

A photograph of a mangrove forest. The foreground is dominated by a dense, intricate network of light-colored, woody prop roots that arch and curve over the water. The roots are thick and have a textured, bark-like appearance. In the background, the green leaves of mangrove trees are visible, creating a lush canopy. The water is calm, reflecting the roots and foliage.

ESKEW+DUMEZ+RIPPLE

RESEARCH IN PRACTICE

Summer 2014 Edition

A FRAMEWORK FOR

# RESILIENT DESIGN

Published June 2014 | New Orleans

Cover Image by Claire Fackler | NOAA Photography Library

In the wake of recent unprecedented natural disasters and the rebuilding that has followed, the term ‘resilience’ has gained new prominence. Used loosely, the term ‘resilience’ means different things to different people. Is it the same as strength, flexibility, or durability? How is it related to sustainability? What’s the difference between resilience and emergency preparedness? How can those who design at the scale of buildings, campuses, neighborhoods, or cities consciously design in ways that promote resilience?

Eskew+Dumez+Ripple has developed case studies and a framework for understanding resiliency in the built environment, with a special focus on threats faced by coastal communities. This topic was further explored by the 2013-2014 Eskew+Dumez+Ripple Research Fellowship recipient Marissa Campos and, working with staff urban planner Cristina Ungureanu, led to the framework outlined on the following pages. The framework was tested during its development through a series of workshops with the full staff. We believe that this framework has value for others, whether facing the challenges of coastal environments, seismic events, tornadoes, wildfires, or other natural disasters.

According to Urban Land Institute (ULI), “‘Resiliency thinking’ requires us to think not only about bouncing back from environmental, economic, and social crises, but adapting to changing circumstances by ‘bouncing forward’ through new paradigms, processes, and ways of working.” Through this publication, we hope to inspire others to examine resiliency through their own relevant lens, expand dialogue, and contribute to a growing common understanding and subsequent best-practices that will define our industry and design responses to environmental traumas in the years ahead.

From our home here in New Orleans, Eskew+Dumez+Ripple has had to face these questions head on. Our experiences in Hurricanes Katrina, Ike, and Rita—and the storms preceding these—have allowed us to observe, experiment, and learn ways of designing in a region facing hurricanes, windstorms, water surge, land subsidence, and sea level rise. What we have learned might at first seem limited in applicability to the Gulf South. However, according to the Urban Land Institute, 75 percent of the world’s rapidly urbanizing population is expected to be concentrated in urban areas located in coastal regions. As was observed after Superstorm Sandy, “We all live in New Orleans, now.”

**Z Smith, PhD, AIA, LEED AP BD+C**

Principal | Director of Sustainability + Building Performance

**Collette Creppell, AIA, LEED AP BD+C**

Principal | Director of Urban Strategies

RESILIENCE IS THE **PRESERVATION OF COMMUNITIES** THROUGH ONGOING PLANNING FOR THE CAPACITY TO **LEARN, ADAPT, AND CHANGE** IN THE FACE OF PRESENT-DAY AND FUTURE THREATS, BOTH PREDICTABLE AND UNKNOWN.

We are drawing from the following 3 definitions of resilience, specifically by the scale at which they focus:

## GLOBAL

### THE ROCKEFELLER FOUNDATION

**CONSTANT LEARNING:** Ability to internalize past experiences linked with robust feedback loops that sense, provide foresight and allow new solutions.

**RAPID REBOUND:** Capacity to re-establish function, re-organize and avoid long-term disruptions.

**LIMITED OR "SAFE" FAILURE:** Prevents failures from rippling across systems.

**FLEXIBILITY:** Ability to change, evolve, and adapt to alternative strategies in the face of disaster.

**SPARE CAPACITY:** Ensures that there is a back-up or alternative available when a vital component of a system fails.

### THE AMERICAN INSTITUTE OF ARCHITECTS

design to **adapt** to changing conditions and to **maintain or regain functionality and vitality** in the face of disturbance

### THE NEW ORLEANS MASTER PLAN

the **capacity to cope with and recover from** present-day risks and the capacity to adapt to changing conditions, including uncertain, unknown, or unpredictable risks, encouraging communities to **learn, adapt and change**

## LOCAL

## RESILIENCE

While the term ‘resilience’ has been used for decades in the fields of ecology and psychology, it has entered common use in the design professions only in recent years, and often goes undefined. Like art, we know it when we see it.

We know resilience has to do with effective recovery and long-term renewal, but what else? Is resilient design synonymous with good design? What’s the difference between resilience and sustainability? Is resilience a quality of resisting damage in the face of disaster, or is it a quality of adaptation once the damage is done? Is the resilience of a thing measured by its strength, its flexibility, or by its ease of recovery? How can resilience be created and promoted by the professional community shaping the built environment?

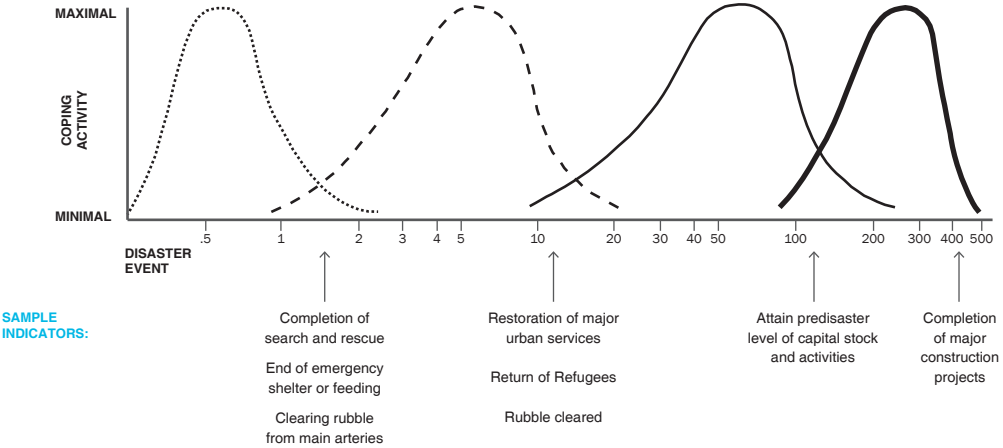
When we are talking about resilience in the built environment, we are actually talking about communities, not buildings. Buildings may endure or survive a disturbance, but it is communities that “come back.” This realization is reflected in the definitions of resilience offered by the Rockefeller Foundation, the American Institute of Architects, and the City of New Orleans master plan, reproduced on the facing page. Drawing from these, and our own experiences, we define resilience as follows:

*Resilience is the **preservation of communities** through ongoing planning for the capacity to **learn, adapt, and change** in the face of present-day and future threats, both predictable and unknown.*

While promoting resilience does indeed involve building strong or building flexibly, it also means building in ways that are attentive to how communities repair themselves and adapt to changing or unexpected circumstance. Community connections, networks and relationships are the cornerstones of community strength. Historians and scientists who study how communities come back from disasters have documented recurring patterns and stages and have produced literature showing that communities lacking cohesion have more difficulty bouncing back, while communities able to organize themselves around common goals respond and recover more rapidly from environmental traumas.

**Resilient design makes this far easier.**

PERIODS:	EMERGENCY .....	RESTORATION -----	RECONSTRUCTION 1 —————	RECONSTRUCTION 2 —————
CAPITAL STOCKS:	Damaged or destroyed	Patched	Rebuilt (Replacement)	Major Construction (Commemoration, Betterment, Development)
NORMAL ACTIVITIES:	Ceased or Changed	Return and Function	Return at Predisaster Levels or Greater	Improved and Developed



This chart modeling the cycle of disaster recovery activity is a product of a research project sponsored by the U.S. National Science Foundation in the mid-1970s. While the researchers concluded that recovery is "ordered and predictable" it does not include the nuances of recovery: who is involved, what is rebuilt, who is left out.

# RESILIENCY FRAMEWORK

As we have become more deliberate about resilient design in our work, certain themes recur—each manifesting themselves at multiple scales. To deal with these topics, we found it useful to break questions of resilience into themes or components at different scales. We call this approach the Resiliency Framework. It breaks explorations of resiliency into ten components, each asking different kinds of questions, and then looks at resiliency at the three scales at which design and planning professionals typically work: the individual building, the district (whether campus or neighborhood), and the city. Each component may require that we consider sudden events and slow changes in the environment over a time scale of years to decades and beyond. Unfortunately, in an era where “100 year storms” are hitting every decade, we cannot base our planning on historical data alone — we have to look forward.

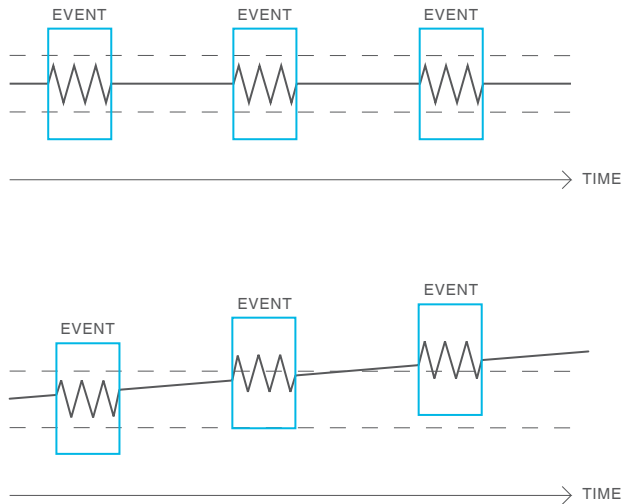
	BUILDING	CAMPUS	CITY
1	Community Connections, and Preservation		
2	Critical Resources, Community Assets, and Economic Continuity		
3	Regional/Contextual Efforts		
4	Emergency Preparedness		
5	Past, Present, and Future Climate Analysis / Risk Assessment		
6	Site Response		
7	Design and Construction		
8	Efficiency, Efficacy, and Redundancy		
9	Systems and Operations		
10	Information Gathering and Feedback Loops		

## RESILIENCE + SUSTAINABILITY

The terms resilience and sustainability have sometimes been used interchangeably, perhaps because some of the design choices that influence one can influence the other. The terms are not identical, nor are they mutually exclusive. Both sustainability and resilience ask that we consider more than the immediate “Now,” but for different reasons. The designer considering sustainability might ask “Could we keep building this way forever,” taking the finite nature of non-renewable resources into account. The designer considering resilience might ask, “Given sea level rise, what if conditions are going to be wildly different after a 100-year storm?” Sustainable design tries to have the least negative impact on the environment when designing for, say, a typical meteorological year; resilient design takes into account that conditions vary in both known and unpredictable ways.

If sustainable design calls for doing the most with the least, resilient design may call for a ‘margin of safety’, a level of redundancy that may require ‘extra’ materials or energy use, putting sustainability and resilience goals in tension. On the other hand, sustainability and resilience often complement each other: a building that uses less energy by employing passive strategies may also be more resilient in times when no utility power is available.

Sustainability and Resilience are both elements of good design, but they are distinct from one another. They sometimes pull a design in the same direction, and sometimes in opposite directions. Both are part of the effort to move towards evidence-based design. Bringing resilience into the foreground does not relieve us of the responsibility to pay attention to other performance goals. Good design resolves conflicting goals in elegant ways while providing functionality and delight within the available budget.



Because we live in a world with changing conditions, the events of the future do not have be drastically different to have dramatic and disastrous effects. The changing baseline conditions (i.e. sea-level) mean that the same intensity of a storm 50 years ago, will affect us differently. Resilience planning addresses how to plan for these changing conditions, both known and unpredictable.



<b>COMMUNITY CONNECTIONS AND PRESERVATION</b>	<b>1</b>
<b>CRITICAL RESOURCES AND COMMUNITY ASSETS</b>	<b>2</b>
<b>REGIONAL AND CONTEXTUAL EFFORTS</b>	<b>3</b>
<b>EMERGENCY PREPAREDNESS</b>	<b>4</b>
<b>ENVIRONMENTAL ANALYSIS AND RISK ASSESSMENT</b>	<b>5</b>
<b>SITE RESPONSE</b>	<b>6</b>
<b>DESIGN AND CONSTRUCTION</b>	<b>7</b>
<b>SYSTEM EFFICIENCY AND REDUNDANCY</b>	<b>8</b>
<b>OPERATIONS</b>	<b>9</b>
<b>INFORMATION GATHERING AND FEEDBACK LOOPS</b>	<b>10</b>



## COMMUNITY CONNECTIONS AND PRESERVATION

GATHERING PLACES MATTER

**Buildings that help reinforce community identity can enhance community resilience.**

Why did some neighborhoods in New Orleans come back more quickly than others after Hurricane Katrina? Why did some small towns in Vermont fare better than others after Tropical Storm Irene? Communities with gathering places that help reinforce local identity—whether a library or a volunteer fire department house—appear to be more resilient. Resilient design looks for opportunities to draw on and reinforce local cultural or historical identity, and shapes projects to maximize community gathering. This can occur at the scale of a neighborhood, a site, or a room.

# ROSA F. KELLER LIBRARY AND COMMUNITY CENTER

## CASE STUDY



The Rosa F. Keller Library and Community Center serves the Broadmoor neighborhood, an economically and ethnically diverse community, by providing residents with a 21st century library, community center, café, community kitchen, gathering spaces, and educational resources.

Before Katrina, the branch library comprised a stately 1917 residence and a nondescript 1993 slab-on-grade expansion. Post-Katrina flooding damaged both structures, with the 1993 expansion determined to be beyond repair. The original residence, however, held great significance for the community—a nationally designated historic structure in a nationally designated historic neighborhood—and its restoration became a key goal of residents returning after the storm. At the insistence of the neighborhood, the iconic, century-old house was restored and became host to community meetings and neighborhood groups; the old house kitchen transformed into a community kitchen.

# GATHERING PLACES MATTER

## ISSUE



The rebuilt Keller Library is, of course, ‘hardened,’ elevated, with impact rated windows and critical systems mounted high. But by definition the building needed to be open and accessible to the community and its needs. At the insistence of the neighborhood, the recognizable house that had stood for nearly a century at a prominent intersection was restored and became host to community meetings and neighborhood groups, the old house kitchen transformed into a community kitchen. But during the initial design charrette, residents also asserted that what the neighborhood really needed was a coffee shop, and they raised their own funds to see it incorporated into the program. The architects fit it into the connector between the old and new structures, and the residents defiantly named it the ‘Green Dot Café,’ a response to those outside planners who had placed a green adhesive dot over the neighborhood on a map of the city, indicating that it was not to be rebuilt. The neighbors see that the facility hosts dozens of meetings, events, and classes each week, even the occasional festival with food trucks in the parking lot.

Like a school or firehouse, the library, as a typology, is a natural gathering place (for information, for safety, for shelter) for the community in times of distress. By linking to history and making it easier to reinforce connections among residents through events and food, the design for Keller goes even further to support neighborhood resilience through meetings, events, and classes held on site each week.



## CRITICAL RESOURCES AND COMMUNITY ASSETS

TO COME BACK, WE NEED HOMES + JOBS + SCHOOLS

### **Resilient design prioritizes restoration & rebuilding of key functions.**

Those who study patterns of community redevelopment after a disaster note that, after initial stabilization and recovery of key infrastructure (water, electricity, etc.), the large-scale return of population requires (at a minimum) homes, jobs, and schools. These and other key elements of daily life such as transportation, health care, and food distribution—and the infrastructure needed to access them—can be phased and improvised at temporary locations, but people need to believe that the essentials for daily living will be restored or they will hesitate to come back.

# L.B. LANDRY HIGH SCHOOL

## CASE STUDY



In the aftermath of Hurricane Katrina, 80% of New Orleans was flooded, and the most of the 100+ public school buildings were either severely damaged or destroyed. A plan was enacted to quickly stabilize the least-damaged buildings; to reestablish routine, security and the familiar comfort of place to accommodate the beginnings of the returning population, while then announcing demonstration “quick-start” construction projects to show that every section of the city would be re-built with state-of-the-art schools combining new construction and historic renovation.

The L.B. Landry High School was one of the five quick-start schools, designed in less than half the time traditionally allowed for projects of this scale. The destroyed school it replaced had been built with a 4-sided inward-looking courtyard typology, closed to the outside but with a magnificent Southern Magnolia tree at its center. The new design preserved the Magnolia but opened the courtyard on one side to capture the views of the city skyline. The design wrapped key public spaces around a multi-story commons intended to promote a sense of unity and re-integration among students. The facility also included community meeting rooms and a health clinic to further knit the new school into the returning community.

## THE ABILITY TO COME BACK

ISSUE



In order for New Orleanians to move back into the city and begin the rebuilding process after Katrina, a set of essential community functions had to be reestablished. Realizing that a city could not be inhabited without first providing citizens with some level of shelter, food, education, employment, health care, and transportation a series of partnerships among , individuals, private organizations, and governmental entities united to quick start the building of some of these basic services. Some were as simple as neighbors helping neighbors. In other cases, institutions infused cash to help individual schools re-start sooner.



# REGIONAL AND CONTEXTUAL EFFORTS

## KNOW YOUR NEIGHBOR

### **Resilient design is contextual, learning from the timeless elements of a place.**

The resilience of a place is connected to scale (e.g., individuals to their neighbors, buildings to their district, districts to their city). Taking steps to allow a building or campus to stand alone, operating even after infrastructure or utilities fail can be a component of resilience planning. It's important, however, to acknowledge that resilient communities are in fact strongly interdependent. We have all marveled at how communities pull together after a disaster, sharing what they have, collaborating to recover. Resilience without community is just survivalist thinking. In other words, friends will get you through times with poor structural protection better than structural protection will get you through times with no friends.

Can design choices help promote community? It has been observed that some elements of vernacular design made it easier to see and know your neighbor—the front porch, the town commons. These are psychological as well as physical rallying places. Modern design can recapture the function and qualities of these spaces without nostalgia in ways matched to the scale and pace of the way we live today.

# 930 POYDRAS RESIDENTIAL TOWER

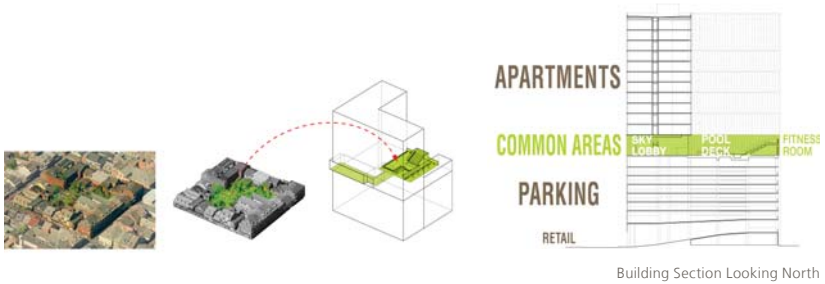
## CASE STUDY



In shaping this 21-floor mixed-use residential high-rise, the designers sought to re-imagine the typically horizontal condition of New Orleans as a vertical condition. As a means to recreate the social interaction found in the hidden courtyards throughout the French Quarter, the design consolidates all tenant amenities at the ninth floor level in order to condense their programmatic force. At this raised “courtyard” level, shuttle elevators transfer occupants from garage to tower in order to instigate opportunities for residents to cross paths with one another in a shared, communal space as opposed to the typically introverted collection of experiences found in most high-rise residential developments. The project represents the first large private downtown residential high-rise to be designed and constructed post Katrina and the client understood the power and positive benefits of forcing social interaction in such spaces to improve the quality of everyday life for those who live in the building and building the connections that support a resilient response to future events.

# TIMELESS ELEMENTS

ISSUE



Building Section Looking North



Reinterpreting the shared space of French Quarter courtyards or front porches, the design creates opportunities for chance interaction among residents while promoting community in what is typically an isolating housing type. Research has shown that during times of emergencies, knowing your neighbors can lead to a higher rate of survival, comfort and security. By providing tenants with various spaces and programmatic functions where they can interact with their neighbors, design can increase the likelihood of the establishment of vital community relationships and networks.



## EMERGENCY PREPAREDNESS

EXPECT THE UNEXPECTED

**Resilient design considers both short-term known emergencies and long-term contingencies.**

Emergency preparedness is part of resiliency planning, but it's not the whole story. Emergency planning is about anticipating or responding to the immediacies of events ("How can we get through this?"); resiliency seeks to lessen the impact of events but focuses on longer-term realignments ("How do we come back?"). The simplest elements of emergency preparedness—generators, flashlight batteries, bottled water, fire drills—are just the beginning. Resiliency requires more than planning for the known, short-term problems; it requires that we play 'spot the assumption'. For example: the emergency plans for the Fukushima nuclear power plant had detailed plans for how to shut down the reactor in case of a seismic event, but they assumed the existence of an active power connection to the rest of the utility grid—which was wiped out by the tsunami. Resilient design involves playing out the scenarios, deciding what is truly mission-critical to any organization.

# NEW ORLEANS EAST HOSPITAL RENOVATION

## CASE STUDY

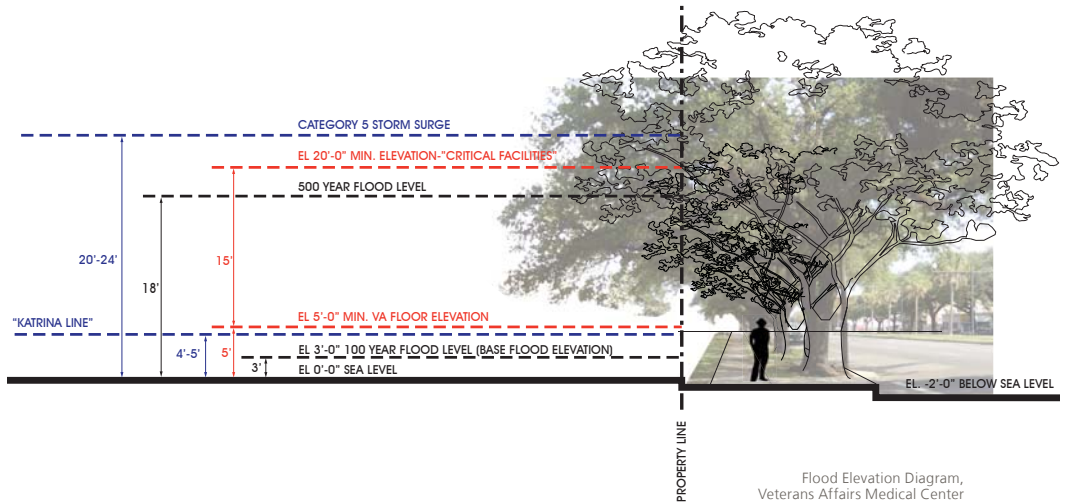


1. Critical functions are located at or above the second level to avoid damage during a flood event. 2. The emergency department ramp can double as a boat ramp during a flood. 3. The diesel fuel tank is raised in order to protect it from flood damage. 4. Detention ponds retain water during a storm event.

The previous hospital on this site suffered substantial flooding after Katrina, and the facility stood empty for several years following the storm. Despite new structural protections for the neighborhood, the population was slow to return with many citing the lack of public services—especially a critical community resource like a hospital—as a significant hindrance. Marshaling several funding streams, the City of New Orleans spearheaded the project to help the neighborhood recover. Working on an accelerated time schedule the design team saved the structure of the old patient tower while providing a new high-performance building envelope and interiors while developing a new emergency services and operating room. The design also included a demonstration of advanced techniques in handling intense storm water events on site.

# SHELTER-IN-PLACE OR EVACUATION?

ISSUE



Hospital design teams typically have to make a clear choice about how the facility intends to operate during emergencies such as severe storms: Do they plan to shelter-in-place, or evacuate patients to remote locations given advanced notice. Planning to evacuate is generally cheaper, but the reality is that sometimes events overtake planning, and so you have to anticipate sheltering in place even if policy says you don't do that.

A phased shutdown approach recognizes that critical functions such as emergency and operating rooms need to remain operational in a disaster, even if routine patients have been evacuated. Certain functions not critical to immediate life-saving care, such as the café and administration, are located on the first occupied floor, while critical functions are raised up and high-value mechanical systems and emergency power fuel storage raised even higher. The vehicle access ramp to the Emergency Room level is designed to be able to function as a boat launch during 500-year flooding events.



## ENVIRONMENTAL ANALYSIS AND RISK ASSESSMENT

FORECAST AND BACKCAST

**Learn from past events to help inform design and anticipate trends.**

Although resilient design tries to 'expect the unexpected', there are in fact many well-established threats with regular frequency. As sea levels rise and storms become more intense, resilient organizations take evacuations and power outages in stride by shaping their workspace and everyday best practices. This can require both technical and social engineering. If forecasting extrapolates present trends forward, 'backcasting' allows us to choose the desired outcome and work backwards to the changes we need to put in place today to get there.

# TULANE UNIVERSITY J. BENNETT JOHNSTON HALL RENOVATION

## CASE STUDY



This renovation converted 63,000 square feet over three floors of an existing building from small, isolated, windowless ‘silo’ biomedical labs and offices into open, daylight ‘ballroom’ style labs with generous social commons areas. The intention of the scientists who spearheaded the project was to break down barriers between isolated researchers and promote collaboration and cross-pollination of ideas. The design team responded to this by shaping the labs and common areas in ways that bring disparate scientists together over both shared equipment and shared coffee. This configuration offers resiliency benefits: as the region faces voluntary or mandatory evacuations in advance of severe storms with increasing frequency, it can be helpful to have collaborators to help ‘batten down the hatches’ if you are out of town when an evacuation is called.

## MAKE ‘EMERGENCY’ MEASURES PART OF EVERYDAY LIFE

ISSUE



Even the best-maintained utility grids in coastal communities will face periodic power outages due to high winds. If a freezer containing biomedical research samples fails, a decade’s worth of research can be compromised. The emergency generator for the building is typically sized to support such freezers during power outages, but is not large enough to support the full air conditioning system. In the aftermath of Katrina—a period of time lasting weeks—facility managers were able to obtain fuel to keep generators running, but the heat from all the equipment in the building raised internal temperatures above 110°F, and some freezers failed. As part of the renovation, the design incorporated an array of ‘Freezer Farms’ (each accommodating up to a dozen freezers), complete with its own independent cooling system. During power outages, the freezers and the rooms they are in stay cool. Researchers are not forced to store their samples in place, but they know they are taking a substantial risk if they do not. The Farms operate as lifeboats for researchers’ samples, and their use every day means that no special emergency procedures relocating samples are required.

But what if the emergency power generator fails too? As an extra layer of security, each freezer farm is equipped with compressed gas cylinders that can keep freezers cool for several days.



## SITE RESPONSE

SITES PROTECT BUILDINGS

### **Resilient design harnesses the site to help deal with threats.**

Sustainable design looks to the potential of the site to reduce environmental impacts or to improve the quality of life for occupants under everyday conditions. Trees provide shade and beauty; landscape features can use biological processes to capture, filter and process rainwater runoff on-site. These 'passive' systems can complement or eliminate the need for the 'active' pipes-and-pumps approach of conventional practice. Resilient design acknowledges these passive strategies, but also asks how the site can help deal with extreme events.

# VARIATIONS ON THE THEME OF STORMWATER HANDLING

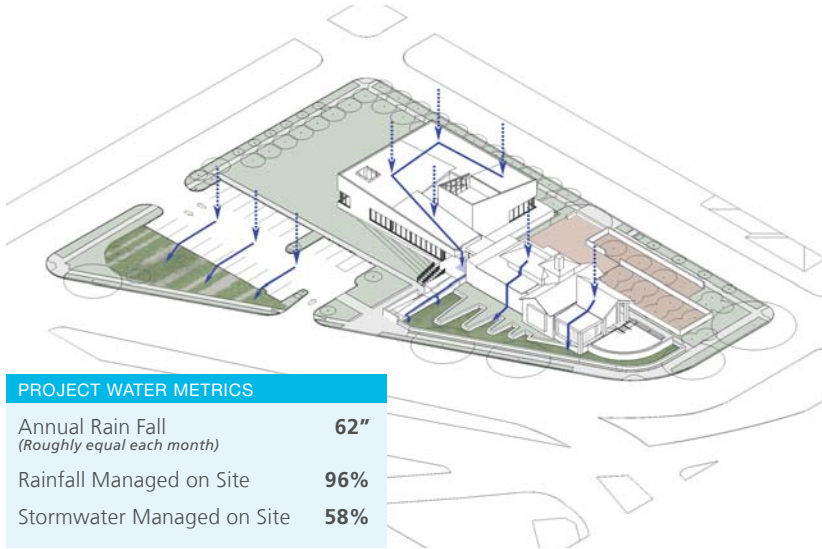
## CASE STUDY



At the heart of a neighborhood nearly destroyed by water, the design of the Rosa F. Keller Library and Community Center celebrates water. The historic building took on more than three feet of water during Katrina. In response, the structure was raised above Hurricane Katrina flooding levels and the mechanical systems were raised still further. The redeveloped site integrates building and landscape forms as part of the whole picture. The roof form of the modern wing spirals around a central atrium leading water to a central leader adjacent to the building entrance. Water then cascades down through terraces containing water-loving native plants, including the Louisiana Iris, where then it slowly drains back into the earth. This path reinterprets the flow of water in Gulf Coast wetlands, where rain is slowed by the tree canopy, slowed by natural basins and then percolated into the ground. These deep basins act as sponges by holding and treating runoff and helping reduce street flooding during the characteristically intense rain events.

# ROSA F. KELLER LIBRARY AND COMMUNITY CENTER

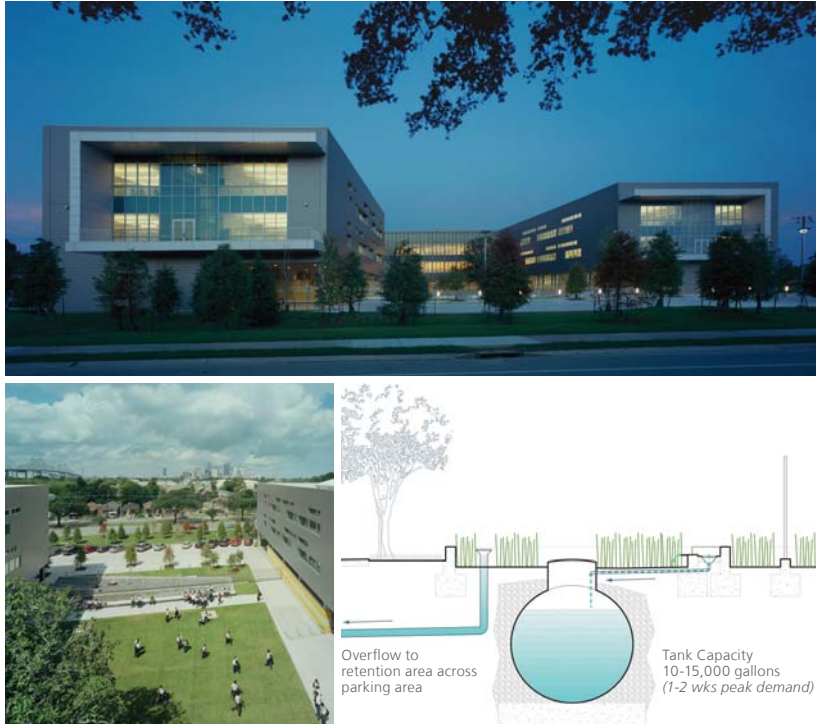
## CASE STUDY



A major consideration for this project is stormwater detention. This detention aids in flood prevention by handling and delaying stormwater onsite rather than allowing it to drain directly into the city's storm sewer system. Water is diverted into bioswales by using the slope of the existing parking lot and disconnected downspouts. With this system, water is not retained at all times, but rather, a wet-dry condition is created. When it rains, water is retained for 6-12 hours, while slowly emptying back into the ground.

# L.B. LANDRY HIGH SCHOOL

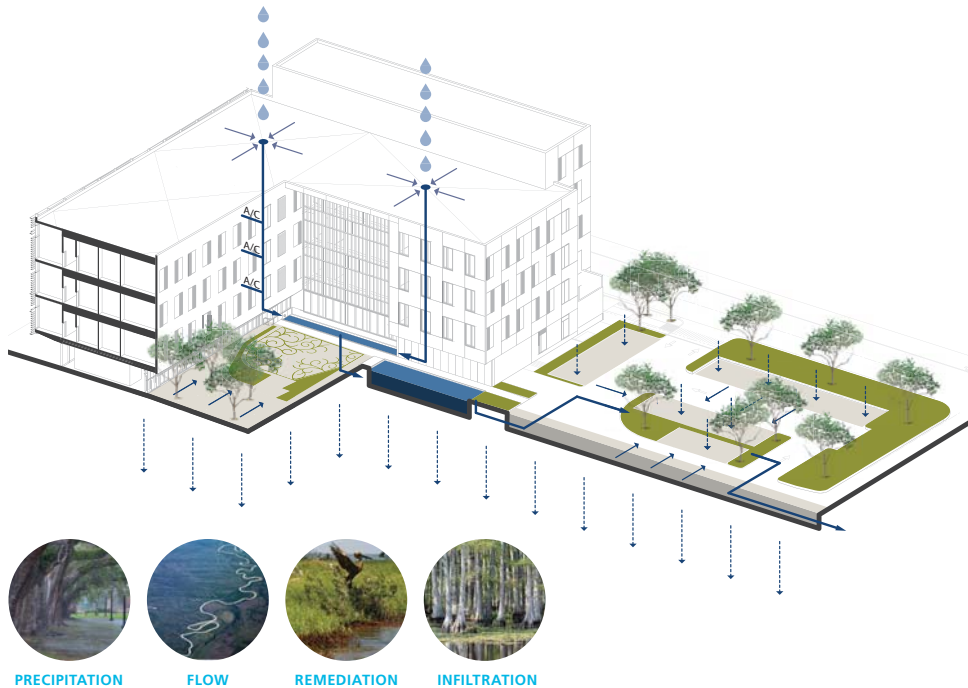
## CASE STUDY



Cascading splash blocks force rainwater into irrigation tanks that can then overflow into the horsetail retention area and an additional detention pond, if necessary. This harvested rainwater accounts for all of the water used for irrigation. Using stormwater detention ponds delays the stormwater's entry into the storm sewer system and allows for the water to be filtered slowly and naturally by trees and other vegetation, cleaning the water.

# NEW ORLEANS BIOINNOVATION CENTER

## CASE STUDY

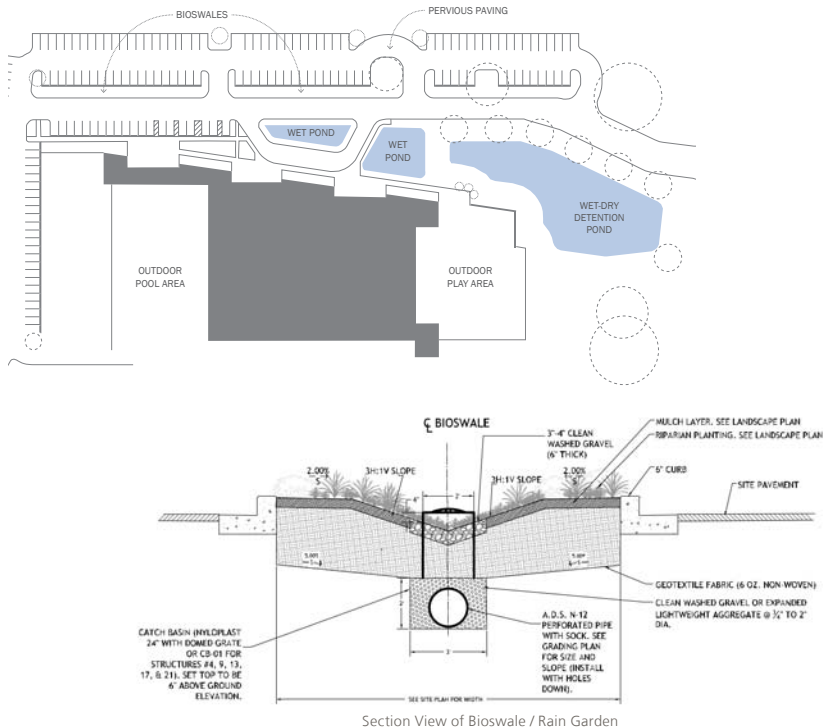


The project feeds all rainfall from the roof into a prominent water feature whose depth fluctuates with the rains, allowing for biofiltration through water plants, then overflowing into a vegetated swale, detention in the parking lot subbase, and percolation back into the soils. The water feature is also fed by the AC condensate (up to 20,000 gallons per week) which provides all landscape irrigation (the only use currently allowed for captured water by state regulation)

Pervious pavers and/or concrete is used in all parking locations and in the landscaped courtyard allowing infiltration and greater reduction of runoff.

# CRAWFISH AQUATICS

## CASE STUDY



This indoor/outdoor natatorium uses various strategies for handling stormwater. Pervious paving and bioswales allow for the collection and filtration of stormwater as do several retention ponds located around the site.

Two of the retention ponds maintain a constant level and volume of water, while the larger retention pond's water level fluctuates as it collects runoff during and after an event allowing it to be treated naturally, on-site, as it slowly seeps into the ground, reducing strain on the city's infrastructure.

## DESIGN AND CONSTRUCTION

BALANCE BEAUTY AND BRAWN



1. Rooms can be converted to double-occupancy in an emergency. 2. Building envelope can withstand at least a Category 3 storm. 3. Raised mission-critical components. 4. Raised primary utility distribution. 5. Million-gallon rainwater storage. 6. 320,000 gallons of fuel, enough to generate one week of power. 7. An 6,000-square-foot emergency storage warehouse. 8. Emergency department ramp/boat launch. 9. The parking garage/helipad.

### Resilient design moves beyond a bunker mentality.

While locating critical functions in bunkers as part of a ‘hardening’ strategy may be part of resiliency, we can’t live and work in an actual bunker. Beyond their denial of the human need for beauty and connection to nature and each other, bunkers are difficult to adapt to changing needs or threats. Bunkers are very good at protecting against one known threat, but can be vulnerable towards others—it’s hard to think of a ‘nimble, reactive bunker.’ The balance of brute strength, beauty, and adaptability is at the core of resilient design.

# VETERANS AFFAIRS REPLACEMENT MEDICAL CENTER

## CASE STUDY

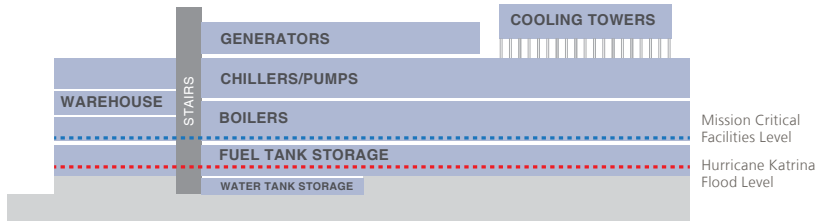


Project Credit: Eskew+Dumez+Ripple, in joint venture with NBBJ and Rozas Ward. Eskew+Dumez+Ripple was responsible for the complete design services for the renovation of the former Pan American Life Insurance Building, the restoration and reuse of the former Dixie Brewery building, and the design of the Central Energy Plant.

The New Orleans Veterans Administration Medical Center—now under construction—replaces facilities damaged during Katrina with a comprehensive 2.4M square foot facility including 220 inpatient beds, an ambulatory outpatient clinic, mental health outpatient treatment facilities, an emergency department, research laboratories, and structured parking. In acknowledgement of the rich architectural fabric of New Orleans, the project includes the adaptive re-use of existing historic and mid-century modern structures, repurposed for administrative use. The project includes a new Central Energy Plant combining the routine services of a traditional central plant with robust emergency power systems.

# RESILIENT BUILDING AND PLANNING

## ISSUE



Due to the vulnerable nature of the occupants, and the inherent challenges of building in New Orleans, it was critical that the design include numerous defend-in-place strategies. The buildings are able to resist winds speeds of 130 mph or a Category 3 hurricane.

The hospital is designed to shelter

1,000 people for 7 days without external resources. Fuel for power generation, sufficient food and potable water and medical supplies are all located on the campus. Flexibility in the design allows for single-occupant rooms to house two people when needed, and all mission-critical functions—including the emergency department—are located on or above the second level, and well above known surge model levels.



## SYSTEM EFFICIENCY AND REDUNDANCY

### DEFENSE IN DEPTH

**Resilient design employs systems that allow for continued occupancy of the building in the face of a threat, including redundant systems and the ability to island.**

Resiliency planning is planning for the worst-case scenario. Often disasters reduce or destroy traditional operational building systems such as power or water. Sustainable design often employs passive strategies to reduce everyday energy use; resilient design takes advantage of this to promote 'passive survivability.' Energy efficient buildings require less backup capacity than traditionally designed buildings, and so redundancy will always be more affordable when the building has incorporated sustainable practices. This combination of efficiency and redundancy creates a more resilient building that is more likely to remain operational during and after an event.

# LOUISIANA SPCA RESCUE AND CARE CENTER

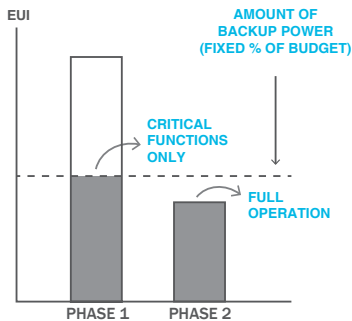
## CASE STUDY



Companion animals play a frequently unappreciated role in community resiliency planning. For example, 42% of those who stayed behind during Katrina said they did so because they could not evacuate with their companion animals. After a disaster, locating and providing humane care for companion animals is a critical community function necessary to re-establishing 'normal.' After the Louisiana SPCA in New Orleans was inundated with 14 feet of water., Eskew+Dumez+Ripple completed a new facility master plan, and assisted with the Design/Build Phase 1 Building Development and Construction in just 9 months. Since that time, the firm has worked with the LA/SPCA to complete its FEMA settlement process and to institute a long-range campus plan accounting for the organization's growth trajectories. Phase II, currently under construction includes 33,500 square feet of expanded adoption facilities, clinics, support, and administration. It also includes a separate 6,000 square foot structure dedicated to support of hurricane evacuation for City residents. These evacuation and temporary animal housing resources are also deployed by the organization in other communities in the region before or after severe weather events.

## RELATIONSHIP BETWEEN EFFICIENCY AND REDUNDANCY

ISSUE



One of the chief differences between sustainability and resiliency is the approach to redundancy. While sustainability strives to use as few resources as possible, prudent resiliency planning uses a strategy of redundancy and ‘defense in depth.’ This means that a resilient building may require more materials and duplicate systems than the most resource-efficient ‘sustainable’ building. While Phase I of LA-SPCA has an efficient mechanical system, the aggressive

schedule drove the selection of a pre-manufactured building poorly suited to daylighting and natural ventilation. Phase II buildings, by employing custom building mass allowing narrow floor plates, courtyards, and natural ventilation with operable windows, is projected to have an Energy Use Intensity (EUI) less than half that of Phase I. This means that for the same percentage of project budget spent on emergency power generation, Phase I could only support critical functions (fresh unconditioned air, lighting, surgical support), while Phase II can support 100% of facility needs.

Phase II is also designed to support multiple layers of emergency power. The project can accommodate solar photovoltaic arrays to complement a conventional natural gas generator. The facility is designed to operate with no power (passive strategies), two levels of emergency power, and utility power.



## OPERATIONS

### KEEP IN TOUCH

**Resilient design allows for buildings and organizations to keep working in the face of disaster, and adapt quickly to post-disaster circumstances.**

Organizational tools play a key role in designing the overall resilience of a building or organization. Such protocols are necessary to implement informed decision making for the daily use of the building as well as use (or evacuation) during emergencies. The human element can and must be woven into resiliency so that planning incorporates all facets of the building and its occupants.

# OUR STUDIO HURRICANE PLAN

## CASE STUDY



Because Eskew+Dumez+Ripple is located in a region affected by hurricanes and tropical storms, the firm developed procedures to be followed during such events. Firm leaders decide when to close the studio, taking into consideration published advisories. While the safety and welfare of staff and families is the first priority, additional protocols have been put in place to ensure operational continuity in the times of an emergency or evacuation. Balancing the needs of families, clients, and the firm during these events is an ongoing challenging effort, but it is one that was proven effective during and after Hurricane Katrina.

Keeping track of scores of employees during an evacuation can be a difficult task, especially when cell phone and communications services are unreliable. By gathering information about where and with whom our employees will evacuate (along with their contact information), the firm was able to account for everyone after the storm. Part of our emergency preparation included the distribution of responsibilities and information among firm members. We also maintained property inventories and up-to-date client information in a grab-and-go format. This, along with storing back up project data, acquiring business interruption insurance, and instituting a post-evacuation daily leadership conference call, allowed the firm to become operational at a temporary location in Baton Rouge shortly after the storm and back in New Orleans within 3 months.

For a Hurricane Preparedness Plan template, visit:

[www.EskewDumezRipple.com/studio-life/blog/Hurricane-Preparedness](http://www.EskewDumezRipple.com/studio-life/blog/Hurricane-Preparedness)



## INFORMATION GATHERING AND FEEDBACK LOOPS

DESIGN / LEARN / REPEAT

**Resilient design harvests learning from each experience and ‘near-miss’ to refine the design and operation of buildings and organizations.**

Resilience is not absolute; it involves a set of trade-offs. Learning resilience requires some amount of trial and error. Incorporating systems and procedures for monitoring and metering into a project will allow for feedback and the ability to make adjustments over time, and to apply lessons learned into future projects. These feedback loops have everyday benefits (better building performance) and long-term resiliency benefits as observations are carried forward into the design of future projects.

# NEW ORLEANS BIOINNOVATION CENTER

## CASE STUDY



Developed on a former brownfield site on New Orleans' famous Canal Street, this 65,500-square-foot biotech laboratory serves as a new business incubator facility in the revitalized downtown medical district. After substantial completion and occupancy of three floors of the four-story structure, the design team and commissioning agent initiated a 'continuous commissioning' exercise, monitoring energy consumption, systems, and comfort performance, identifying a substantial number of items that had cropped up after initial commissioning. This allowed energy and comfort performance to be further tuned. The project is now part of a commitment of all team members involved to long-term engagement and learning. Now reaching full occupancy, the measured energy consumption continues to track the calibrated model, with high occupant comfort. The building has earned LEED Gold certification with measured first-year energy use intensity better than 90% of peer institutions.

## LEARNING AND MOVING FORWARD

### ISSUE

The BioInnovation Center has been the subject of intensive post-occupancy engagement, including long-term monitoring of occupant comfort, energy and water consumption, and materials performance. One of the sustainable design elements of the project used a water feature and pervious hardscaping over several feet of crushed stone to act as a rainwater detention and re-infiltration system. During design, the Owner requested that one portion of the site—the loading dock— not be handled by this ‘passive’ strategy, but rather, be actively connected to the city’s storm drainage system via a conventional hard-pipe approach. During the final weeks of construction, an especially heavy rain event caused the streets and the city’s storm water system to back up, shooting water backwards onto the site and, in fact, flooding the only area to which it was directly connected. Luckily, the loading dock area had been built of materials that were unaffected by water. Following this event, a backflow preventer was installed on the storm water connection to the city. Based on this evidence, this practice is easier to carry in subsequent projects.

## CONCLUSIONS

Resilience in the built environment is more than hardening, more than durability, more than emergency preparedness. Resilience is often complementary to sustainability, while sometimes drawing design in new directions. Resilience is in many ways not an attribute of buildings at all, but of communities. Design professionals are granted opportunities and the responsibility to shape buildings, campuses, and cities in ways that can enable communities not just to survive threats and disasters, but to thrive. We offer this framework as a way of looking at resilience that promotes communities that endure through thoughtful and rigorous design.

## ACKNOWLEDGMENTS

Many people have contributed to the Resiliency Framework, both locally and nationally. We are grateful to the City of New Orleans for its progressive work on resiliency and wish to acknowledge, in particular, beneficial conversations with Charles E. Allen III, Director of the Office of Coastal and Environmental Affairs for the City of New Orleans. We have also learned much from the efforts of New York and Boston, including reports such as “A Stronger, More Resilient New York”, Urban Green Council’s “Building Resiliency Task Force”, and “Building Resilience in Boston: Best Practices for Climate Change Adaptation and Resilience in Existing Buildings.” Our own efforts have been buoyed by the Rockefeller Foundation’s leadership in recognizing resiliency as an emerging global concern. Conversations with the Mary Ann Lazarus of the AIA’s repositioning initiative and Alex Wilson of the Resilient Design Institute have also enriched our thinking.



