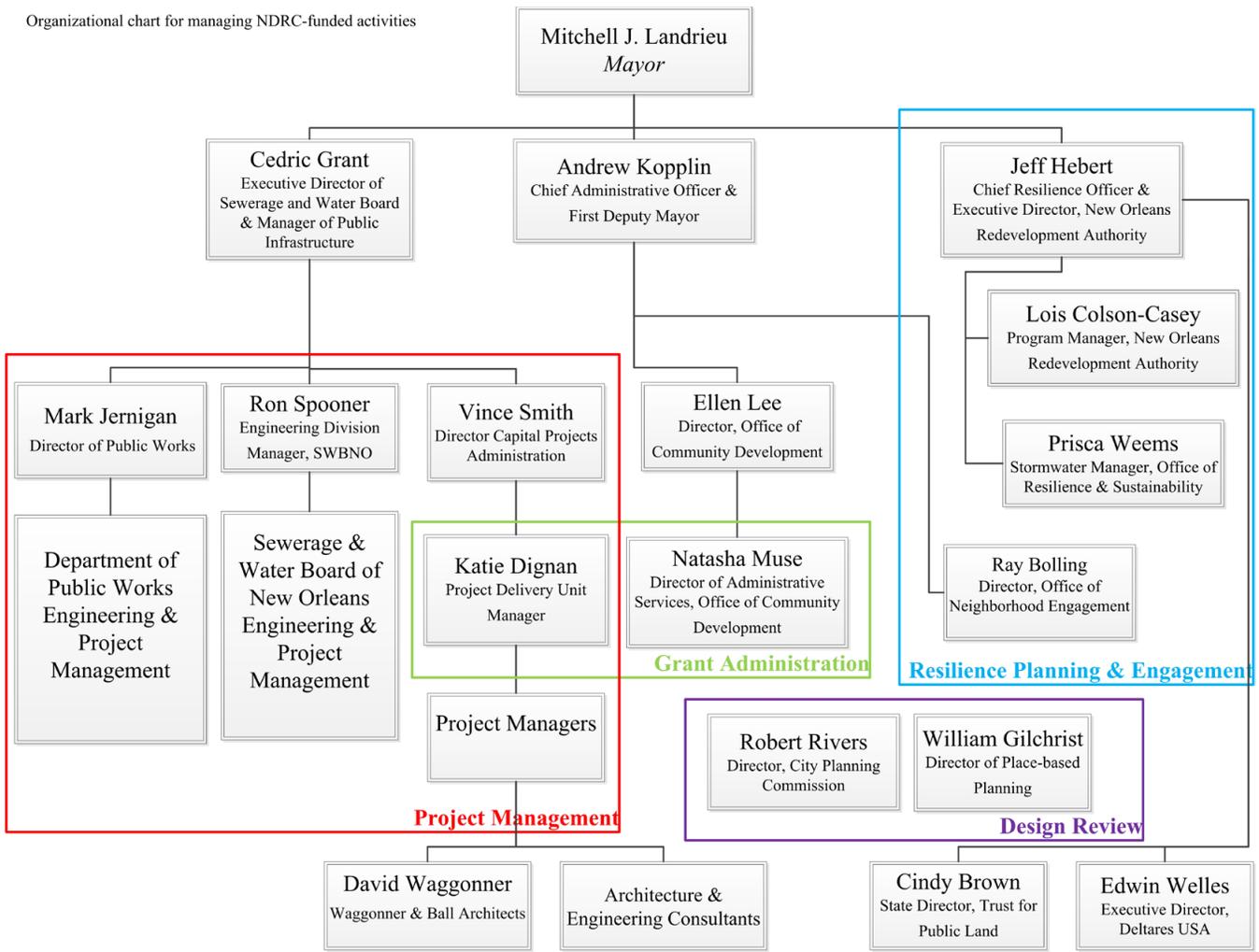
Management Structure. New Orleans has developed a seamless and coordinated structure for the management of federal funds from various sources that leverage one another to carry out the City's project portfolio. The City's Office of Community Development (OCD) manages all HUD funds, and when these funds are used as cost share or leverage to FEMA funds, or when they are employed for capital projects, OCD co-manages the planning, fiscal management, and reporting with the Project Delivery Unit within the Capital Projects Administration. The Capital Projects Administration and the Department of Public Works have been unified with the Sewerage and Water Board of New Orleans (SWBNO) via a cooperative endeavor agreement and co-location of project management staff. This allows New Orleans to deliver projects efficiently, employing the over \$400 million in CDBG-DR funds currently under management. New Orleans has the internal controls to assure quality and to comply with HUD financial and procurement regulations, as defined by 24 CFR 85.20(b)(3). The City's 2014 financial audit for fiscal year 2013 confirmed that HUD funds are under sound management, demonstrating the ability to maintain the highest standards of fiscal responsibility. OCD will coordinate with the Capital Projects Administration to manage the performance of all partners and sub-recipients that use NDR funds to ensure that they are budgeted, expended, and reported on in accordance with HUD guidelines and within the project timeline.

Key Roles and Positions. The following individuals will guide the planning, design, and implementation of projects supported with NDR funds. The role each individual will play in carrying out NDRC-funded

projects follows their title. The working relationships among individuals and departments are further detailed in the organizational chart that follows.

- Cedric S. Grant – Executive Director, Sewerage and Water Board (SWBNO) & Manager of City Infrastructure: *Capital and Infrastructure Management*
 - Katie M. Dignan – Project Delivery Unit Manager: *Capital and Infrastructure Budget and Grant Administration*
 - Mark Jernigan – Director of Public Works: *Project Management Supervision for Department of Public Works*
 - Ron Spooner – Engineer Division Manager Sewerage and Water Board: *Project Management Supervision for Sewerage and Water Board*
 - Vincent Smith – Director Capital Projects Administration: *Project Management Supervision for Facilities*
 - William Gilchrist – Director of Place-based Planning: *Design Review for all projects and coordination with City Planning Commission*
 - Robert Rivers – Director, City Planning Commission: *Design Review for all projects and coordination with Place-based Planning*
- Jeff Hebert – Chief Resilience Officer & Executive Director, New Orleans Redevelopment Authority (NORA): Project design, development, and engagement
 - Prisca Weems – Stormwater Manager, Office of Resilience: *Project design*
 - Lois Colson – Program Manager, NORA: *Program administration*
- Andrew Kopplin – Chief Administrative Officer City of New Orleans:
 - Ellen Lee – Director, Office of Community Development: *HUD Liaison*
 - Natasha Muse – Director of Administrative Services OCD: *Grant Administration*
 - Ray Bolling – Director, Mayor’s Office of Neighborhood Engagement: *Community engagement and awareness building*

Organizational chart for managing NDRC-funded activities



Partner Capacity and Experience.

Sewerage and Water Board of New Orleans (SWBNO). A public agency that owns and operates New Orleans’ potable water supply, drainage system, and sewerage system, SWBNO has recently undertaken a massive \$3.3 billion capital improvement program to repair and upgrade this extensive, aging system along with \$2.5 million dedicated to green infrastructure. A cooperative endeavor agreement between SWBNO and the City of New Orleans’ Department of Public Works (DPW) enables the close coordination of all public works projects through an integrated project management structure. These actions, along with governance enhancements, such as adding groundwater to its charter, have established SWBNO’s comprehensive role in water management.

New Orleans Redevelopment Authority (NORA). A public agency and key partner in the redevelopment

of storm-damaged and underinvested neighborhoods, NORA has returned over 3,000 properties to commerce from the CDBG-DR-funded Road Home buyout program, invested over \$30 million in NSP2 funds to create more than 450 units of affordable housing, and invested \$8.3 million in CDBG-DR funds in catalytic commercial revitalization projects. In combination, these projects have leveraged over \$184.9 million in private investment and created 653 permanent jobs. NORA also owns and maintains a portfolio of more than 2,000 vacant lots across the city, most of which are in low-lying areas with substantial flood risk or areas where the market cannot support development. NORA has been repurposing selected vacant lots for stormwater management, ecological restoration, urban agriculture, and community gathering spaces. NORA is building upon this work of neighborhood reinvestment and green infrastructure as the lead agency for developing the city's resilience strategy and is now creating an implementation framework to guide the multiple public and private actors involved in executing the strategy.

Trust for Public Land. The Trust for Public Land (TPL) is a national leader in creating parks and protecting land for people. Since 1972, TPL has protected more than 3 million acres, completed more than 5,200 park and conservation projects in the United States, and incorporated green infrastructure elements into its urban projects. TPL was instrumental in land acquisition for the Lafitte Greenway and the Orleans Land Bridge, two major resilience-enhancing projects in New Orleans. TPL has already begun to augment the City of New Orleans' capacity by building the Climate-Smart Cities tool for the City (*Att. EGraphics.pdf*, page 247, <http://bit.ly/1k4bqkr>). This GIS platform provides a spatial analysis that can deliver insight into the risks and benefits of implementing green infrastructure projects in relation to vulnerable populations and their associated climate risks of extreme heat, flooding, and mobility.

Deltares. The world's leading research organization for coastal, deltaic cities, Deltares has decades of experience with the technical challenges of soil subsidence, groundwater management, coastal health, and flood protection. Deltares has already raised New Orleans' capacity by consulting through several learning and design exchanges supported by the Royal Netherlands Embassy, called Dutch Dialogues, and through the *Greater New Orleans Urban Water Plan*, the region's blueprint for living with water.

Currently, Deltares is supporting New Orleans on research and strategy through an agreement with the City of New Orleans and SWBNO and as a technical assistance provider through the 100 Resilient Cities program.

Waggonner & Ball Architects. Waggonner & Ball Architects is an architecture and planning firm with more than 30 years' experience. The firm's knowledge and co-creation of holistic resilience strategies has been recognized by the American Institute of Architects Honor Awards and the American Planning Association State and National Excellence Awards. The firm initiated Dutch Dialogues, served as principal authors of the *Greater New Orleans Urban Water Plan*, and provided technical assistance in the development of this application.

The City of New Orleans references are:

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**EXHIBIT D - NEED/EXTENT OF PROBLEM
CITY OF NEW ORLEANS
<ExhibitDNeedExtent.pdf>**

FACTOR 2 – NEED/EXTENT OF THE PROBLEM

New Orleans’ Resilience Challenge. New Orleans faces physical, social, and economic shocks and stresses that require an integrated and comprehensive approach. New Orleans’ Qualifying Disaster, Hurricane Isaac, exposed gaps in the city’s resilience and major risks for vulnerable communities through failures of water and energy infrastructure, environmental degradation, and a subsequently slow recovery.

The entire city of New Orleans, which is coextensive with Orleans Parish, is the NDRC-eligible MID-URN area, though many of the challenges it faces are shared with neighboring jurisdictions, including the physical risks of compacting and sinking soils, coastal flooding, flooding from intense rainfall events, and loss of power and damage from high-speed wind events. These shocks are exacerbated by the physical stresses of coastal erosion and sea level rise, which compound the risk of storm surge from outside the region’s protective levee system. Sinking delta soils, known as subsidence, also exacerbate flood risk from rainfall within the levee system by damaging ground-based infrastructure (*Att. EGraphics.pdf*, page 234, <http://bit.ly/1k4bqkr>). However, New Orleans’ resilience needs differ from much of the region in that its social stresses are more extreme. According to the Data Center, a local data clearinghouse, New Orleans experiences higher rates of crime, concentrated poverty, income inequality, and incarceration than its surrounding jurisdictions. These social stresses make much of New Orleans’ population less capable to prepare, respond, and recover from the shocks they face, multiplying their potential risk, and only reinforcing vulnerabilities to future shocks. This raises the importance of connecting New Orleans’ physical resilience with its social resilience by focusing on flood risk as a matter of environmental justice and the economic growth potential of environmental adaptation as a driver for building income equality and employment opportunity.

Unmet Recovery and Resilience Needs. In Phase I, New Orleans demonstrated unmet recovery need from Hurricane Isaac in infrastructure and environmental degradation (see Attachment I, page 290). The threshold examples are symptomatic of New Orleans’ unmet recovery needs and greatest resilience challenges across the city, including the need for transformative urban water management practices, a sustainable and productive coast, and reliable and smart systems to support the efforts, all while

connecting the most vulnerable to the opportunities of economic growth.

Stormwater Management and Drainage. One of the unmet resilience needs in infrastructure represents a citywide challenge to increase the capacity and effective management of its stormwater to protect the safety and property of its residents. The rain brought by Hurricane Isaac demonstrated how vulnerable the city's aging and antiquated drainage infrastructure is to heavy rainfall even without major infrastructure damage. For more than 100 years, the city's stormwater management system has been based on a gray infrastructure drainage model where all rainfall is collected in more than 60,000 catch basins, conveyed through hundreds of miles of pipes, pumped into canals, and pumped over levees into Lake Pontchartrain as fast as possible (*Att.EGraphics.pdf*, pages 236-239, <http://bit.ly/1k4bqkr>). During Isaac, the city pumps could not keep up and many of the pipes were overwhelmed resulting in major, citywide street flooding (*Att.EGraphics.pdf*, page 242-243, <http://bit.ly/1k4bqkr>). Street flooding is not limited to major storms like Isaac, however. Many neighborhoods, especially in the lowland areas of the city between natural ridges and manmade levees, experience chronic flooding during regular rain events (*Att.EGraphics.pdf*, page 240, <http://bit.ly/1k4bqkr>).

When constructed in the early 20th century, the canals and the pumping technology that supported them revolutionized drainage and sanitation in New Orleans and provided a model for the rest of the world (*Att.EGraphics.pdf*, page 242, <http://bit.ly/1k4bqkr>). They also created newly drained land for development that made possible homeownership for LMI residents in suburban-style areas, including the first subdivision in the city created for African Americans, Pontchartrain Park, which is located within this application's sub-area of focus, the Gentilly Resilience District. However, the city's 20th century drainage system also exemplifies the perils of building single-purpose infrastructure designed to work against, rather than with, natural systems.

The same pumps and canals that made possible the postwar American Dream for many New Orleanians served to destabilize the former cypress swamp's delta soils and accelerate compacting and sinking soils throughout the city. This is most acute in lowland neighborhoods, transforming these areas of former opportunity into landscapes of risk, which disproportionately impact low-income areas and communities of color. The single-purpose infrastructure has also served to divide neighborhoods with concrete

floodwalls, segregating areas of different incomes, races, and residential market strength. The City of New Orleans seeks to transform these landscapes back into areas of opportunity by safely reintroducing water and mitigating the damaging effects of land subsidence.

Subsidence. As the delta soil is constantly pumped dry it shrinks and compacts, causing the soil and everything built upon it to sink—known as subsidence. Professor and geographer Richard Campanella estimates that some parts of New Orleans, particularly in lowland areas like Gentilly, have lost more than eight feet of elevation due to soil subsidence during the 20th century. The conservative estimate of costs resulting from subsidence over the next 50 years was calculated at \$2.1 billion for the *Greater New Orleans Urban Water Plan*, not including major infrastructure effects. These costs can be attributed to the regular maintenance and damage to streets, housing, utilities, and any other infrastructure that is constructed upon the ever-shifting soils (*Att. EGraphics.pdf*, page 241, <http://bit.ly/1k4bqkr>).

The City Stormwater Management Capital Improvements Plan (Drainage Master Plan) estimates the costs of expanding the current system capacity to adequately address citywide flood risk during a 10-year storm using the traditional system of pipes and pumps at an unattainable \$4 billion. The Sewerage and Water Board of New Orleans (SWBNO) pays millions of dollars per year in energy costs to pump stormwater into Lake Pontchartrain and sewage through its treatment systems and into public water bodies. Failure of any components of this system, typically from loss of electric power, results in far greater financial and environmental costs. New Orleans' resilience needs for improved drainage and energy infrastructure touch every corner of the city. This application addresses the unmet recovery need resulting from the fundamental link between water and power.

Energy reliability and interdependent systems. Reliance on pumping as a stormwater management strategy has made New Orleans dependent on reliable energy to protect the safety of residents and neighborhoods, and represents New Orleans' other infrastructure unmet resilience need. The Phase I threshold example of a sewer pumping station damaged by a loss of power from the electrical grid is emblematic of New Orleans' larger resilience needs. Key facilities such as fire and police stations, critical infrastructure such as pumping stations and traffic signals, and vital services such as grocery stores and fueling stations all rely on the electrical grid to function. The cascading effects of a power

failure that lasts for days, as took place during Hurricane Isaac, can result in public health crises and environmental damage and always results in economic losses. The City estimates a loss of \$3 million in sales tax revenue due primarily to the extended energy outage caused by the Qualifying Disaster that prevented commercial activity from resuming.

Even less extreme events can cause emergency situations for New Orleans' power and water systems. During the past five years, a key element of the power generation system that keeps much of the drainage, sewer, and water treatment pumping equipment operating smoothly has experienced outages or surges at least eight times. Because of the dependence on this system for potable water services, those power irregularities have resulted in boil-water advisories for hundreds of thousands of water users.

Coastal Restoration. New Orleans' unmet resilience needs related to environmental degradation are found in the coastal wetlands that make up one third of city's land area and serve as the first line of defense against storm surge. To reduce risk from coastal flooding, the U.S. Army Corps of Engineers built a \$14.5 billion surge protection and pumping system that still only provides protection against a 100-year storm, and the Coastal Master Plan calls for over \$25 billion of the total \$50 billion plan to be spent on coastal restoration simply to *slow* the rate of land loss—not eliminate it. It is estimated that the Louisiana coast loses more than an acre of coastal wetlands every hour and remains one of the most vulnerable areas in the United States to climate change, experiencing the world's greatest relative sea level rise—4.3 feet anticipated by 2100 according to NOAA climate change projections—due to the combination of coastal land loss and global sea level rise (*Att. EGraphics.pdf*, page 235, <http://bit.ly/1k4bqkr>).

Social Resilience Needs. In addition to vulnerabilities related to physical shocks and stresses, New Orleans faces social stresses from high levels of poverty, unemployment, and violence. New Orleans has experienced a post-Katrina economic boom; however, it has not benefited all residents. According to recent research by The Data Center, there is no evidence that the economic gains enjoyed in New Orleans since 2005 have improved poverty and jobless rates of African-American men. The median income of \$25,102 for African-American households is less than half of that for white households in New Orleans. According to the 2013 American Community Survey, 27% of New Orleans residents are

living in poverty—a figure that exceeds 40% for children and 53% for single mothers. Over one third of working age New Orleanians are jobless, and more than half of working age African-American men are jobless.

In addition to economic disparities, there are wide disparities in public health outcomes, including higher rates of heart disease, diabetes, cancer, and homicide for African-American residents compared to white residents, according to a June 2013 report by the City's Health Department.

New Orleans' resilience needs are citywide but the risks they present are borne unevenly across the city. Risk is concentrated in low-lying areas, where flood risk is greatest—both from coastal surge and rainfall flooding—and where rates of subsidence are higher due to the soil composition. This unequal landscape is itself an environmental injustice as it disproportionately affects low-income households and people of color (*Att.EGraphics.pdf*, page 246, <http://bit.ly/1k4bqkr>).

Sub-Area Resilience Needs. While the entire city of New Orleans is identified as the NDRC-eligible MID-URN area, this proposal is primarily focused on the Gentilly Resilience District, a sub-area within the MID-URN, the reasons for which are described in detail in Exhibit E. The Gentilly sub-area of focus presents several unique conditions that demonstrate a concentration of the aforementioned unmet resilience needs and is a priority for building resilience, especially for low- and moderate-income (LMI) households. Situated between ridges that were naturally created thousands of years ago from the river and swamps that originally carved New Orleans' landscape, the sub-area contains neighborhoods that sit between eight feet above sea level to eight feet below sea level. It contains roughly 11,000 households, 64% of which are homeowners. The entire area is 48% LMI, but where over 50% of NDR funds will be invested, in the lowest-lying neighborhoods, the LMI household percentage is 57% (*Att.EGraphics.pdf*, page 245, <http://bit.ly/1k4bqkr>).

Resilience within Recovery. As described above, New Orleans' unmet needs are generally resilience needs. New Orleans recovered quickly by focusing on returning systems to pre-storm conditions but without adaptation to future risks. Best estimates indicate that the city lost \$3 million in sales tax revenue due to the power failure that endured across the city for several days during the Qualifying

Disaster. Local government expended over \$2.25 million partly for repairs to public infrastructure but the majority was spent on personnel that had to be paid while the City was closed for business due to energy failures and flooding. Twenty-two million dollars was expended by FEMA for debris removal, labor, and public infrastructure, which were matched with \$15 million from HUD.

Losses averted through resilience investments. Global reinsurance firm Swiss Re, through a comprehensive 2015 Economics of Climate Adaptation study, has estimated that through nine key resilience-building strategies, the Gulf Coast region could avert more than \$7 billion (2010 USD) in annual expected losses (AEL) by 2030. The City of New Orleans, through this NDRC proposal and other efforts, is directly acting on five of the nine cited resilience-building strategies, including improved building standards, beach nourishment, wetlands restoration, levee protection improvements, and electric grid reliability upgrades. Had the City enacted resilience measures prior to Isaac, the estimated savings would undoubtedly be millions of dollars.

Science-based approach to risk identification. The City of New Orleans' approach to risk assessment is guided by research and analysis conducted with the best available quantitative and qualitative data. For quantitative data on the risks associated with coastal land loss, sea level rise, soil subsidence, and storm frequency, New Orleans utilizes the best data from national and regional sources. National sources include the National Oceanic and Atmospheric Administration (NOAA) Climatic Data Center, U.S. Department of Environmental Protection (EPA), the U.S. Global Change Research Program, and the White House Climate Data Initiative. Local sources include the Coastal Protection and Restoration Authority (CPRA), Louisiana State University Hurricane Center, the Water Institute of the Gulf.

Additionally, in the development of this application, the City of New Orleans worked with expert consulting hydrologists, engineers, landscape architects, and modelers to devise bold, yet practical solutions to complex problems, including the Trust for Public Land to map urban heat island effect and Deltas to accurately calculate urban water assignments and storage capacity (*Att.EGraphics.pdf*, pages 247 and 259, <http://bit.ly/1k4bqkr>). Earlier this year the Sewerage and Water Board of New Orleans contracted with BCG Engineers to convert the USACE HEC-RAS model to SWMM5 and connect it to the City's subsurface drainage model, resulting in a single comprehensive SWMM5 model of the entire

city of New Orleans drainage system. This comprehensive model simulates storm events to predict results in the form of hydrographs. Those hydrographs can then be used to develop overflow maps, showing the extent of flooding to be expected in a hypothetical storm event.

Most Appropriate Approach. This NDRC proposal is a crucial step forward in the ongoing effort to build city and regional resilience, but it is not the capstone. In many ways, the New Orleans approach to building resilience expands the idea of “multiple lines of defense” to beyond its conventional local application to storm and flood risk. For New Orleans, resilience is a matter of survival, requiring all sectors—social, environmental, economic, and others—to problem solve in an integrated and multi-disciplinary way. In August 2015, New Orleans became the first city in the world to release a dedicated resilience strategy to serve as a guide for adaptation and preparation for future shocks and stresses. The strategy, *Resilient New Orleans: Strategic actions to shape our future city*, which can be viewed here <http://resilientnola.org>, outlines many of the most crucial elements of New Orleans’ “Most Appropriate Approach,” including areas of focus across environmental adaptation, social and economic equity, and dynamic city systems.

For example, the City of New Orleans is dedicated to expanding transit service and reliability to connect more residents to opportunity, despite not being directly included in this NDRC proposal. A recent study from Harvard economists highlighted the critical relationship between transportation and social mobility, finding commuting time to be the single strongest factor in predicting income mobility. Many New Orleanians lack reliable and efficient public transportation options to get them to their jobs and schools. The local transit advocacy organization Ride New Orleans found that by the end of 2012, just 36% of pre-Katrina transit service offered by the New Orleans Regional Transit Authority in 2005 had been restored and these service reductions have been worse in areas where transit service is most critical: low-income neighborhoods, communities of color, and areas where people have less access to personal vehicles.

Additionally, the City is dedicated to preserving housing affordability for all. Housing costs are an increasing economic stress for many New Orleanians. Renters in the city now pay on average 35% of their income on rent, up significantly from historical averages of 15% and above what is considered

“affordable” by national measures.

Other issues critical to resilience but not featured in this application include improving mental and behavioral health services, mitigating air and soil pollutants, and pursuing utility-scale reliability and redundancy through renewable generation. The City’s NDRC application reflects this approach to the extent possible but the ineligible NDR components in the Resilience Strategy represent a more complete vision of necessary efforts that the City will pursue outside of NDRC.

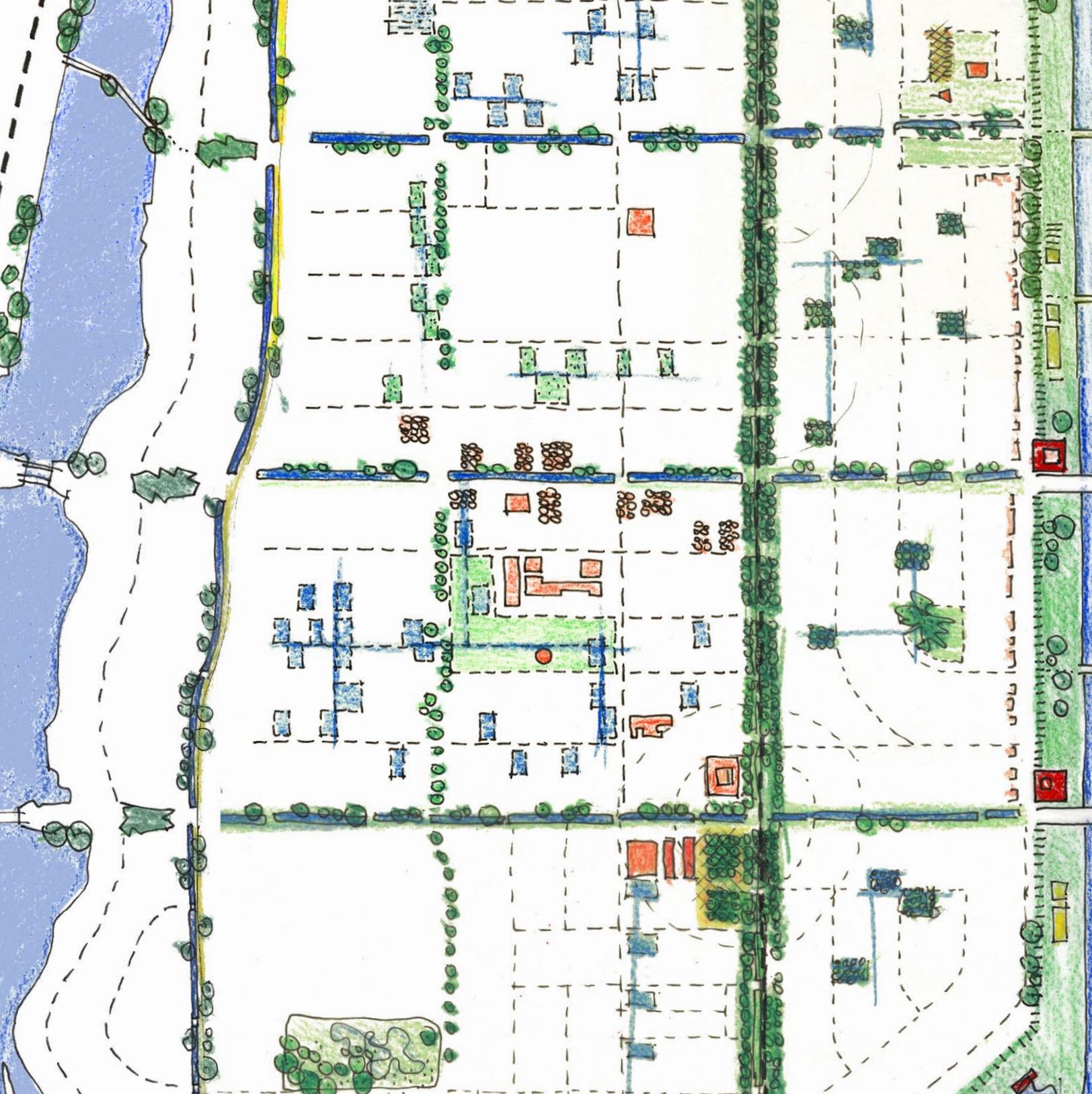


EXHIBIT E - SOUNDNESS OF APPROACH CITY OF NEW ORLEANS

< ExhibitESoundness.pdf >

The New Orleans Approach: Adapting to thrive in the urban delta. The future New Orleans must be a dynamic, equitable, and adaptable city that is responsive to the risks posed by the natural environment and serves the needs of its most vulnerable residents. To realize that vision, New Orleans’ approach connects the development of physical resilience and social resilience, focusing on reducing risk to the city’s most vulnerable populations and increasing income equality and economic growth through investments in adaptation to the future risks of climate change. To achieve these goals, New Orleans will take a series of integrated and strategic actions organized into four focus areas:

- innovative urban water management in the public realm,
- private property owner interventions and adaptation,
- energy grid reliability and smart systems, and
- coastal protection and restoration.

From curb to coast: building resilience at multiple scales. As a coastal city, New Orleans’ approach to building resilience carries across its landscape—from its dense urban core to its suburban-style residential neighborhoods to its wetlands along the Gulf of Mexico—from curb to coast. New Orleans also recognizes that individual and neighborhood action is just as important as major infrastructure interventions, and all scales of action are more effective when implemented in a coordinated and complementary way. Similarly, the city’s resilience requires collaboration between public and private, community, regional, and national actors. The City of New Orleans is seeking to amplify these efforts with the aim of becoming a model for environmental adaptation for other urban areas in South Louisiana and around the nation.

Region. The continent’s largest river, its deltaic plain, and the coastal wetlands tie the Greater New Orleans region together physically and economically. A future coast is critical to the economic infrastructure of the country, as 25% of U.S. waterborne exports are shipped through Louisiana’s five major ports. To protect the coast and the vital economic and environmental benefits they provide, New Orleans is working within the framework of the Coastal Master Plan to address accelerating rates of coastal land loss, with which come a loss of critical hurricane and storm intensity mitigation (*Att.*

EGraphics.pdf, page 235, <http://bit.ly/1k4bqkr>). New Orleans is also building upon the research and vision provided by the *Greater New Orleans Urban Water Plan* which offers a comprehensive approach for adapting urban areas throughout the region to live with water. Since risks and opportunities are not unique to any one jurisdiction in the region, the most effective strategies will only happen through solidarity and deliberate action to work together as a region.

City. As discussed in Factor 2, much of today's urbanized area of New Orleans was marshland less than a century ago (*Att.EGraphics.pdf*, pages 231 and 232, <http://bit.ly/1k4bqkr>). Drained and prepared for suburban-style development in the 20th century, these former cypress swamps became areas of opportunity, especially for African Americans and moderate-income residents, to own property, build homes, open businesses, and establish communities. However, this new landscape also came with compacted and sinking soils, prone to flash flooding and infrastructure failure (*Att.EGraphics.pdf*, page 241-243, <http://bit.ly/1k4bqkr>). These areas of opportunity created by single-function technologies in the lowest-lying land were gradually revealed as landscapes of elevated risk, especially for low- and moderate-income households. Through an integrated approach to water and infrastructure management, paired with programs to encourage individual adaptation and water management career training programs for the city's most vulnerable residents, the City of New Orleans seeks to reverse many of these trends, transforming the lowland landscapes of risk once again into geographies of social and economic opportunity.

At the citywide scale, New Orleans is addressing the confluence of social and environmental challenges with common solutions. As outlined in *Resilient New Orleans: Strategic actions to shape our future city*, the city's groundbreaking resilience strategy released in August 2015, New Orleans is re-imagining how it lives with water, increases equity, and transforms the systems that support the city. This will not only require technical solutions, but behavioral evolution as well. Engaging a broad base of diverse communities in deep and meaningful ways, over time and across cultures, is the only way to achieve this change. Guided by 41 actions outlined in *Resilient New Orleans*, the City, its partner agencies, organizations, and residents are taking steps toward a bold yet achievable vision for a resilient future.

District. Developing physical and social resilience requires both immediate action and generational change. It is therefore critical to focus the investments possible today so as to have a transformative impact and set a replicable precedent for the investments of tomorrow. In order to develop a network of integrated solutions to social and environmental challenges, New Orleans is geographically focusing the implementation of resilience-building activities at the scale of the district.

New Orleans has created six resilience districts across the city based on geographic areas of shared risks and opportunities, rather than arbitrary political or perceived cultural divisions (*Att.EGraphics.pdf*, page 254, <http://bit.ly/1k4bqkr>). Each district is comprised of several neighborhoods, communities, and real estate markets. Watershed and drainage systems, flood risk, social and economic vulnerability, institutional assets, critical services, and community amenities all help determine the place-based focus areas for implementation action.

The district approach compels specific design approaches that address both the threats of flooding and subsidence and the particular needs of each community, such as strengthening the real estate market, improving pedestrian and bicycle safety, creating spaces for social interaction and environmental learning, and increasing public safety. In some cases, activities will be implemented outside the boundaries of the district in order to create the greatest benefits inside. For example, stormwater will need to be retained and stored in areas of slightly higher elevation in order to mitigate flooding in lowland neighborhoods. The smaller geographic area also allows New Orleans to build a local culture of adaptation and preparedness that emanates from the neighborhoods and is owned by residents.

The City of New Orleans proposes to use NDR funds to support comprehensive and integrated resilience efforts in the city's first Resilience District, focusing investments for maximum place-based efficacy in an area prioritized for its particular nexus of physical and social vulnerability. Subsequent districts will serve as targeted areas of focus for citywide implementation, aggregating impact and benefits to low- and moderate-income communities.

For each district, the City of New Orleans will tailor a suite of intervention types and a methodology for how they interconnect and directly benefit vulnerable communities. New Orleans will learn from the

performance of each district to guide the implementation of other districts, creating a resilience-building pattern language for the city to survive and thrive. The district will be a place that demonstrates what resilience looks like in practice, making the city's adaptation visible and tangible throughout the urban environment. The ability to experience the outcomes of accumulated benefits from strategic actions will make it a model for visitors to learn from and replicate throughout the region and in other coastal delta cities worldwide.

Sound Process. New Orleans' proposal for this NDRC application was developed through a robust stakeholder engagement process that examined shocks, stresses, challenges, and opportunities for New Orleans and the region and built upon existing plans and projects. This application and the proposed projects included were developed by researching the challenges facing New Orleans, gathering input from stakeholders with relevant knowledge and expertise, and sourcing best practices locally and globally.

The city's resilience strategy and this NDRC application build upon a decade of community-driven planning processes in which tens of thousands of New Orleanians have participated and crafted visions for the future city (*Att.EGraphics.pdf*, page 228, <http://bit.ly/1k4bqkr>). More than 350 individuals, including public officials, private sector representatives, non-profit advocates, community leaders, and cross-disciplinary technical experts, participated in the development of the resilience strategy through dozens of workshops and hundreds of direct consultations during 2015. These stakeholders provided valuable insight, local expertise and knowledge, and revealed critical resilience needs. Cross-disciplinary working groups then identified potential actions for building physical and social resilience in New Orleans and explored financing, risk modeling, and design. The proposals developed through this process directly inspired the actions set forth in the resilience strategy and this NDRC application (*Att.EGraphics.pdf*, page 251, <http://bit.ly/1k4bqkr>).

New Orleans' process also builds upon years of research and design contained in the award-winning *Greater New Orleans Urban Water Plan* (the Urban Water Plan). Developed with HUD Disaster Recovery funds, the plan is a visionary framework with detailed engineering, landscape, and urban design proposals that illustrate how the region can live with water rather than fight against it. The City

of New Orleans was supported by the same team of architects and engineers that led the development of the Urban Water Plan to design the specific activities for this NDRC application. This application directly builds off of the extensive research, community engagement efforts, modeling, design, and engineering that went into the Urban Water Plan’s transformative vision for a future water city. The Urban Water Plan process began almost 10 years ago with a series of Dutch Dialogues workshops, a forum for sharing knowledge and best practices with leading experts in stormwater management from the Netherlands. During the NDRC application development process, workshops were again held with Dutch engineers, hydrologists, landscape architects, and urban planners in both New Orleans and the Netherlands (*Att.EGraphics.pdf*, page 252, <http://bit.ly/1k4bqkr>).

Consultation with other regional jurisdictions. Throughout the NDRC application development process, New Orleans coordinated closely with other jurisdictions around the region and state on their respective NDRC applications. During Phases I and II, New Orleans consulted with neighboring parishes Jefferson and St. Tammany, along with the State of Louisiana, on shared approaches to risk reduction and complementary actions to shape a resilient future for Southeast Louisiana. The State of Louisiana’s application focuses on three primary concepts—reshaping, retrofitting, and resettling—utilizing a forward-thinking, risk-aware approach to guide the state’s land use and development patterns throughout its Coastal Zone. Within this statewide framework, New Orleans offers a model for multiple lines of defense strategies at the regional level while also serving as a potential resettlement area for relocated coastal communities. In order to institutionalize cross-jurisdictional coordination of resilience activities in the region, New Orleans initiated the formation of the Resilience Committee at the region’s metropolitan planning organization, the Regional Planning Commission (RPC).

Community engagement and awareness-building. Community engagement is an inherent component of the New Orleans approach. The City is committed to fostering widespread public engagement that facilitates community education, empowerment, and behavioral adaptation. Through the NDRC process, the City has already begun to work with key neighborhood leaders to develop strategies for engaging community members who usually do not attend public meetings. The City hosted a water learning tour and exchange with community leaders in the Gentilly Resilience District, the area of focus for this

NDRC proposal. Together, City officials and neighborhood leaders toured drainage canals, floodgates, rain gardens, and homeowner retrofits in Gentilly in order to learn about problems and potential innovative solutions. The group brainstormed creative community engagement practices over a shared lunch under oak trees at the site of the future Mirabeau Water Gardens, one of the proposed activities within this NDRC application (*Att.EGraphics.pdf*, page 253, <http://bit.ly/1k4bqkr>).

Among the techniques proposed by stakeholders that the City plans to pursue during NDRC project implementation are: home tours with homeowners who have implemented water retention and infiltration measures on their properties; citizen science opportunities for middle- and high-school students; family-friendly events such as festivals that include education on stormwater management, coastal restoration, and energy redundancy. These creative engagement strategies will make participation enjoyable and accessible, and will also provide a bridge into opportunities for job training in the growing water and energy sectors. Ultimately, these activities will help create “ambassadors” for the behavioral changes needed to adapt New Orleans’ landscape to live with water.

Gentilly Resilience District. New Orleans is requesting NDR funds to implement the city’s first Resilience District in Gentilly (*Att.EGraphics.pdf*, page 256, <http://bit.ly/1k4bqkr>). The district, comprised of multiple diverse neighborhoods, is surrounded on three sides by water—Lake Pontchartrain to the north, the Industrial Canal to the East and the Orleans Avenue Canal to the West—and bisected by the London Avenue Canal. However, much of this water is hidden behind high concrete walls or difficult to access. The exception is Bayou St. John, a historic waterway within the Gentilly District that connects the central part of New Orleans to Lake Pontchartrain and serves as an important recreational amenity for residents and a model for what is possible district-wide. The district is bounded on the south by the Gentilly Ridge, a long stretch of historic high ground along the former banks of Bayou Gentilly. Elevation in the district ranges from 8 feet above sea level to 8 feet below. The area is a prime example of 20th century urban expansion into drained cypress swamps (*Att.EGraphics.pdf*, page 232, <http://bit.ly/1k4bqkr>). The walled London Avenue Canal, part of the single-purpose infrastructure system that made development possible in the former marshland of Gentilly, has historically divided

communities of different races and incomes. In many ways, Gentilly is a microcosm of New Orleans and the greater region. Its history as a place of opportunity for low- and moderate-income households and people of color, combined with its elevated environmental risks, make it an ideal place to combine interventions that build equity, reduce risk, and adapt the city to its natural environment.

The population of Gentilly is 29,000 based on American Community Survey 2013 5-year estimates. Three quarters of residents are African American, and owner-occupied units make up the majority of households (63% compared to only 47% citywide). The total population in Gentilly is two-thirds what it was in 2000, having lost population due to the floods caused by Hurricane Katrina (*Att.EGraphics.pdf*, page 245, <http://bit.ly/1k4bqkr>). The landscape is dotted by vacant lots, many of which are publicly owned former Road Home properties (*Att.EGraphics.pdf*, page 244, <http://bit.ly/1k4bqkr>). However, there has been significant public and private investment in the area in recent years and a rebound in residential value in pockets of the district. New Orleans also has created significant momentum for urban water management in this area through community engagement around funded projects and has developed substantial financial leverage for proposed resilience-building projects. The district is anchored by three universities—Dillard University, the University of New Orleans, and Southern University at New Orleans—providing an opportunity to connect innovative design and technologies in water management, energy infrastructure, and coastal restoration to research and job training (*Att.EGraphics.pdf*, page 255, <http://bit.ly/1k4bqkr>).

Reshaping the Urban Delta: Projects and Program. The Urban Delta is New Orleans’ comprehensive proposal for this NDRC application. With the same vigor and determination that made New Orleans an international leader for water management in the early 20th century, the city will redress a legacy of shortsighted urban development through the transformation of its urban grid—reshaping the urban delta (*Att.EGraphics.pdf*, page 229, <http://bit.ly/1k4bqkr>). New Orleans is reimagining urban infrastructure networks as integrated and multifunctional systems to retain water as an asset in the landscape, improve the reliability and redundancy of energy distribution, increase safety, beautify neighborhoods, filter pollutants, provide spaces and places for recreation and social gathering, and create new upwardly mobile career opportunities for low-income residents (*Att.EGraphics.pdf*, page 248, <http://bit.ly/1k4bqkr>).

[ly/1k4bqkr](http://bit.ly/1k4bqkr)).

Transformation of the urban grid will not only be realized through infrastructure projects, but also through new management, monitoring, and maintenance paradigms to ensure maximum longevity and adaptability of those investments. It will rely on new relationships between government, civil society, and the landscapes they inhabit (*Att.EGraphics.pdf*, page 249, <http://bit.ly/1k4bqkr>). Transformation will spur economic growth that New Orleans will harness to narrow disparities in risk, income, and health outcomes. In order to aggregate interventions for a transformative impact, activities within the City's Urban Delta proposal are focused within the Gentilly Resilience District, with primary benefits accruing in low-lying flood-prone areas within the district with high concentrations of low- and moderate-income earners (57% of total population, based on HUD LMI summary data by Census Block Group). Across Gentilly, the ongoing reconstruction of streets and boulevards provides the basis for reshaping the urban streetscape and public spaces to reduce risk and provide a model for living with water in a deltaic urban environment. Features such as open waterways, wide bioswales, extensive tree plantings, and rain gardens will reshape the public realm as a place where ecology, water management, and beauty join the street grid as fundamental urban patterns. Each resilience-building project will also serve to forge a distinct identity for the area with iconic, accessible water features, visible public art installations, places for expression and creativity, and economic growth. The diverse residents of the future Gentilly will also be more engaged—with both local ecology and wider economic opportunities. A major outcome of the coordinated interventions in Gentilly will be to create a solid yet adaptable foundation for further investments citywide (*Att.EGraphics.pdf*, pages 282-283, <http://bit.ly/1k4bqkr>).

Integral to each of the proposed actions is a workforce development component that connects unemployed New Orleanians to careers in the growing environmental services sector. Economic growth will not be enjoyed widely without an equity strategy. Just as the infrastructural endeavors of the early 20th century were as much a workforce initiative as a city-building one, so too is connecting New Orleanians to opportunity central to this transformative vision.

New Orleans' NDRC proposal, the Urban Delta, is organized under three Projects and one Program

that each address one or more of New Orleans' identified Unmet Resilience Needs and together build comprehensive resilience within Gentilly and beyond (*Att.EGraphics.pdf*, pages 257-258, <http://bit.ly/1k4bqkr>):

1. Urban Water
2. Community Adaptation
3. Reliable Energy and Smart Systems
4. Coastal Restoration

Not only will the Gentilly Resilience District serve as a precedent for other areas of the city and the Southeast Louisiana region, but will also provide a national model for retrofitting postwar suburban neighborhoods to work with natural systems to build resilience and create safer and more equitable communities of opportunity for the 21st century.

Project: Urban Water. This proposed Urban Water Project is a comprehensive water management initiative that strives to realize the vision of living with water, transforming water from a threat into an asset and from a phantom into a friend (*Att.EGraphics.pdf*, page 233, <http://bit.ly/1k4bqkr>). The project consists of a network of integrated interventions at multiple scales that fundamentally changes how water flows through the lowland area and transforms the typical suburban grid into a lush and distinctive area of opportunity. The proposed interventions reduce risks from flooding and subsidence by creating spaces for capturing rainwater in the urban landscape (*Att.EGraphics.pdf*, page 250, <http://bit.ly/1k4bqkr>). Together these interventions will significantly increase safety, especially for vulnerable populations living in the lowest-lying areas of Gentilly. The project, fully implemented, functionally eliminates flooding from a 5-year storm and reduces by 50% flooding from a 10-year storm within the Gentilly Resilience District (*Att.EGraphics.pdf*, page 259, <http://bit.ly/1k4bqkr>).

The current system of pipes and pumps works from a paradigm of draining and pumping water as fast as possible out of the city when it rains (*Att.EGraphics.pdf*, page 238, <http://bit.ly/1k4bqkr>). This single-purpose infrastructure is aging and overwhelmed, as the city experienced with broken pipes during Hurricane Isaac, the Qualifying Disaster. This current approach also relies on a significant amount of

energy to pump stormwater, exacerbates subsidence by drying soils, and conveys pollutants directly into Lake Pontchartrain. The system hides water behind concrete floodwalls and in pipes underground, obfuscating future risk and disconnecting residents from the city's coastal delta environment. New Orleans is transforming the way that it manages stormwater in order to increase safety and build a distinct local identity around water.

Interventions on higher ground will hold water where it falls, so as to stop water from burdening lower-lying vulnerable communities. In the lowest areas, interventions will create extra storage space that directs water to designated areas, keeping it away from people's homes and cars. Letting water infiltrate into the ground will slow subsidence, reducing costly damage to streets, pipes, utilities, and building foundations.

In addition to increasing safety from flooding and subsidence, this project builds social resilience through developing a culture of environmental awareness, bridging communities, and creating upwardly mobile career opportunities for those who need them most. These interventions create a linked system of new public spaces and commons for all that connect people to the natural environment and to each other. Adaptation must be both physical and behavioral. The historical experience of living with water in Southeast Louisiana has been largely forgotten. Much of the city's water flows behind walls and through culverts, where residents rarely see it. This Urban Water project creates spaces where residents can regularly encounter the water that surrounds the city, learn about how it shapes the city, and explore ways to manage its presence. The planning, construction, maintenance, and monitoring of interventions at the scale proposed are expected to result in significant job creation. As detailed later in this section, the City of New Orleans will work to ensure these job opportunities and the training necessary to excel in the growing water management economy go towards those residents who need them most, particularly jobless African-American males.

Described below are four types of project activities—Blue-Green Parklands, Blue-Green Corridors, Neighborhood Network, and Canals—and the specific site interventions within each that New Orleans proposes as part of this application. This project will create a network of interventions—linking

activities that exist and are planned into a larger vision and system (*Att.EGraphics.pdf*, page 257-258, <http://bit.ly/1k4bqkr>). While each of these interventions separately reduces risk from flooding and subsidence and provides co-benefits, collectively they create a network of solutions with exponential benefits that transform the way New Orleanians live with water.

1.1 Construct a series of large-scale Blue-Green Parklands on underutilized sites for significant water storage, ecological benefit, and recreational opportunities. Critical to the future resilience of Gentilly and the Greater New Orleans region at large is designing spaces to safely store rainwater within neighborhoods in order to take pressure of the city's drainage system, which reduces flooding in streets and homes. Large, underutilized sites provide some of the most impactful spaces for water retention. They also provide an opportunity to transform hidden amenities into neighborhood and citywide destinations for learning about the natural landscape, recreating, and connecting with neighbors. New Orleans proposes to construct three large-scale (25+ acre) Blue-Green Parklands on such sites within the Gentilly District. Each of these sites will be designed with natural landscape features to infiltrate water into the soil, recharging groundwater in order to slow subsidence in the neighborhood and improving water quality through natural filtration. Interventions at this scale will prove catalytic—sparking neighborhood revitalization and increasing property values in areas with high rates of low- and moderate-income homeownership. These three Blue-Green Parklands, described in detail below, will provide a model for how large underutilized spaces within other Resilience Districts across the city can serve as anchors of an integrated network of solutions that reduce flooding and subsidence, build environmental awareness, improve community health, catalyze future investments, and connect neighborhoods.

Mirabeau Water Garden. The city plans to transform the 25-acre cleared site of a former convent into an engineered Blue-Green Parkland (*Att.EGraphics.pdf*, page 260, <http://bit.ly/1k4bqkr>). The City has entered into a cooperative endeavor agreement (CEA) with the Community of St. Joseph for a 99-year lease to fulfill their goals of community open space and facilitating systemic change at the site of the former convent which suffered catastrophic flooding as a result of Hurricane Katrina. The Mirabeau Water Garden, within the heart of the mixed-income, mixed-race, and flood-prone Filmore

neighborhood, designed with a terraced wetland filtration system, will store and cleanse approximately 1.23 million cubic feet of stormwater redirected from neighboring residential blocks while also serving the entire city as an education center for water and ecology. Based on hydraulic modeling, the transformed site will eliminate flooding caused by a 10-year storm (and more frequent events) within its watershed and reduce flooding by 72% in a 100-year storm. Further, it reduces flooding caused by 1-year storm events by 45% in the entire drainage basin served by Pump Station #4, which serves the low-lying area in the Gentilly Resilience District. The project diverts water from a drainage pipeline on Mirabeau Avenue into the site and creates a water plaza and terraced wetland filtration system. These terraces provide habitats for wetland species, plants, and organisms that play an important role in filtering stormwater before it flows into a freshwater pool. This public water parkland aims to minimize flooding and subsidence while offering neighborhood residents, the larger community, and local government a new amenity.

The Mirabeau Water Garden is a key component of the Gentilly Resilience District and will be a research site for testing landscape integration in water management features. As an environmental classroom, the site will be programmed for active environmental education for the general public, schools, and practitioners, with particular focus on urban water management, ecology, and climate change impacts.

<i>Mirabeau Water Garden</i>	Total Budget: \$30,188,178	NDRC Budget: \$15,688,178
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Dillard Wetland. Tucked along the western side of the London Avenue Canal across from the Dillard University campus in the Dillard section of Gentilly is a 27-acre dense woodland owned by the City of New Orleans. The parcel is the only remaining forested wetland in the area. For reasons partly geographical, partly historical, and largely accidental, this city-owned forest never urbanized and remains wild and mostly inaccessible and unused, its existence known by few today. This hidden amenity provides a stark contrast between the cypress forest landscape that once existed in Gentilly and the suburban grid build over it. Currently there is little opportunity to witness pre-development New Orleans within the urban environment and to safely explore wetland ecologies. This project transforms the site into an educational and recreational natural preserve open to the public, schools, and connects

to the Dillard University campus via a new pedestrian bridge (*Att.EGraphics.pdf*, page 261, <http://bit.ly/1k4bqkr>).

The primary objective of this project is to restore the character and function of the original landscape by mimicking its pre-development hydrology. The woodland will be disconnected from the drainage system in order to handle its own rainfall—relieving further stress from the engineered drainage system. A new perimeter berm allows the diversion of neighborhood runoff into the site, minimizing flood risk in surrounding areas, improving water quality, and restoring the historic natural function of the site. The Dillard Wetland will store and cleanse approximately 712,300 cubic feet of stormwater redirected from the surrounding neighborhood while also serving the entire city as an education center for water and ecology. Based on hydraulic modeling, the transformed site will eliminate flooding caused by 1-year storm event and reduce flooding by almost 20% in a 10-year storm in its drainage basin.

<i>Dillard Wetland</i>	Total Budget: \$15,746,799	NDRC Budget: \$13,746,799
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City Park Stormwater Management and Flood Mitigation. City Park is a large part of one of the lowest lying parts of the city, but it is not currently being used strategically for water storage. The 1,300-acre public park defines the western end of the Gentilly District and is almost fifty percent larger than Central Park in New York City. City Park attracts more than 5 million visitors annually. New Orleans proposes to retrofit the park to store more stormwater within its existing network of waterways and lagoons and within additional constructed wetlands and operable weirs in order to reduce flooding in surrounding neighborhoods and stabilize soils through infiltration (*Att.EGraphics.pdf*, page 262-263, <http://bit.ly/1k4bqkr>).

Operable weirs in the park allow the manual drainage of the lakes in advance of a storm event and control of the flood stages. Reshaping the banks of the lagoons and increasing inter-connectivity adds water storage capacity and improves water quality, while dredging improves drainage flow. Detention strategies temporarily flood the park during extreme events without inundating structures. The City Park project will store and cleanse approximately 23 million cubic feet of stormwater redirected from the surrounding neighborhood. By reducing dependence on the drainage system as the sole and primary

means of water management, the groundwater level in surrounding neighborhoods can be raised, as is necessary to stabilize the weak, deltaic soils and manage subsidence. Based on preliminary hydraulic modeling, the transformed site potentially eliminates flooding caused by 1-year and 10-year storm events and reduces flooding by 70% in a 100-year storm in its drainage basin.

<i>City Park</i>	Total Budget: \$21,086,670	NDRC Budget: \$19,086,670
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1.2 Reshape major boulevards into a network of Blue-Green Corridors. The uniform street network of Gentilly includes a grid of major boulevards with wide, underutilized medians that exist at a higher grade than the adjacent land. New Orleans proposes constructing a network of circulating canals and sunken gardens in major boulevards that connect the other interventions within the district together as an integrated system. These Blue-Green Corridors profoundly transform the character of Gentilly, providing the backbone of district’s new identity as an Urban Delta (*Att.EGraphics.pdf*, page 264-265, <http://bit.ly/1k4bqkr>). These corridors were strategically selected and designed so as to create a core network of interventions around the areas within Gentilly at greatest risk of flooding with the highest concentration of vulnerable populations, where 57% of residents are low- to moderate-income. The nine blue corridors and seven green corridors can store and cleanse approximately seven million cubic feet of stormwater redirected from the surrounding neighborhood while also infiltrating below the surface to nourish soils and maintain proper groundwater balance reducing subsidence. By minimizing flooding and subsidence in these low-lying areas, vulnerable populations are protected and neighborhood investment is stimulated.

Blue Corridors. Circulating canals are ideal elements to recharge groundwater in the lowlands. Curb cuts will allow stormwater from streets to be collected by these new features created by excavating existing wide medians. Planted edges can filter and infiltrate water as water flows through these canals. New trees provide shade and improved environmental quality for the district.

Green Corridors. Green corridors consist of wide bioswales in medians, new tree canopy, and permeable sidewalks. In street sections where live oaks line the median, roadside bioswales are added for extra infiltration.

<i>Blue-Green Corridors</i>	Total Budget: \$95,472,127	NDRC Budget: \$92,472,127
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1.3 Develop a Neighborhood Network of green infrastructure interventions. The Urban Water project proposes comprehensive and integrated water management that includes large-scale storage in the form of new canals and parklands, which will transform Gentilly into a model for safely living with water in a delta city. Within this larger system, a Neighborhood Network of smaller-scale green infrastructure retrofits to neighborhood streets, publicly owned vacant lots, and parks will work to capture rainwater where it falls—reducing localized street flooding, tempering subsidence, improving water quality, and creating public amenities close to homes and schools. Campus interventions at schools and other public facilities will be designed with improved playfields and recreational amenities that also store water when it rains.

New Orleans has already implemented several green infrastructure interventions at this scale that provide a precedent in the Gentilly Resilience District, and more interventions are being supported through FEMA Hazard Mitigation Grant Program (HMGP) funds. As proposed, NDR funds would leverage these existing and planned interventions to enhance resilience co-benefits not eligible under FEMA funds and link these neighborhood-scaled interventions into a larger comprehensive and integrated urban water management system.

St. Anthony Green Streets. This proposed activity establishes a new standard for neighborhood streets and vacant lots that incorporates stormwater management as a key component (*Att. EGraphics.pdf*, pages 268-269, <http://bit.ly/1k4bqkr>). The St. Anthony Green Streets are within a section of the Gentilly Resilience District comprised of eight neighborhood blocks bounded by and integral to the Blue-Green Corridor network. It includes green infrastructure enhancements such as street and curb bioswales and bump-outs, permeable sidewalks, new street trees, subsurface water storage, and rain gardens in vacant publicly owned parcels. The main objectives are to reduce localized street flooding, control subsidence through infiltration, improve water quality, and add aesthetic value to the neighborhood, thereby improving quality of life for residents. The St. Anthony Green Streets can store and cleanse 352,846 cubic feet of stormwater, which equates to 13% of street flooding during a 1-year storm. It is the City’s

ambition to implement these solutions throughout the lowland districts in future phases for maximum stormwater capture and maximum benefit to the community.

<i>St. Anthony Green Streets</i>	Total Budget: \$28,090,135	NDRC Budget: \$27,090,135
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Milne Campus. This activity proposes to develop an existing historic site with green infrastructure enhancements including: permeable parking lots, landscaping, and recreational facilities that double as stormwater management (*Att.EGraphics.pdf*, page 270, <http://bit.ly/1k4bqkr>). The Milne campus is a 17-acre city-owned historic site that was formerly the Milne Municipal Boys Home. This site, famously known as being Louis Armstrong’s childhood home, is located in the Milneburg neighborhood of the Gentilly Resilience District. The site currently houses the headquarters of the City’s recreation department and non-profits supporting the city’s NOLA FOR LIFE integrated violence reduction program. The low elevation of the property presents an opportunity for stormwater detention to alleviate repetitive flood losses. There is available acreage for green infrastructure interventions that, combined with an expansion of recreational programs, can benefit the campus itself, the city’s drainage system, and the flood-prone surrounding neighborhood.

The design proposes a playing field with subsurface water storage and bioswales strategically located to collect stormwater without disrupting recreational program elements. Other design components include constructed wetlands to provide habitat for birds and fish and reduce subsidence by raising groundwater levels. These interventions provide a water storage capacity of 490,740 cubic feet, reducing almost 20% of street flooding from a 1-year storm event while also incorporating environmental education into existing recreation department programming. This site demonstrates on a key Blue-Green Corridor how retrofitting large scale public properties with water detention features can not only reduce flooding in the adjacent neighborhood but also enhance environmental quality and sense of place.

<i>Milne Campus</i>	Total Budget: \$10,594,525	NDRC Budget: \$9,594,525
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St. Bernard Neighborhood Campus. This activity area sits between the newly completed McDonogh 35 High School and the Juvenile Justice Center (a juvenile detention facility and court), and is adjacent to Bayou St. John in the Gentilly Resilience District. This area provides a prime opportunity for joint green

infrastructure and recreational interventions that will also connect the surrounding neighborhood with the Bayou as a critical recreational waterway. This intervention will benefit the campus and surrounding institutions, the City’s drainage system, and surrounding neighborhoods that suffer repetitive flood losses (*Att.EGraphics.pdf*, page 270, <http://bit.ly/1k4bqkr>).

Stormwater detention will occur through construction of a high-performance football field that stores significant amounts of stormwater and includes perimeter berms. In addition, the City will construct an educational water playground that will raise awareness of water’s role in the New Orleans urban environment through interactive activities for children as well as educational content for all ages. The site will also hold a permeable plaza, pro basketball court, concessions building and a practice ball field. These interventions serve as a resource for at-risk youth and students as well as an educational asset around urban water management, with included water storage and detention capability.

In addition, this project includes creation of a pedestrian bridge across Bayou St. John to connect the neighborhood to City Park, and an adjacent Bayou Crossing and Boat Launch area that offers Bayou-based recreational and boating opportunities. These components of the St. Bernard Neighborhood Campus activity encourage residents to view and use the Bayou as one of the City’s main open waterway resources for recreation. In addition to serving McDonogh 35 and the Juvenile Justice Center directly, the site also incorporates a plaza and pedestrian enhancements along Milton Drive to connect to Columbia Parc, a mixed-income public housing development that was reconstructed with HUD funds after Hurricane Katrina. These interventions provide a water storage capacity of 516,000 cubic feet, eliminating street flooding from a 1-year storm event while also incorporating recreation and environmental education into the site.

<i>St. Bernard Neighborhood Campus</i>	Total Budget: \$13,910,224	NDRC Budget: \$12,910,224
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Pontilly Neighborhood Green Infrastructure. The Pontilly Neighborhood Green Infrastructure activity will integrate improvements to the Dwyer Canal with a network of green infrastructure interventions along streets, in alleyways, and within vacant lots in the Pontchartrain Park and Gentilly Woods neighborhoods within the Gentilly Resilience District (*Att.EGraphics.pdf*, page 271, <http://>

bit.ly/1k4bqkr). The neighborhood-based green infrastructure components of this activity will slow stormwater flow in the neighborhood to reduce flooding, and promote natural water filtration for a safer and healthier neighborhood. The design also includes the creation of a series of walking paths, grading improvements, and several pedestrian bridges to allow for community use of the space along the Dwyer Canal.

Historically, the Dwyer Canal was a border between segregated neighborhoods; Gentilly Woods, south of the canal, was a white neighborhood and Pontchartrain Park, north of the canal, was an African-American neighborhood. The design and infrastructure interventions within this activity will transform the Dwyer Canal from a barrier between neighborhoods into a recreational asset that brings together and connects residents from both sides of the canal. Native plantings and erosion control techniques will increase the performance of the canal from an engineering standpoint while adding aesthetic value to both neighborhoods. This project leverages existing FEMA HMGP funds to add additional benefits otherwise ineligible.

<i>Pontilly Neighborhood</i>	Total Budget: \$19,164,085	NDRC Budget: \$4,006,085
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Bayou St. John Neighborhood Green Infrastructure. This project demonstrates the interdependencies that exist across districts in building resilience. Currently, the Bayou St. John neighborhood, within another district, has significant flooding from small events. This project would reduce stormwater discharge into Pumping Station #2 which directly funnels into the London Avenue and Orleans Avenue Canals in the Gentilly Resilience District. By increasing the storage and pervious area, stormwater can be naturally absorbed in the drainage basin thereby reducing flows into the gray infrastructure system. Green infrastructure elements include underground retention and detention, pervious sidewalks, rain gardens at street corners, and retention basins in the Lafitte Greenway (a separate CDBG-DR funded project) as well as a pedestrian bridge and educational kiosks for public awareness of environmental vulnerabilities. This project will accommodate/and or mitigate the 10-year, 24-hour storm event and leverages existing HMGP funds to add multiple benefits otherwise ineligible (*Att. EGraphics.pdf*, page 272, <http://bit.ly/1k4bqkr>).

<i>Bayou St. John Neighborhood</i>	Total Budget: \$13,924,458	NDRC Budget: \$4,924,458
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St. Roch Green Streets. This project represents an opportunity to fundamentally alter the way streets in New Orleans function in terms of conveyance of runoff. These blocks in the St. Roch neighborhood, just to the south of the Gentilly Resilience District, is an opportunity to demonstrate the benefit of retaining and storing stormwater within higher ground districts in order to decrease the burden on lowland districts. Therefore retaining and storing stormwater in St. Roch, on higher ground, increases the capacity of the low-lying Gentilly District to the north to manage more localized stormwater. For this project, a renewed and transformed streetscape will include subsurface stormwater detention and surface green infrastructure. The new streetscapes offer a connective, accessible pedestrian network. A series of Green Corridor interventions along Elysian Fields, the only boulevard in New Orleans that stretches from the Mississippi River to Lake Pontchartrain, connects the interventions in St. Roch directly to the Gentilly Resilience District (*Att.EGraphics.pdf*, page 272, <http://bit.ly/1k4bqkr>).

<i>St. Roch Green Streets</i>	Total Budget: \$25,020,450	NDRC Budget: \$12,520,450
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1.4 Transform drainage canals into public waterfronts. The extensive drainage system in New Orleans is anchored by a series of pumping stations and three drainage canals that carry rainwater from low-lying areas out to Lake Pontchartrain. Unlike beautiful canals that have shaped urban identity and brought economic opportunity to iconic places like Amsterdam and Venice, these canals were built for a single purpose and are hidden behind high concrete walls. As described in Factor 2, the construction of this infrastructure had many unintended consequences that increased risk and divided communities. An ultimate ambition is to remove the walls lining these drainage canals and transform their banks into a series of open accessible waterfronts that unite people and neighborhoods, directly reversing the impact of putting up high walls in the preceding century (*Att.EGraphics.pdf*, page 273, <http://bit.ly/1k4bqkr>). Doing so creates many resilience co-benefits—it supports health and recreation, builds awareness of the city’s coastal geography and the infrastructure systems that keep residents safe, catalyzes neighborhood revitalization, and builds social cohesion across historic divides.

The City wishes to strategically remove the canal walls when and where it is safe to do so. Stormwater

management modeling conducted by expert hydrologists and engineers indicates that, with the new pump stations and closure structures being constructed at the lakefront, it is now possible to lower water levels in these canals as they are hydrologically disconnected from the lake. This increases canal capacity and allows for the safe removal of concrete walls. Model results also show that the walls safest to remove first are at Orleans Avenue along the western edge of City Park and the Gentilly Resilience District.

Strategic removal of walls along Orleans Avenue Canal. The Orleans Canal and its concrete floodwalls form a high barrier between the Lakeview neighborhood and City Park that limits visual and physical access. The city proposes strategically removing walls of the canal to allow for this single-purposed structure to become a beautiful public asset accessible to all for recreational use. Additional water storage capacity will be provided by bank modifications and floodable areas in City Park to the east of the canal. This intervention will act as a precedent for a similar future removal of concrete walls along the London Avenue Canal that bisect the Gentilly Resilience District (*Att. E Graphics.pdf*, page 274, <http://bit.ly/1k4bqkr>).

<i>Orleans Ave. Canal</i>	Total Budget: \$20,113,189	NDRC Budget: \$20,113,189
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London Avenue Canal art and awareness building. The London Avenue Canal cuts through the heart of the Gentilly Resilience District, bisecting the Filmore neighborhood to the west and the St. Anthony neighborhood to the east. Its concrete walls exist as a stark divide—Filmore has a historically stronger real estate market and wealthier residents while St. Anthony has been slower to redevelop and has a higher percentage of residents of color and low- to moderate-income residents.

An ultimate resilience goal for the district is to strategically remove the walls, reconnecting the two neighborhoods, making water a visible and attractive amenity in the landscape, a place of ecological wealth and aesthetic beauty, and creating a direct recreational pathway to the Lakefront accessible to all. Safely doing so requires taking additional pressure off of Drainage Pump Stations #3 and #4 that pump rainwater into the canals. The network of stormwater management interventions outlined in this application take significant steps towards achieving this future ambition.

As part of this NDRC project, the City proposes investing in art installations at key intersections along the drainage canal and at the pump stations that build public awareness of how the city’s drainage infrastructure works and interest in the canal’s eventual transformation. Through the community engagement process that will run in parallel with the design and fabrication of these installations, the community will provide critical input into the future transformation of the London Avenue Canal, so that the result is a waterway and a public space that is unique to Gentilly and New Orleans.

<i>London Ave. Canal Art</i>	Total Budget: \$500,000	NDRC Budget: \$500,000
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Metrics for evaluating performance

- Resiliency Value: Eliminated flooding damage from 5-year storm, reduced road maintenance costs from subsidence.
- Environmental Value: Improved water quality from filtration, groundwater recharge from water retention, reduced urban heat island effects, improved air quality.
- Social Value: Equal access to resilient community assets based on walking distance to parks and amenities.
- Economic Revitalization: Increased real estate assessments for properties near interventions.

Feasibility

Site control. Many Urban Water activities are proposed for property under the jurisdiction of the City of New Orleans or its partners. Where that is not the case, the City of New Orleans has consulted with the authorized agency to obtain support for the proposed activity. Over the last several months the City has worked in partnership with City Park, Orleans Parish School Board (OPSB), and the Southeast Louisiana Flood protection Authority and has obtained letters of support for the projects located at City Park, McDonough 35 High School, Orleans and London Ave Canals, Lake Pontchartrain coastline, and the central wetlands.

Climate Change Risks. New Orleans has partnered with the Trust for Public Land (TPL) to assess the impact that investments in water management and green infrastructure will have mitigating the effects of climate change. New Orleans worked with TPL to develop a local version of TPL’s Climate-Smart Cities

platform, a web-based GIS decision-support tool that assesses projects projected effects in mitigating climate change risks such as extreme heat, and flooding and their relative benefit to vulnerable communities (*Att.EGraphics.pdf*, page 247, <http://bit.ly/1k4bqkr>). By making available to both public officials and non-governmental actors the ability to conduct a complex spatial suitability analysis for green infrastructure projects, New Orleans is democratizing data and decision-making and empowering a broader base of stakeholders to participate in the practice of climate adaptation. The beta version of the New Orleans-specific Climate-Smart tool was used in the formation of the resilience districts strategy and informed this application. Should additional funds be awarded under this grant, New Orleans will work with the Trust for Public Land to expand the tool to its full capability to inform the intersecting decisions on transportation and public health by modeling air quality impacts among other vital indicators.

Project modeling & design. New Orleans is partnering with Deltares USA to provide robust modeling and design support for urban water management projects. The Deltares Adaptation Support Tool (AST) is an innovative software platform that facilitates collaborative design between stakeholders with varying backgrounds and expertise. Using a table-size touch screen, participants can jointly plan and model green infrastructure interventions on actual locations of interest to them. The tool generates estimates of the hydrologic impacts and the associated costs and benefits. A key asset within the City's neighborhood engagement strategy, the AST will be made accessible to the public through training and the dissemination of touch-screen tables at select public facilities should New Orleans be awarded funding under this grant.

Operations and maintenance. New Orleans' investments in urban water management projects will require significant ongoing operations and maintenance costs to sustain their functionality, aesthetics, and performance. The overall estimated annual Operations and Maintenance Costs Urban Water is \$4.2M and these costs are detailed in the Benefit Cost Analysis. New Orleans is partnering with the Trust for Public Land (TPL) to research and design a comprehensive financing strategy to support these costs. TPL has helped research, design, and pass nearly 500 state and local ballot measures yielding \$60 billion in new public funding for conservation, parks, and green infrastructure. Beyond public finances,

TPL will evaluate innovative ways to raise private financing to leverage the public investment. TPL will also support New Orleans with public opinion research to determine how to build coalitions and public support for urban water management and green infrastructure. The City is also researching the possibility of pursuing Wetland Mitigation Credits as a source of ongoing revenue to support operations and maintenance costs.

Scaling and Scoping. While the Urban Water activities will be most impactful when implemented together, New Orleans can adjust the scale and scope of these interventions. New Orleans will prioritize activities that provide the most direct benefit to vulnerable communities by reducing flood risk to low-lying areas with higher concentrations of low- and moderate-income households. Even at a smaller scale within the Gentilly Resilience District, New Orleans will maintain the approach of designing projects with spatial and hydrological connections between to realize the greatest benefits. New Orleans can also phase its interventions by implementing first those activities of highest priority and greatest benefit. The sequencing of these activities within the Urban Water project will be designed to maintain connections between interventions and establish a foundation upon which future phases can build (*Att.EGraphics.pdf*, page 281, <http://bit.ly/1k4bqkr>).

Project: Urban Water	Total Budget \$293,810,840	NDRC Budget: \$232,652,840
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Program: Community Adaptation. New Orleans cannot achieve its resilience goals through public investment alone. Private investment will also play a vital role in sufficiently reducing both individual and collective risk. When property owners implement stormwater management features and other risk reduction measures on their property, they enhance the value of their property, reduce their own risk, and contribute to collective risk reduction. As New Orleans seeks to adapt its urban fabric to its delta conditions, homeowners can play a critical role by installing a variety of small-scale, relatively affordable interventions such as rain gardens, rain barrels, and porous pavement conversions in order to effectively manage stormwater on their property. When done at a sufficient scale throughout the Resilience District, the city, and the region, such stormwater management interventions have the potential to significantly improve local drainage, build a network of “neighborhood ambassadors” and foster overall community resilience (*Att.EGraphics.pdf*, page 275, <http://bit.ly/1k4bqkr>).

New Orleans is taking steps to incentivize these investments through regulation, fees, discounts, and financing opportunities. To bring about wide-scale adoption of these practices, the City, in partnership with Deutsche Bank, plans to launch a Property Assessed Clean Energy (PACE) program in early 2016 and in addition to energy-efficiency will expand the eligible activities to include stormwater management, home elevation, and storm resilience features. This will allow private property owners to use private financing to improve their own property, reduce future fees, and contribute to the public and neighborhood benefit of reduced runoff and risk. To extend the opportunity to participate to those with fewer means, New Orleans proposes to use NDR funding to subsidize these investments for low-to-moderate income (LMI) households. This program would complement the investment of federal funds that the city and the New Orleans Redevelopment Authority (NORA) have made in the Gentilly Resilience District via the Neighborhood Stabilization Program, CDBG-DR, and CDBG, building high-quality affordable housing and critical public facilities.

Feasibility. NORA will administer the program and design it based on existing programs that NORA has successfully managed for several years. These programs include the Growing Home program where properties bought out voluntarily with CDBG-DR funds through the Road Home program are returned to commerce as vacant lots and the buyer receives a discount against the purchase price in exchange for investing in the greening of the lot. The program would also be informed by NORA's Façade Renew program where property owners along key commercial corridors are eligible for matching grants and technical design assistance to support the repair and improvement of their building facades.

Homeowners will qualify by demonstrating that their household earns below 80% of the area median income and will design their intervention in consultation with a licensed landscape architect with expertise in stormwater management practices. The costs of the consultation and the construction of the interventions will be supported by NDR funds up to \$5,000 per household. NORA will manage any vendors used in the delivery of the design and construction services. NORA will develop detailed policies and procedures for the program design and eligibility criteria.

NORA will also be launching a neighborhood resilience program in 2016 to bring resilience planning

to individuals and grassroots community organizations. The program will provide technical assistance and planning support to neighborhoods to assess their resilience and devise strategies and projects that address their challenges and risks. By working together to address their common risks, neighbors can build social cohesion, develop new solutions, and reduce their exposure to risk. Additionally, NORA will use the opportunity of working directly with neighborhoods facing flood risk to promote participation in the National Flood Insurance Program. The neighborhood resilience program will be launched in select neighborhoods including within the Gentilly Resilience District and will build upon the community development work previously undertaken by the city and NORA. NORA has committed \$2,000,000 in initial funding to this program which will work as leverage to the homeowner adaptation program. The Neighborhood Resilience program will serve as leverage by providing an avenue for neighbors to learn about the Homeowner Adaptation Program, share their own retrofit solutions with their neighbors, and develop strategies to bring their individual actions to a larger scale serving as ambassadors across their neighborhood, their city, and the region (*Att. EGraphics.pdf*, page 276, <http://bit.ly/1k4bqkr>).

This program will create a direct benefit to vulnerable communities and the low- and moderate-income households that face a disproportionate flood risk. The metrics NORA will use to evaluate the program's performance include the number of program participants and the water volume detained and stored due to the interventions. The goals of the program are to reach 1,000 participants and create a collective water storage capacity of over 200,000 cubic feet as a result. Furthermore, the interventions will increase property values and reduce future liability against fees, providing additional benefit to low- and moderate-income households.

Metrics for evaluating performance

- Resiliency Value: Increased resilience of structures
- Environmental Value: Improved water quality from filtration
- Social Value: Benefit to LMI persons
- Economic Revitalization: Stormwater storage avoiding gray infrastructure investment

Scaling/Scoping. New Orleans will scale the Homeowner Incentives to the level of funding available and will phase the program by focusing on the Gentilly Resilience District when the program is first

launched to develop a critical mass of subscribers before marketing the program citywide.

Program: Community Adaptation	Total Budget \$7,000,000	NDRC Budget: \$5,000,000
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Project 3: Reliable Energy and Smart Systems. In order for New Orleans to support the health, safety, and prosperity of its people, critical systems like power and water must be reliable and flexible—both in times of crisis and in our daily lives. Shocks like hurricanes have cascading effects on critical infrastructure systems: when one system is compromised, it negatively impacts the function of other critical systems. This project proposes three activities that seek to support the function and reliability of the city’s interconnected energy, stormwater, drinking water, groundwater, and sewerage systems through monitoring and redundancy.

Part of reliability is an understanding of where redundancy is most appropriate—knowing where backups can ensure the continuity of critical services. By creating redundancy in the electrical grid, downtime can be reduced at facilities like hospitals and pumping stations, thereby limiting the potentially devastating impact of electrical outages, supporting faster disaster response and recovery, and avoiding losses of life and property—particularly for vulnerable communities who rely on these services the most.

Monitoring current conditions and function of infrastructure systems allows for more responsive, iterative, and adaptive management. The City can better learn about what is working and what is not. In order to design resilient sites and systems that are replicable across the city and across the nation, monitoring their efficacy is critical.

Real-time monitoring of energy and water systems will also make New Orleans a more prepared city. Just as stormwater is hidden in pipes and behind flood walls, energy generation and use is invisible as it passes through the wires overhead, out of sight, out of mind. This lack of awareness engenders a dearth of preparedness among New Orleanians to shocks and stresses. New Orleans will address this challenge by providing visibility into the critical and integrated infrastructure systems that support the city’s safety, keeping the challenges the city faces present and visible in daily life.

3.1 Install microgrids to support critical services during outages. New Orleans often experiences power outages during routine storm events and almost always during severe tropical storms and hurricanes, which, as described in Factor 2, can leave the city without power for days, and even weeks, at a time. Within the Gentilly Resilience District, New Orleans proposes to design and install two localized microgrids, small backup electrical generation and distribution systems that can disconnect from the traditional grid to operate autonomously and help mitigate the health and safety effects of outages.

The first microgrid will be located near the Dillard University providing back-up power to a municipal library facility, a post office, banking operations, a pharmacy, a gas station, the university, and a water pump station. A second microgrid will be situated between the University of New Orleans and the London Avenue Canal pumps that are responsible for pumping stormwater from the drainage system out into Lake Pontchartrain. Built on the high ground of the lake’s levee system, this public university offers a place for potential shelter, provides facilities for food preparation, storage, and dining, health services and pharmacy, recreational and facilities and communications distribution (*Att.EGraphics.pdf*, page 277, <http://bit.ly/1k4bqkr>).

With the heavy storm season paralleling the summer months, power outages mixed with hot temperatures and closed businesses create uncomfortable conditions for the fortunate, unhealthy conditions for the vulnerable, slower recovery progress, and higher than necessary economic loss. Through our planning and model projections we are encouraged that we can fortify our critical infrastructure operations to limit damages and support key community assets to continuously offer needed services for a quicker recovery while subsequently limiting the economic impact of such stresses.

<i>Microgrids</i>	Total Budget: \$11,656,450	NDRC Budget: \$7,656,450
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3.2 Develop energy redundancy and monitoring systems at critical water infrastructure sites. By enabling public visibility and awareness on how energy is critical to urban systems like drainage and water treatment and to overall safety, New Orleans can continue building a culture of preparedness for future disasters. New Orleans proposes to leverage existing investments in energy redundancy to build

a more cost-effective, integrated, and adaptive system that builds resilience and supports the safety of vulnerable communities.

New Orleans is making a major investment of more than \$170 million to provide backup energy generation to the power plant that supplies the power to both the drainage system and the potable water system using FEMA Hazard Mitigation funds and Sewerage and Water Board Capital Funds. The Sewerage and Water Board currently relies on two power sources to power the drainage, water, and sewerage systems that serves the East Bank of the City of New Orleans: 1) an outside provider, Entergy, which is unreliable due to the provider shutting down power when winds exceed 40 mph and overhead distribution wires are susceptible to failure when impacted by lightning strikes, minor rain events, or power disruptions and 2) SWBNO's steam boiler turbine systems which were designed in the early 1900's and are beyond their functional lifespan.

When power interruptions occur it elongates the time needed to drain stormwater and exacerbates flooding in neighborhoods that are repetitive flood risk areas. For safe drinking water, sustained power is needed to maintain 72 pounds per square inch (psi) the water pressure within purified water pipes. When pressure drops below 15psi, a mandatory residential boiled-water order is issued. Since 2010, the main water treatment plant, serving more than 300,000 residents, has suffered outages or surges eight times, in many cases resulting in boil-water advisories for users of the potable water system. FEMA and SWBNO are providing funding to retrofit of the Power Plant and Oak Street Raw Water Intake Pumping Station. The Power Plant Retrofit is currently under Construction with a Design-Build Delivery scheduled to be complete in 2019. The HMGP-funded project will create a complete solution by allowing the Sewerage and Water Board to be able to produce power independently from the local energy provider and operate during flood or high wind events.

The City and its partner SWBNO propose to augment the backup power generation investment with NDR funds to add the monitoring and reporting equipment required to provide real-time and longitudinal data on energy generation, energy use at pumping stations, water levels and volumes, and spare pumping capacity. This data will inform decision making for power plant and pumping

station operators and, when the information is paired with data on groundwater levels, will provide a platform from which to analyze the performance of the water system holistically. As an added benefit, straightforward dashboards of performance data and displays of the systems will inform and educate New Orleanians about the various functions and capacities of each system. Presently, it is not immediately obvious how energy-intensive the New Orleans drainage, sewer, and water treatment systems are. Once this system is brought online the City plans to install digital education stations at each of the blue-green parklands so that visitors of the park can learn about how the City’s water, sewerage and drainage systems function and possibly see real time data indicating the current water levels in the canals, or how much water the drainage pumps were pumping, or how much energy was being used by the drainage system (*Att.EGraphics.pdf*, page 277, <http://bit.ly/1k4bqkr>).

<i>Energy Redundancy & Monitoring</i>	Total Budget: \$172,510,228	NDRC Budget: \$714,839
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3.3 Develop a comprehensive and centralized Water Monitoring Network. Smart and responsive systems add value and efficiency to many types of critical infrastructure systems. The City of New Orleans will support its comprehensive urban water management project with a centralized Water Monitoring Network (*Att.EGraphics.pdf*, page 278, <http://bit.ly/1k4bqkr>). This network and associated data collection will be critical to refining the operations of all of the Urban Water project activities. Furthermore, the network will provide information that will be used to guide the design and implementation of infrastructure systems throughout the city and region as strategies first employed in the Gentilly Resilience District are replicated elsewhere.

The City will construct a district-scale Gentilly Water Monitoring Network including 84 groundwater monitoring wells. The location of these elements will allow for data collection and analysis of the impact of specific project components, e.g., the impact of the St. Anthony Green Streets on local groundwater, or the impact of a single Blue-Green Parkland like Mirabeau on runoff rates, water quality, and groundwater levels. These wells and sensors will be integrated into a regional network of 52 wells and sensors that will be arrayed throughout a three-parish region. This network will serve as the basis for effective regional coordination and long-range planning, scientific research, and improved operations of shared infrastructure systems. This network will monitor key issues related to water and soil conditions

and provide the basis for setting regional targets for surface water and groundwater management.

Integral to all smart systems in New Orleans will be their public-facing aspects. Throughout the network, and also at key locations throughout the city, including the Oak St. Power Plant and Carrollton Water Treatment Plant, French Quarter, Lafitte Greenway, City Park, and at primary intersections throughout the Gentilly Resilience District, accessible and readable wells, sensors, and monitoring stations will be highlighted in the urban landscape, providing opportunities for the general public as well as researchers and scientists to understand soil and water conditions as well as creating transparency around City management of critical infrastructure for a delta city. There will be associated programming and opportunities for citizen science, with a wide range of partners—including neighborhood groups and environmental advocacy organizations and schools and universities—introducing these critical pieces of infrastructure to the citizens of the region.

<i>Water Monitoring Network</i>	Total Budget: \$750,000	NDRC Budget: \$750,000
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Feasibility. The microgrid installations will have minimal lifecycle costs, but will require and estimated \$2,000/year in testing and maintenance. The City of New Orleans, the Sewerage and Water Board of New Orleans (SWBNO), and the New Orleans Redevelopment Authority already employ inspectors who could perform many of the testing and maintenance tasks required. SWBNO is currently spending over \$22.8M in annual Operations and Maintenance for Water Pumping and Power Generation. The retrofitting and upgrading of the Power Plant and the Oak Street Raw water intake station are expected to drastically reduce the overall O&M budget due to the upgrading from century old equipment. The Operations and Maintenance costs for water monitoring are estimated to be about \$22,000 per year, including annual field activities, maintenance, and reporting. Much of this activity will be performed by and sourced from a partnership with Deltares, including through an arranged technical assistance offering from 100 Resilient Cities – Pioneered by The Rockefeller Foundation.

Metrics for evaluating performance

- Resiliency Value: Reliability of energy grid
- Environmental Value: Reduced energy use, stabilized groundwater levels

- Social Value: Accessibility of healthcare and services in disaster
- Economic Revitalization: Economic losses avoided in power outage

Scaling/scoping. Two initial NDR-supported microgrids are proposed for the Gentilly Resilience District as part of this application, but their introduction into the electric grid will create an opportunity for replication both within the district and citywide. Sandia National Laboratories have already produced feasibility studies and project designs for at least two more installations, and the City intends to expand the impact of these energy reliability upgrades. The Water Monitoring Network and energy data collection will begin with the most critical facilities, including the major pumping stations and water treatment facilities, but further efforts will be focused at the district and regional scales. The density of water monitoring sites in the Gentilly Resilience District will be crucial to understanding the nuances of water management in lowland urban neighborhoods experiencing subsidence, producing useful data for future Resilience Districts and groundwater management techniques throughout South Louisiana.

Project: Energy & Smart Systems	Total Budget \$184,166,678	NDRC Budget: \$9,121,289
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Project: Coastal Restoration. Protecting and restoring the Louisiana coast both inside and outside of New Orleans is key to New Orleans’ ability to withstand future disasters. Coastal wetlands are the region’s first line of defense from coastal storm surge, making them a critical component of New Orleans’ overall approach to building resilience (*Att.EGraphics.pdf*, pages 230, 231, and 235, <http://bit.ly/1k4bqkr>). In its phase I application, New Orleans described the threat of unmet damages in environmental degradation and how addressing this need was an essential element to confronting the existential threat of storm surge exacerbated by coastal land loss and projected sea level rise. While the threat remains, New Orleans and the State of Louisiana’s opportunities have since improved with the settlement of the BP Oil Spill lawsuit. Louisiana now stands to receive billions of dollars to fund coastal restoration initiatives and fulfill many of the designs envisioned in the Coastal Master Plan. For this reason, New Orleans has maintained coastal restoration as a project within its phase II application as a component of its overall approach, is dedicating supporting leverage to specific coastal restoration activities, but is not requesting NDR funds for these activities.

New Orleans will co-invest with the state in coastal restoration projects within its boundaries, providing matching funds for projects within the Coastal Master Plan and developing additional projects beyond the plan (*Att. EGraphics.pdf*, page 279, <http://bit.ly/1k4bqkr>). New Orleans will also play a role in advocating for coastal restoration and protection across the state and the gulf coast since many of the projects that provide protection benefits to New Orleans are outside of its boundaries. Furthermore, New Orleans' approach to adapting its urban grid to its deltaic conditions is the city's innovative and complementary component of the Coastal Master Plan.

Within New Orleans, the city is planning to support several projects including the effort to restore wetlands in Bayou Bienvenue and the Central Wetlands Unit adjacent to the Lower 9th Ward, repair the Orleans Land Bridge from damage incurred during Hurricane Isaac, and marsh creation activities in the Golden Triangle at the eastern edge of the city. New Orleans is dedicating funds from the BP Oil Spill settlement and the first round of RESTORE Act funds as supporting leverage to these projects. New Orleans anticipates receiving and dedicating many more resources for coastal restoration from several sources of funding including future rounds of funding from the RESTORE Act and the Gulf of Mexico Security Act. However, much of these sources cannot be documented as leverage at the time of this writing as they have yet to be formally obligated. For this reason, New Orleans focused on the integrated benefits that the urban water projects described above will have on a healthy and functional coast.

As stormwater is drained from the city and pumped into Lake Pontchartrain, it carries pollutants that present health risks, damage ecosystems, and inhibit recreation. According to the Center for Watershed Protection, the stormwater projects described above will remove 50-90% levels of suspended solids and significant portions of phosphorus, nitrogen, and heavy metals, making it feasible to convert stormwater from a waste stream into a resource.

One such project that integrates with the urban water projects that New Orleans designed in the process of developing this application is the Living Shoreline project, which will create a marsh area along the lakefront, reinforcing the existing protective sea wall by reducing wave action and improving water quality by intercepting additional pollutants from outfall canals. The project will work with nature, strengthening as it gathers sediment and plant life. This project will also create a visible coastal wetland

at the lakefront, providing an opportunity for environmental learning and awareness (*Att.EGraphics.pdf*, page 280, <http://bit.ly/1k4bqkr>).

Metrics for evaluating performance

- Resiliency Value: Reduced flood risk from storm surge
- Environmental Value: Improved water quality
- Social Value: Improved recreation
- Economic Revitalization: Improved potential for fishing and oyster harvesting with associated business development

Developing a skilled workforce. As New Orleans invests in adapting its urban fabric to the natural environment, it stands to become a national leader in the environmental services and water management sectors. However, sustained growth and benefits to the local workforce and economy are not inevitable. Building upon recent initiatives to foster local business growth, train and prepare unemployed individuals for the job market, and establishing local hiring practices, New Orleans will harness NDR funding to develop bold outcomes for unemployed and underemployed individuals.

As stated in Factor 2, profound inequities in employment and income plague the city. New Orleans plans to address this both in the short term by training working-age individuals for job readiness and over the long term by developing the next generation of designers, builders, and problem-solvers. New Orleans will use NDR funds in both cases, incentivizing the hiring and training of unemployed individuals to build NDR-funded projects and designing the projects to be outdoor laboratories for schools to pursue project-based learning. Just as importantly, by creating an economic sector with export potential, New Orleans will establish a labor market with career opportunities for the next generation.

Using the GDP multiplier analysis from the 2011 report *Water Works: Rebuilding Infrastructure, Creating Jobs, Greening the Environment* by Green For All, New Orleans estimates that its Urban Water project alone will create over 2,200 jobs. The city of New Orleans has a goal that over 10% of those jobs will be filled by unemployed or underemployed individuals. When letting projects for bid, New Orleans will invite bidders to demonstrate how they can go above and beyond Section 3 requirements to hire,

train, and sustain graduates of the city's technical and soft skills training programs. The additional costs the employers incur to provide this training will be eligible costs as long as they are within reasonable costs measures. To create a pipeline of individuals ready for employment, New Orleans will build upon existing workforce development initiatives such as the city's Network for Economic Opportunity and the partnership between SWBNO, Delgado Community College, and the GE Foundation to train certified water infrastructure professionals through a water management training module.

The City's existing workforce programs already track graduates beyond the program and track Section 3 and DBE compliance. This program will be built into that portfolio of tracking so that graduates are tracked as they are hired by contractors. This will allow the workforce compliance officers to verify beyond the reports submitted by contractors that the hires are indeed receiving the training and employment opportunities pledged by the contractors.

Evaluating Outcomes. The City is creating a citywide performance management program, ResilienceSTAT, to track all of its resilience initiatives and NDRC-funded projects will be reported on directly within this structure. Both project outputs and outcomes will be tracked. ResilienceSTAT will pilot the City Resilience Index, a global set of measures and indicators, developed by Arup for the Rockefeller Foundation, to track cities' resilience building efforts throughout the world.

The City has used STAT programs to great success in everything from blight reduction, to contract management, to quality-of-life services. The STAT model – where key department and agencies gather regularly in a public meeting to report on their progress towards achieving their publicly stated goals and targets – increases transparency and accountability. Furthermore, it drives innovation and efficiency as upstream road blocks are discovered and removed. It also allows for the tracking of universal outcomes in relation to project-level outputs. For instance, the outcome goal of reducing blight by 10,000 units within the first 3 years of Mayor Landrieu's first term drove the department-level monthly output goals of code enforcement inspections, adjudication hearings, and court filings. This, in turn, drove the consolidation of departments with duplicative functions, an overhaul of a critical software platform, and the re-balancing of staffing and resource needs to meet these goals.

How the Projects Increase Resilience. The three projects and one program proposed within this application, and the intertwined efforts around workforce development and community engagement, address the core goals of the NDRC competition – they leverage one another to realize long-term improvements in physical adaptation, economic opportunity, and social cohesion, while addressing the unmet recovery needs of the Qualifying Disaster. Together, our improvements to Urban Water, Individual Adaptation, Reliable Energy and Smart Systems, and Coastal Restoration will assist our most-impacted communities to meet critical challenges around flood risk, climate change, energy interruptions, and economic well-being at the household, district, and citywide levels.

Increased Safety. Our first key resilience benefit realized from the projects is increased safety for residents of the Gentilly Resilience District and for residents of New Orleans and the greater region as a whole. Residents will be safer from stormwater-based flooding, which currently occurs regularly and is projected to occur with increased frequency due to climate change and subsidence. This regular flooding causes significant property damage and safety hazards to households and businesses; the Urban Water projects will functionally eliminate flooding from a 5-year storm and reduce flooding from a 10-year storm by 50%, and will assist in preventing additional soil subsidence that would otherwise increase flood risk over time (*Att.EGraphics.pdf*, page 259, <http://bit.ly/1k4bqkr>). The BCA estimates that the value of this reduction in flood risk is more than \$20 million. Reducing street flooding and increasing energy redundancy through the Reliable Energy and Smart Systems activities will also increase residents’ access to critical facilities and health care in times of emergency. In the event of serious storm surges outside the levee system, the Coastal Restoration project will reduce the risk of levee overtopping by mitigating the impact of storm surge and contributing to the regional flood protection system outlined in the Coastal Master Plan. The Coastal Restoration activities outlined in this application increase protection for New Orleans as well as St. Bernard Parish and the parishes along the Pontchartrain Basin (*Att.EGraphics.pdf*, page 279, <http://bit.ly/1k4bqkr>).

Reduced Economic Shocks and Stresses. The ongoing property damage caused by street flooding and soil subsidence presents an economic stress to some of the city’s most vulnerable populations, and inhibits the investment that could otherwise assist in increasing property values and household in New

Orleans. Reduced soil subsidence will avoid \$123.8 million in costs over 50 years. In addition, due to the lack of energy reliability and likelihood of flooding during disaster events, residents are more likely to need to evacuate, which presents a serious economic burden for low-income families due to the need to arrange for alternate housing while also foregoing income from New Orleans-based jobs. Our Urban Water, Coastal Restoration, Energy Reliability and Smart Systems, and Individual Adaptation projects and programs all help to decrease these economic stresses and shocks and help households and businesses recover as quickly as possible from a disaster event, thereby decreasing economic burdens on vulnerable families. For example, the PACE-financed homeowner retrofit program will provide \$28.8 million in benefits to LMI homeowners to help them decrease their energy bills and their flood risk.

Jobs and Opportunity. Through these projects and programs, New Orleans will increase opportunities for skilled employment, and will focus on connecting unemployed and under-employed New Orleanians to a growing “water economy” through sustained outreach and job training. By focusing job training and workforce development efforts on groups who are most likely to experience unemployment and financial instability, including low- and moderate-income communities and in particular jobless African-American males, New Orleans will work to reverse the trends of increasing inequality and stagnant wages that have caused serious problems for vulnerable families. We estimate that the Urban Water projects alone will create 2,000 jobs and offer \$17.7 million in compensation to workers on these projects. In addition, by creating a safer and more stable environment for businesses to open and grow, New Orleans and Gentilly will experience increased commercial development, job growth, and entrepreneurship.

Health Benefits. New and enhanced recreational spaces that emerge from the Urban Water activities will provide public health benefits; studies have shown that increased green space and contact with nature decreases stress, increases heart health, and decreases the number of minor medical complaints in communities as a whole. Increased opportunities for outdoor exercise also improve collective health outcomes. In addition, the increased tree cover provided through these projects will reduce air pollution and the urban heat island effect; many of the most-impacted communities lost much of their tree cover due to the Qualifying Disaster and Hurricane Katrina in 2005, meaning that these vulnerable communities also experience increased heat that can be especially harmful to senior citizens and can

discourage outdoor activity. During emergencies, reduced flooding due to the Urban Water project, and energy redundancy due to Reliable Energy and Smart Systems activities, will offer improved access to health care; this has proven to be particularly important for those with chronic health conditions who often have difficulty evacuating during storm events, but who also are particularly vulnerable to power outages and severe heat.

Foundation for Growth and Future Investments. As a whole, these projects and programs provide a foundation for growth, increased property values, and new investments that will help decrease wealth gaps and increase quality of life throughout the Gentilly Resilience District and the city of New Orleans (*Att.EGraphics.pdf*, page 282 and 283, <http://bit.ly/1k4bqkr>). As a historically low- to moderate-income community that was heavily affected by both Hurricane Katrina and the Qualifying Disaster, Gentilly continues to experience lower levels of housing and commercial development than comparable areas, and residents contend with a lack of commercial diversity as well as significant numbers of vacant residential properties. The proposed Urban Water project and the new water-based public realm features it produces will provide a strong foundation for new, dense residential and commercial development. New development will also support additional investments in multimodal transportation that will increase residents' access to jobs in the district and throughout the city and region. These investments, along with the Individual Adaptation program for property owners, will help increase property value and diminish the wealth gaps caused by lower property values in predominantly African-American areas of Gentilly. The BCA estimates that the networked Urban Water system will create \$392.4 million in additional property value in Gentilly over the next 50 years.

Social Cohesion, Education, and Awareness. Ongoing community engagement around the proposed projects and programs will increase awareness of the importance of water management and resilience interventions to the future of New Orleans as a whole. Residents will have opportunities to come together around diverse issues including urban design, employment and job training, citizen science, education, subsidence and infrastructure, energy, coastal restoration, and many other issues—providing residents with multiple ways to care and learn about the impacts of these projects on their everyday lives. Creative engagement strategies will also occur in multiple venues that draw in parents, children,

teachers, senior citizens, neighborhood association members, employees, the jobless, and many more groups. The goal of the full creative engagement strategy is to ensure that a large, highly-diverse group of residents will understand the need for generational change around stormwater, coastal, and energy issues and will be able to both contribute to and realize benefits from project implementation.

Benefit to Vulnerable Communities. Throughout each project and program, New Orleans will maintain a special focus on benefiting the most vulnerable communities who were particularly impacted by the Qualifying Disaster and by Hurricane Katrina in 2005. Within the sub-area of focus, which incorporates some of the lowest-lying areas of the city, 57% of households are low- to moderate-income; these households are therefore especially vulnerable to flooding and associated risks, and are less able to accommodate the economic and social shocks that accompany disaster. The physical interventions we propose will therefore concentrate on improving the safety and health of these vulnerable populations. In addition, job training and workforce development efforts will focus on providing skills and jobs to jobless and underemployed individuals across the city, while improved transit and commercial development will increase the availability and accessibility of jobs within the Gentilly Resilience District as a whole.

Regional Impacts. New Orleans will contribute to regional resilience through implementation of Coastal Master Plan measures, as well as providing regional models for stormwater management and energy redundancy that can be replicated throughout South Louisiana. Increased development and transit accessibility will also benefit regional economic growth, while the availability of a skilled “water workforce” will enable other communities to employ and benefit from a locally developed employee base. In addition, through the Regional Planning Commission and through local partnerships, New Orleans will coordinate with other municipalities and parishes in the region to operate and maintain federally funded storm reduction measures.

A national model for resilience. New Orleans is leading on city resilience nationally and internationally. As part of the growing 100 Resilient Cities Network, New Orleans has been able to connect with resilience leaders around the world to learn from their wisdom and experience, while also sharing its own. New Orleans was the site of the inaugural Chief Resilience Officer Summit in

November 2014, where the city had the opportunity to showcase its progress along with the challenges that remain. In August 2015, New Orleans launched the first city resilience strategy in the world—a model for other cities to look to as they work towards identifying shocks and stresses of their own and opportunities to address them.

The Urban Delta, New Orleans’ proposal for this NDRC application, works from the scale of the district—demonstrating a scale at which it is possible to implement transformational change and build physical and social resilience through smart investments in innovative water management, community adaptation, energy reliability and smart systems, and coastal restoration. The City of New Orleans will replicate this same district approach to implementing integrated projects that build comprehensive and holistic resilience, with a focus on reducing risk for vulnerable communities, across the rest of the city (*Att.EGraphics.pdf*, page 254, <http://bit.ly/1k4bqkr>). New Orleans’ approach provides a model for the rest of the urbanized area of Southeast Louisiana as well. As described in Factor 1, New Orleans is working closely with the Coastal Protection and Restoration Authority (CPRA) to develop and provide a model for the urban area “non-structural” components of the state’s 2017 update to the Coastal Master Plan. Scaled region-wide, these replicable activities build towards a future coast that is safer, more prosperous, and more equitable.

Climate change adaptation. A recent report from Climate Central warned that, even with immediate and significant global action to reduce green house gas emissions, over 400 coastal towns and cities in the United States are on a pathway to being partially below sea level given projections for rising seas. Because of New Orleans’ sinking deltaic soils, the city and the Southeast Louisiana region are already experiencing this inevitable future for coastal areas. New Orleans and the region are innovating in water management and coastal protection and exporting this expertise across the country. The city provides a model for how adaptation is not only possible, but also a mechanism for equitable growth. However, it takes bold, comprehensive, and integrated actions like those proposed in this application to achieve this future. By embracing its changing environment and investing in adaptation, the city can thrive.

Schedule. Following is a brief schedule breakdown of the city’s Urban Delta proposal, which includes 23 activities within 3 Projects plus 1 Program. Detailed schedules were developed through consultation

with engineers and environmental consultants and provided in Attachment D. (Att.DConsultation.pdf, pages 219-225)

Urban Water – A project that includes 12 activities. Thus, the milestones are presented as a range. Moreover, several of the activities have commenced initial phases of design or construction utilizing leveraged funds. The NDR scope will be incorporated in later phases after CDBG-NDR due-diligence is completed.

Design	Procurement	Environmental	Construction	End	Full function and benefits begin
2015 – Q1 of 2018	2015 – Q1 of 2018	Q2 of 2016 – Q3 of 2018	2015 to 2022	2022	Q4 of 2018 – Q4 of 2022

Reliable Energy and Smart Systems – A project that includes 3 activities. The most complex of the 3 activities, Energy Redundancy and Monitoring, is a vital component to ensure the success of the proposed NDR network of water management interventions. The Oak Street Station within the Energy Redundancy and Monitoring activity has already commenced design and is about to embark on construction using FEMA recovery funds. Through consultation with project engineers and FEMA managers, the city confirmed that the NDR scope can be incorporated once all CDBG-NDR due-diligence is complete.

Design	Procurement	Environmental	Construction	End	Full function and benefits begin
2015 – Q3 of 2018	2015 – Q4 of 2017	Q2 of 2016 – Q3 of 2018	2015 – Q1 of 2021	2021	Q3 of 2019 – Q1 of 2022

Community Adaptation – As one of the only program proposed, the individual property adaptation are anticipated to be one of the first CDBG-NDR interventions to commence given the experience and capacity of the partner who will administer it, the New Orleans Redevelopment Authority.

Design	Procurement	Environmental	Construction	End	Full function and benefits begin
Q1 2016	Q2 2016	Q4 2016	Q3 of 2018	Q4 of 2019	Q4 2019

Coastal Restoration – As one of the components of the Multiple Lines of Defense Strategy, natural coastal restoration is critical to any resilience approach in the region. Recognizing this, the city looks at all coastal restoration projects as one network with each rehabilitation activity supporting the next. Below is the schedule representing 6 coastal restoration activities that are critical to protecting New Orleans.

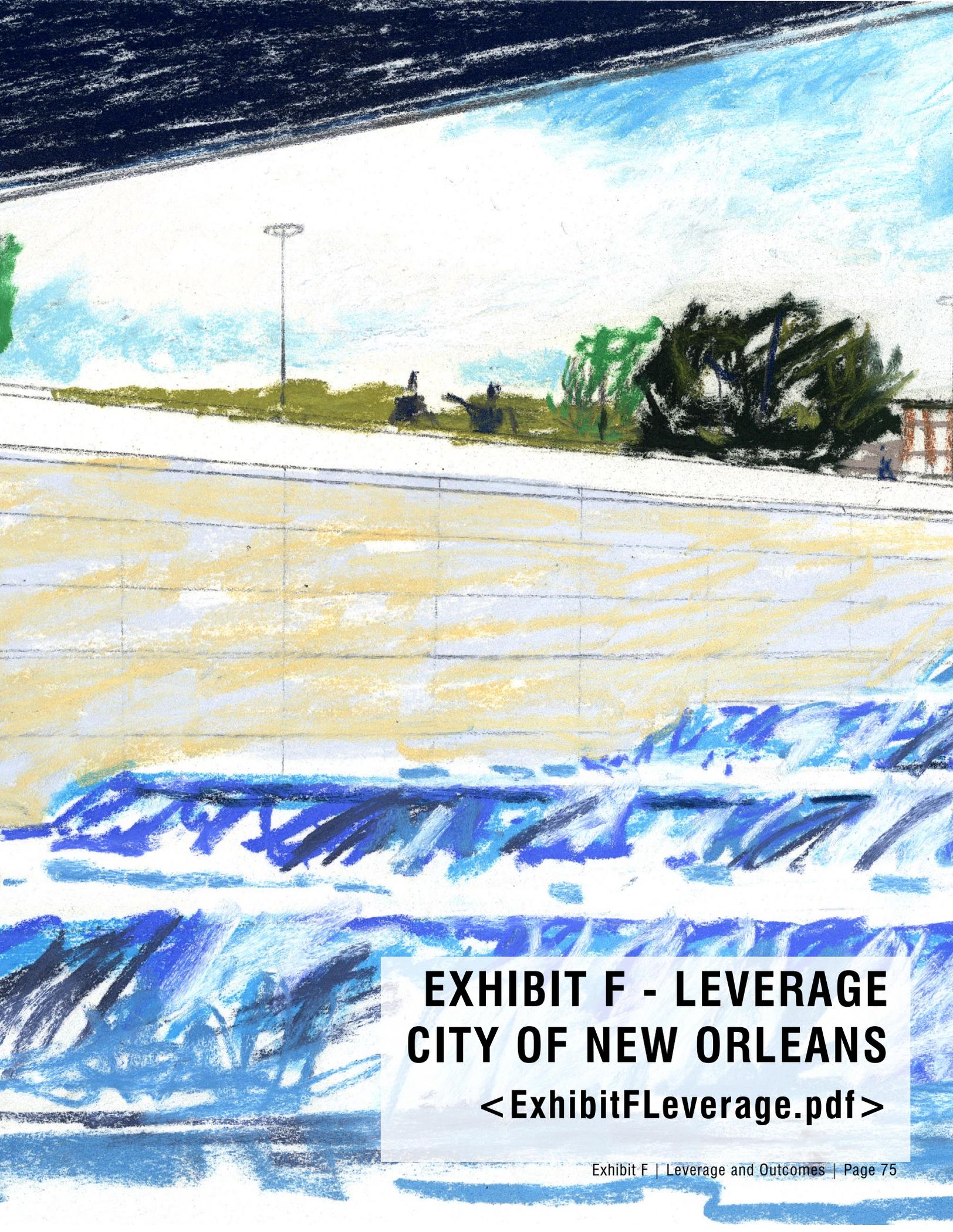
Design	Procurement	Environmental	Construction	End	Full function and benefits begin
Q2 of 2016 – Q1 of 2017	Q2 of 2016 – Q2 of 2017	Q4 of 2016 - Q1 of 2018	Q4 of 2017 - Q4 of 2018	Q3 of 2018 - Q4 of 2020	Q4 of 2019 - Q4 of 2023

Budget. In order to establish the budget listed above detailed cost estimates were developed for each of the proposed infrastructure projects. Arcadis, a sub-consultant to Waggoner and Ball has extensive experience in developing comprehensive and reliable cost estimates and developed a cost estimating template that was utilized for each of the projects. The first step of the budgeting process was to determine individual line items’ probable construction cost which was obtained from a comprehensive database of cost data developed over the past 4 years. Once the total probable construction costs was established, percentages were applied to determine the design, testing, construction administration and supervision, and contingency costs. In order to ensure cost-effectiveness the City will utilize existing project management staff to supervise the Architect/Engineer (A/E) assigned to each project. During each phase of the design process, (schematic design, design development, and construction documents) the City will require the A/E to deliver detailed probable cost estimates. All plans will be submitted to City Planning Commission’s Design Advisory Committee (DAC) to ensure that all relevant codes and standards are addressed in the design. In an effort to mitigate potential change orders during construction prior to going to bid all respective agencies will review and sign off on the projects plans and specification to ensure that all requirements and regulations are met. Louisiana Public Bid Law R.S. 38:2212 requires that all public works over \$150,000 be advertised and let by contract to the lowest responsible and responsive bidder. Further 44 Code of Federal Regulations (CFR) 13.36 (f) (1) requires a cost analysis determining that the procurement is cost reasonable be performed on all Federal funded activities. City Project Managers and Fiscal Staff have attended several training on developing cost

analysis and the City has adopted a requirement that a cost analysis be developed prior to executing a contract or construction contract change order for additional cost.

Projects and Activities	Total Budget	Direct Leverage	NDRC Budget	
1 Urban Water				
<i>Canals</i>				
Orleans Ave Canal	\$ 20,113,189	\$ -	\$ 20,113,189	
London Ave Canal Art/Intervention	\$ 500,000	\$ -	\$ 500,000	
<i>Blue-Green Parklands</i>				
City Park	\$ 21,086,670	\$ 2,000,000	\$ 19,086,670	
Mirabeau Water Garden	\$ 30,188,178	\$ 14,500,000	\$ 15,688,178	
Dillard Wetland	\$ 15,746,799	\$ 2,000,000	\$ 13,746,799	
<i>Blue-Green Corridors</i>	\$ 95,472,127	\$ 3,000,000	\$ 92,472,127	
<i>Neighborhood Network</i>				
St. Anthony Green Streets	\$ 28,090,135	\$ 1,000,000	\$ 27,090,135	
Pontilly Neighborhood Green Infrastructure	\$ 19,164,085	\$ 15,158,000	\$ 4,006,085	
Bayou St. John Neighborhood Green Infrastructure	\$ 13,924,458	\$ 9,000,000	\$ 4,924,458	
St. Roch Green Streets	\$ 25,020,450	\$ 12,500,000	\$ 12,520,450	
Milne Campus	\$ 10,594,525	\$ 1,000,000	\$ 9,594,525	
St. Bernard Neighborhood Campus	\$ 13,910,224	\$ 1,000,000	\$ 12,910,224	
<i>Subtotal</i>	\$ 293,810,840	\$ 61,158,000	\$ 232,652,840	
2 Community Adaptation				
LMI Homeowner Resilience Retrofit Program	\$ 7,000,000	\$ 2,000,000	\$ 5,000,000	
<i>Subtotal</i>	\$ 7,000,000	\$ 2,000,000	\$ 5,000,000	
3 Reliable Energy and Smart Systems				
Microgrids	\$ 11,656,450	\$ 4,000,000	\$ 7,656,450	
Energy Redundancy & Monitoring	\$ 172,510,228	\$ 171,795,389	\$ 714,839	
Water Monitoring Network	\$ 750,000		\$ 750,000	
<i>Subtotal</i>	\$ 184,916,678	\$ 175,795,389	\$ 9,121,289	
4 Coastal Restoration				
Living Shoreline	TBD	\$ 4,000,000	\$ -	
Bayou Bienvenue Marsh Restoration	TBD	\$ 5,203,882	\$ -	
Orleans Land Bridge	TBD	\$ 3,000,000	\$ -	
Golden Triangle Marsh Creation Project	TBD	\$ 1,000,000	\$ -	
<i>Subtotal</i>	\$ -	\$ 13,203,882	\$ -	
SUBTOTAL	\$ 485,727,518	\$ 252,157,271	\$ 246,774,129	
Workforce Development			\$ 3,000,000	
Project Management & Monitoring			\$ 14,806,448	6%
Total Implementation			\$ 264,580,577	
Planning & Administration			\$ 15,874,835	6%
TOTAL NDRC REQUEST			\$ 280,455,411	

All of the above projects and activities meet an Eligible Activity and National Objective as described in Exhibit B.



**EXHIBIT F - LEVERAGE
CITY OF NEW ORLEANS
< ExhibitFLeverage.pdf >**

New Orleans is in the midst of an historic rebuilding period, with billions of dollars to replace streets, upgrade drainage, and redevelop public facilities. New Orleans will leverage the funds dedicated to these rebuilding projects by designing and building them resiliently with CDBG-NDR funds. An NDRC award will serve as the catalyst for this transformation, enabling New Orleans to design, enhance, and augment its public works projects into a portfolio of resilience projects.

FEMA Hazard Mitigation and Public Assistance Funds. New Orleans has marshaled substantial FEMA Hazard Mitigation funds to address its resilience needs. New Orleans has \$198 million in Hazard Mitigation Grant Program (HMGP) funds under its control, all slated for projects that reduce flooding and enhance neighborhoods through green infrastructure or support energy redundancy to maintain the stability of the water infrastructure systems. These projects will be significantly enhanced with an NDR award since New Orleans will use the NDR funds to transform these projects from functional spaces into neighborhood amenities with workforce development benefits. This is the true definition of leverage: the multiplication of gains through the strategic use of resources.

New Orleans is also devoting tens of millions of dollars in FEMA Public Assistance funds to repair streets, infrastructure, and public facilities across the city. New Orleans will leverage the FEMA Public Assistance funds with NDR funds to build resilience design into each project. The \$103 million in street and subsurface utility repair scheduled for the Gentilly Resilience District will serve as supporting leverage to the green infrastructure investments made throughout the district. Each street rebuilt with FEMA funds will be designed, wherever feasible, to incorporate green infrastructure supported by NDR funds. The City of New Orleans and Sewerage and Water Board (SWBNO) are currently in negotiations with FEMA to consolidate all remaining funds into a settlement so that the City and SWBNO could re-assign the funds among streets within the District as needed to address the most appropriate recovery needs.

Sewerage and Water Board (SWBNO) Capital Funds. In December of 2012, the City Council of New Orleans authorized an increase in the rates for water and sewerage usage. The additional revenue generated by the increases will be used to fund \$3.3 billion in infrastructure projects to renovate the city's 300-year-old water and sewerage system. One of the major projects funded as part of this effort

is the retrofit of the Power Plant and Oak Street Raw Water Intake Station. SWBNO has allocated \$20 Million of capital funds for this project. In addition, SWBNO initiated in 2014 an annual investment of \$500,000 to community-based green infrastructure education and demonstration projects. Lastly, the SWBNO has committed to investing \$100,000 in software to assist in modeling green infrastructure improvements.

City of New Orleans Funds: New Orleans is dedicating all the resources it has received from the judgment against BP for the 2010 oil spill, \$36 million in criminal fines, to build resilience and serve as leverage for the NDR funds. While the funds can be used to support a wide array of activities, many of which would not serve to build resilience, New Orleans is committed to use the funds in the spirit in which they were intended, to improve the sustainability of the coast, improving water quality and restoring habitat. These funds are a crucial source of leverage for this proposal and they support the green infrastructure projects which will improve water quality and the coastal restoration projects that will restore critical habitat and provide flood protection benefits.

Coastal Restoration Funds: On July 6, 2012, the President signed into law the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act; Subtitle F of Public Law 112-141). The Act established the Gulf Coast Restoration Trust Fund in the U.S. Treasury Department. As of March 19, 2015 the Gulf Coast Restoration Trust fund had \$1,203,882 directly allocated to the City of New Orleans and the City has committed these funds to restore degraded marsh in Central Wetlands near Bayou Bienvenue in Orleans Parish. The Coastal Restoration and Protection Authority have funds dedicated to the coastal projects in New Orleans that form an integral part of New Orleans' overall approach. The funds provide supporting leverage and are dedicated to carry out the design and implementation of marsh restoration projects that provide flood protection, ecosystem, and recreation benefits.

Partner Leverage: The New Orleans Redevelopment Authority (NORA) is also providing leverage through its Neighborhood Resilience Program. Employing CDBG-DR program income funds, NORA will work with community members to build awareness, develop strategies, and implement projects that enhance resilience at the scale of the neighborhood. These funds will support the adoption of best

management practices for stormwater and will therefore serve as a critical source of supporting leverage for the Community Adaptation program. Other Partners that are contributing toward this effort are; Sandia National Laboratories which has pledged internal resources towards the Microgrid Project, and Trust for Public Land which is developing software to assist the Climate Smart Cities decision support tool and green infrastructure financing analysis.

All leverage documentation is included in Attachment B.

The funding sources that will provide leverage to CDBG-NDR funds are as follows:

Direct Leverage

Source	Amount
FEMA Hazard Mitigation Grant Program (HMGP)	\$192,953,389
City Funds	\$24,000,000
Sewerage and Water Board Capital Funds	\$20,000,000
NORA Program Income	\$2,000,000
Total Direct Leverage	238,953,389

Supporting Leverage

Source	Amount
FEMA Hazard Mitigation Grant Program (HMGP)	\$6,500,000
FEMA Public Assistance (PA)	\$103,647,459
Sewerage and Water Board Capital Funds	\$600,000
Coastal Protection and Restoration Authority (CPRA)	\$650,771
NORA Program Income	\$141,189
City Funds for Coastal Restoration Projects	\$12,000,000
City Restore Act Allocation	\$1,203,882
Sandia National Laboratory	\$1,160,000
Trust for Public Land	\$150,000
Total Supporting Leverage	\$126,053,301
Total Leverage	\$365,006,690
Total NDRC Budget	\$280,455,411
Percent Leveraged Funds	130%



**EXHIBIT G - LONG-TERM COMMITMENT
CITY OF NEW ORLEANS**

< ExhibitGLongterm.pdf >

New Orleans seeks to become a model for resilience thinking and action as it approaches its tricentennial in 2018 and has already made concerted efforts toward building resilience. Since NDRC was launched on September 17th, 2014, the City of New Orleans has named a Chief Resilience Officer, created an Office of Resilience and Sustainability, and launched the world's first City Resilience Strategy under the aegis of 100 Resilient Cities – Pioneered by the Rockefeller Foundation. The City hosted the first international summit of Chief Resilience Officers and pledged to dedicate at least 10% of its budget to resilience-building investments. This focus on resilience has already begun to catalyze a series of innovations and improvements across policy, budgeting, design, performance management, and public works.

Resilience Planning. The City launched *Resilient New Orleans: Strategic actions to shape our future city*, the city's comprehensive Resilience Strategy, on August 25th, 2015, after more than a year of planning research, stakeholder engagement, and initial program design. The Resilience Strategy outlines three visions for New Orleans for building resilience and this application proposes projects within each vision. This NDRC application was developed in tandem with the resilience strategy and provides an opportunity to support those specific actions that tie back to the Unmet Recovery Needs from Hurricane Isaac as identified in Phase I of the NDRC application. The actions are designed to reduce risk, improve resilience, create multiple benefits, and benefit low- and moderate-income (LMI) households.

The Resilience Strategy was developed in a similar and coordinated process with the City's NDRC application: a first phase in which New Orleans assessed its shocks and stresses, sourced scientific data and best practices, and gathered stakeholders' perceptions, followed by a second phase of deeper inquiry into risks and vulnerabilities, more stakeholder engagement to develop feasible actions, and the prioritization of activities to address New Orleans' most critical challenges and opportunities. More than 350 stakeholders from around the region, from formal leaders to community members, participated in the development of the strategy and many non-governmental partners will continue to play key roles throughout implementation of the actions. All of the projects proposed in this application are aligned with the themes and targets of the resilience strategy and are complementary to the actions outlined within the strategy.

In concert with the Resilience Strategy, New Orleans has been conducting an update to its Hazard Mitigation Plan. When formally adopted in March 2016, New Orleans' Hazard Mitigation Plan will reflect the comprehensive approach embodied by the resilience strategy, going beyond natural hazards to include all perils, considering the potential impacts of climate change, and focusing on issues of equity and the disproportionate risks faced by vulnerable communities. The draft plan, now under review by the Governor's Office of Homeland Security and Emergency Planning and FEMA, has goals and objectives that dovetail with the actions and approaches within the resilience strategy.

Capacity Building. In addition to appointing its first Chief Resilience Officer, New Orleans has been adding significant staff capacity to improve city resilience. The city has already met the commitment it made in Phase I of the NDRC by adding 11 positions within city government to work directly on resilience and stormwater management. Furthermore, the newly-formed Mayor's Office of Resilience and Sustainability provides a central unit from which the City is managing the coordination of resilience-building activities across departments and agencies.

To advance the city's social resilience, the City of New Orleans created the Network for Economic Opportunity (the Network). As an outcome of the Sustainable Communities Planning Grant, The Network focuses on connecting disadvantaged job seekers and disadvantaged businesses to opportunities. The Network forged a partnership with Delgado Community College's Water and Wastewater Treatment Program and the Sewerage and Water Board of New Orleans to train certified water infrastructure personnel, creating direct local career pathways in advanced manufacturing. New Orleans will build upon this capacity to connect disadvantaged jobseekers to the opportunities created through NDR-supported projects.

The City of New Orleans is leading by example in building financial stability and resilience for low- and moderate-income earners. New Orleans added to its local hiring and disadvantaged business entity requirements the adoption of a Living Wage Ordinance on August 6, 2015. The ordinance requires city contractors and grant recipients to pay a "living wage" of \$10.55 per hour and provide sick leave. The impact of the increased wages will be significant affecting an estimated \$56.9 million worth of City contracts. More than \$500,000 of the 2016 operating budget is dedicated to compliance with

disadvantaged business enterprise and living wage policies.

The city is also increasing its capacity by upgrading its management and monitoring systems. The city is investing in a state-of-the-art asset management system as a component of its Enterprise Resource Planning system. This technology platform will allow the city to plan, budget, monitor, operate, and maintain its physical infrastructure systems including drainage pipes, green infrastructure, streets and street lights, among others, with greater efficiency and better data. The city is also investing in an energy audit and implementing energy-efficiency measures and energy-use monitoring technology in public facilities throughout the city to reduce its energy costs and carbon footprint.

Best Practices Development. As part of the City's engagement with 100 Resilient Cities – Pioneered by The Rockefeller Foundation, New Orleans has forged new knowledge and resource partnerships with many of the other cities in the global network and also with private and non-profit organizations providing technical assistance for project implementation and strategic planning. In October 2015, the city of New Orleans participated in a professional exchange in The Netherlands with 10 other cities from around the world also facing water challenges.

The City of New Orleans is establishing a Center for Resilience, with organizational inspiration from models in The Netherlands, to serve as a permanent site for best practices research, vocational training, community outreach and development, and entrepreneurial activity. The City is partnering with the Rockefeller Foundation, Tulane University, and the regional economic development alliance GNO, Inc to launch the center, which will be a hub for economic development and community engagement around approaches to building physical and social resilience. The Center for Resilience already has more than \$500,000 in grant funding committed for the first year of design, implementation, and operations.

Legislative Action and Policy Commitments. New Orleans has made many policy commitments to enable and incentivize resilient actions. New Orleans adopted a completely overhauled Comprehensive Zoning Ordinance (CZO), which went into effect on August 12, 2015, that included stormwater management requirements for all sizeable commercial developments or redevelopments. This fulfilled New Orleans' NDRC Phase I commitment to codify stormwater regulations. Now New Orleans has

begun to implement it, adding capacity to manage the permit review process and currently has the first permit applications under review. New Orleans also passed a local ordinance establishing Property Assessed Clean Energy (PACE) financing, enabled under state legislation. New Orleans is now examining the law to expand the eligible expenses to include stormwater mitigation interventions, storm-resilience retrofits, and home elevations. The City's newly developed Integrated Housing Policy establishes the framework by which the City will invest in both places and people to expand access to a range of safe, quality housing options that are affordable to them and with access to jobs, services, and neighborhood amenities that support their families and wellbeing.

Raising Standards. The City of New Orleans is partnering with the American Institute of Architects to develop resilient design standards for new construction and retrofits in Southeast Louisiana, focused on storm resilience, water management, and energy efficiency. These design standards will inform a citywide property owner retrofit incentive program using the newly authorized and aforementioned PACE financing, whereby homeowners can access low-interest capital for retrofits that improve the property's and the city's overall resilience. Upon bond commission authorization, the New Orleans Redevelopment Authority (NORA) will be the local administrator of the \$20 million in available bond financing. NORA hopes to begin administering the program in the third quarter of 2016 with a goal of at least 25 participating households by the first quarter of 2017. (Att.DCconsultation.pdf, page 226.)

The City and NORA have already led by example through the administration of Neighborhood Stabilization Program Phase II (NSP2) funds for the construction of resilient affordable housing. For example, over 200 new homes that were constructed with NSP2 funds included Hazard Resilience Standards mandated by NORA that went above and beyond the local building code, such as hurricane clips and wraps that conform to the International Residential Code, and roof shingles with 130 mph wind ratings and window protection that meets ASTM E 1886 or 1996. Another example can be found in the homes NORA recently developed with on-site water management measures, such as rain barrels, and storm-resilience upgrades, including storm shutters. Additionally, the City of New Orleans is working with the University of New Orleans and representatives from the reinsurance industry, including Swiss Re, to research the effects of individual adaptation measures and retrofits on flood insurance premiums.

Research, Analysis, & Monitoring. New Orleans has made a long-term commitment to investing in the tools, research, and analysis required to address our resilience challenges. The City has partnered with the Trust for Public Land to tailor the Climate-Smart Cities decision support tool for focus area site selection that compares areas with the most exposure to flooding, heat, and the most vulnerable populations. Customized with local data, the decision support tool combines hydrological systems analysis with social vulnerability indicators. Future plans include developing comprehensive models to combine the Coastal Protection and Restoration Authority’s coastal storm surge risk analysis with urban flood risk predictions. The Sewerage and Water Board is conducting hydraulic and hydrologic studies throughout the city to determine the baseline conditions required to design green infrastructure throughout the city. In partnership with ESRI, the City of New Orleans Office of Information Technology and Innovation (ITI) has developed a web-based application to catalogue, grade, and map property characteristics and conditions citywide. The system is being piloted in the Gentilly Resilience District as the Gentilly Resilience Study to help gather more detailed information about the built environment and help guide the implementation of resilience-building projects. Through the 100 Resilient Cities technical assistance offering, New Orleans will partner with Trimble to develop a land cover classification analysis to determine tree canopy coverage and impervious surface coverage as a baseline tool for measuring the impacts green infrastructure development.

Regional Coordination. Cutting across every element of the city’s resilience strategy is the importance of coordination with neighboring jurisdictions. The shocks and stresses that New Orleans faces are the same as those facing all of coastal Louisiana. The shocks of storm surge, flood events, heat waves, and electricity outages and the stresses of sea level rise, soil subsidence, income inequality, and violent crime do not stop at political boundaries. New Orleans’ approach is a local component inside the larger regional and statewide approach to resilience and serves as a model for how coastal urban communities can adapt to climate change while creating opportunity and safety for their most vulnerable communities.

The City of New Orleans is already leading by example on regional coordination, initiating the formation of the Resilience Committee at the region’s metropolitan planning organization, the Regional

Planning Commission (RPC). RPC will convene the eight parishes (counties) in the region, including New Orleans and two other NDRC applicants—St. Tammany and Jefferson Parishes—to share best practices and designs and to collaborate on addressing shared risks and opportunities. The focus will be on critical infrastructure and services such as coastal restoration, flood protection, storm-water management, potable water, and energy infrastructure, among others. These systems will also be examined in how they intersect with other vital services such as transit, economic development, and the environment. The committee members will deliver project updates from each parish, discuss how the projects can create complementary outcomes and shared benefits, and share best practices and lessons learned. In addition to member parishes, stakeholders in the public, private, and non-profit community will be invited to present on their projects and initiatives. By creating a more resilient region, the committee will contribute to the region’s growth, prosperity, and sustainability.

Regional Workforce Strategy. All four Louisiana NDRC applicants will be working with the regional economic development alliance for the Greater New Orleans region, GNO, Inc., on a regional workforce strategy. Leveraging the vast relationships GNO, Inc. has across the region with two-year schools, four-year universities, Workforce Investment Boards, small business associations and various firms working in resilience, this opportunity will extend across Southeast Louisiana. Already, over 30 individuals from the above stakeholder groups have been brought together with GNO, Inc. and the four NDRC applicants to learn about the projects being proposed to align projects and programming around workforce development.

Regional Resilience Exchange. Via a partnership with the Rockefeller Foundation, the four Louisiana applications will have the opportunity uplift best practices in the form of case studies to share with one another and other communities as well. While the Regional Resilience Committee will be the place for sharing on an ongoing basis, this online portal will serve as a mechanism to memorialize and share success and challenges far beyond the grant period and with partners outside of the NDRC process.

Stakeholder and Community Engagement. New Orleans has demonstrated commitment to long-term stakeholder and community engagement. Beyond the 350 stakeholders involved in developing the city’s resilience strategy, and the stakeholders consulted in the development of this application (*Att.*

DConsultation.pdf, page 207), New Orleans has created a host of opportunities for residents and practitioners to provide insight and gain knowledge on how resilience can be developed throughout the city.

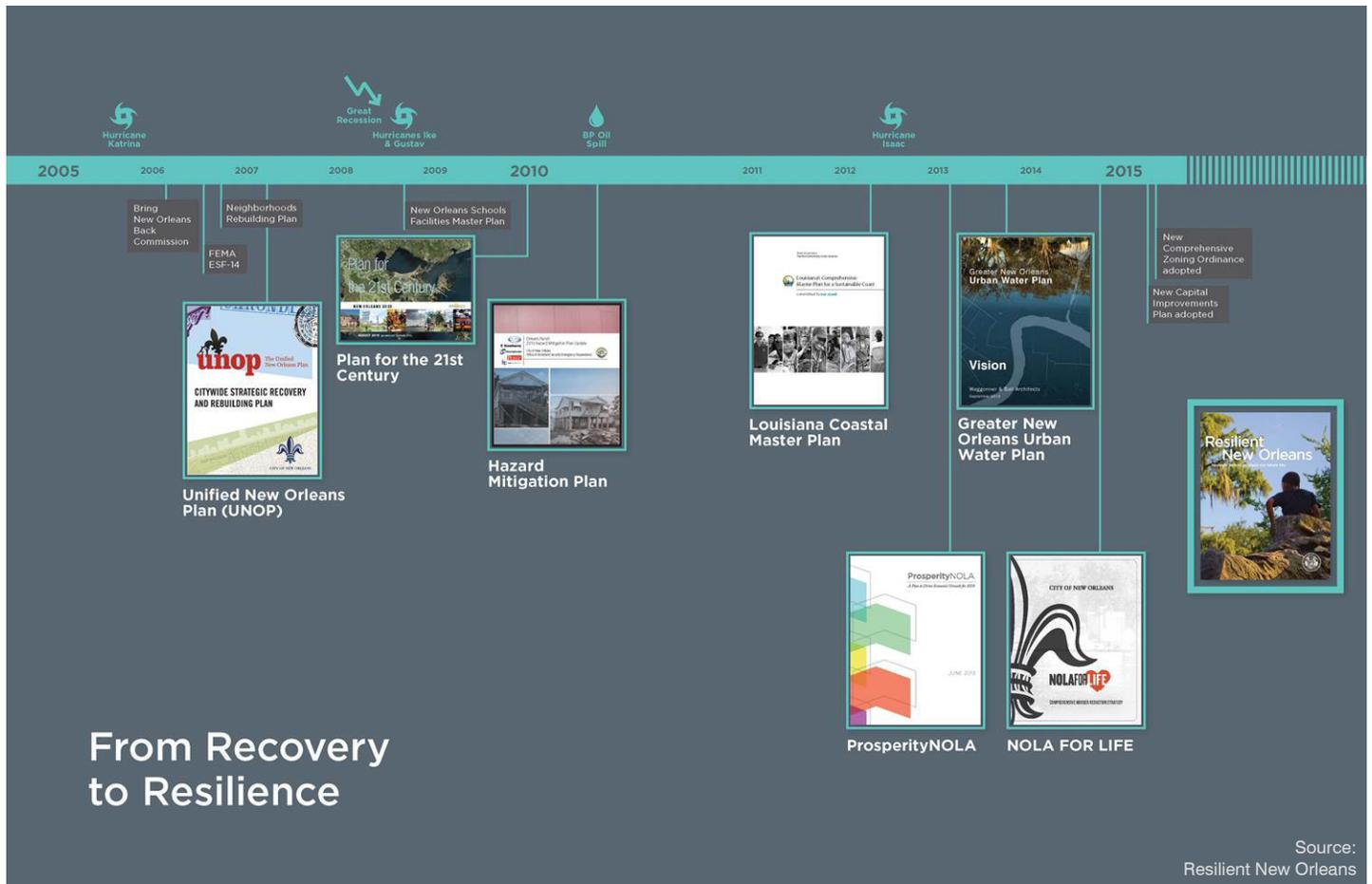
The New Orleans Redevelopment Authority (NORA) has built eight demonstration sites to show how vacant lots can be retrofitted to delay and detain infiltrate stormwater. The sites, which are clearly marked and contain informational and educational signage, are used on tours and site visits to help visitors and residents alike understand how these principles can be applied to New Orleans' landscape. NORA also developed an animated video to help explain the principles of green infrastructure and New Orleans' specific challenges with stormwater management. NORA is also hosting a one-day workshop on resilience in partnership with 100 Resilient Cities at the Louisiana Smart Growth Conference, to advance the knowledge and sharing of best practices throughout the state and region.

NORA will be launching a neighborhood resilience program in 2016 to bring resilience planning to neighborhood- and community-based organizations. The program will provide technical assistance and planning support to neighborhoods to assess their resilience and devise strategies and projects that address their challenges and risks. By working together to address their common risks, neighbors can build social cohesion, develop new solutions, and reduce their exposure to risk. Additionally, NORA will use the opportunity of working directly with neighborhoods facing flood risk to promote participation in the National Flood Insurance Program. The neighborhood resilience program will be piloted in select neighborhoods building on community development work previously undertaken by the City and NORA. NORA has committed \$2,000,000 in initial funding to building resilience in neighborhoods citywide and intends to pilot the first neighborhood strategic process during the third quarter of 2016, with a second by the second quarter of 2017. (*Att.DConsultation.pdf*, page 226.)

Link to Maps and Graphics:
<http://bit.ly/1k4bqkr>

**ATTACHMENT E - MAPS AND GRAPHICS
CITY OF NEW ORLEANS
<Att. EGraphics.pdf>**

PLANNING FOR RESILIENCE

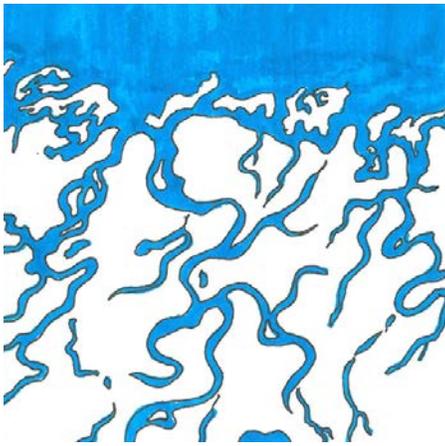


10 years of planning efforts addressing issues from urban water management to job creation

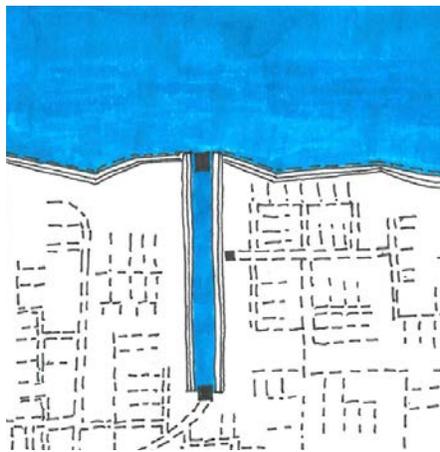


Key planning efforts and documents that guide the NDRC proposal's strategies and approach

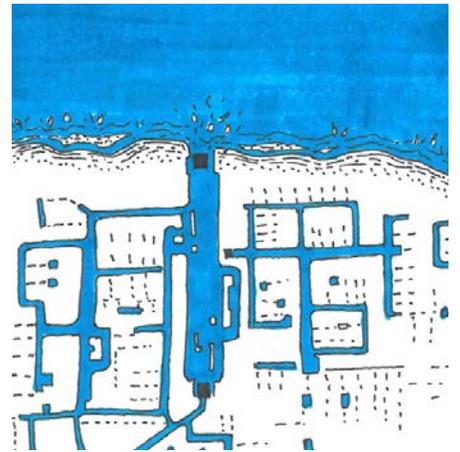
DELTA ADAPTATION



Past



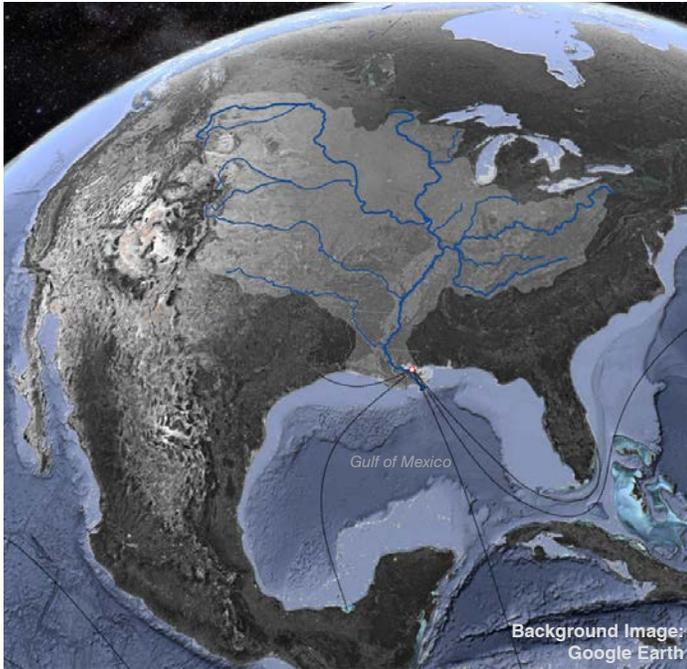
Current



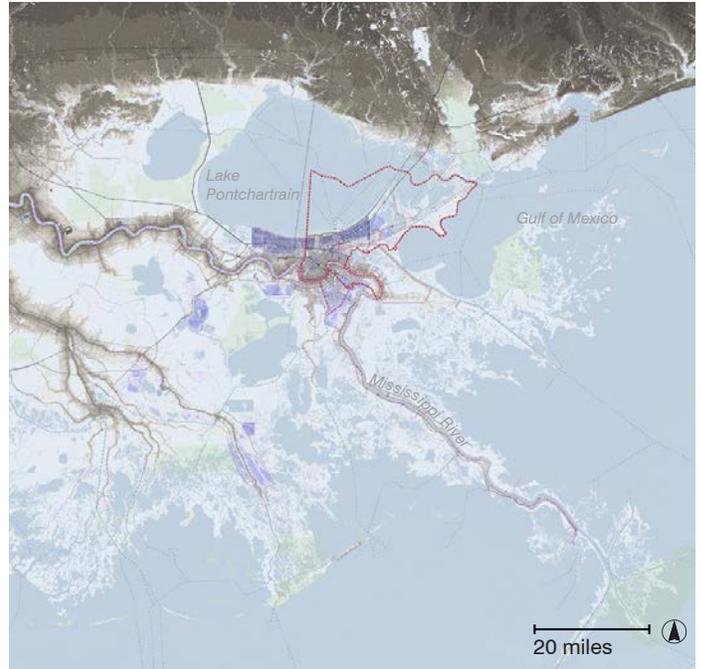
Future

Images:
Waggoner & Ball Consultant Team

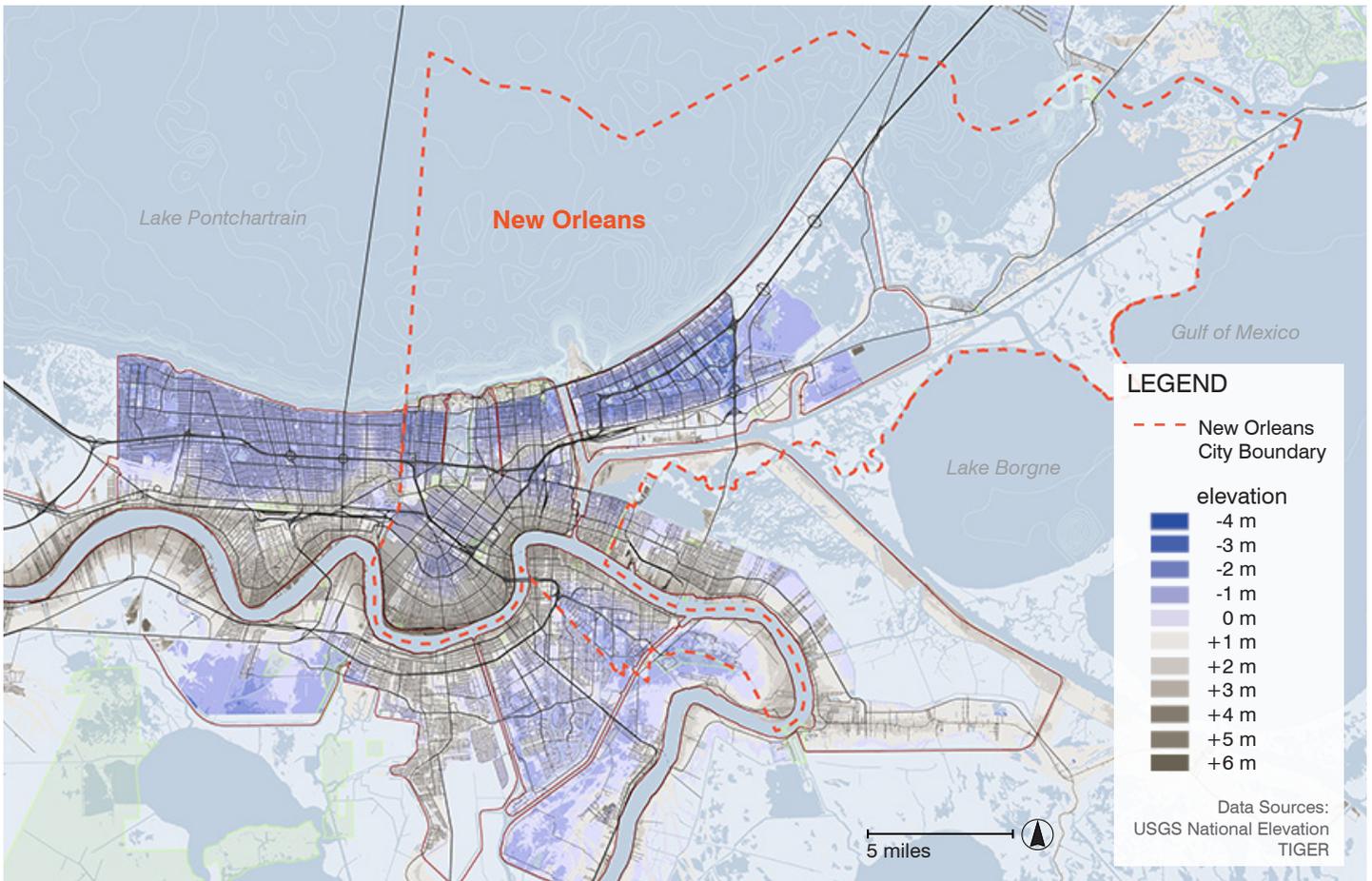
DELTA CONTEXT



Mississippi River Watershed



New Orleans | situated between the Mississippi River and Gulf of Mexico



Surface Elevations and City Boundary | a landscape equal parts land, wetlands, and water

Images:
Waggoner & Ball Consulting Team

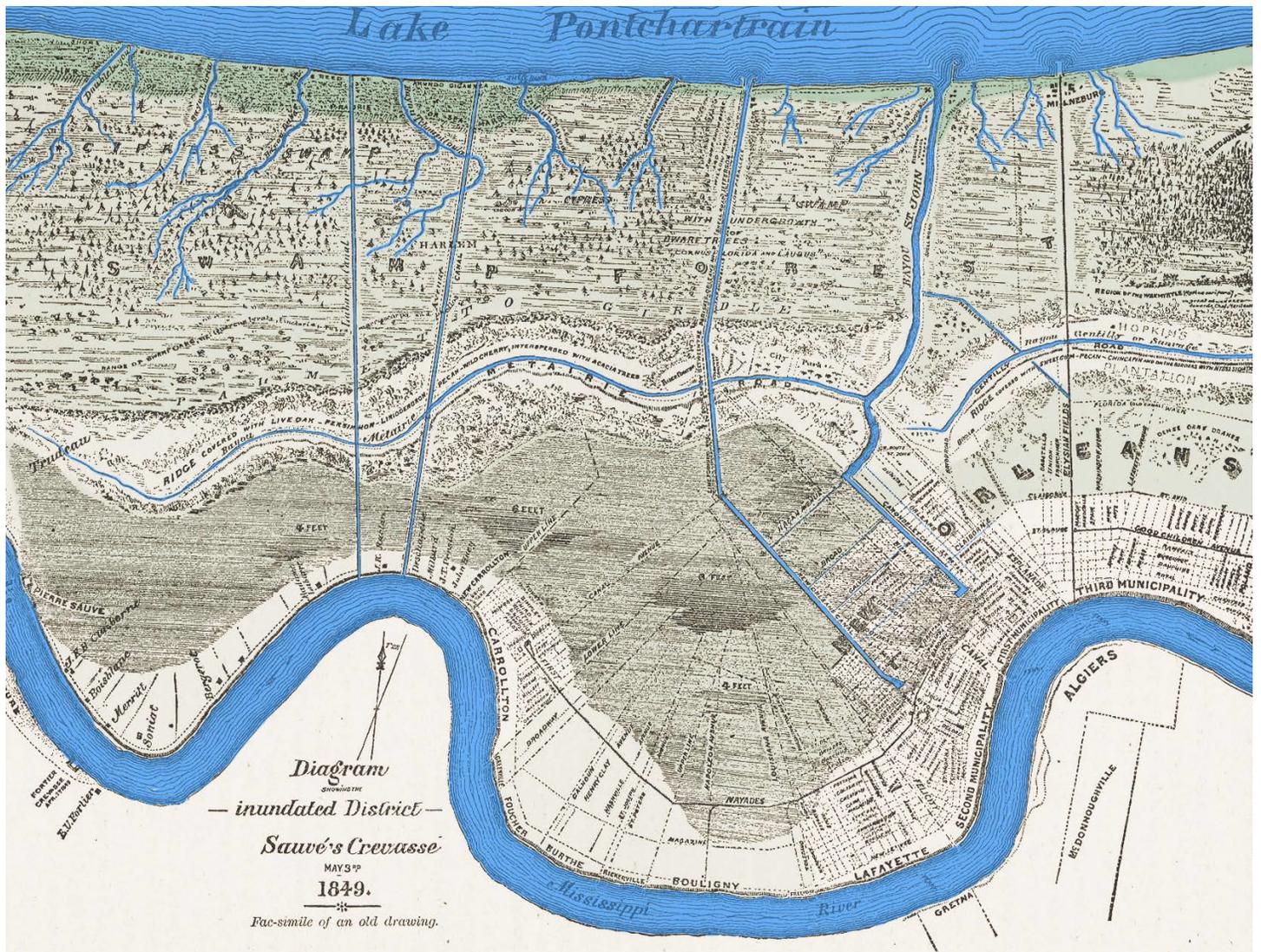
MISSISSIPPI RIVER DELTA



Flowing water shapes every aspect of life in the delta

Source: Jaap van der Salm

WATER CITY | HISTORIC



Large swaths of New Orleans were once marsh and swamp

Source: Louisiana Digital Map Library



Historical lakefront | an ecologically rich edge

Source: William Henry Buck painting



Drainage and clearing of swamps enabled human settlement

Source: New Orleans Public Library

WATER CITY | PRESENT POTENTIAL



Source:
Waggoner & Ball Consulting Team

New Orleans | a city defined by the Mississippi and its water assets



Source:
Waggoner & Ball Consulting Team

Bayou St. John | early settlements were on high ground next to waterways



Source:
Waggoner & Ball Consulting Team

Riverfront | historic core of city



Source:
Bill Lang

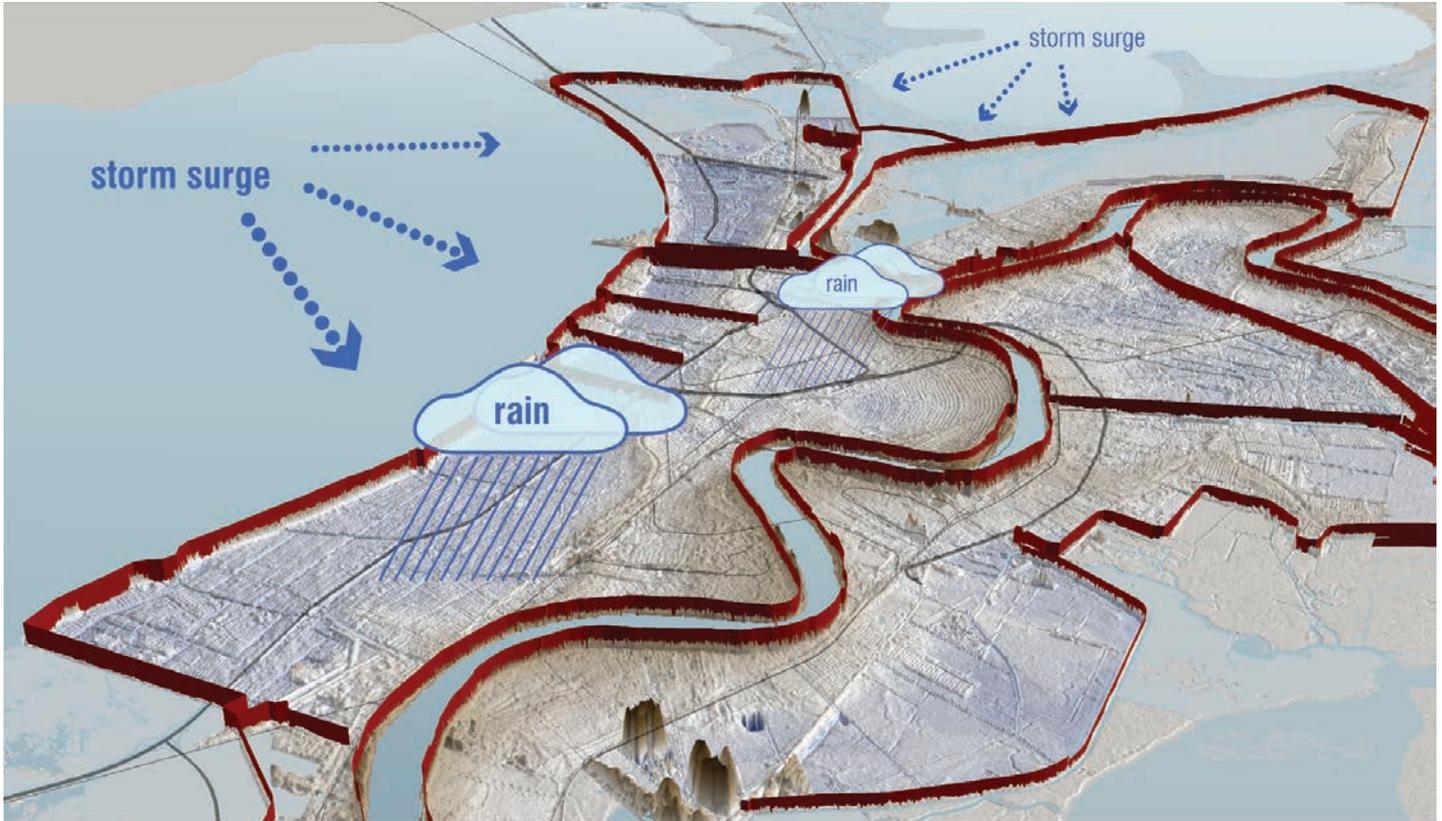
Bayou Sauvage | wetlands as components of urban delta



Source:
Waggoner & Ball Consulting Team

Lakefront

WATER CITY | EXISTING PERIMETER DEFENDED



Floodwalls and levees protect New Orleans from storm surge; pumps evacuate stormwater that falls within these boundaries

Source:
Waggonner & Ball Consulting Team



Armoring and lifting levees as ongoing process

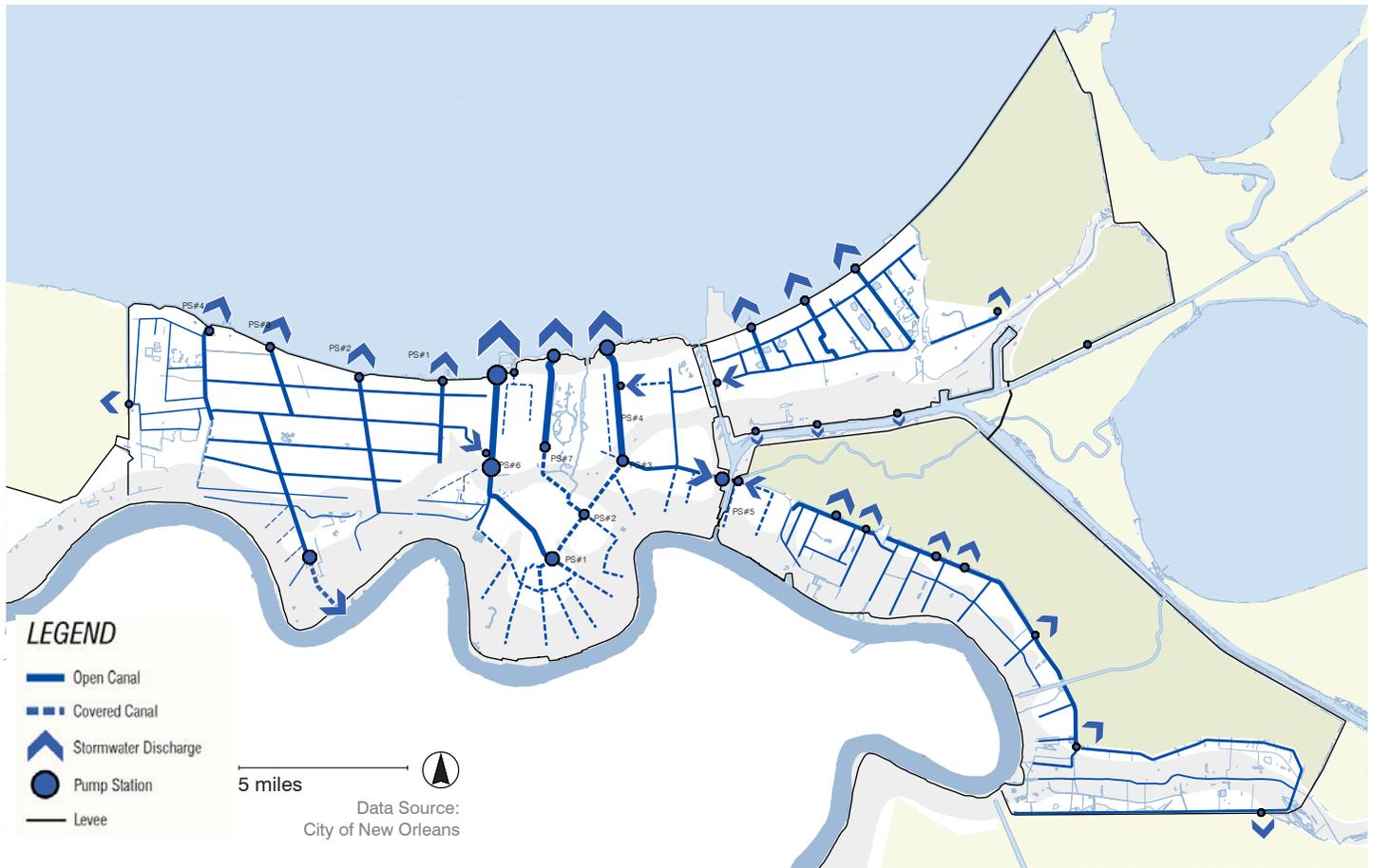
Source:
Waggonner & Ball Consulting Team



New closure structures at the lakefront that protect New Orleans from storm surge

Source:
City of New Orleans

EXISTING DRAINAGE SYSTEM



Existing drainage system consisting of underground pipes, culverts, canals, and pump stations

Source:
Greater New Orleans Urban Water Plan



Internal and perimeter pump stations | machinery to move stormwater, but with high energy and economic cost

Source:
Waggonner & Ball Consulting Team



Existing drainage infrastructure | single purpose and unsightly

Source:
Waggonner & Ball Consulting Team

EXISTING DRAINAGE SYSTEM



Existing Canal | water infrastructure as barrier

Source:
Waggoner & Ball Consulting Team

CURB TO COAST



Gutters and storm drains | where runoff enters drainage system

Source:
Waggonner & Ball Consulting Team



Pipes and culverts | conveyance of runoff to pump stations

Source:
New Orleans Public Library



Pump stations | lifting of runoff over levees and out towards the Gulf of Mexico

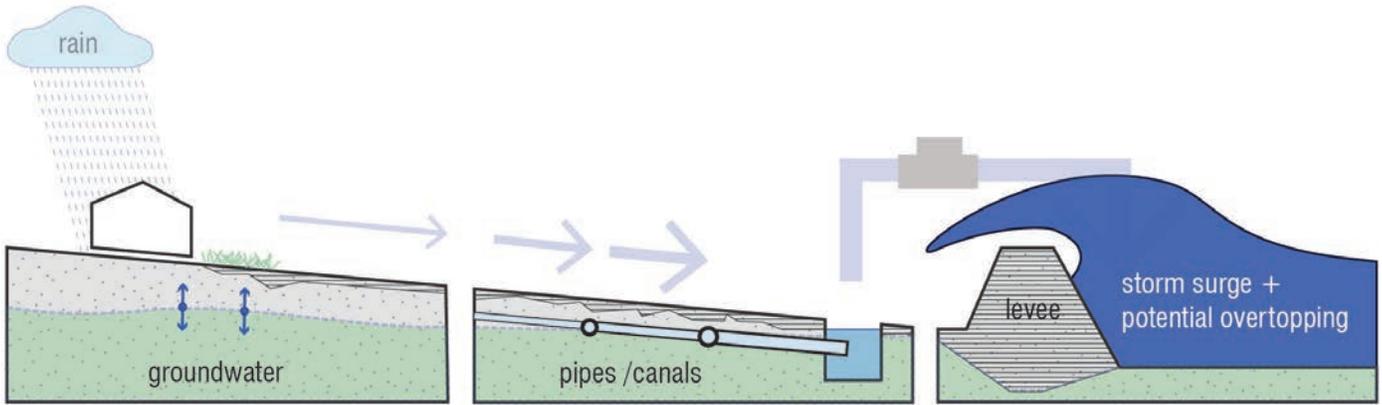
Source:
John McCusker/The Times-Picayune



Gulf of Mexico | urban runoff impact waters quality and regional ecology

Source:
Waggonner & Ball Consulting Team

RISK & MANAGEMENT



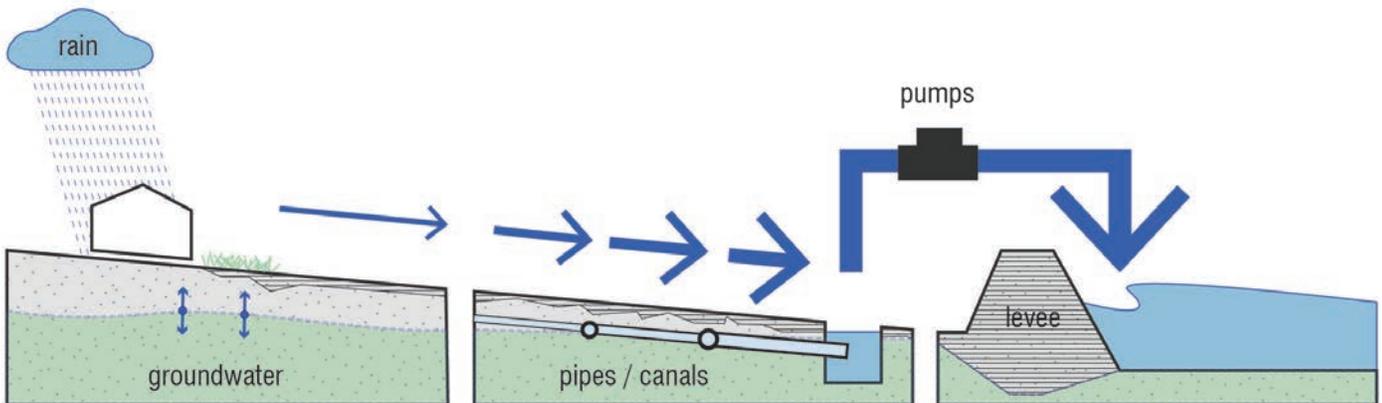
Surge protection | levees protect New Orleans from the surge of a 100 year event, with residual risk from overtopping



High water levels in Lake Pontchartrain during and after Hurricane Issac, 2012



Intense rainfall | another source of flood risk, when pipes and pumps are overwhelmed by large rainfall volumes



Existing drainage system | pipes and pumps drain urban runoff; groundwater levels tied to natural cycles and drainage regime

Images: Waggoner & Ball Consulting Team



Subtle natural and spatial features have been exaggerated by urban settlement and twentieth century drainage infrastructure



Backslope | high ground next to river, e.g., French Quarter and Central Business District



Bowls | low ground and former swamp; typically suburban development



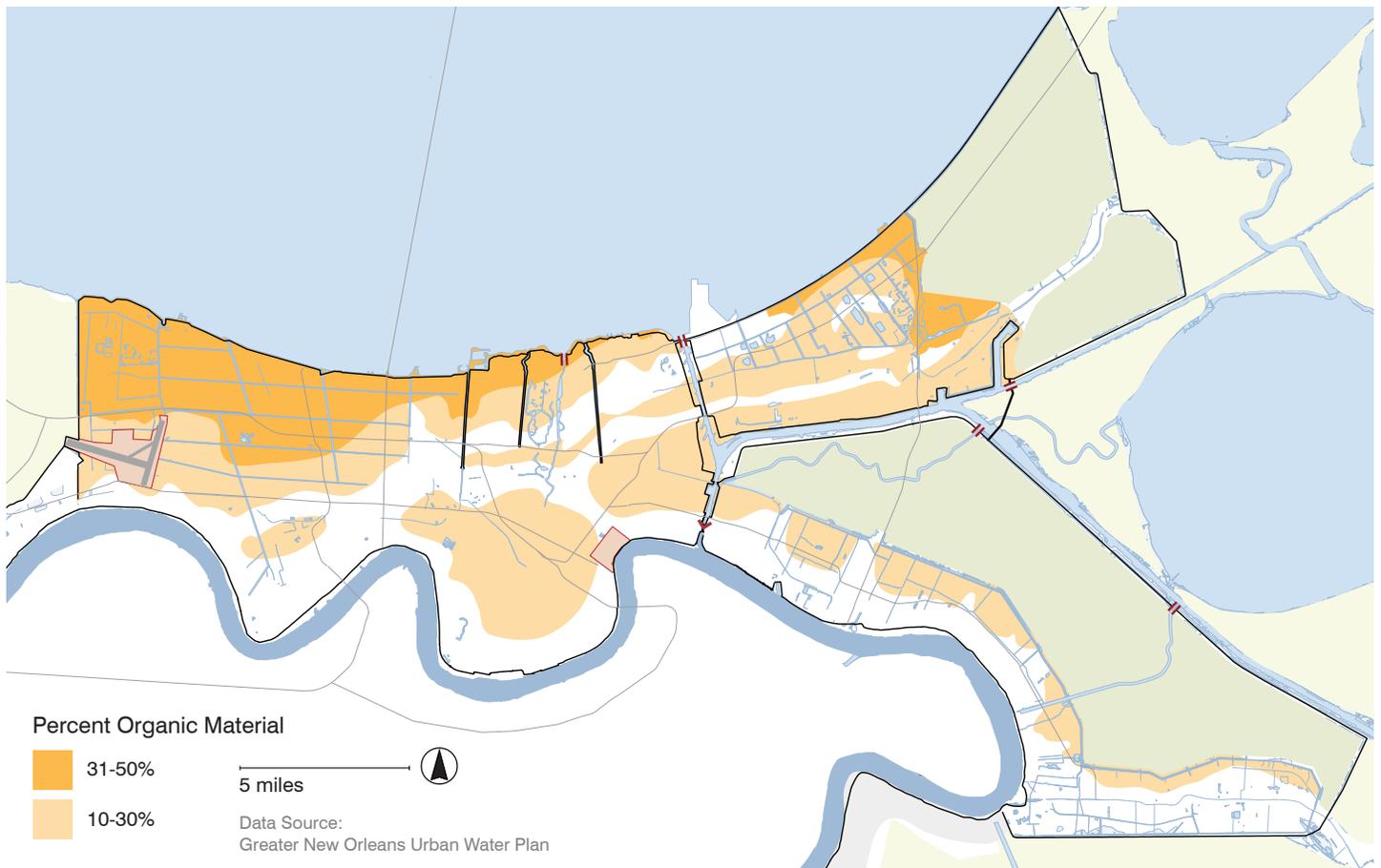
Lowlands | former swamp and marsh, typically with organic soils and low surface elevations; includes Gentilly



Wetlands | rich ecosystems that surround the city, and a few located in urban areas

Images: Waggoner & Ball Consulting Team

SUBSIDENCE



Subsidence Potential | soils with high organic material content typically have the highest potential for subsidence

Source:
Greater New Orleans Urban Water Plan



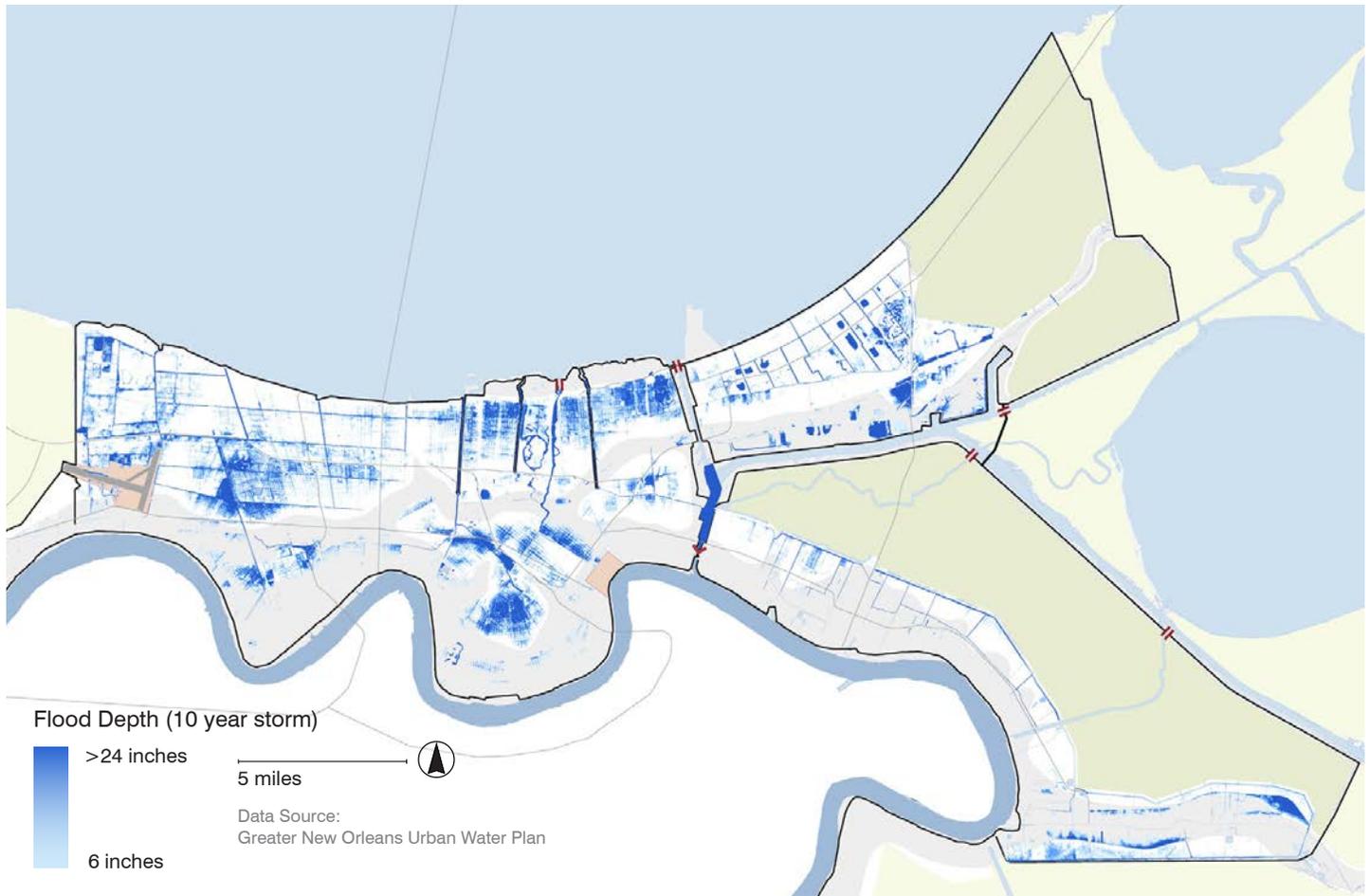
Effects of Subsidence | damage to roadways, utilities, and other infrastructure



Effects of Subsidence | structural damage to homes and businesses, and with high costs for property owners

Images:
Waggoner & Ball Consulting Team

FLOOD RISK



Flood Risk | modeled impact of a 10-year storm caused by excess urban runoff, and with disproportionate impact on low-lying neighborhoods

Source:
Greater New Orleans Urban Water Plan



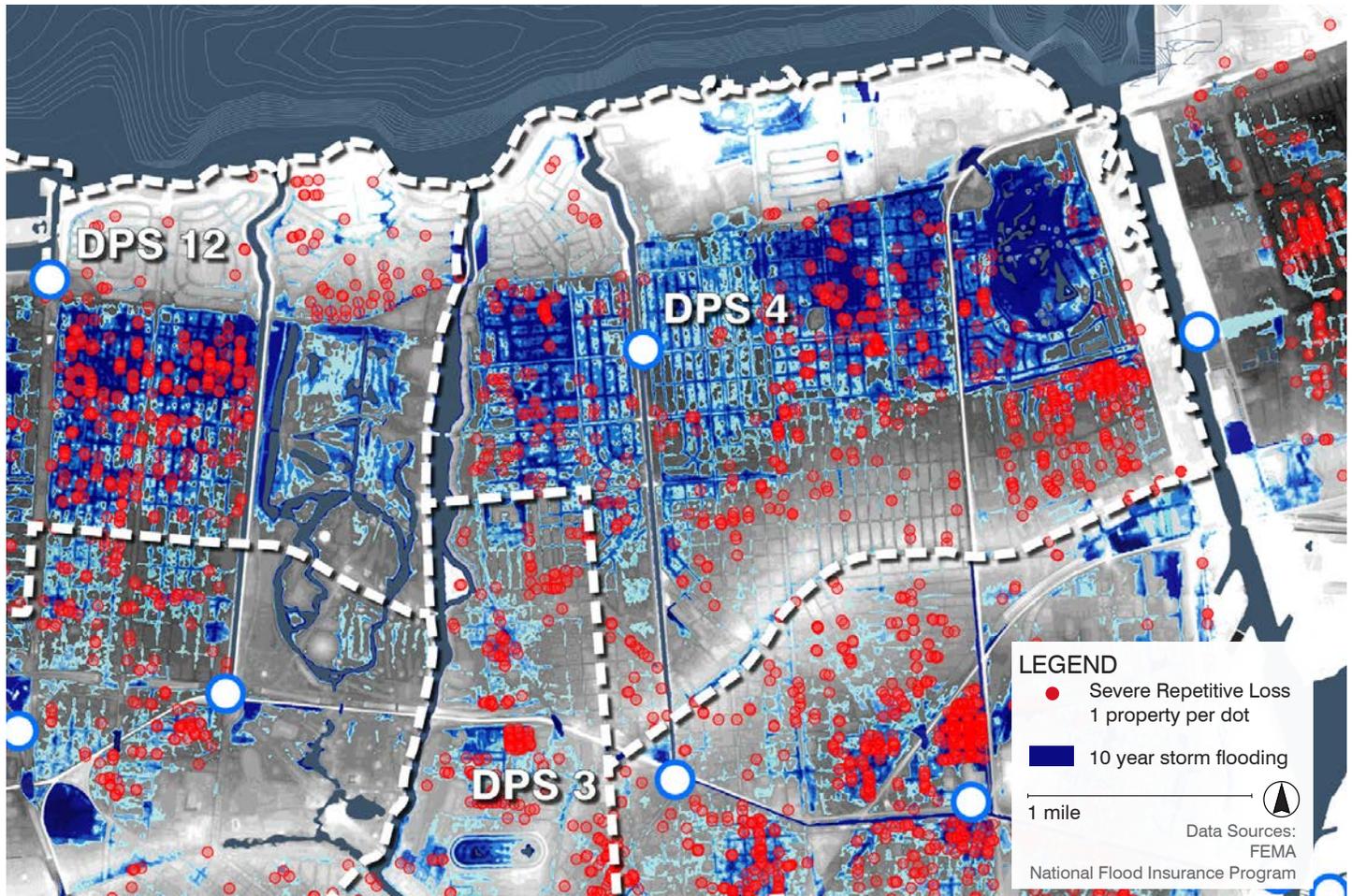
Pluvial flooding | a common occurrence throughout New Orleans due to subtropical climate and high rates of urban runoff



Flooding in Gentilly caused by 2012 summer thunderstorm

Images:
Waggoner & Ball Consulting Team

FLOODING & SEVERE REPETITIVE LOSS



Source:
Waggoner & Ball Consulting Team



Effects of Flooding | business interruption and traffic disruptions in Gentilly during Hurricane Isaac



Effects of Flooding | damages to homes, businesses, and infrastructure in Gentilly during Hurricane Isaac

Images:
Waggoner & Ball Consulting Team

VACANCY



Vacant Lots | common throughout the lowlands of New Orleans, including the Gentilly Resilience District

Source:
Waggoner & Ball Consulting Team



Vacant lot and typical suburban ranch house next to London Avenue Canal levee and floodwall



Blight | disinvestment in many of city's low-lying neighborhoods

Images:
Waggoner & Ball Consulting Team

GENTILLY | PEOPLE & MARKETS



Low & Moderate Income

LEGEND

>51% LMI

Data Source:
HUD FY 2015 LMISD
by Census Block Group



Race & Density

LEGEND

Black or African American

White

Hispanic

Asian

Other

1 Dot = 5 people

Data Source:
2010 US Census



Residential Market Strength

LEGEND

A Strong Market

B

C

D

E

F

G

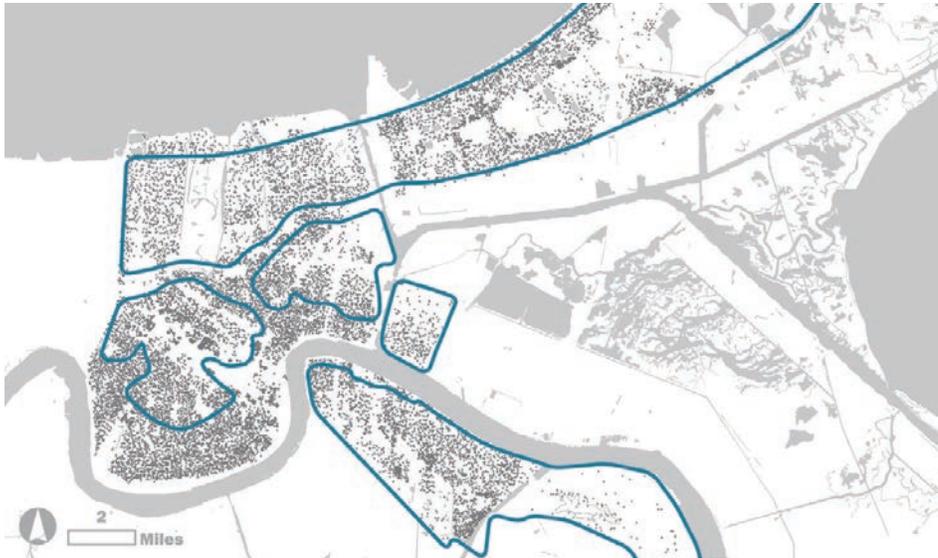
H Weak Market

Data Source:
The Reinvestment Fund
Market Value Analysis, 2013

Gentilly Resilience District Census Tracts and Block Groups

17.01	17.02	25.01	25.02	25.03	25.04	33.01	33.02	33.03	33.04	33.07	33.08	37.01	133.02	138.00
BG 1-3	BG 1-4	BG 1-4	BG 1-4	BG 1-3	BG 1-4	BG 1-3	BG 1-4	BG 1-3	BG 1-2	BG 1	BG 1-5	BG 2	BG 1-2	BG 1-3

DISPROPORTIONATE RISK



Total Population + Flood Risk

DATA SOURCES:
U.S. Census, 2010
FEMA Flood Insurance Rate Map, Revised Preliminary 2014

● **1 dot = 20 people**
by Census Block

▭ **Areas of higher flood risk**
(based on FEMA flood zones -
100-year and 500-year storms)

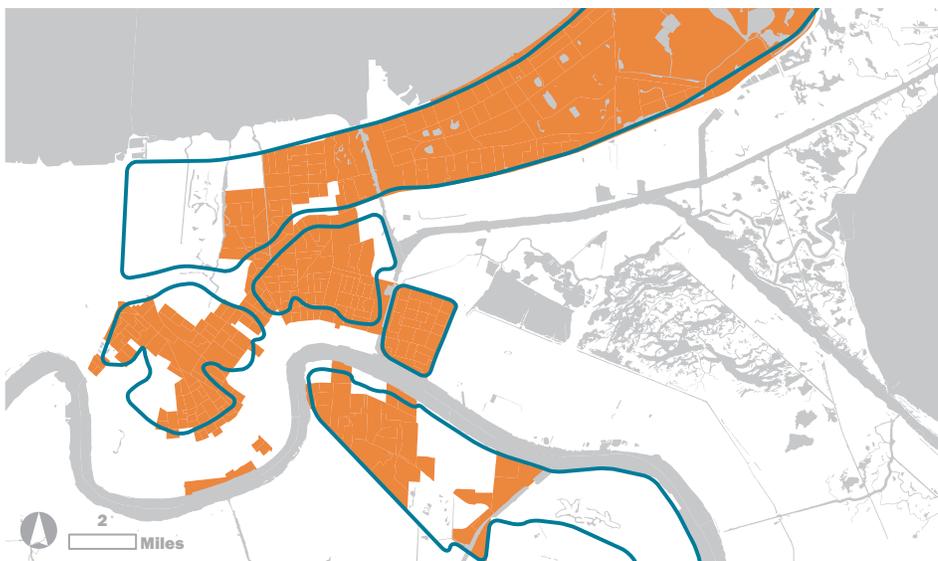


Low Income + Flood Risk

DATA SOURCES:
American Community Survey, 2013 5-year estimates
FEMA Flood Insurance Rate Map, Revised Preliminary 2014

▭ **< \$30,000**
Median Household Income
by Census Block Group

▭ **Areas of higher flood risk**
(based on FEMA flood zones -
100-year and 500-year storms)



Populations of Color + Flood Risk

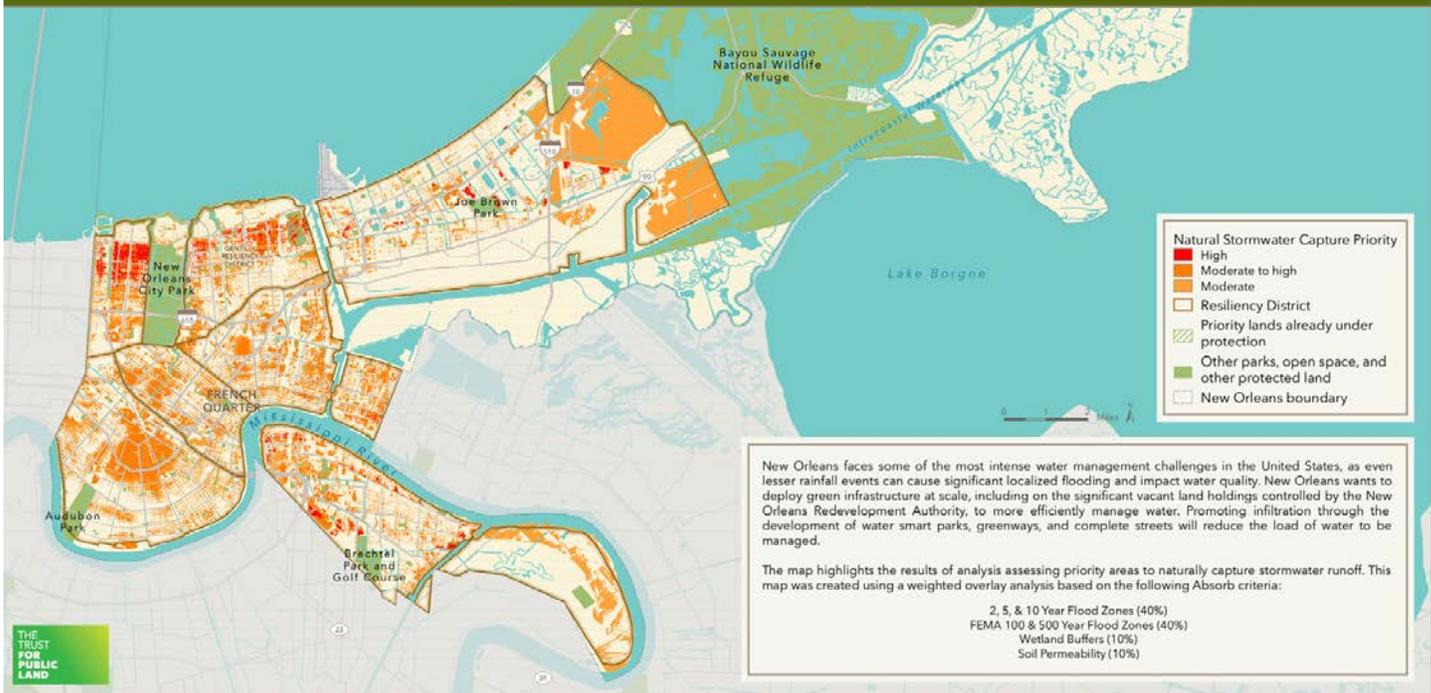
DATA SOURCES:
U.S. Census, 2010
FEMA Flood Insurance Rate Map, Revised Preliminary 2014

▭ **> 75% Persons of Color**
(defined as non-"White Alone", including
Hispanic or Latino, by Census Block Group)

▭ **Areas of higher flood risk**
(based on FEMA flood zones -
100-year and 500-year storms)

CLIMATE-SMART CITIES: NEW ORLEANS

STACKED PRIORITIES FOR ABSORB CRITERIA

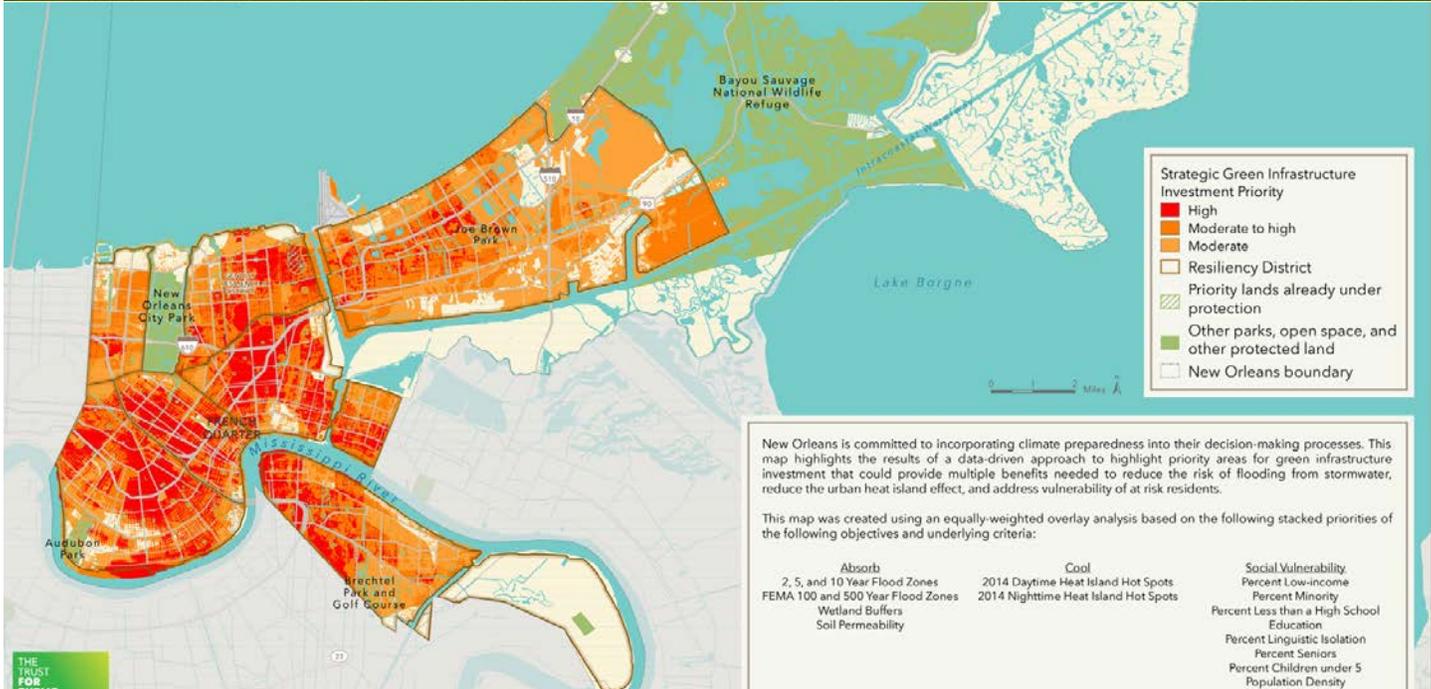


Mapping Analysis | high priority areas for natural stormwater capture

Source: The Trust for Public Land

CLIMATE-SMART CITIES: NEW ORLEANS

OVERALL STACKED PRIORITIES FOR INVESTMENT IN GREEN INFRASTRUCTURE INTERVENTIONS



Mapping Analysis | high priority areas for green infrastructure investments

Source: The Trust for Public Land

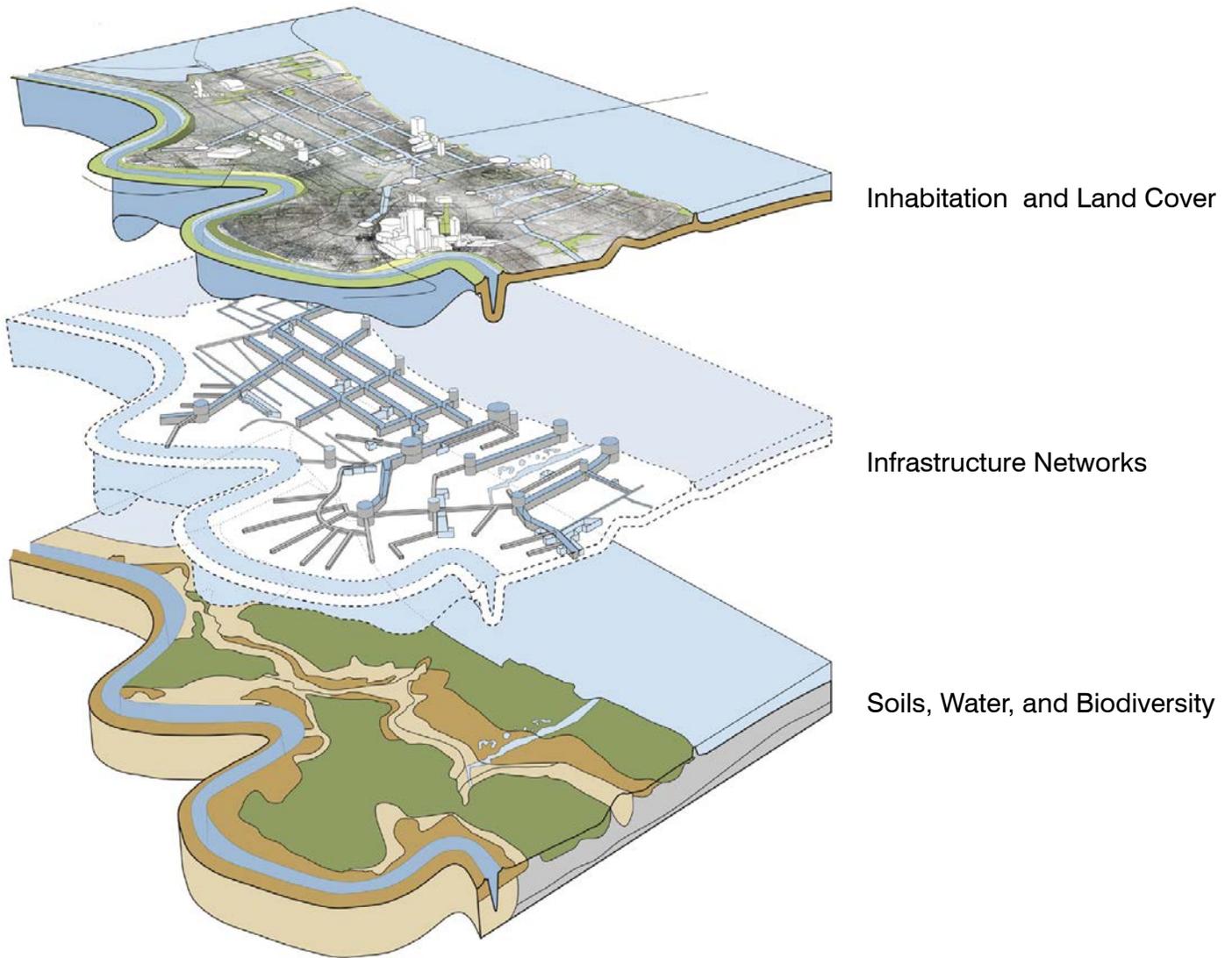
VISION



Regional Vision | New Orleans and neighboring parishes as nation's foremost water city, and as beautiful, equitable, and resilient environment

Source:
Greater New Orleans Urban Water Plan

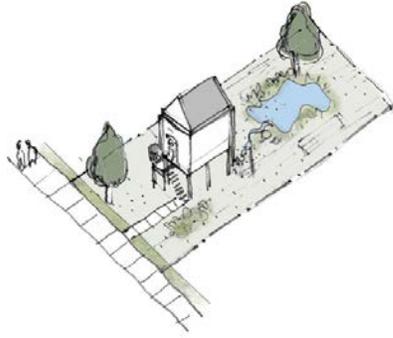
MULTI-LAYERED PLANNING APPROACH



Multi-layered Planning Approach | integration of strategies addressing the layers that comprise the urban delta

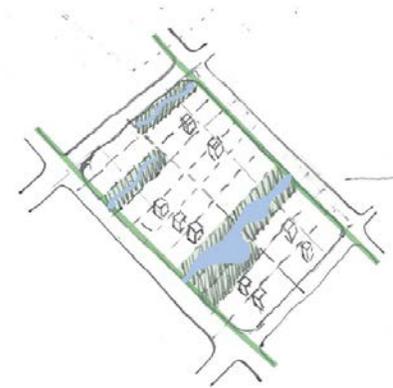
Source:
Greater New Orleans Urban Water Plan

INTEGRATED SCALES



1. House & Garden

Retention and infiltration of stormwater on individual properties



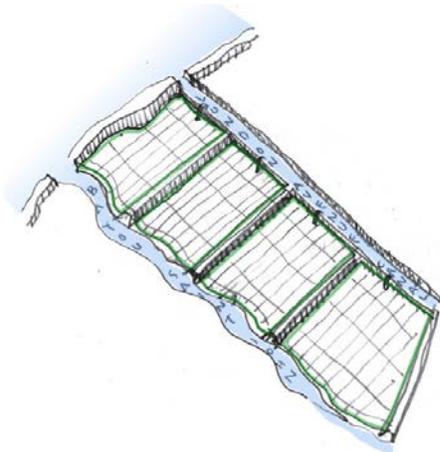
2. Block

City-owned vacant lots as sites for stormwater retention at block level



3. Neighborhood

Neighborhood-scale networks of streets, bioswales, parks, and vacant lots that provide storage capacity and reduce flooding and reliance on pumping



4. District

Blue-green corridors provide additional storage capacity and serve as water sources for balancing groundwater during dry periods



Top and above | workshops with 350+ representatives of government agencies, businesses, NGOs, community groups, and technical experts instrumental to the development of the city's approach to resilience



Above and above right | community and cultural leaders workshoping create engagement possibilities with renowned landscape architect and artist Walter Hood as part of the development of the NDRC proposal

Images:
City of New Orleans



In the Field | Visiting Indonesian delegation climbing to see hidden canal

Source:
Waggoner & Ball Consultant Team



Collaborative Design Workshop | with public agencies, designers, and planners at the table throughout NDRC planning process



Integration of Disciplines | scientific research, hydraulic modeling, and integrated design and planning approach as drivers of NDRC proposal

Images:
City of New Orleans



Water Learning Tour and Exchange | with community leaders at Mirabeau Water Garden site



Tour | visit to pilot vacant lot rain garden



Creative Possibilities | community leaders proposing ideas for engaging full cross-section of city's residents

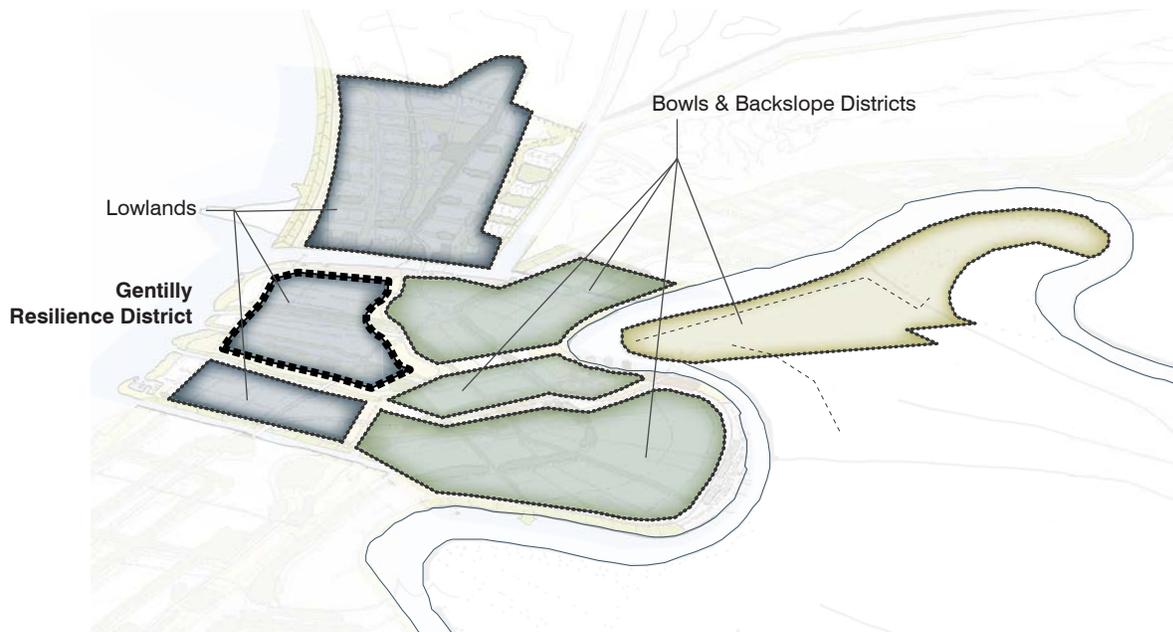
Images:
City of New Orleans

REGIONAL APPROACH AND REPLICABILITY



Regional Approach | NDRC proposal for the Urban Delta builds upon regional approach to urban water management and resilience articulated in Greater New Orleans Urban Water Plan

Source: Greater New Orleans Urban Water Plan



Gentilly Resilience District | one of three lowland areas, with strategies and design principles replicable across other lowland districts and informing resilience strategies for bowl and backslope districts

Source: Waggonner & Ball Consultant Team

CASE FOR GENTILLY



Gentilly | Leafy residential neighborhoods, diverse residents, universities, schools, and commercial corridors all bisected by the London Avenue Canal, bounded by City Park and lakefront, and connected to downtown by Lafitte Greenway and Elysian Fields

Source:
Waggoner & Ball Consultant Team



Dillard University | one of the places of research and higher learning located in Gentilly



Bayou St. John | existing urban waterways are sites for public gatherings and festivities

Images:
Waggoner & Ball Consultant Team

GENTILLY RESILIENCE DISTRICT



View across Gentilly Resilience District, towards lakefront

Source:
Waggoner & Ball Consultant Team

URBAN DELTA | GENTILLY DISTRICT



The four projects and programs for the Gentilly Resilience District that comprise the New Orleans NDRC proposal

1 mile 

Source: Waggoner & Ball Consultant Team

URBAN DELTA | PROJECTS & PROGRAM



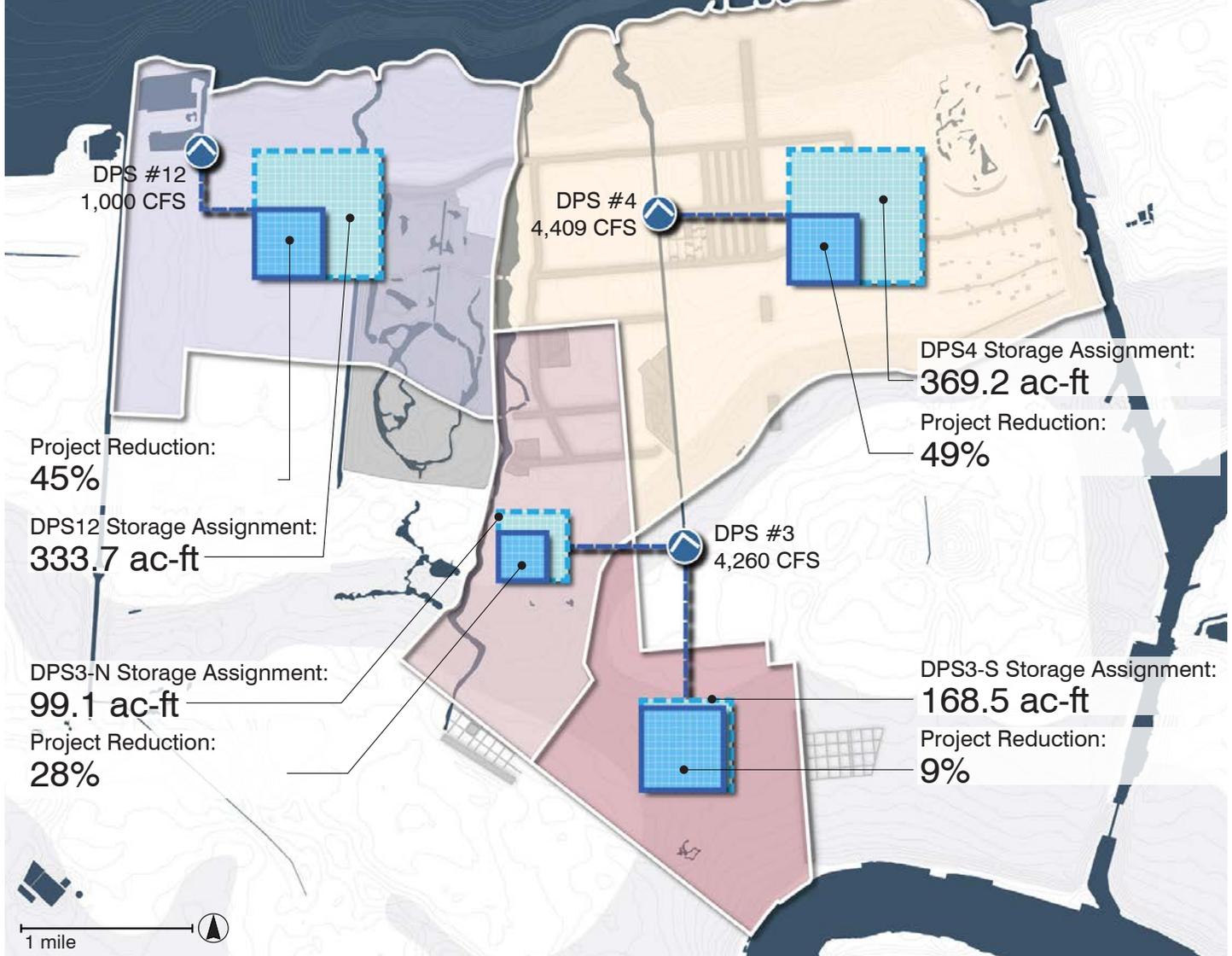
1 mile



Source: Waggoner & Ball Consultant Team

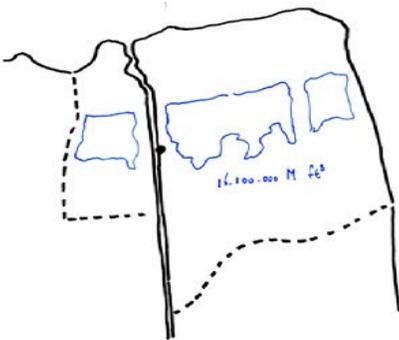
FLOOD RISK REDUCTION

PROJECT IMPACT ON STORAGE ASSIGNMENT

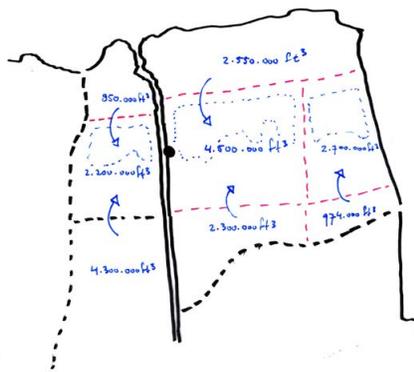


Storage Assignment | volume of stormwater runoff that exceeds drainage system capacity and results in flooding

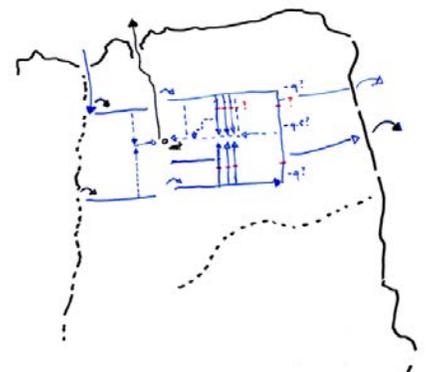
Project Reduction | impact of proposed projects and programs on flood volume



Drainage Pump Station #4 Catchment Area

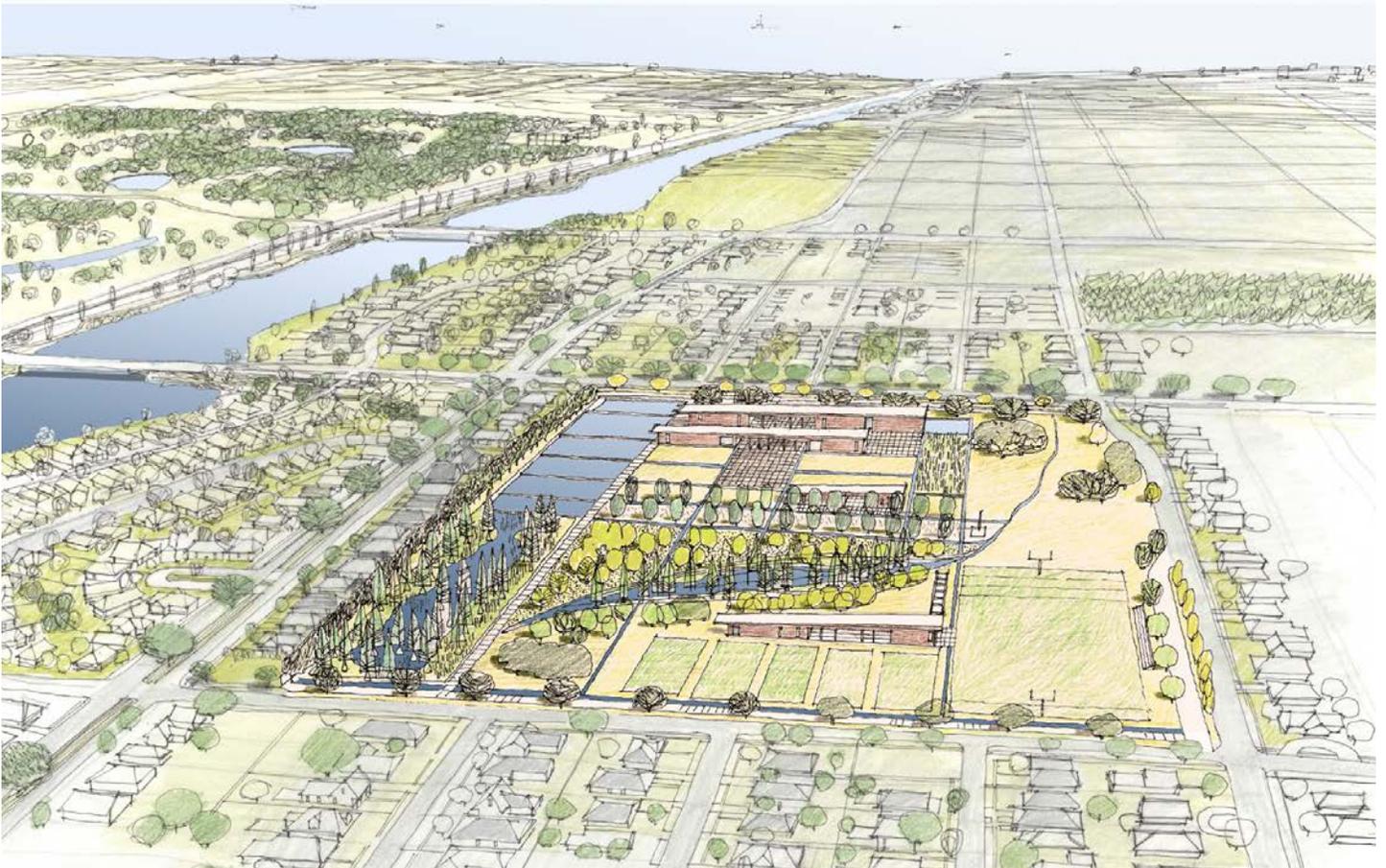


Strategy | hold water where it falls



Strategy | improve circulation

Images: Waggoner & Ball Consultant Team



Mirabeau Water Garden | community and environmental education center that stores, filters, and infiltrates stormwater



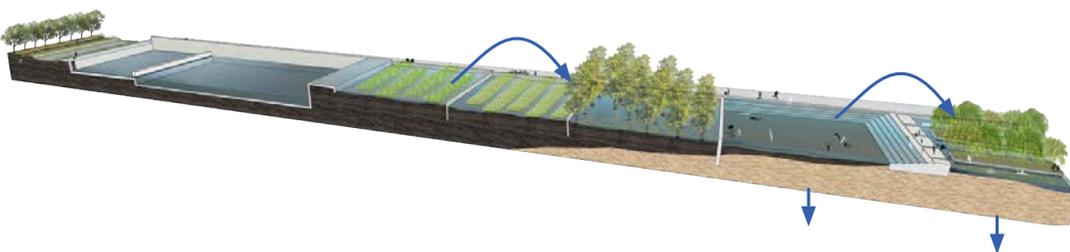
Dry



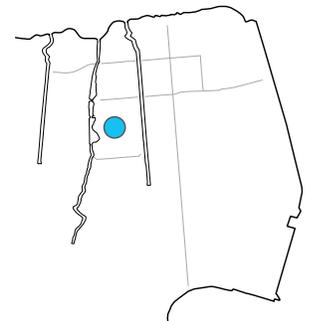
Wet



Mirabeau Water Garden site today



Filtration | constructed wetland terrace that cleans stormwater drawn from neighboring drainage trunk line



Images:
Greater New Orleans Urban Water Plan



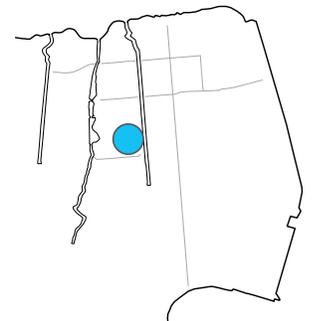
Public Asset | urban wetland integrated into urban water management system as retention basin, habitat, and public amenity



Integrated development of wetland site, London Avenue Canal transformation and Dillard University Campus expansion



Natural Flow | design uses existing channels to guide flow and retention of runoff from neighboring areas



Images:
Greater New Orleans Urban Water Plan



City Park | site for expanded system-scale water storage and wetland habitat creation

Source:

Dutch Dialogues New Orleans



Diverting Runoff | redirection of runoff from lakeside neighborhoods into park for retention and filtration, reducing flood risk and pumping

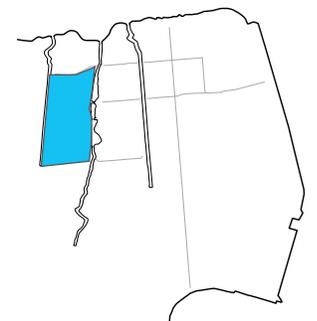
Source:
New Orleans City Park

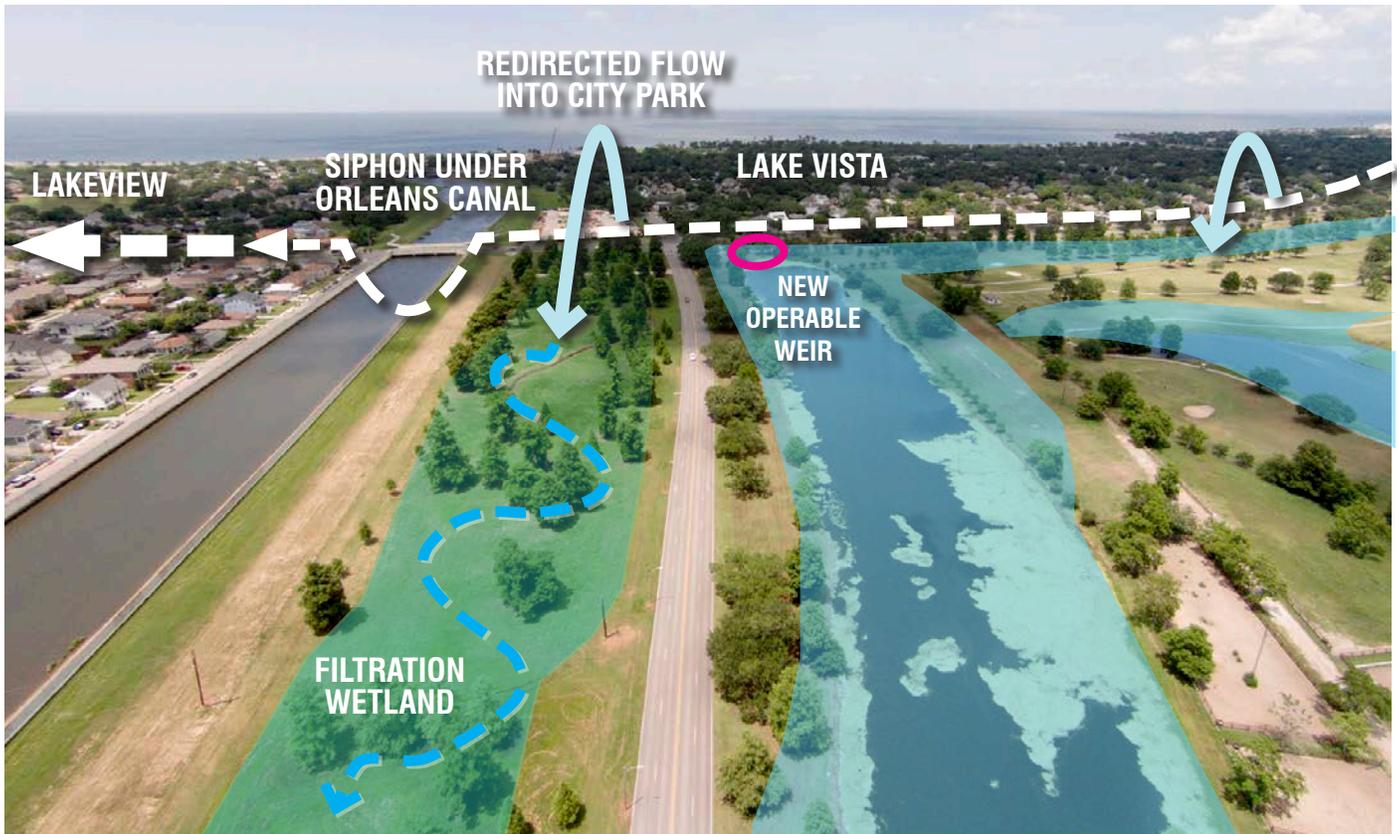


Unintentional Storage | a small corner of park currently demonstrates the capacity of park for safety storing stormwater

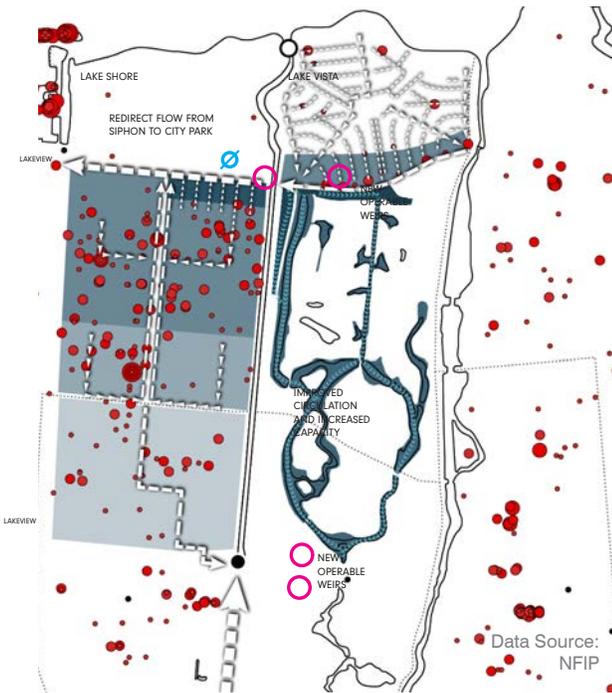


Hurricane Isaac 2012
Photos: Waggonner & Ball Consultant Team

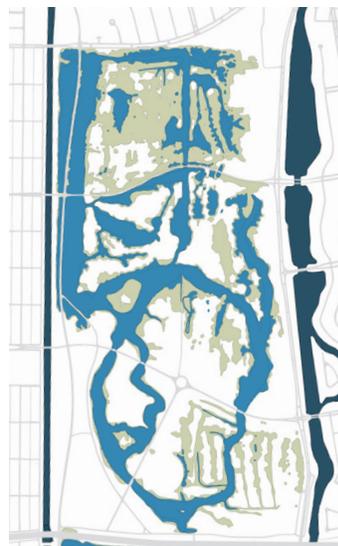




Utilizing Parklands to Reduce Flood Risk | stormwater running east to west along Robert E Lee is diverted into new filtration wetlands and expanded lagoons to reduce flooding in both upstream and downstream neighborhoods



Interrelationships | Hydraulic improvements in Gentilly Resilience District benefits neighboring lowland districts like Lakeview, and vice versa



3 ft of storage: 540 ac/ft



4 ft of storage: 982 ac/ft

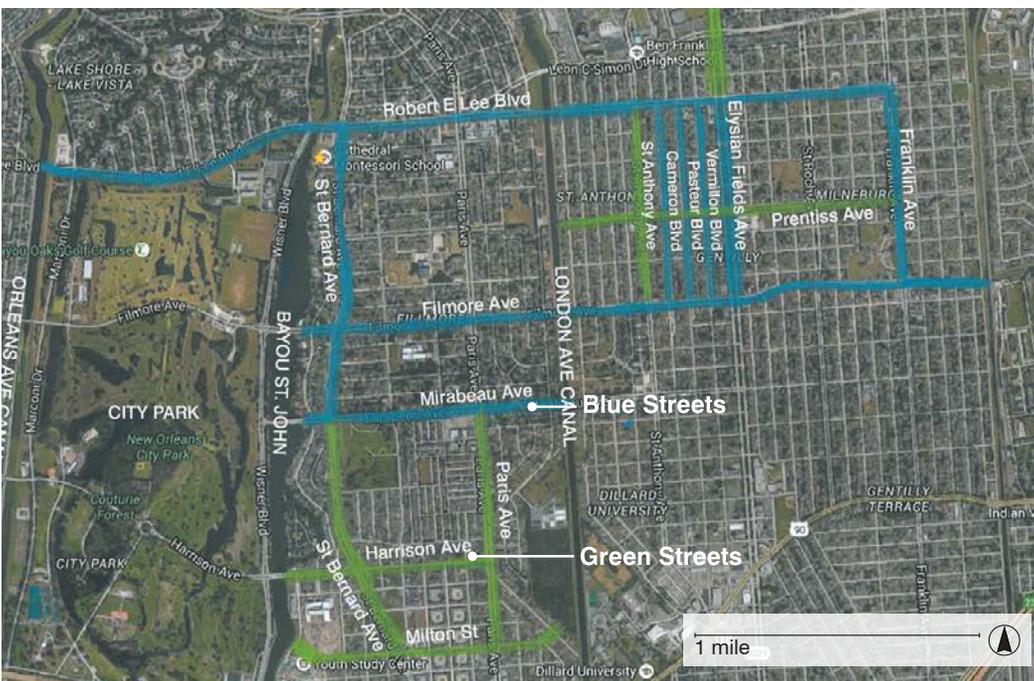
Storage Capacity | City Park's North Lakes can add between 500 and 1000 acre-feet of storage

Images:
New Orleans City Park



Elysian Fields and Robert E. Lee | blue corridor interventions with new commercial and housing development in foreground

Source: Waggoner & Ball Consultant Team



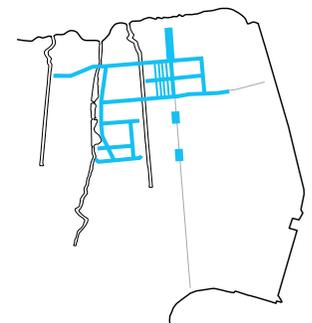
Proposed Blue and Green Corridors | water retention and circulation network utilizing Gentilly's existing street grid

Source: Waggoner & Ball Consultant Team



Existing | low intensity

Source: Google



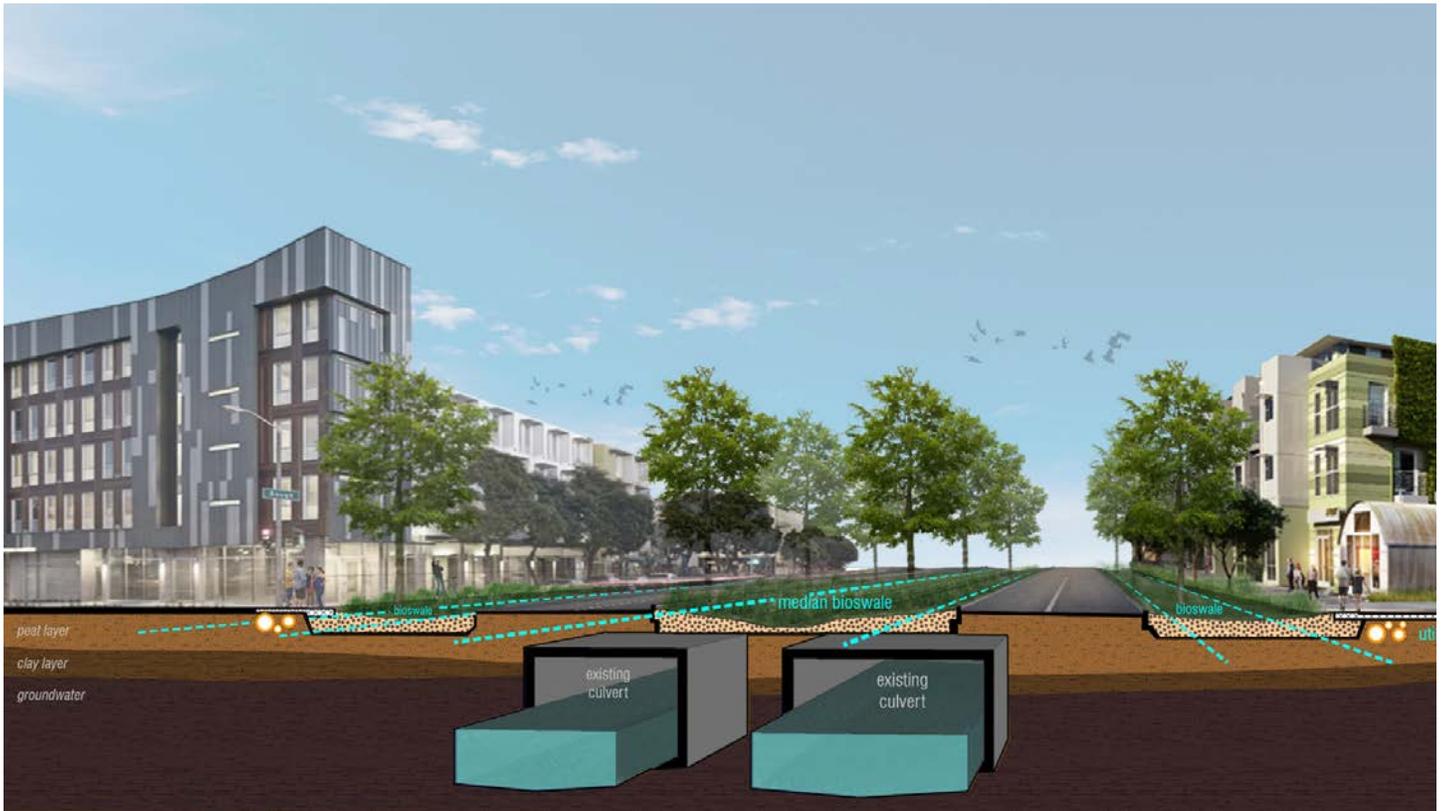


Wet Condition | Wide neutral ground (median) of Elysian Fields Avenue, reshaped to hold and filter stormwater

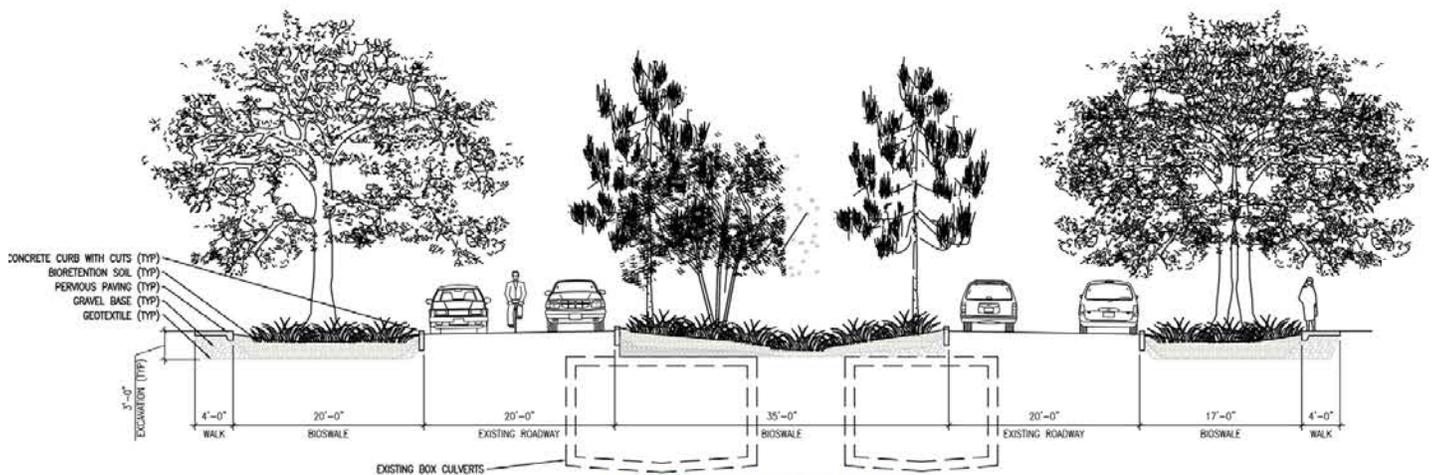


Dry Condition | Elysian Fields redesign improves connectivity between Gentilly and downtown and enhances opportunities for housing and commercial redevelopment along corridor

Images:
Waggoner & Ball Consultant Team

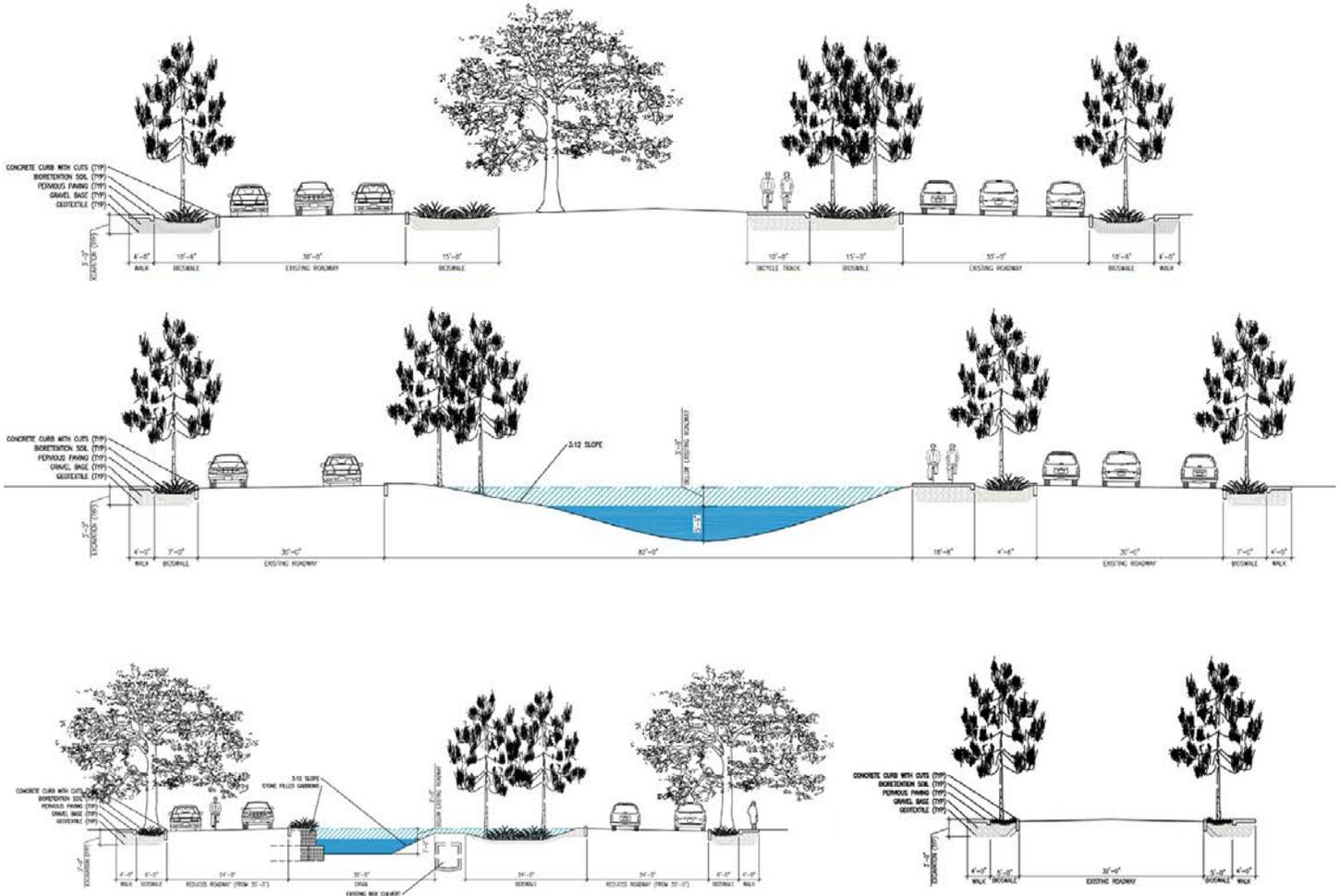


Adapting Today's Streets | Prentiss Avenue as example of a green corridor, with neutral ground and roadside bioswales capturing, storing, and infiltrating stormwater



Adapting Today's Streets | design takes into account existing drainage culverts and introduces additional capacity in the form of vegetated bioswales

Images:
Waggonner & Ball Consultant Team



Street Types | design of blue-green corridors adapts base hydraulic and hydrologic principles to a variety of existing conditions and street sections



Canal Boulevard, Dry | WPA project from the first half of the twentieth century that demonstrates the capacity of streetscapes to store stormwater and reduce flood risk



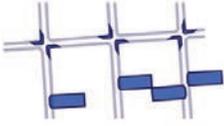
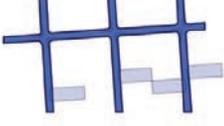
Canal Boulevard, Wet | depressed neutral ground of Canal Blvd served as a retention basin during Hurricane Isaac in 2012

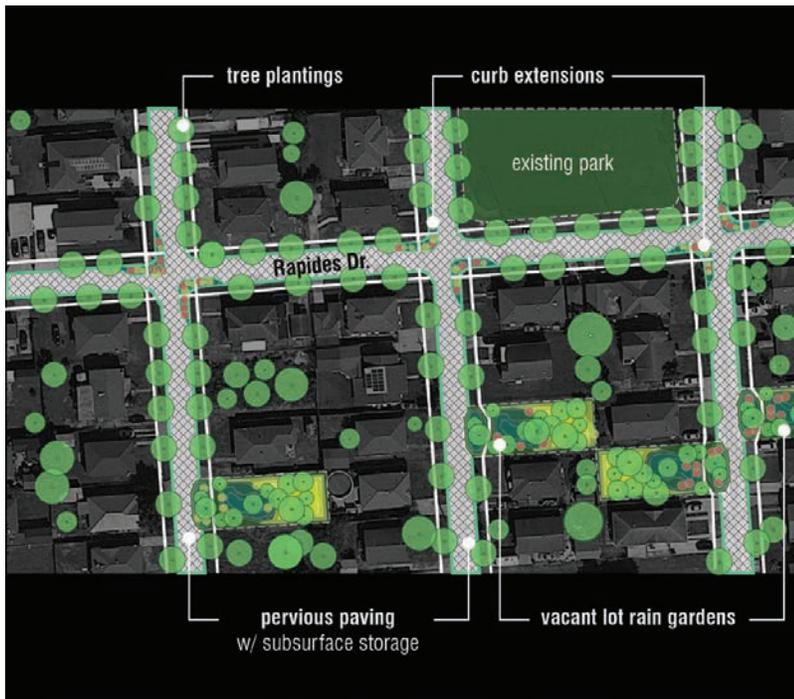
Images:
Waggoner & Ball Consultant Team



A comprehensive approach to addressing water and environmental issues at the block and neighborhood scales

Green Streets Elements

-  trees and plantings
-  roadside bioswales
-  curb extensions & vacant lot rain gardens
-  pervious surfaces and gravel subbase



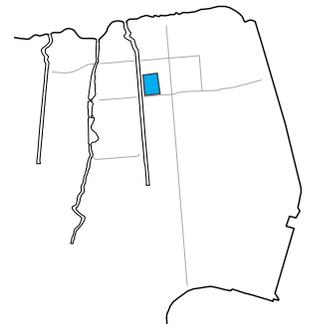
Integrated Approach | network of smaller interventions captures water where it falls, reduces runoff flowing into city's drainage system, infiltrates stormwater, and reduces flooding in lowest-lying neighborhoods

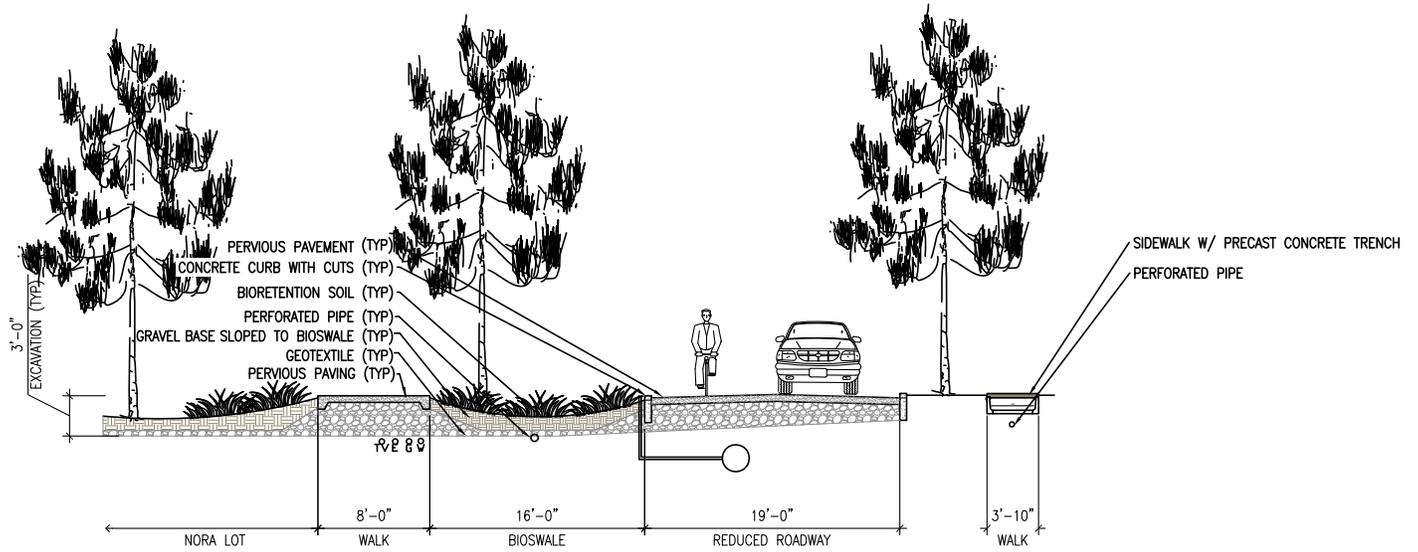
Images: Waggonner & Ball Consultant Team



Close up of roadside bioswale during rain event

Source: Greater New Orleans Urban Water Plan





A Better Neighborhood Street | roadside bioswale and gravel subbase store and infiltrate stormwater

Source: Waggonner & Ball Consultant Team



Public Spaces | vacant lot rain gardens capture street runoff and double as beautiful neighborhood-scale public spaces

Source: New Orleans Redevelopment Authority



Milne Campus | open land and athletic fields are connected to the city's drainage network to provide 81 acre feet of storage capacity
 Source: Waggonner & Ball Consultant Team



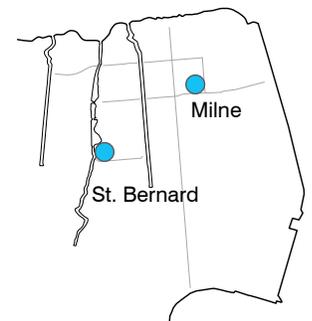
Institutional Sites and Campuses | integral elements in the fabric of the Urban Delta
 Source: Dutch Dialogues New Orleans



St. Bernard Neighborhood Campus | new bayou crossing, water plaza and playground, green streets, and athletic fields that double as retention basins connect neighborhood and institutions
 Source: Waggonner & Ball Consultant Team



Wally Pontiff Park | example in nearby Jefferson Parish of managing stormwater by converting existing park space into retention basin
 Source: Waggonner & Ball Consultant Team





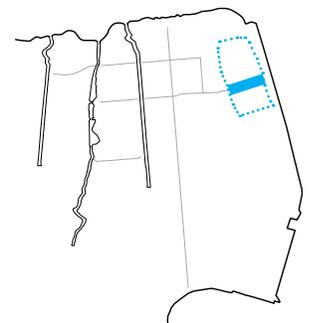
Dwyer Canal Design | improvements to connect Pontilly's two sides, and Pontilly to other neighborhoods in Gentilly



Dwyer Canal | existing conditions

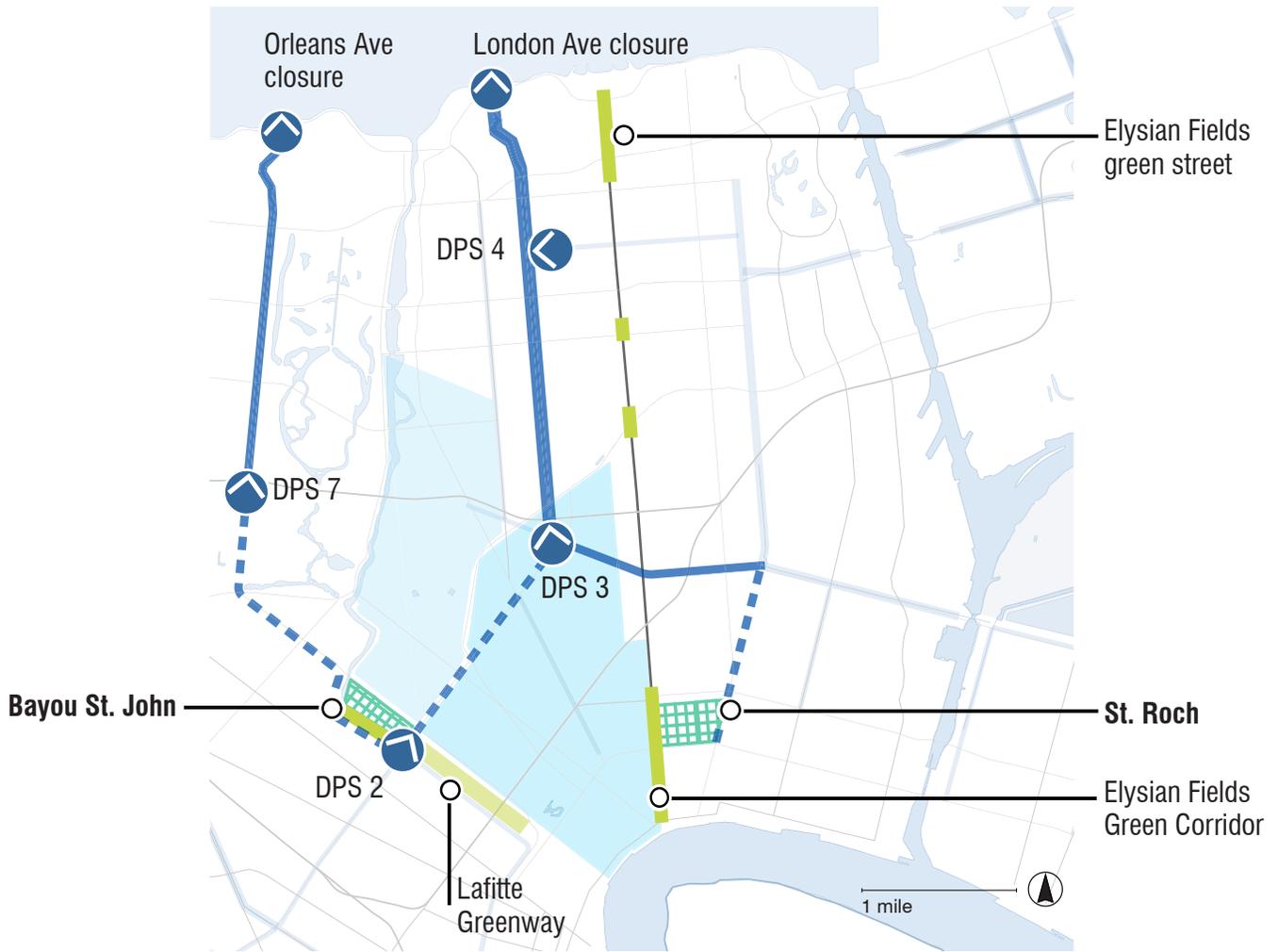


Public Space Network | green infrastructure enhances connectivity throughout neighborhood



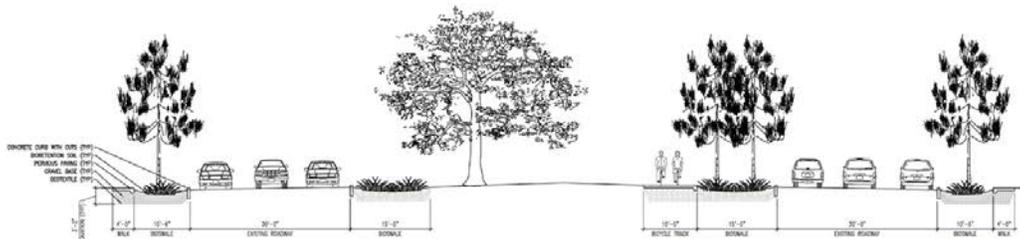
Green Infrastructure | small scale interventions as more sustainable and economical alternative to expanding grey infrastructure

Images: New Orleans Redevelopment Authority



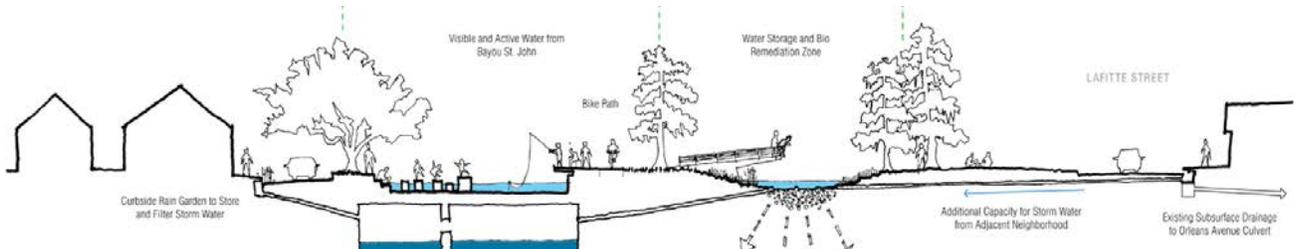
Upstream Interventions | adaptations at key junctures of neighborhood green streets with the Lafitte Greenway and Elysian Fields Avenue directly benefit the Gentilly Resilience District by reducing runoff flowing to Pump Station 3

Source: Waggoner & Ball Consultant Team



St. Roch Green Streets | new bioswales to enhance hydrology of Elysian Fields and anchor St. Roch Green Streets network

Source: Waggoner & Ball Consultant Team



Bayou St. John Neighborhood Green Infrastructure Network | excess neighborhood runoff redirected into the Lafitte Greenway, alleviating pressure on Drainage Pump Station 3 and connecting residents to the amenities and public spaces of the greenway

Source: Lafitte Greenway Sustainable Water Design



Open Waterways | floodwall removal and reshaping land will allow for use of canals as vital public spaces

Source:
Greater New Orleans Urban Water Plan



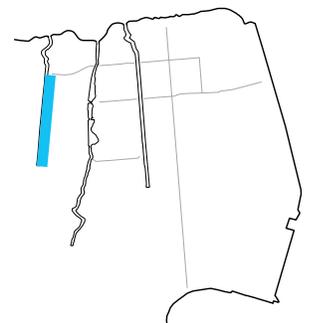
Long-term Vision | future connections to wetlands and parklands that strengthen the ecological function of the city's canals

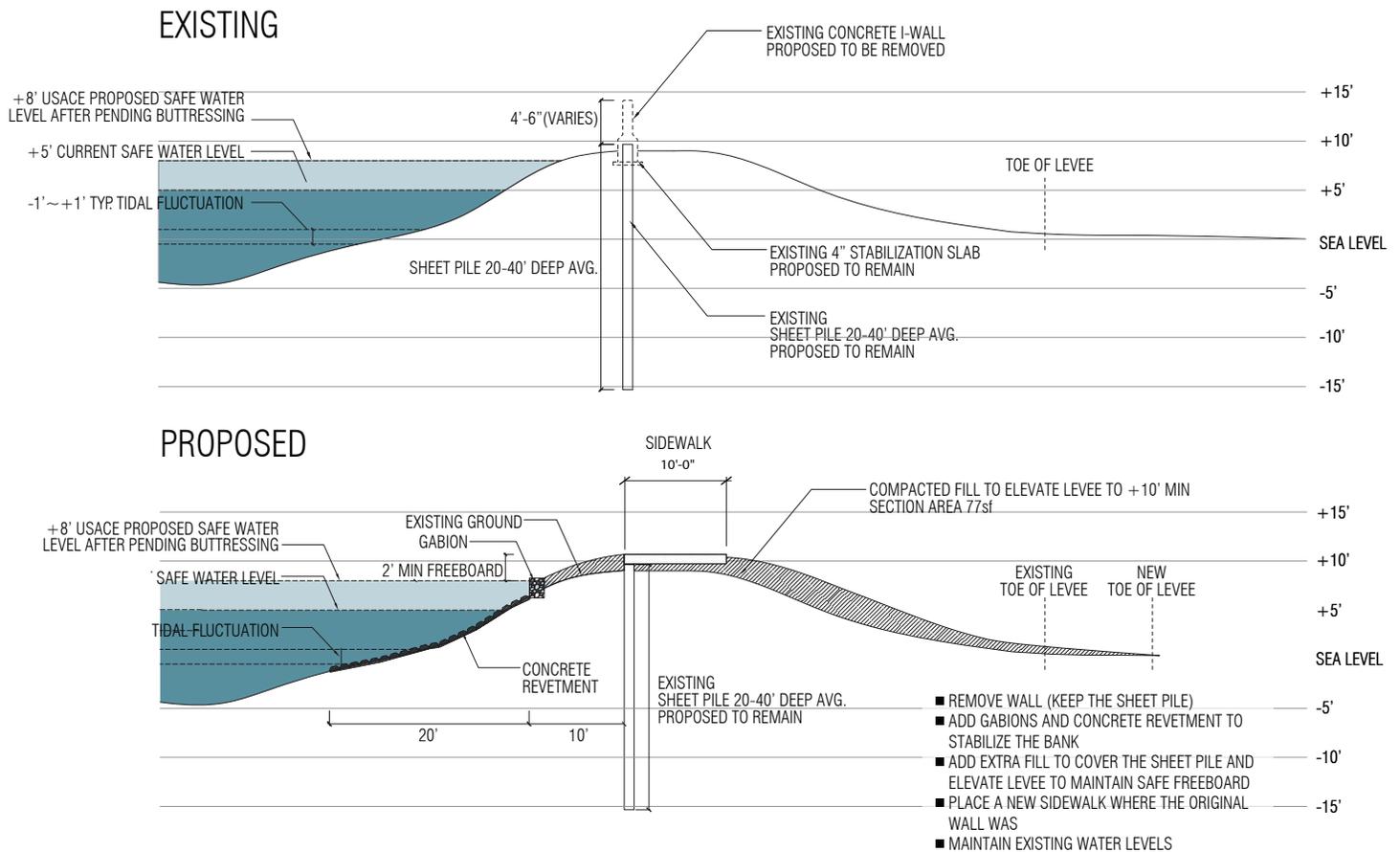
Source:
Dutch Dialogues New Orleans



Source:
Greater New Orleans Urban Water Plan

Existing floodwalls | hidden water





Taking Down Walls | construction of closure structures at the lake-front means that the city can now safely remove internal floodwalls that block access to the city's canals

Source: Waggonner & Ball Consultant Team



Seeing Behind The Walls | rowers making use of the city's canals as recreational amenity

Source: Waggonner & Ball Consultant Team

COMMUNITY ADAPTATION



Ambassadors | Participants in LMI Homeowner Resilience Retrofit Program will share best practices and strategies with neighbors



Working Together | volunteering students assist homeowner with construction of bioswale as part of WaterWise program



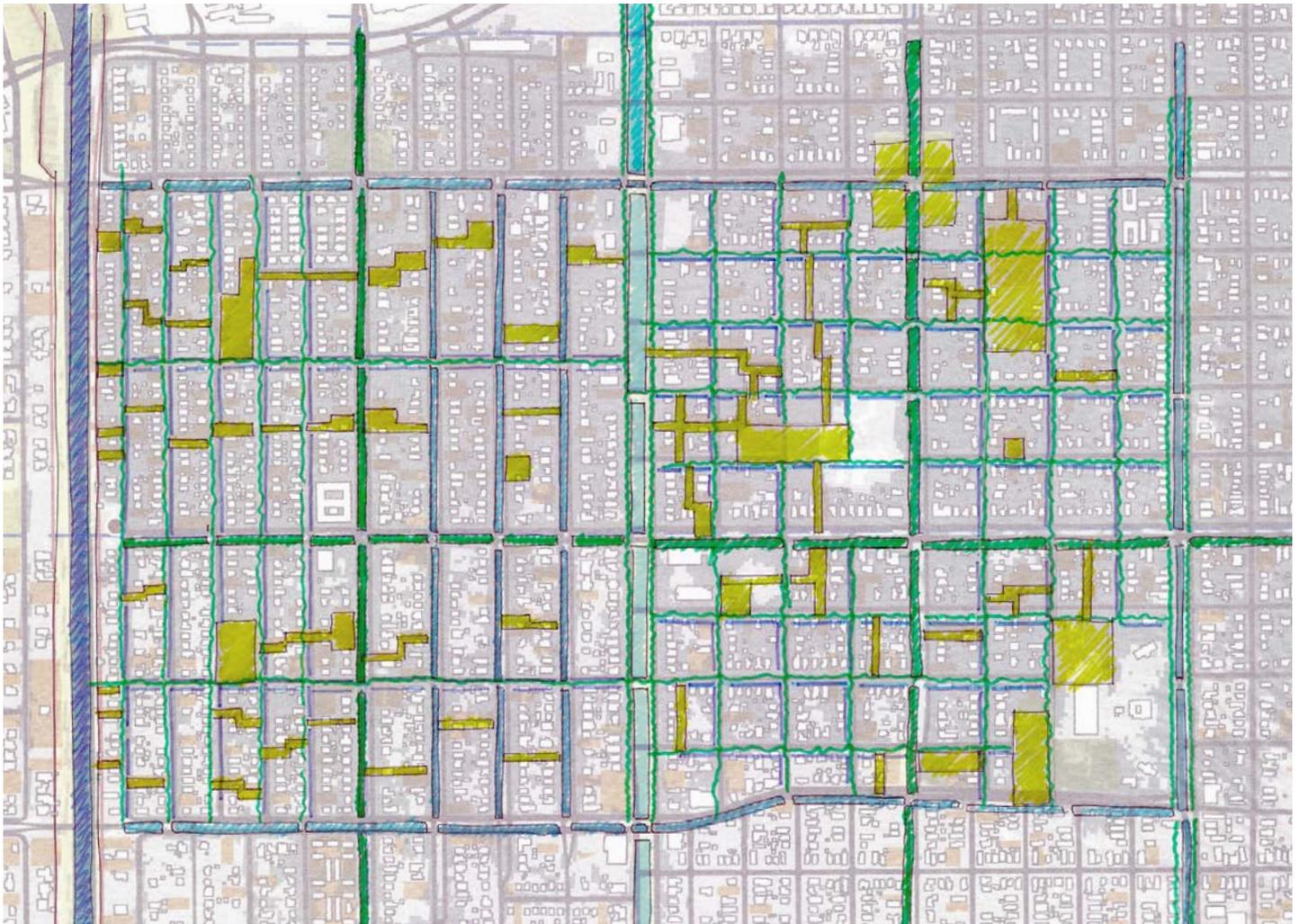
Permeable Driveway | example of low cost retrofit



Homeowner constructing bioswale to capture water where it falls

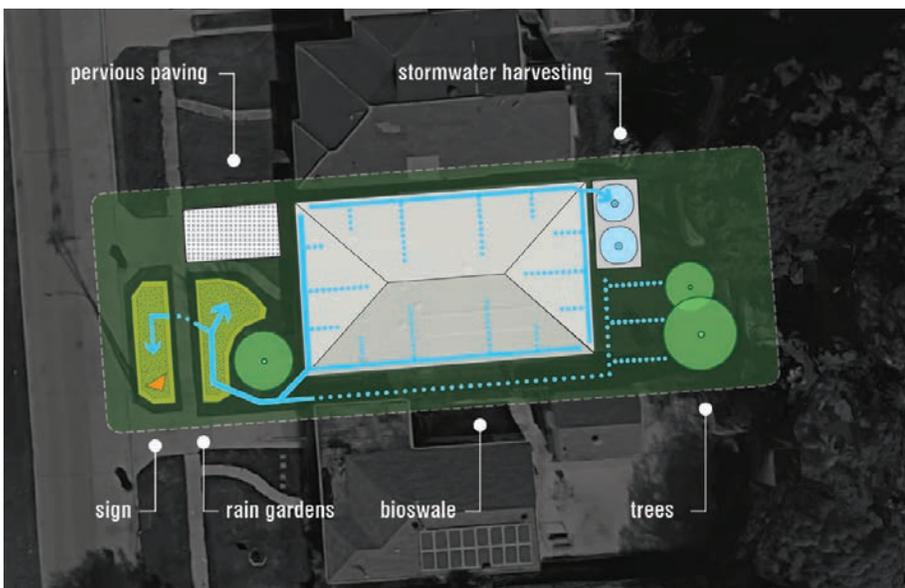
Images:
Waggoner & Ball Consultant Team

COMMUNITY ADAPTATION



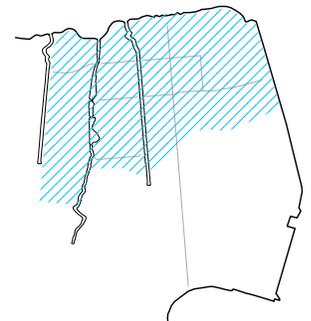
Homeowner-driven Adaptation | a new pattern of plantings, retention, and engagement across the Gentilly Resilience District

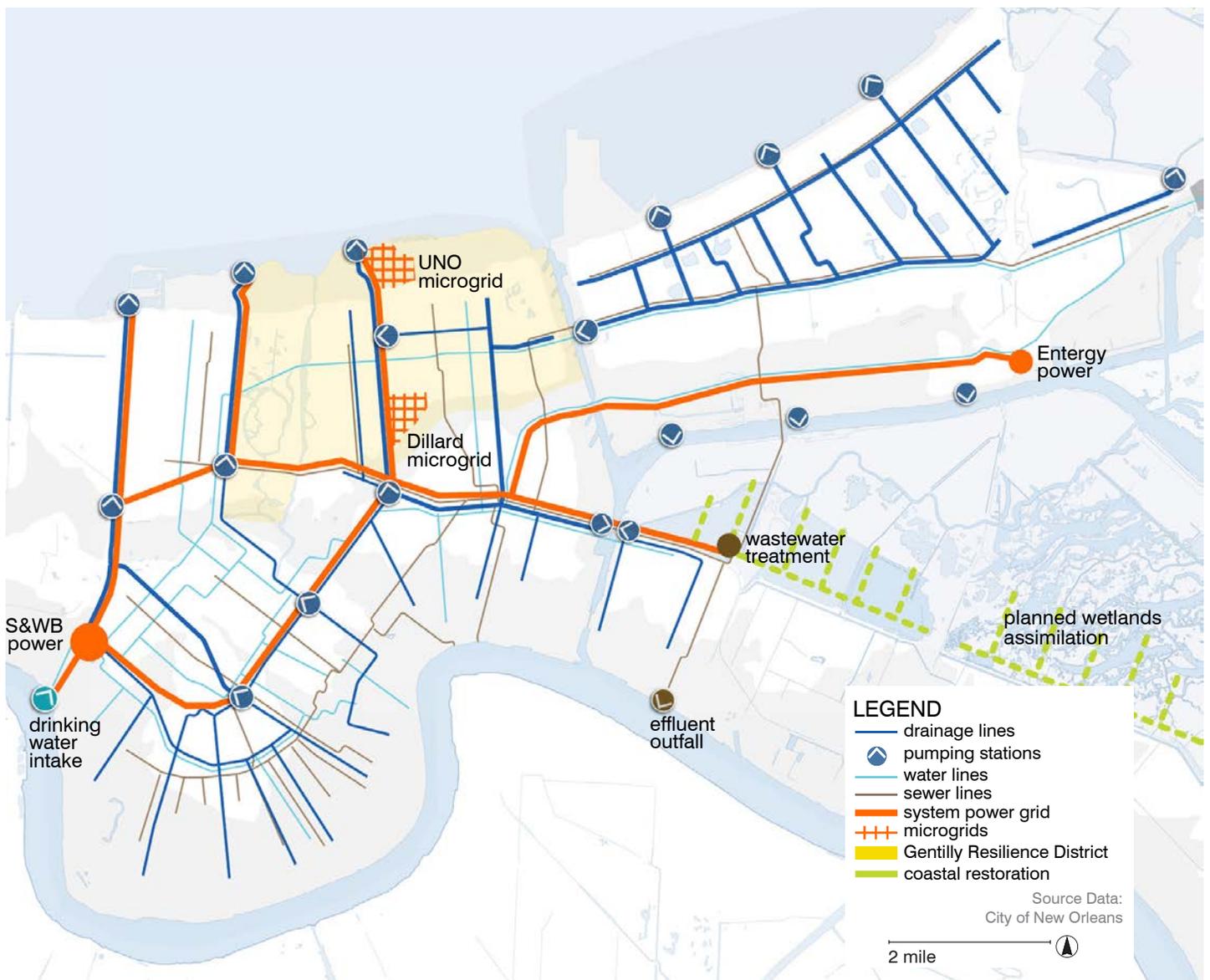
Source:
Waggoner & Ball Consultant Team



Resilience Retrofits | program participants will choose and implement retrofits

Source:
Waggoner & Ball Consultant Team





Redundant Energy | upgrades and microgrids bolster reliability of power, drinking water, sewerage, and drainage systems

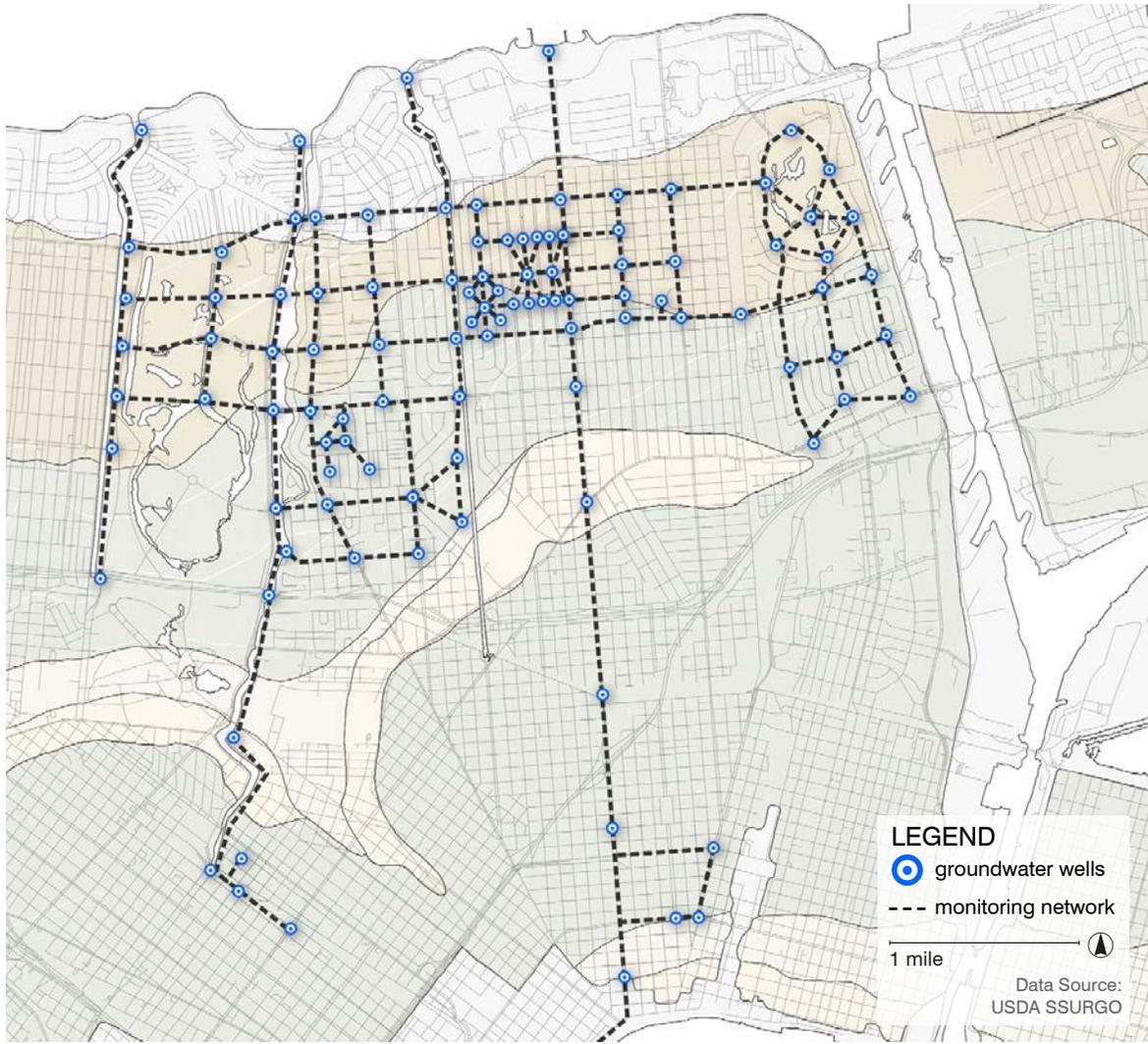
Source: Waggoner & Ball Consultant Team



Oak Street Power Plant | facility vital to performance and resilience of city systems and public health

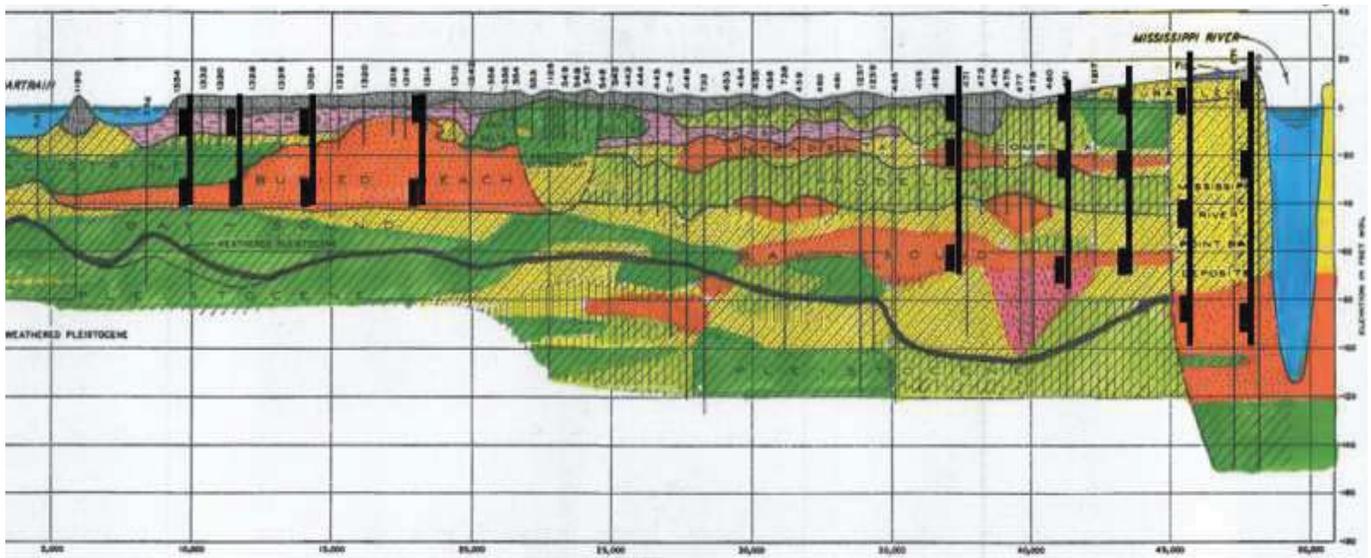


Pump / Power Dependency | critical drainage infrastructure relies on Sewerage and Water Board-generated power



Data Collection | wells and sensors enable collection of surface water, water quality, and groundwater data, enabling optimization of systems operations

Source: Waggoner & Ball Consultant Team



Tracking Soil/Water Interactions | sensors at different elevations to track deep and shallow groundwater interactions with subsurface soil layer as well as rates of subsidence

Source: Greater New Orleans Urban Water Plan



Coastal Restoration | the Urban Delta relies on thick and abundant wetland edges to support local economy, provide habitats for the region's flora and fauna, and buffer urbanized areas against storm surge and tidal action

Source: Waggonner & Ball Consultant Team



Bayou Bienvenue

Cypress swamp restoration to protect and benefit the Lower Ninth Ward and the rest of New Orleans

Source: Waggonner & Ball Consultant Team



Land Bridge

Strengthening the Lake Borgne edge to protect all of New Orleans

Source: CPRA



Golden Triangle

Restoration of marsh to enhance vitality of the eastern edge of New Orleans just inside the IHNC surge barrier

Source: Waggonner & Ball Consultant Team



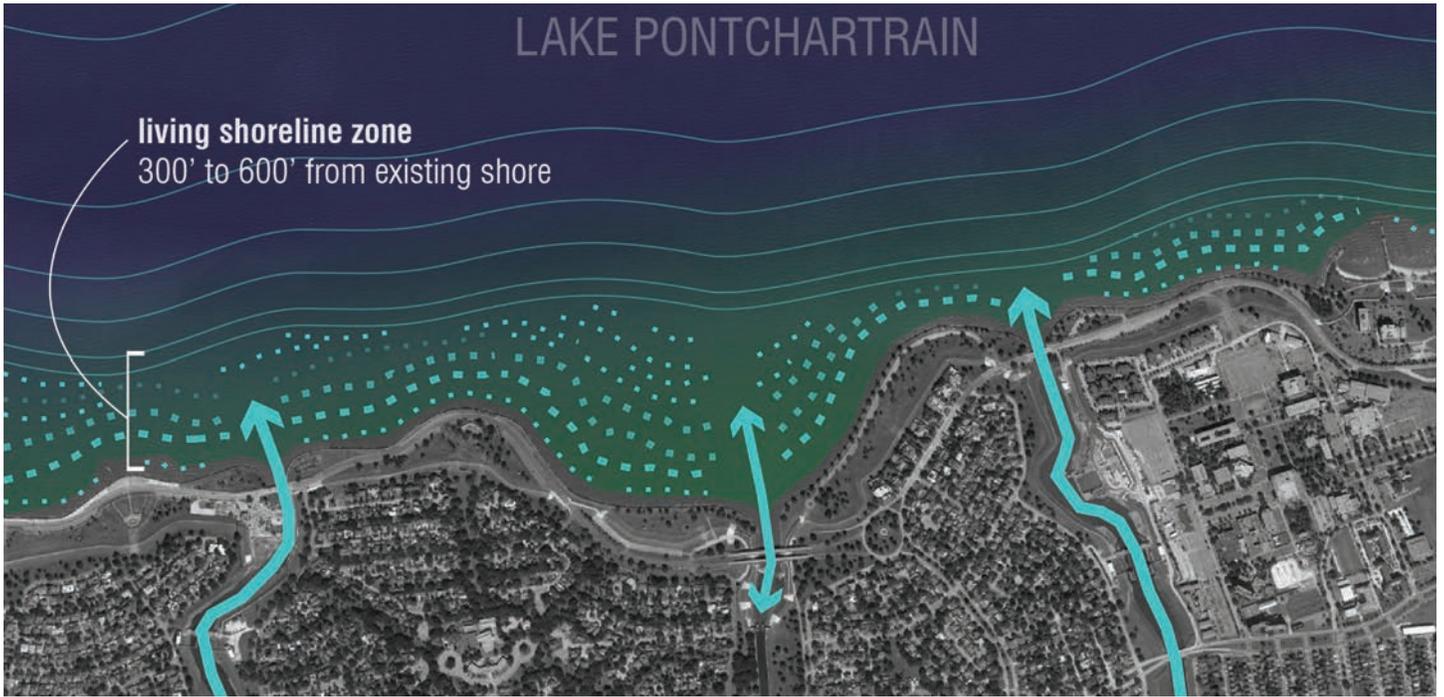
Living Shoreline

Naturalized wetland edge to protect the lakefront seawall from wave action and filter urban runoff pumped into the lake

Source: Frog Environmental



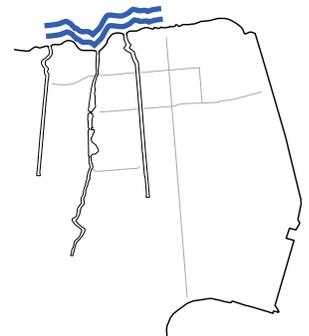
A Living Edge | wetland beds along the lakefront as habitat, buffer, and recreational amenity



Shallow Water | wetland plantings in shallow water zone adjacent to lakefront seawall

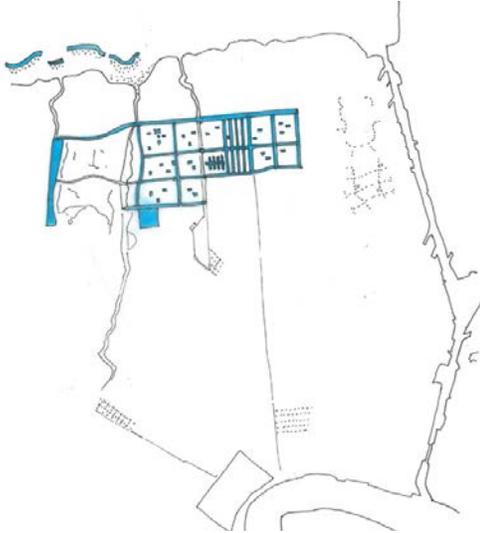


A Living Edge | proposal will expand passive and active recreational uses of the lakefront



Images:
Waggoner & Ball Consultant Team

PHASING OF PROJECTS & PROGRAMS



High priority interventions at multiple scales provide immediate benefits to residents of lowest lying neighborhoods and most vulnerable populations in the Gentilly Resilience District



Expansion of Urban Water strategies and Community Adaptation Program into other neighborhoods with Low and Moderate Income populations and also high levels of environmental risk



Broad implementation of Urban Delta proposals results in a district transformed, with canals as public spaces, buffered coastline, integrated network of green streets, parklands, and campuses, and development along blue-green corridors

Images:
Waggoner & Ball Consultant Team

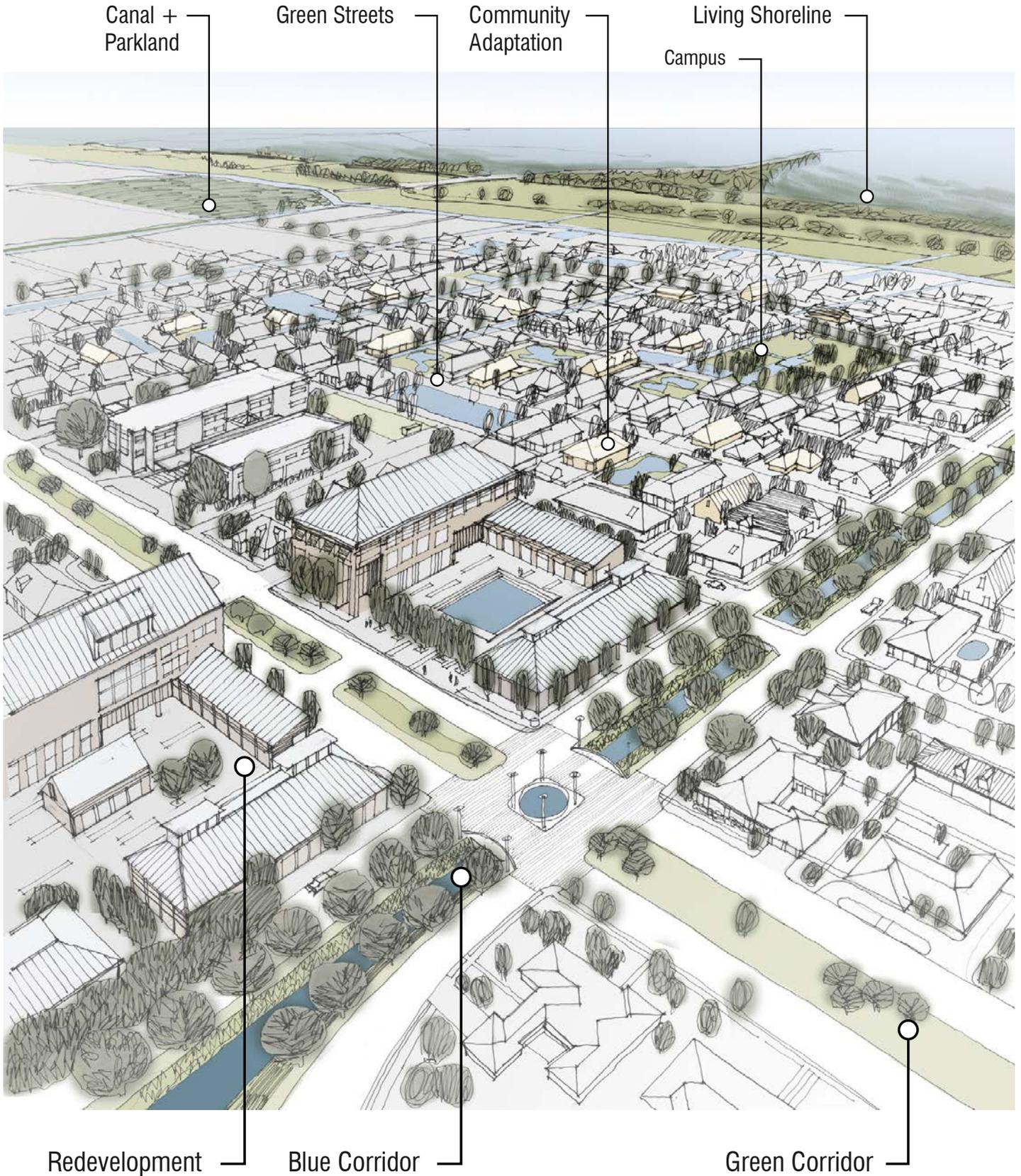


Gentilly | proposed NDRC strategies will result in an urban delta landscape with oak and cypress canopies and flowing water



View down Robert E. Lee Boulevard | a blue corridor that will convey, store, and infiltrate water, spur commercial development and redefine northern edge of the Gentilly Resilience District

Images:
Waggoner & Ball Consultant Team



Gentilly | model for resilience across the region's lowlands and for building a sustainable and ecologically rich urban delta

Source:
Waggoner & Ball Consultant Team