CITY OF NEW ORLEANS

VEOLIA

Resilient Water and Wastewater Systems

June 2017

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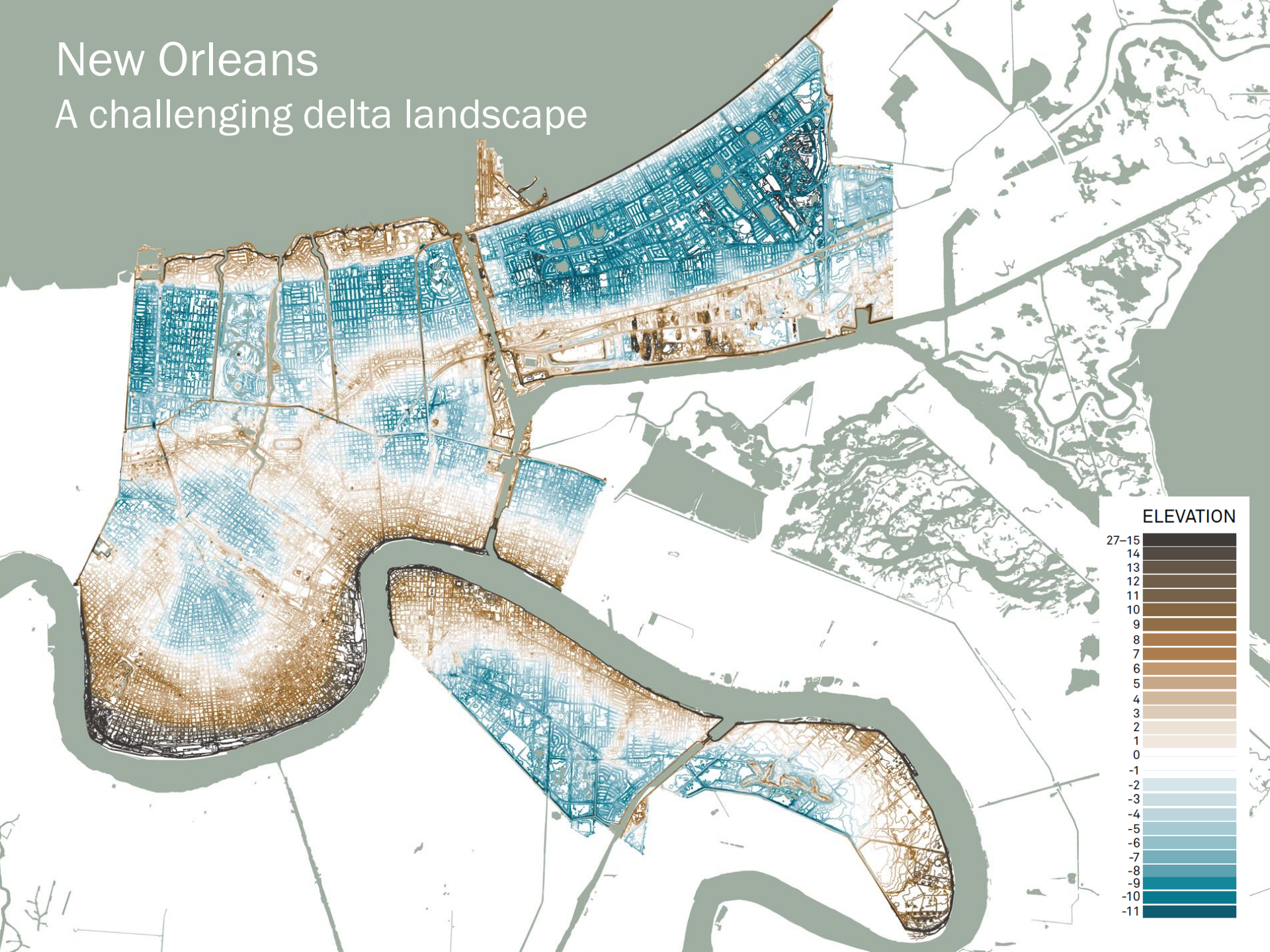
New Orleans

A challenging delta landscape



Our Problems

- Sea Level Rise
- Coastal Erosion
- Flooding
- Subsidence

Our Opportunities

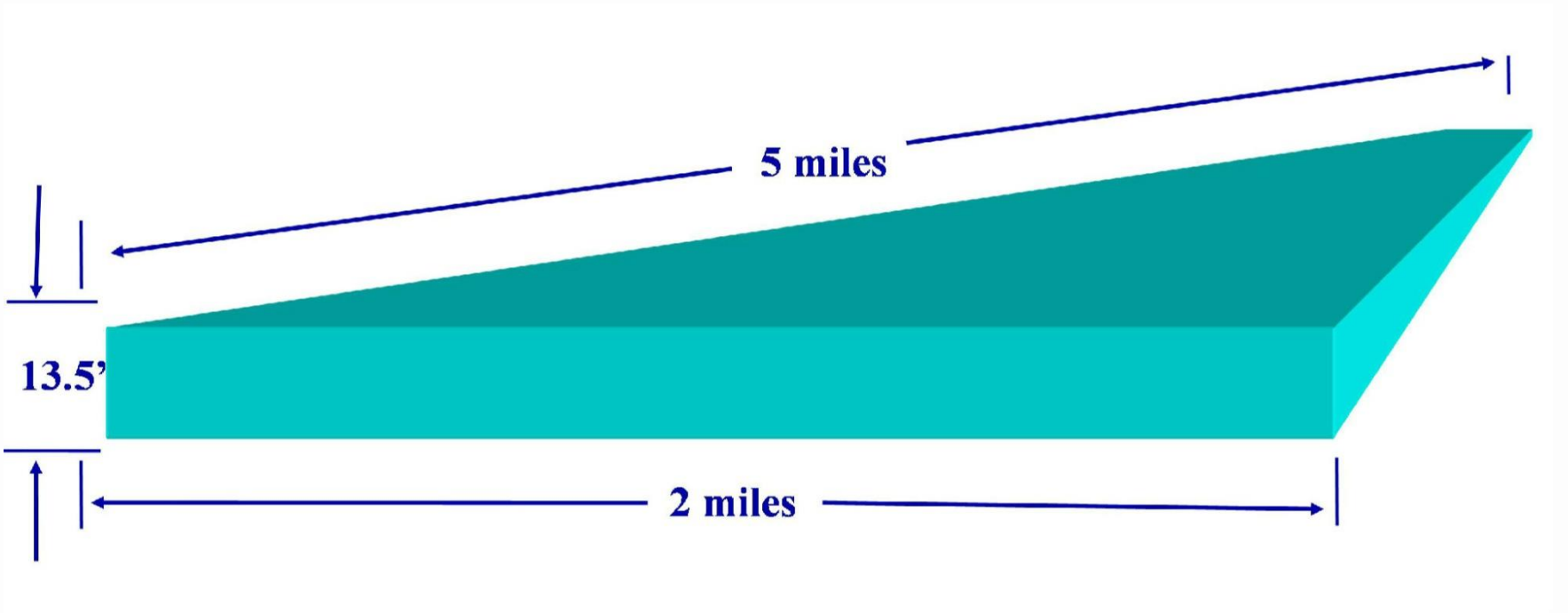
- Improved Safety
- Economic Vitality
- Living with Water
- Enhanced Quality of Life

Drainage System

Facts and Figures

- 150 Miles Covered Canals
- 100 Miles Open Canals
- 200 Miles Pipes > 36”
- 24 Pumping Stations
- 119 Pumps
- 51,000 CFS Capacity

Pumping Capacity



- Capacity: >29 billion gallons per day
- Enough to empty a 10 sq. mi., 13.5ft. deep lake every 24 hours

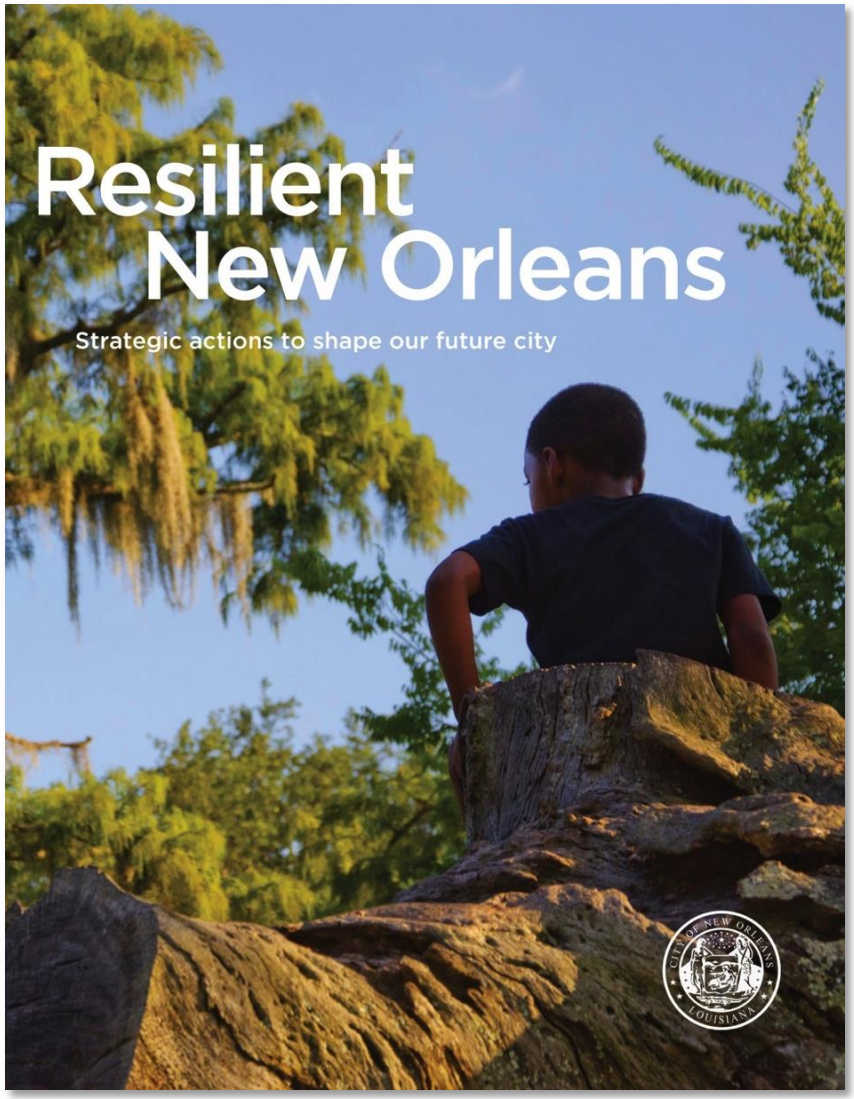
Investing in Water Resilience:

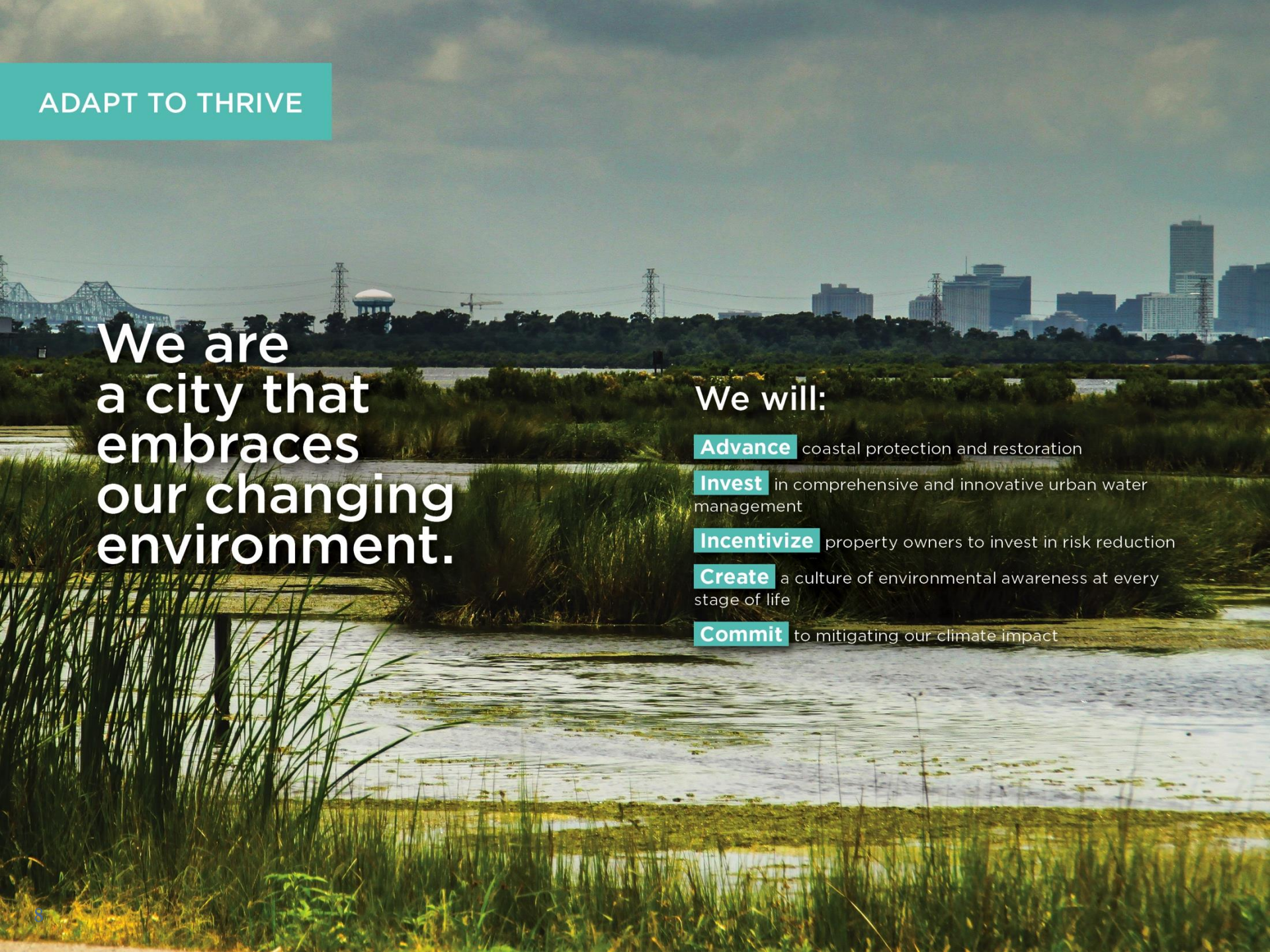
Greater New Orleans Hurricane & Storm Risk Reduction System

- >**$14.6 billion invested** in 133 miles of levees, floodwalls, floodgates and pump stations

New Orleans City Resilience Strategy

Released August 2015





ADAPT TO THRIVE

We are a city that embraces our changing environment.

We will:

Advance coastal protection and restoration

Invest in comprehensive and innovative urban water management

Incentivize property owners to invest in risk reduction

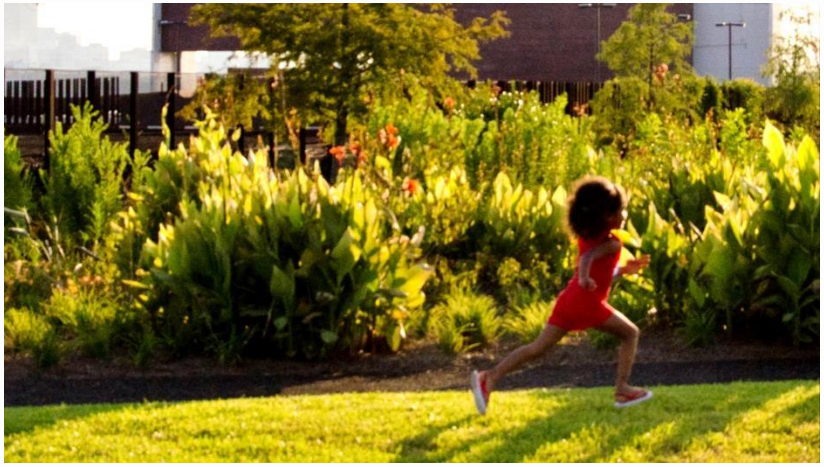
Create a culture of environmental awareness at every stage of life

Commit to mitigating our climate impact

Resilience Dividend: Designing projects for multiple benefits

Reduced risk of flooding & subsidence

Neighborhood revitalization & economic development



Improved health & quality of life

Environmental education & workforce development

Gentilly Resilience District: Urban Water & Community Adaptation Activities

Parks & Playgrounds

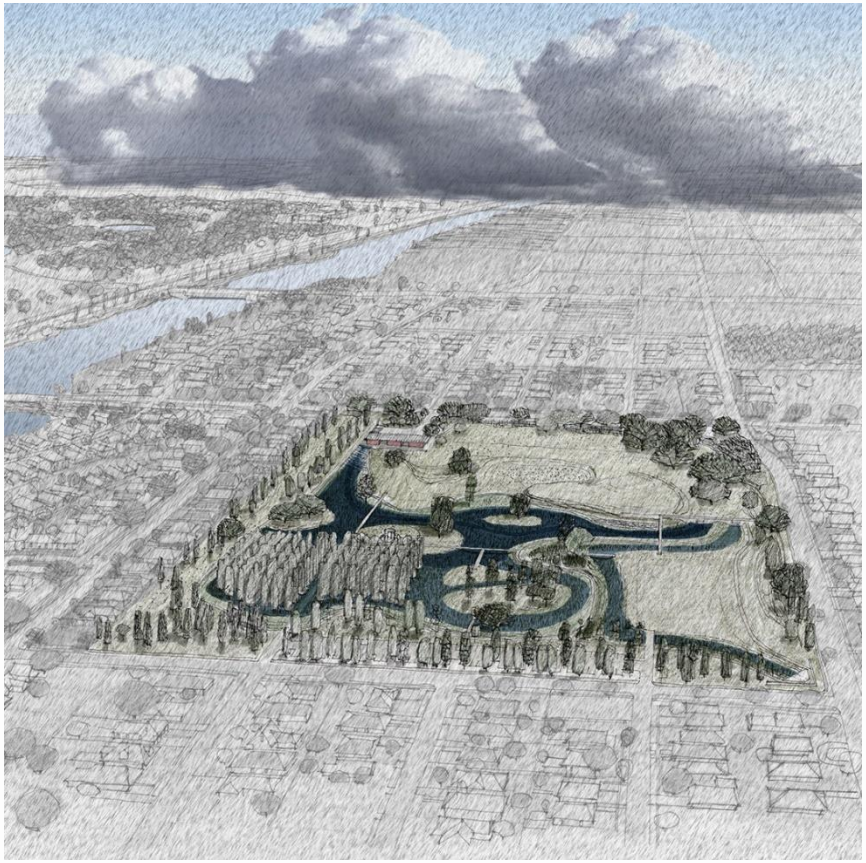
Vacant Lots

Streets & Corridors

Open Spaces

Home & Property Improvements

Mirabeau Water Garden

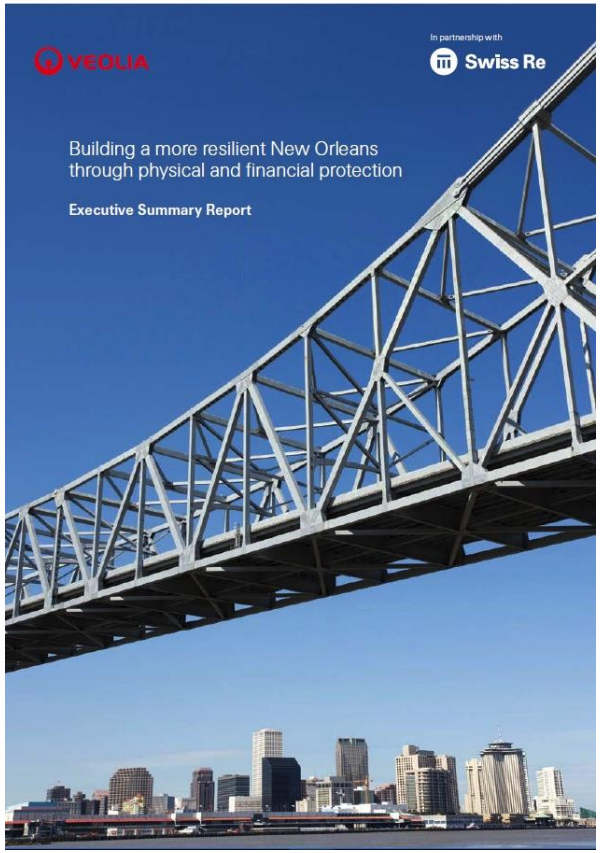


- **Project Scope:** 25-acre site of a former convent of the Sisters of Saint Joseph designed to store up to 10 million gallons of stormwater while also serving as a space for recreation and environmental learning
- **Budget: $12.5M** HMGP; **$12M** NDR
- **Phase: 60% Design on HMGP; Scoping NDRC**

Critical Infrastructure Risk Transfer

Swiss Re and Veolia partnership to conduct a risk evaluation of Sewerage and Water Board of New Orleans' (SWBNO) critical infrastructure and identify opportunities to protect assets by pre-funding catastrophic losses. SWBNO has completed study and is looking to implement recommendations. The City of New Orleans is interested in performing similar analyses for city-owned critical infrastructure.

- Combines risk modelling expertise of Swiss Re with urban systems management expertise of Veolia
- Takes latest climate change models into account
- Modelled based on strategic upgrades and infrastructure improvements to assets
- Recommends strategic mitigation efforts
- **Partners:**
  - Swiss Re
  - Veolia



Strategic Partnerships

Creating and Delivering Resilience Solutions

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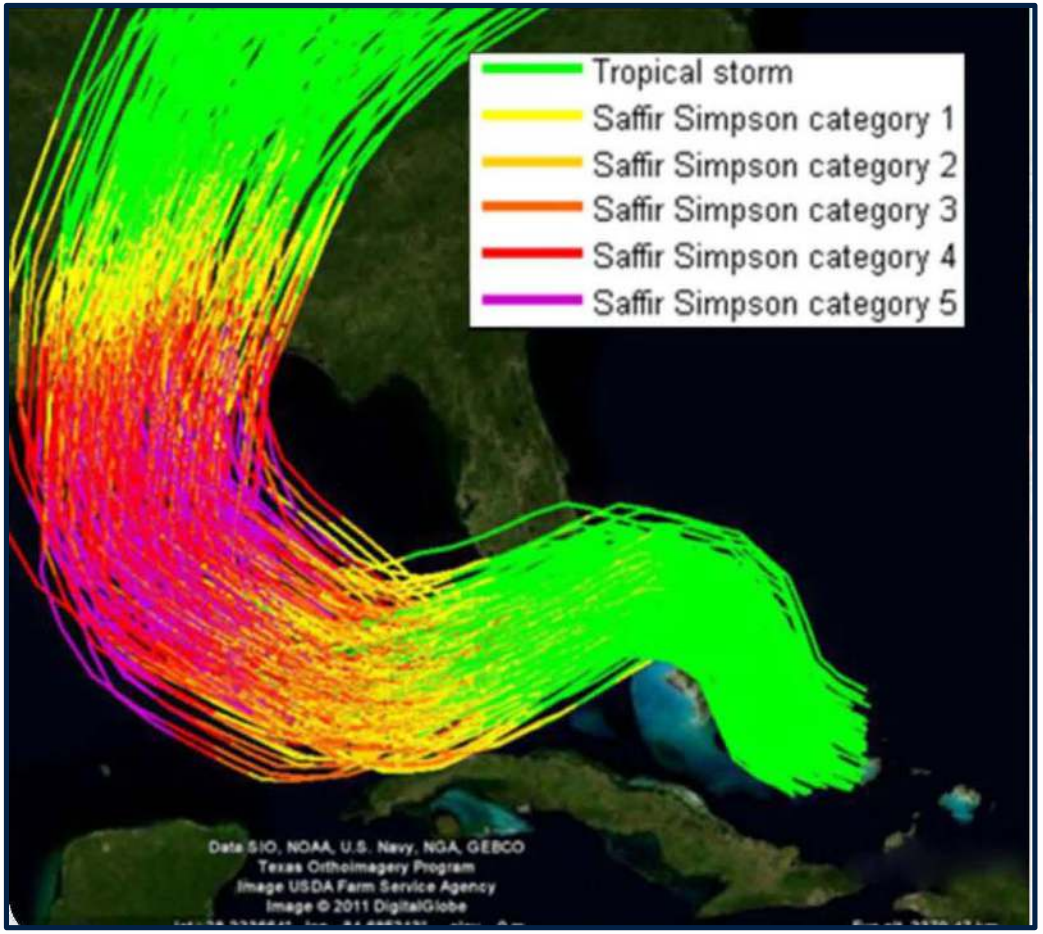
- Utility Management
- Adaptation Measure Delivery
- Expense Optimization

Swiss Re

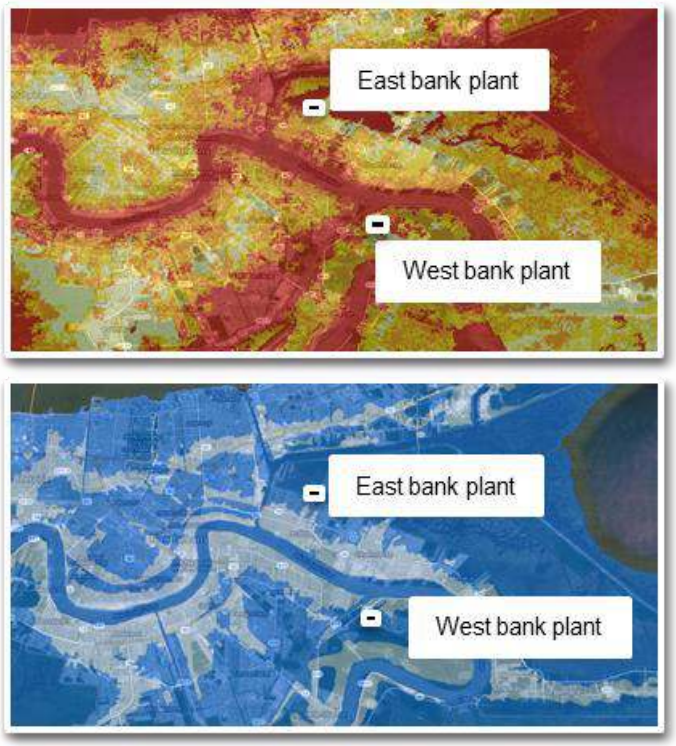
- Risk Modelling
- Financial Capacity
- Risk Transfer Solutions

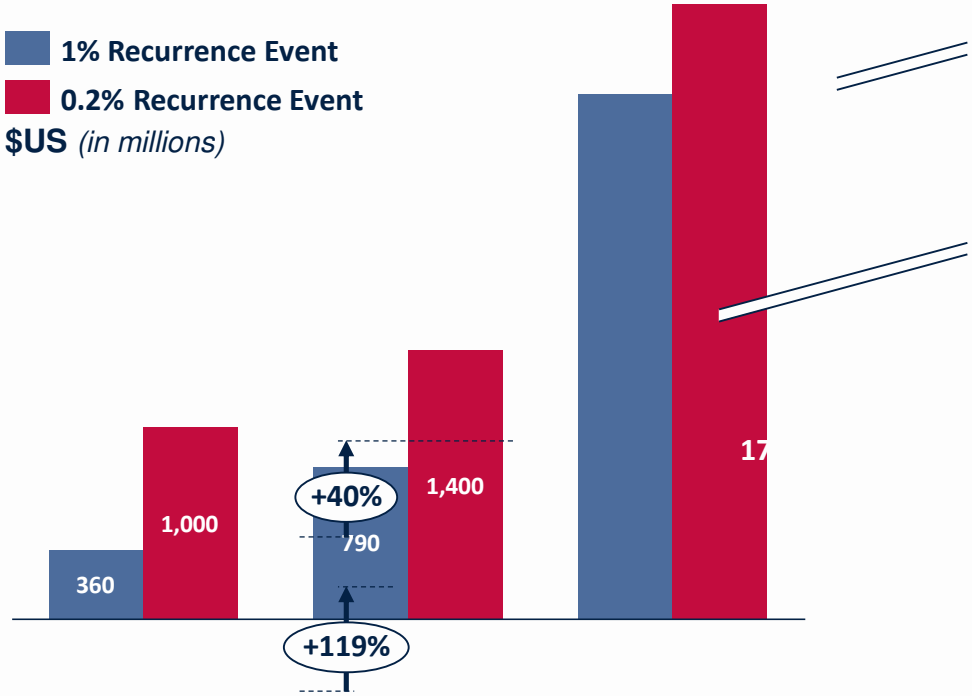
To define risk, SwissRe uses its Tropical Cyclone model under current and future climate scenarios

- >1,100 historical events over 120 years used to develop probabilistic track set
- Contains about 225,000 tropical cyclones



The model shows significant increases in property damage loss exposure with future climate changes





** Future climate exposure corresponds to increased frequency and 2.5 ft of sea-level rise by 2050*

*** Includes all insured residential, commercial and auto assets*

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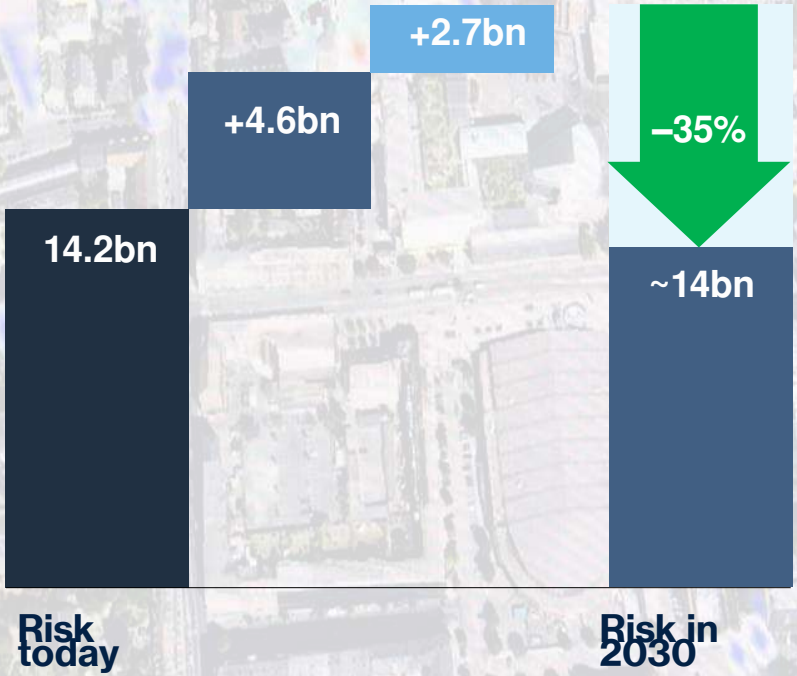
Resilience is a difficult balancing act
Identification of cost-effective measures is critical

Gulf Coast Scenario

Climate risk to critical energy assets

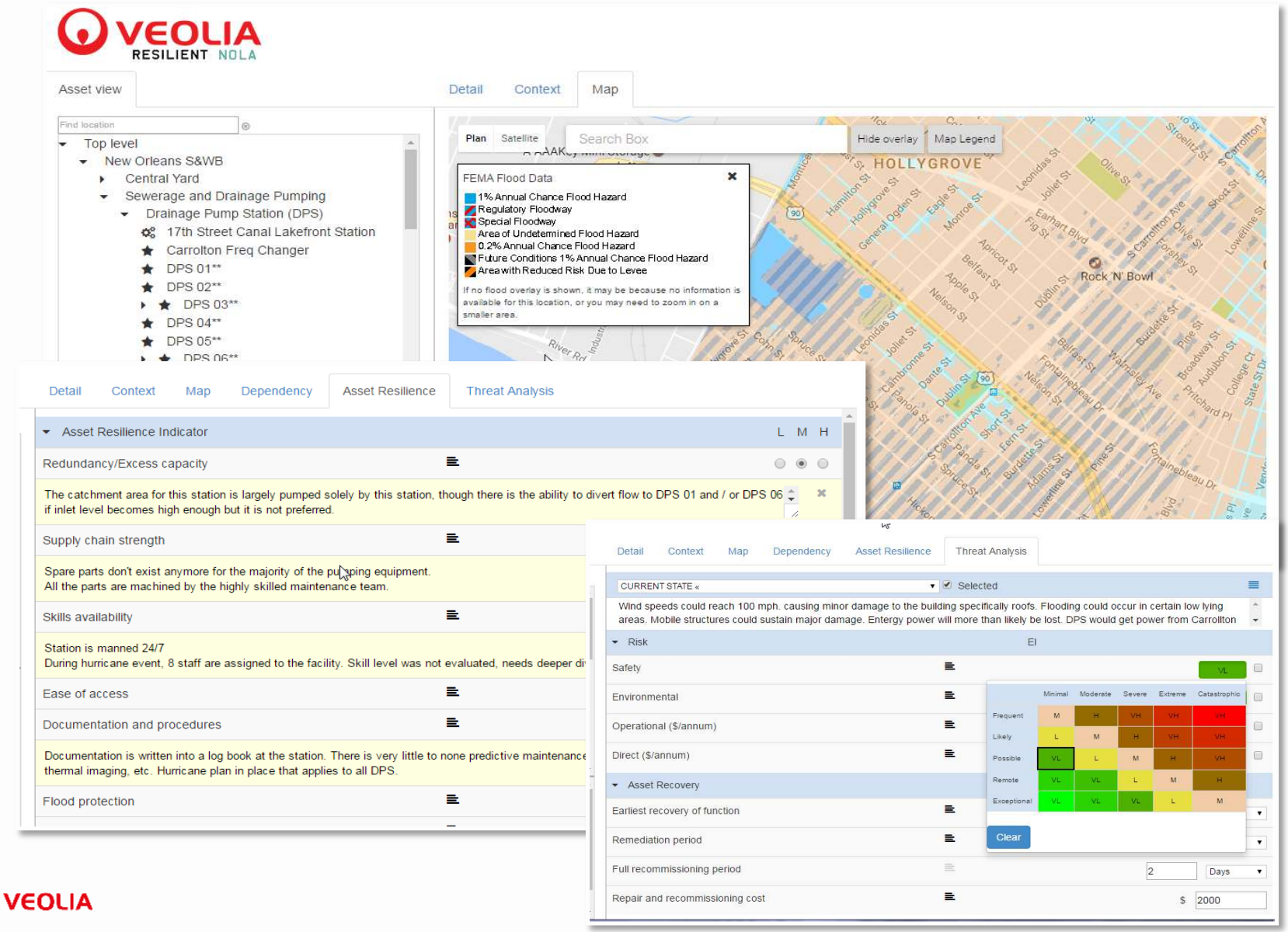
- Additional risk due to **economic development**
- Additional risk due to **moderate climate change**



- **Climate adaptation**
  Risk reduction potential through cost-effective adaptation measures
- **Residual risk**
  Remains as not all losses are avoidable such as low frequency-high severity events

Source: Swiss Re, ECA Group, Building a Resilient Energy Gulf Coast

Veolia's proprietary Resilience Tool was then used to evaluate resilience and threats to each S&WB asset



Meaningful resilience planning needs to be at the asset level

Sewerage and Water Board Assets

>200 assets

- 65 focus assets
- 13 WWTP (132 MGD – 1,600 miles)
- 83 Sewage pump stations
- 59 WTP (146 MGD – 353,000 people)
- 35 Drainage pumping stations (29 BGD)

>150,000 hurricane events modeled in the Atlantic Ocean & Gulf of Mexico

$160M of must-have surge hardening investments to reduce expected loss by 60%

$6.5M of quick-win surge hardening investments to reduce expected loss by 72%

PLUS operational excellence recommendations focused on asset reliability and workforce development

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A Holistic Approach to Developing Resilience Recommendations

UNDERSTAND VULNERABILITIES | **PLAN YOUR RESPONSE** | **IMPLEMENT MITIGATION MEASURES** | **TRANSFER RISK**

Effort to Date:

- Current **baseline risk exposure calculated** for all assets
- Identified **potential risk mitigation measures** for all assets, where appropriate
- Selected the **2050 climate change scenarios** to include in model
- **Evaluated the existing resilience** of all assets

Remaining Scope to be Completed:

- **Re-model the risk exposure** for all assets, accounting for identified mitigation measures and using future climate change scenarios
- Develop a **resilience plan** to maximize investment funds for **risk reduction and cost savings**

Next Steps:

- Implement the resilience plan
- Extend program to other critical City assets to evaluate health and economic impacts
- Develop a risk transfer agreement

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