



CITY OF NEW ORLEANS



# Resilient Water and Wastewater Systems

June 2017

**Ryan Berni**

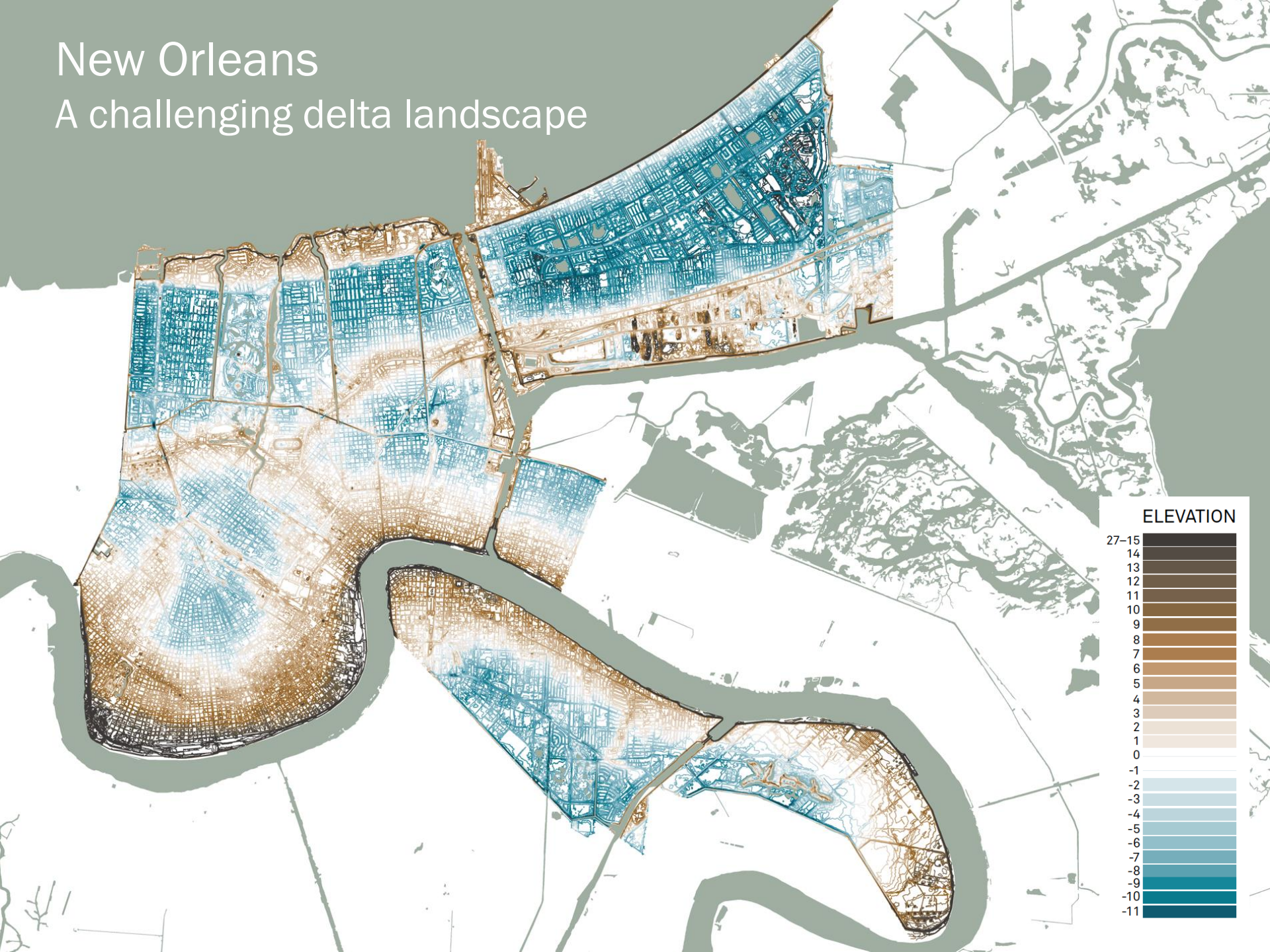
Deputy Mayor  
City of New Orleans

**Patrick Schultz**

Principal & General Manager, Resource Optimization  
Veolia

# New Orleans

## A challenging delta landscape



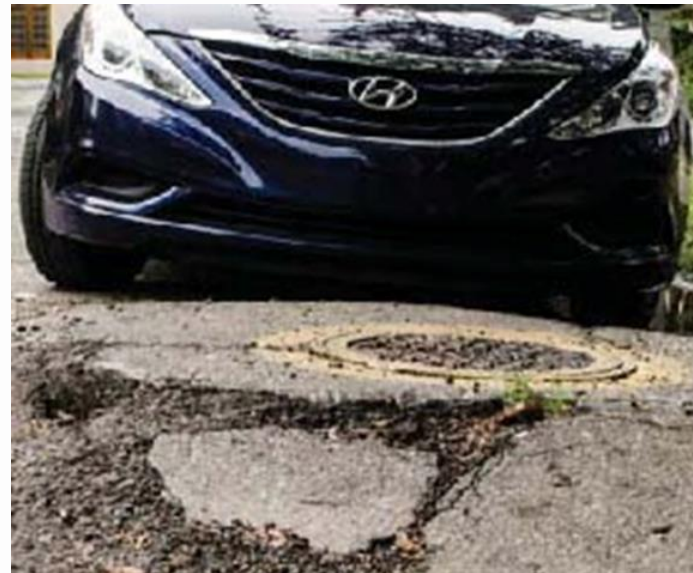
# Our Problems

- Sea Level Rise
- Coastal Erosion
- Flooding
- Subsidence



# Our Opportunities

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



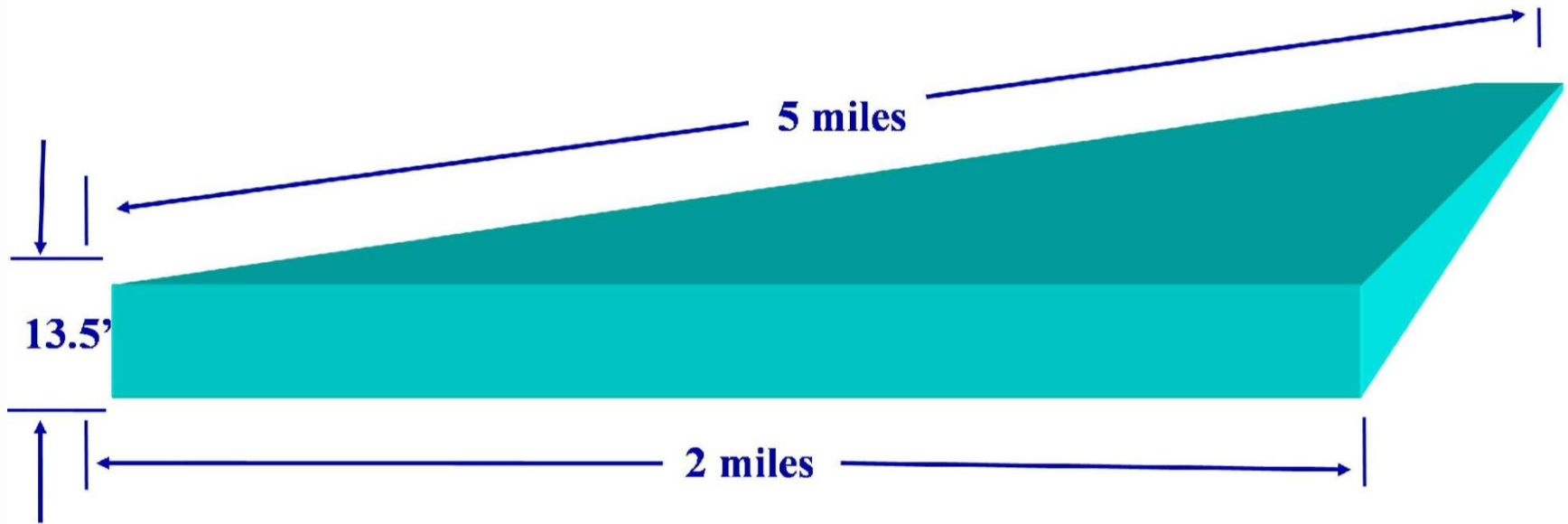
# Drainage System

## 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:

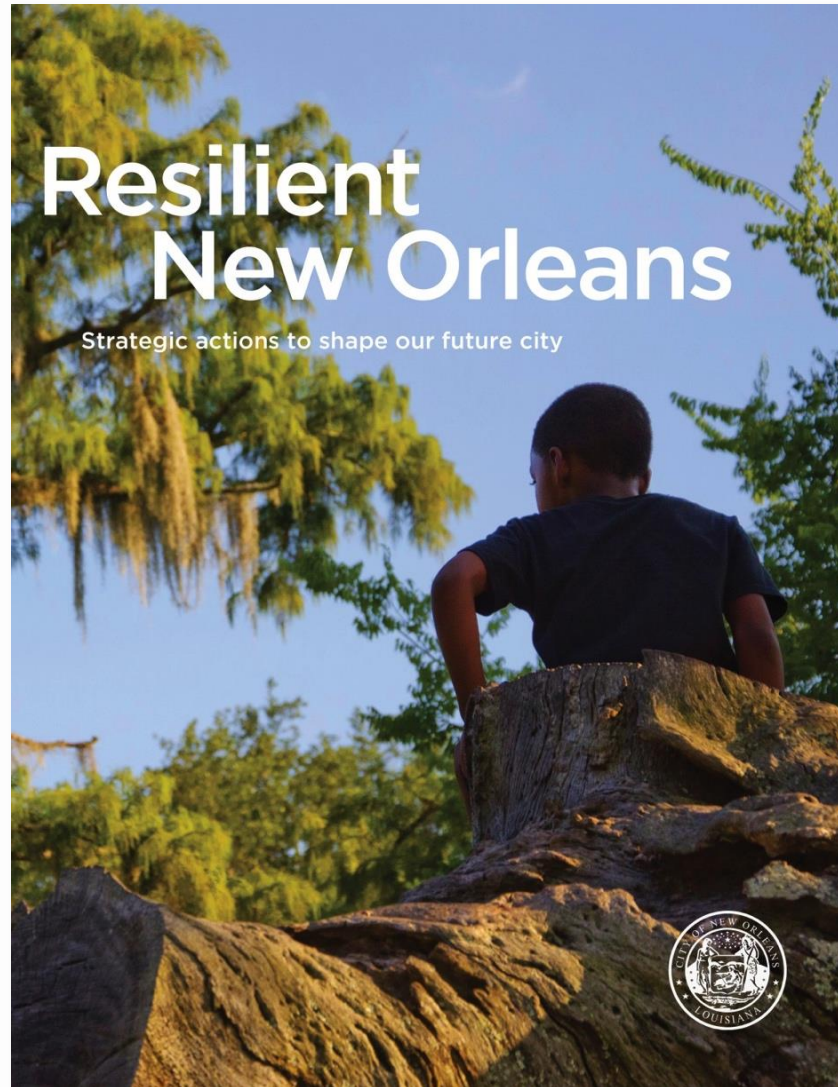
## Greater New Orleans Hurricane & Storm Risk Reduction System

- >\$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

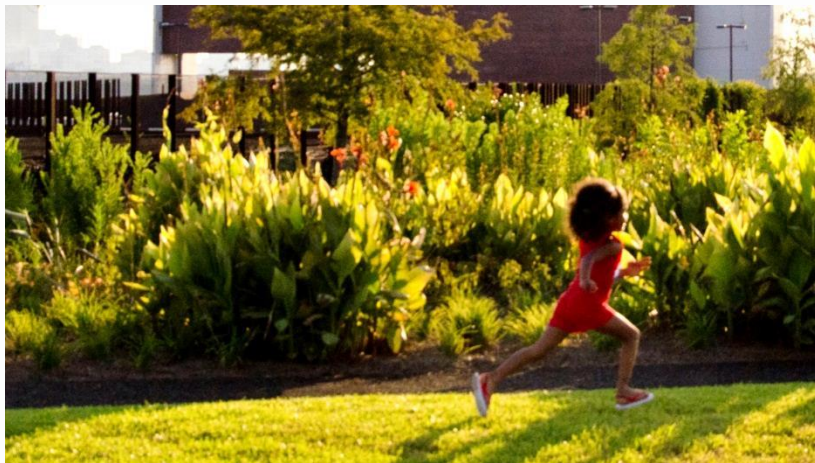
# Resilience Dividend: Designing projects for multiple benefits



**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

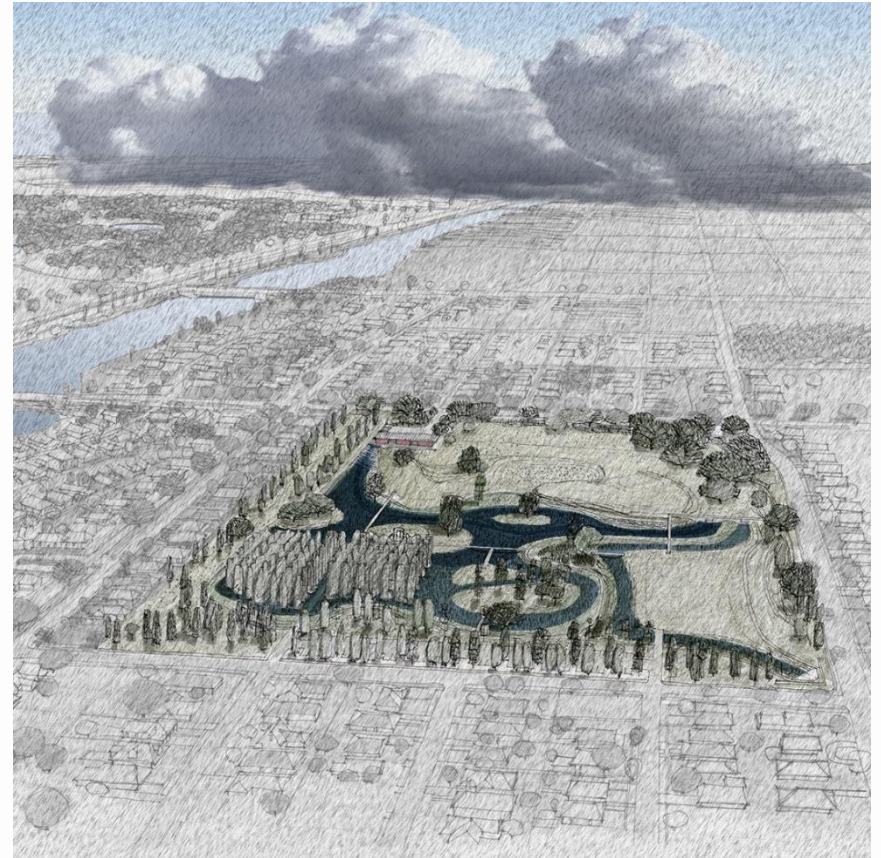


Open Spaces



Home & Property Improvements

# Mirabeau Water Garden

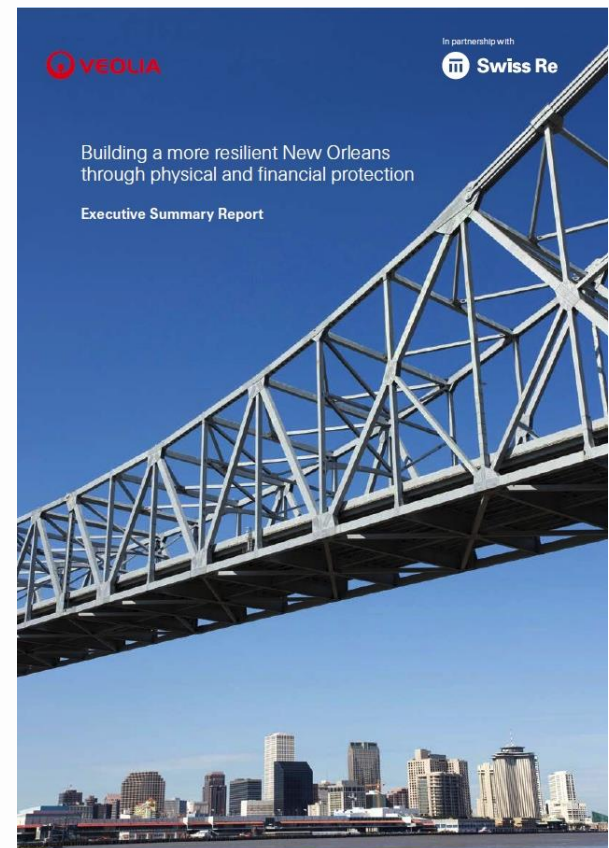


- **Project Scope:** 25-acre site of a former convent of the Sisters of Saint Joseph designed to store up to 10 million gallons of stormwater while also serving as a space for recreation and environmental learning
- **Budget:** \$12.5M HMGP; \$12M NDR
- **Phase:** 60% Design on HMGP; Scoping NDRC

# 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



- Utility Management
- Adaptation Measure Delivery
- Expense Optimization

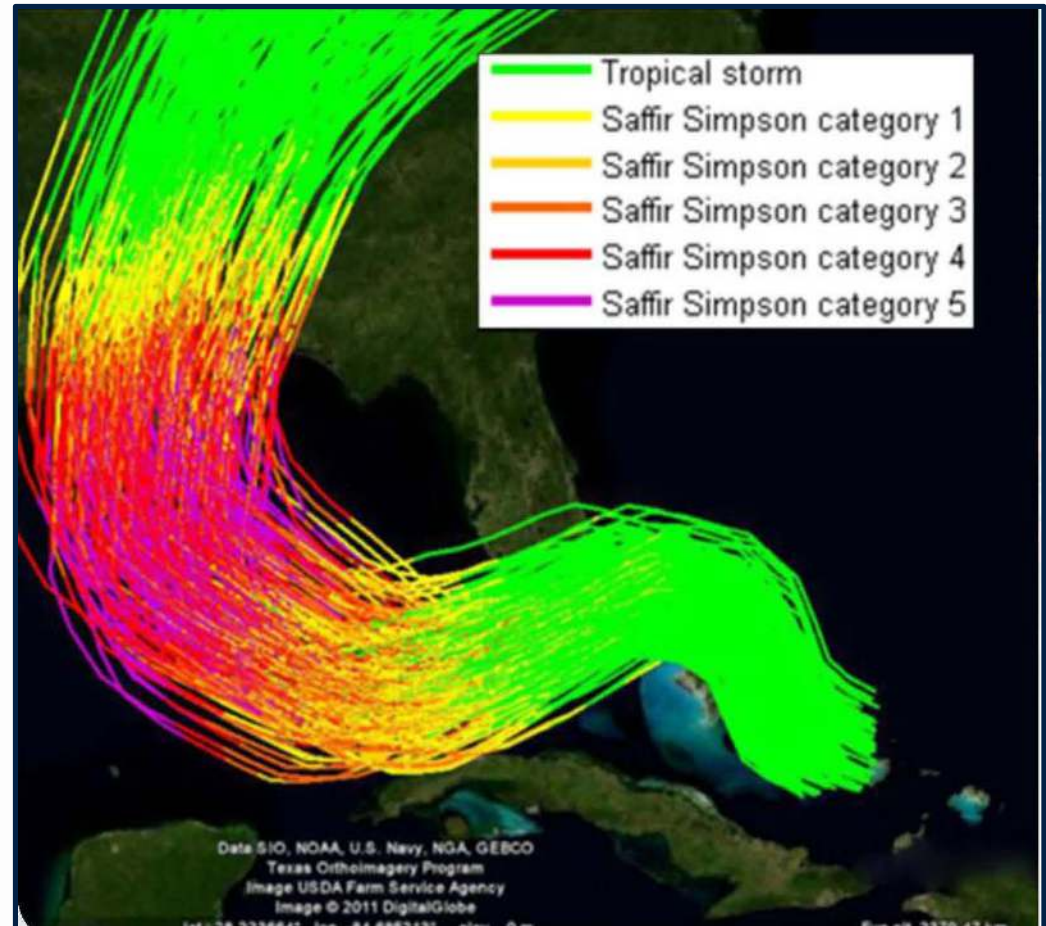


- Risk Modelling
- Financial Capacity
- Risk Transfer Solutions

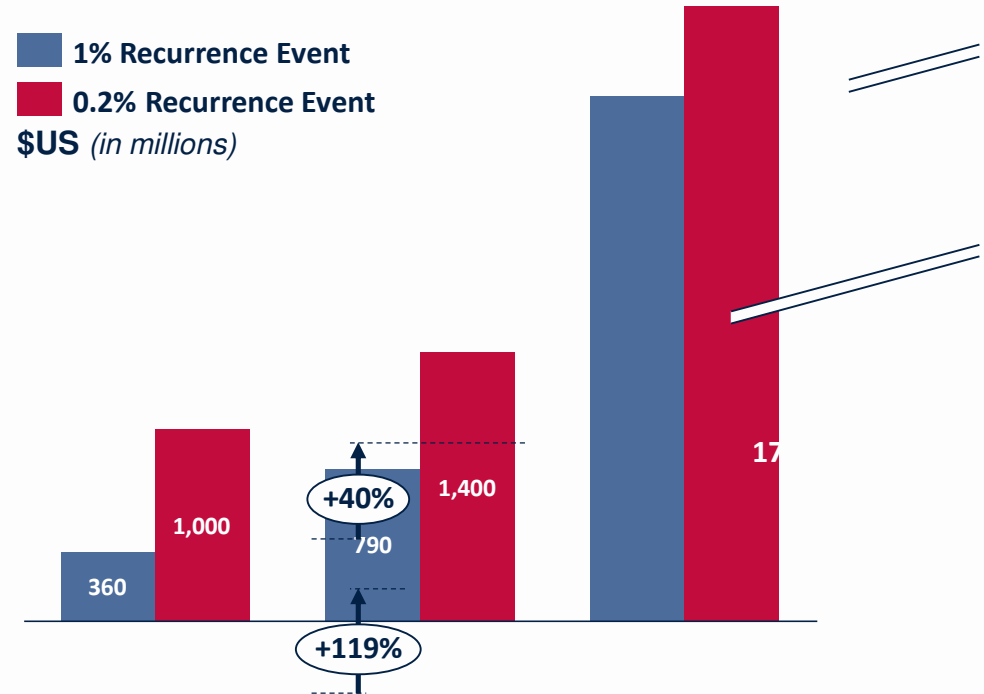
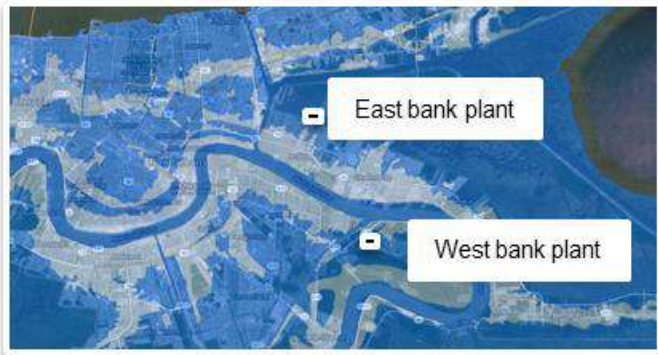
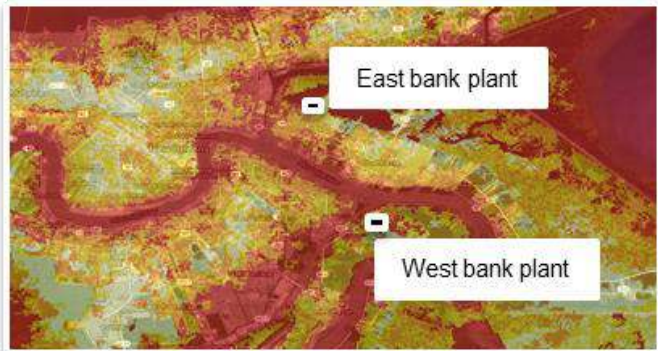


To define risk, SwissRe uses its Tropical Cyclone model under current and future climate scenarios

- >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



S&WB Current Exposure

S&WB Future  
Climate Exposure\*

NOLA Exposure\*\*

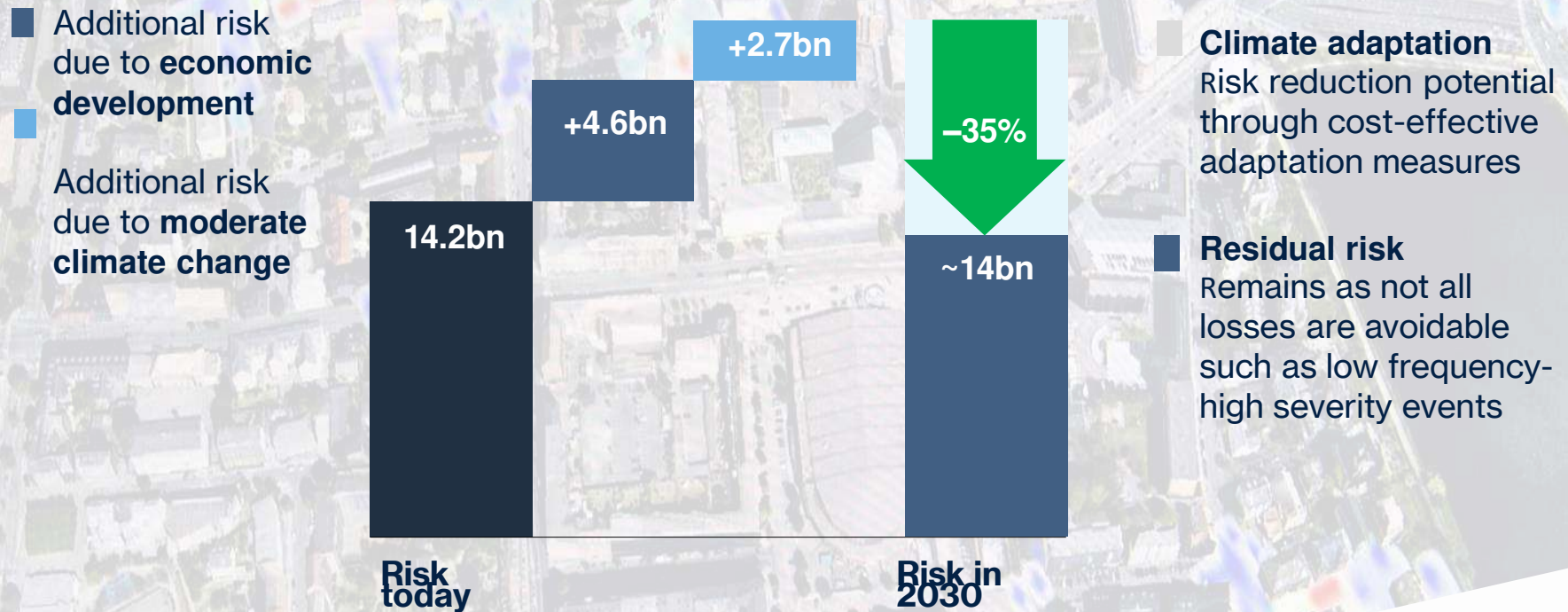
\* Future climate exposure corresponds to increased frequency and 2.5 ft of sea-level rise by 2050

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

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

## Gulf Coast Scenario

### Climate risk to critical energy assets



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

The screenshot displays the Veolia Resilient NOLA software interface, which is used for evaluating the resilience and threats to various S&WB assets. The interface is divided into several sections:

- Asset view:** A sidebar on the left showing a hierarchical list of assets under the "Top level" category. The list includes "New Orleans S&WB", "Central Yard", "Sewerage and Drainage Pumping", "Drainage Pump Station (DPS)", "17th Street Canal Lakefront Station", "Carrollton Freq Changer", "DPS 01\*\*", "DPS 02\*\*", "DPS 03\*\*", "DPS 04\*\*", "DPS 05\*\*", and "DPS 06\*\*".
- Map:** A map view on the right showing the location of the selected asset. A "FEMA Flood Data" overlay is visible, showing various flood hazard zones. The legend for the FEMA Flood Data includes:
  - 1% Annual Chance Flood Hazard
  - Regulatory Floodway
  - Special Floodway
  - Area of Undetermined Flood Hazard
  - 0.2% Annual Chance Flood Hazard
  - Future Conditions 1% Annual Chance Flood Hazard
  - Area with Reduced Risk Due to Levee
- Asset Resilience:** A section on the left showing the "Asset Resilience Indicator" and a list of resilience factors. The factors include:
  - Redundancy/Excess capacity: The catchment area for this station is largely pumped solely by this station, though there is the ability to divert flow to DPS 01 and / or DPS 06 if inlet level becomes high enough but it is not preferred.
  - Supply chain strength: Spare parts don't exist anymore for the majority of the pumping equipment. All the parts are machined by the highly skilled maintenance team.
  - Skills availability: Station is manned 24/7. During hurricane event, 8 staff are assigned to the facility. Skill level was not evaluated, needs deeper dive.
  - Ease of access
  - Documentation and procedures: Documentation is written into a log book at the station. There is very little to none predictive maintenance thermal imaging, etc. Hurricane plan in place that applies to all DPS.
  - Flood protection
- Threat Analysis:** A section on the right showing the "CURRENT STATE" and a risk matrix. The risk matrix is a table with rows for "Safety", "Environmental", "Operational (\$/annum)", "Direct (\$/annum)", and "Asset Recovery". The columns represent the severity of the threat, ranging from "Minimal" to "Catastrophic". The risk matrix is color-coded, with green indicating low risk and red indicating high risk.

# 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

# 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

# Resilient

## NEW ORLEANS



CITY OF NEW ORLEANS

