

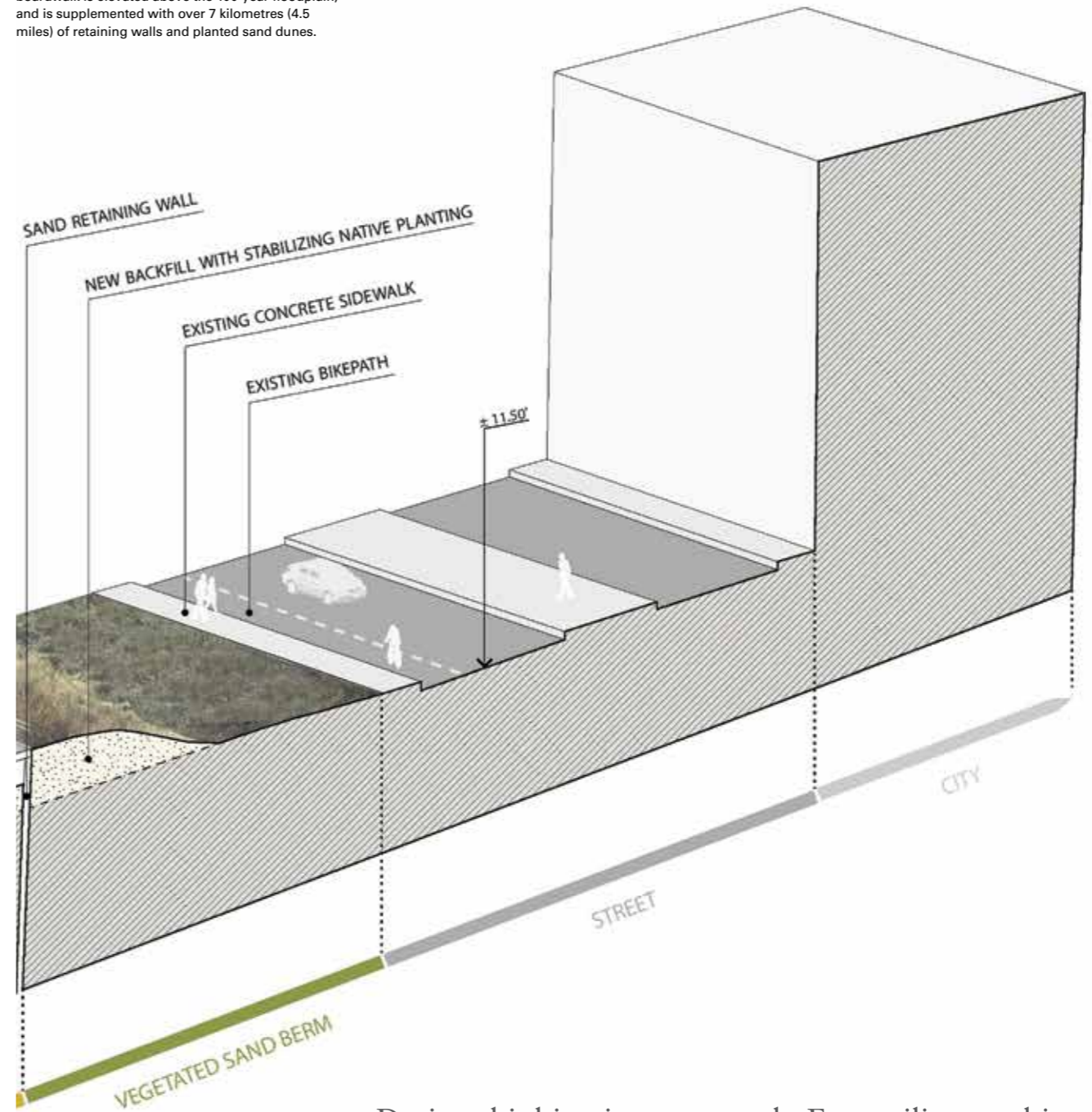
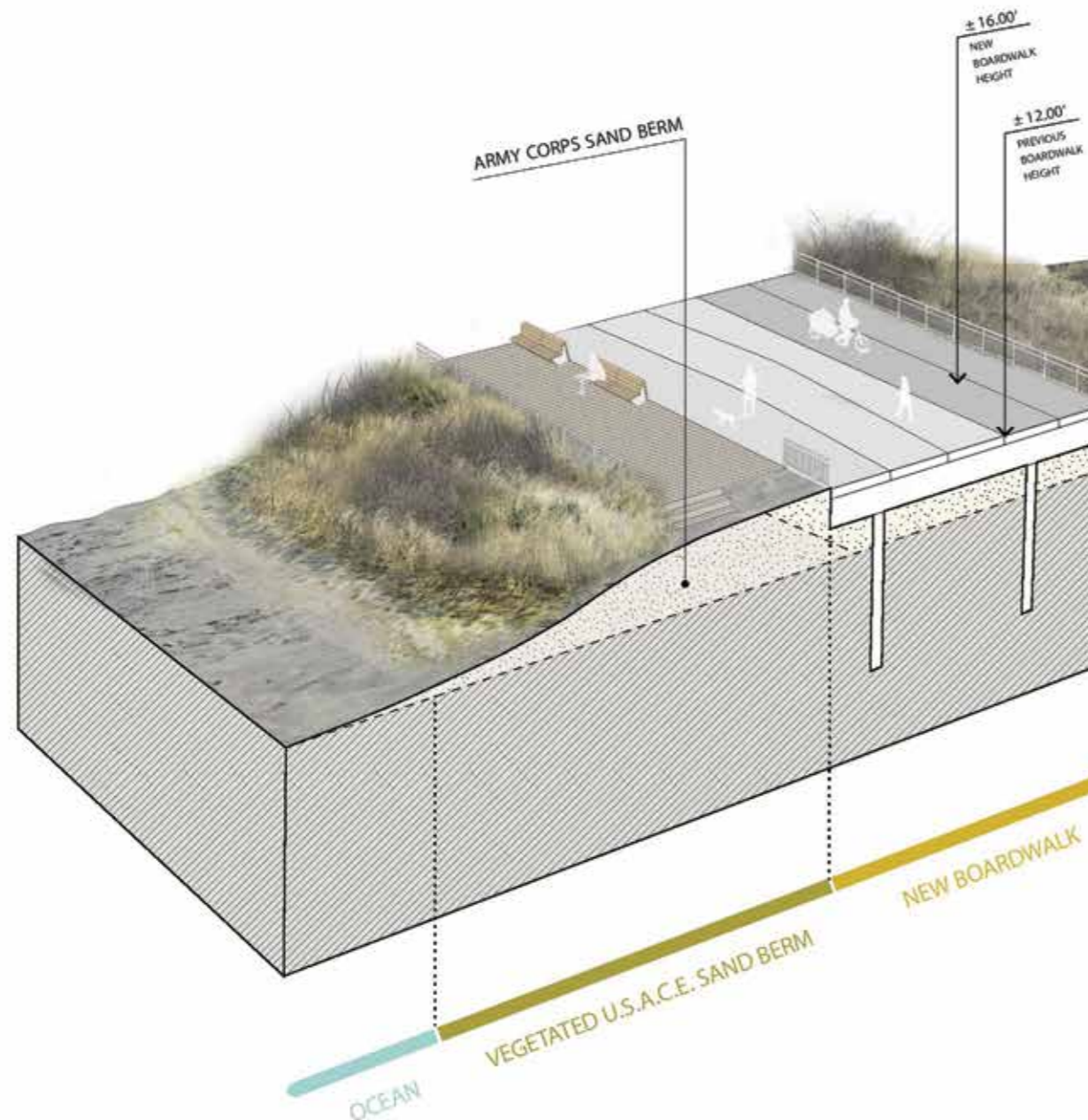
# Resilient Design

‘Systems Thinking’ as a Response to Climate Change

Claire Weisz

WXY architecture + urban design,  
Rockaway Boardwalk reconstruction,  
Queens,  
New York,  
2017

The project is intended to create a more protected and active peninsula. The new reinforced-concrete boardwalk is elevated above the 100-year floodplain, and is supplemented with over 7 kilometres (4.5 miles) of retaining walls and planted sand dunes.



Design thinking is not enough. For resilient architecture and urbanism to meet the challenges of global warming head on, what is needed is systems thinking: an in-depth, interdisciplinary approach which recognises that change is constant. **Claire Weisz** – founding partner of New York urban design, planning and architecture practice WXY – highlights a number of small, innovative US firms that are leading the way, and describes some of their ventures to date.

The North American expertise in resiliency – the practice of designing environments for climate change – is fundamentally rooted in science, and therefore the most innovative approaches to planning and design focus on locality. In the absence of large-scale, top-down federal mandates and funding – and very different regional ecological and political conditions – the evolution of resiliency in North America is also highly fractal. The macro- and microcosmic scales of these strategies are as varied as the disciplines and financial resources needed to execute them. Out of this fractal environment emerge complex, innovative projects – often led by small, multidisciplinary firms – that are pushing practitioners beyond ‘design thinking’ to ‘systems thinking’.

While not mutually exclusive, there are some key differences. Design thinking tends to be event-focused, while systems thinking looks at the relationships between interdependent components. Using an iceberg analogy, a design thinking approach is focused on the tip – the part that is visible and immediately actionable. In a constantly changing, increasingly complex world, however, a systems thinking approach becomes critical to understanding the interdependent variables that exist below the surface.

Design thinking is a linear approach to developing a product or outcome, while system thinking is a nonlinear approach to living systems. One is born out of a business philosophy that a designer can solve any problem, while systems thinking identifies leverage points within complex relationships. One is rooted in an end-user analysis (observation) while the other demands rigorous modelling (science). Perhaps more importantly, a conventional or status-quo design thinking approach can be accomplished by a single expert, while a systems thinking process by definition cannot be top-down or driven by narrow expertise.

Of course, applying a systems thinking approach to resiliency, be it adaptation or mitigation, is not an entirely new concept. But until very recently it has largely been discussed by theorists, not by practitioners who are employing this approach under difficult circumstances. The political, financial and environmental conditions tend to work against the arduous process of applying a rigorous scientific methodology across multiple disciplines to posit, test, design and build resilient environments. And yet a handful of small, nimble interdisciplinary firms are leading innovative resiliency projects by using both design thinking and systems thinking to set a new standard.

#### Change is Constant

The unifying theory underpinning this emerging systems thinking approach is that change is constant. The origin of this seemingly contradictory idea comes from Heraclitus, considered the first Ancient Greek philosopher of nature. He posited that ‘you cannot step in the same river twice’, a concept that is instructive for designers to understand how resiliency requires a systems thinking approach that design thinking is simply too narrow to tackle.

New York-based WXY has grappled with this realisation through local crises such as 9/11 (2001) and Superstorm Sandy (2012). As an architecture, urban design and planning

practice with an emphasis on integrating infrastructure into the urban landscape, the firm had a natural bridge into the uncharted territory of resiliency. By the time Hurricane Sandy hit New York, WXY had already spent a dozen years revitalising waterfronts through sustainable, design-driven projects, particularly for Battery Park City in Lower Manhattan. This work spanned multiple disciplines and required the firm to develop close relationships with numerous city agencies, which prepared it well for working on post-Sandy resiliency projects.

In December 2012, New York City initiated the Special Initiative for Rebuilding and Resiliency, which prioritised planning the areas hardest hit by Sandy and those most vulnerable to future storms. WXY acted as the community planner and designer on the multidisciplinary team covering the industrial waterfront. Each of the area planners was charged with developing and presenting solutions for five different parts of the city that were directly affected. In some cases, discrete green infrastructure strategies emerged, while in other locations grey infrastructure was proposed, such as new surge gates or levees.

In the process of testing resiliency measures, however, it soon became apparent that even conventional engineering solutions would require significant changes to existing infrastructure and urban design. For example, the complications of creating barrier systems in areas with low elevations and dense populations were too difficult to resolve on land. In other areas, studies of berms and floodwalls showed that solutions both large and small were going to be more costly than the value of the property.

These realisations moved WXY more deeply into a systems thinking approach, laying the foundation for WXY with West 8 to lead one of the teams responding to the federal government’s call for ideas, the ‘Rebuild By Design’ competition, launched in 2013. The team’s submission, *Blue Dunes: Climate Change by Design*, resulted from a systems thinking process unlike anything the firm had attempted to organise until this opportunity came about.<sup>1</sup> Analysts, architects, ecologists, engineers, physicists and planners came together to contemplate and model a system of artificial barrier islands to protect the Mid-Atlantic coast.

A positive test indeed showed that artificial barrier islands would have a significant mitigating effect in the case of a storm surge, as well as rehabilitate lost habitat due to population and development along the East Coast. While the *Blue Dunes* proposal was one of the finalists, the ‘Rebuild by Design’ jury did not commit to funding the linchpin of the *Blue Dunes* plan – the foundational research and data collection necessary to inform an interdisciplinary design and scientific collaboration. The jury concluded that *Blue Dunes* was not ‘design’ – an unfortunate failure to recognise that developing a ‘systems thinking’ approach is in fact a design process.

#### Resilient Design and Economic Development

As the *Blue Dunes* investigation was underway, the City of New York commissioned WXY in 2013 to lead a multidisciplinary team to reconstruct the Rockaway Boardwalk along the 11-mile (18-kilometre) peninsula in Queens. The project also required a new urban design for

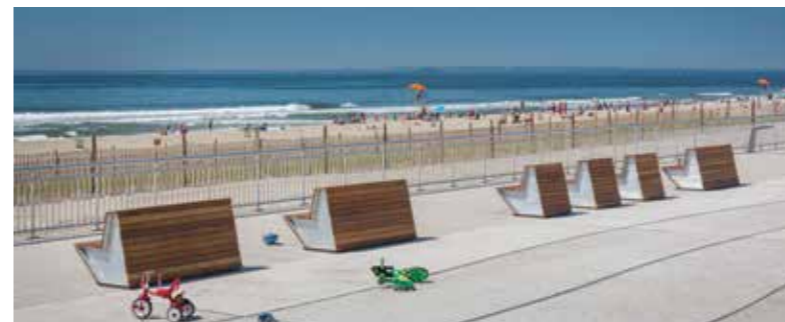


WXY architecture + urban design,  
Blue Dunes,  
Coastline of the New York-New Jersey area,  
2014

Blue Dunes is a research proposal for a string of barrier islands in response to the challenges of regional coastal resiliency in the northeastern US. The proposal brought together designers, climate scientists, financial advisers, risk managers and various community boards and members in an effort to address and mitigate the damage of future storms in a changing climate.

WXY architecture + urban design,  
Rockaway Boardwalk reconstruction,  
Queens,  
New York,  
2017

The new boardwalk design responds to the immediate context of the Rockaways neighbourhoods, as well as the Rockaways’ larger role as a recreational destination for all New York City residents.



entry points from the beach to the neighbourhoods that were devastated by the storm surge. The objective was not to rebuild the boardwalk back the way it was, but to create a new model for coastal resiliency. This goal, however, held the potential for conflict: the redesigned boardwalk had to provide both access to the beach and protection for the communities that dot the peninsula. The larger economic development imperative meant that the beach and boardwalk needed a distinct and locally desirable appearance, to attract people from around the city as well as provide protection and economic activity for the neighbourhoods. Achieving one goal but not the other would undermine the whole project.

This conflict was resolved by situating a new reinforced concrete boardwalk, with the structure designed as large S-curved planks between two planted dunes at an elevation 1 metre (3 feet) above the 100-year floodplain. The soft infrastructure mediates the transition between the low-lying park space and the newly elevated boardwalk by tucking sand baffle walls under the newly created dunes. This solution arose from a close collaboration between WXY and engineers at the global firm CH2M, which centred on extensive modelling to determine the effectiveness of beach nourishment and flood protection. Finished in 2017, as the longest and largest resiliency project competed to date by the city of New York, the Rockaway Boardwalk has become the blueprint for coastal infrastructure around the New York archipelago.

In the wake of 2012’s Hurricane Sandy, WXY was commissioned by the City of New York to rebuild the Rockaway Boardwalk and to develop a conceptual plan to improve existing parks across the peninsula. Both projects uniquely integrate resiliency and recreation in the area’s rich history as a leisure destination and vital New York neighbourhood.

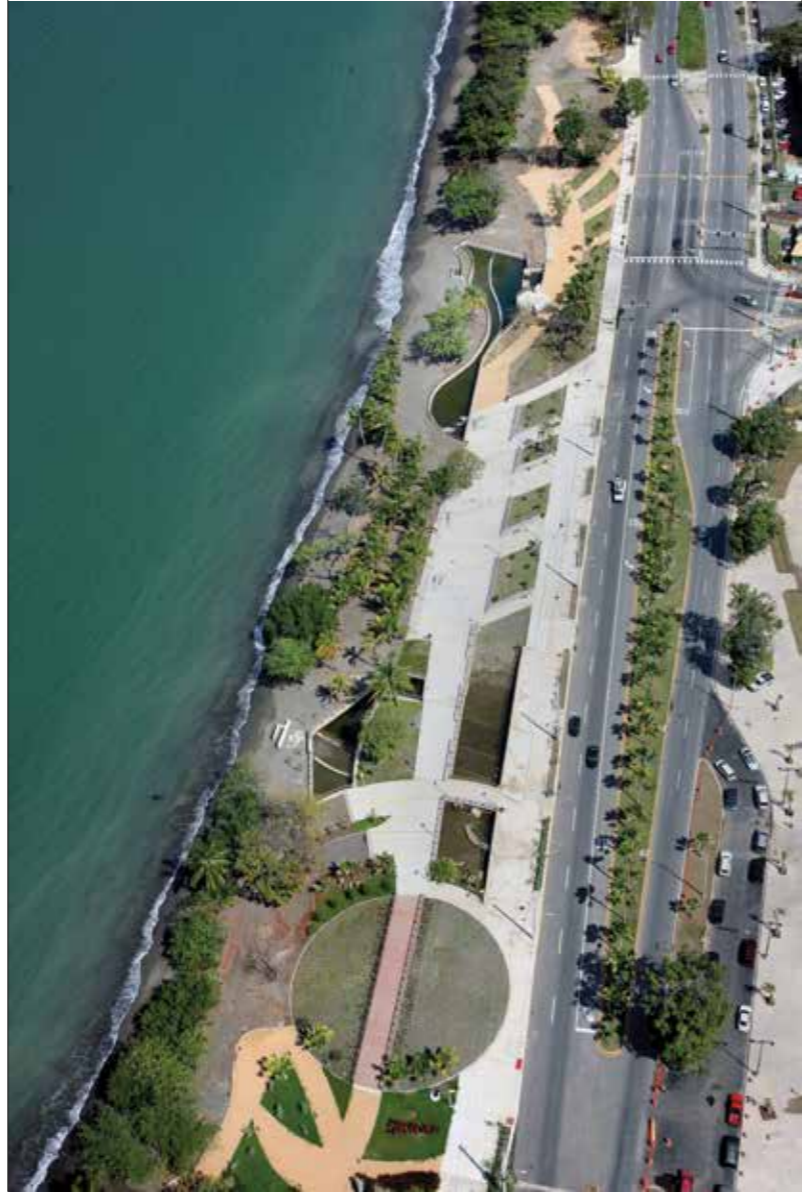
**Resilient Design at All Scales**

Local Office Landscape Architecture (LOLA), based in Brooklyn, has been pioneering a local ecology approach to resilient design since the inception of the firm 10 years ago, founded by Walter Meyer and Jennifer Bolstad, an urban designer and landscape architect respectively. They are so focused on local conditions that they put it right in their name, and like to say that the third partner on all projects is the locality where they are working.<sup>2</sup> Two projects, one a park, the other a streetscape, illustrate how an inquiry-based approach can work at all scales.

The firm designed Mayagüez Parque del Litoral, completed in 2010, the largest urban waterfront park built in Puerto Rico. It has since withstood hurricane seasons while dramatically improving water quality with soft (or green) infrastructure – all on a limited budget. Conversely, Miracle Mile, which will be completed in 2017, is a complex streetscape designed to withstand extreme rain events in an upscale shopping district in Coral Gables, Florida. What unites all of LOLA's projects is an intensive investigation into local systems to provide guidance for how to design resilient projects in tandem with the forces that are already shaping the landscape.

As an example, the partners point to a cloudburst mitigation plan developed by a Danish firm after several extreme rain events damaged Copenhagen. The idea, a classic design-thinking approach, is to prevent overflowing the sewer system by controlling water on the street surface and gradually guiding it away from infrastructure. But an extreme rain event in Copenhagen is about 75 millimetres (3 inches) of rain an hour. That happens almost every summer day in South Florida, where an extreme rain event might produce 125 to 150 millimetres (5 to 6 inches) of rain in an hour. LOLA's systems-thinking approach is to ask, how has the local ecology adapted to cloudbursts under the most extreme conditions, and what can be learned and applied to the built environment where rain events are likely to get much worse?

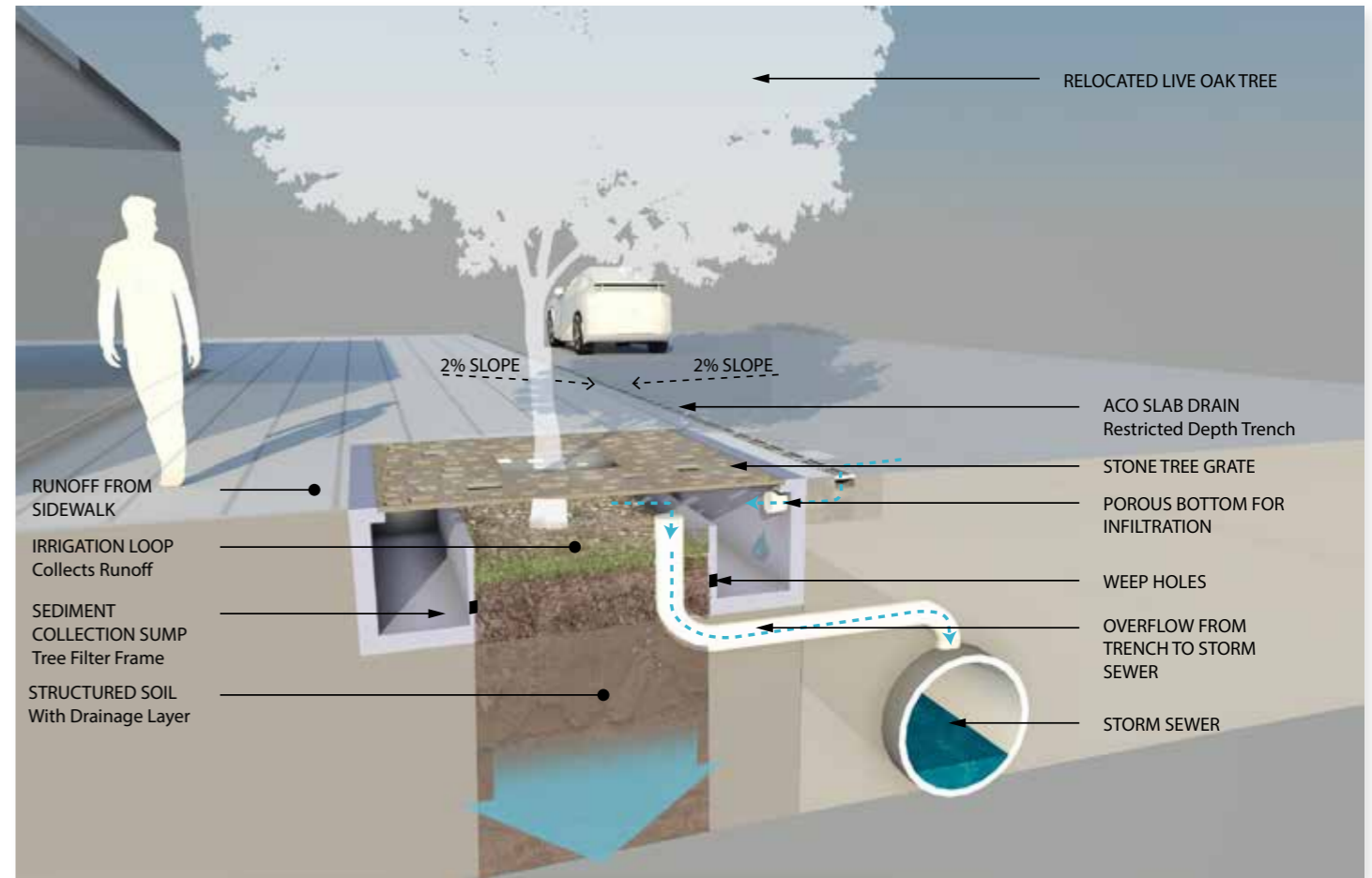
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Local Office Landscape Architecture, Mayagüez Parque del Litoral, Mayagüez, Puerto Rico, 2010

below: Landscape as coastal infrastructure protecting the city from the sea, and the sea from the city, with urban wetlands, dunes and forest.

opposite: Phytoremediating wetlands polish urban runoff from street end pipes, and help reduce flooding.



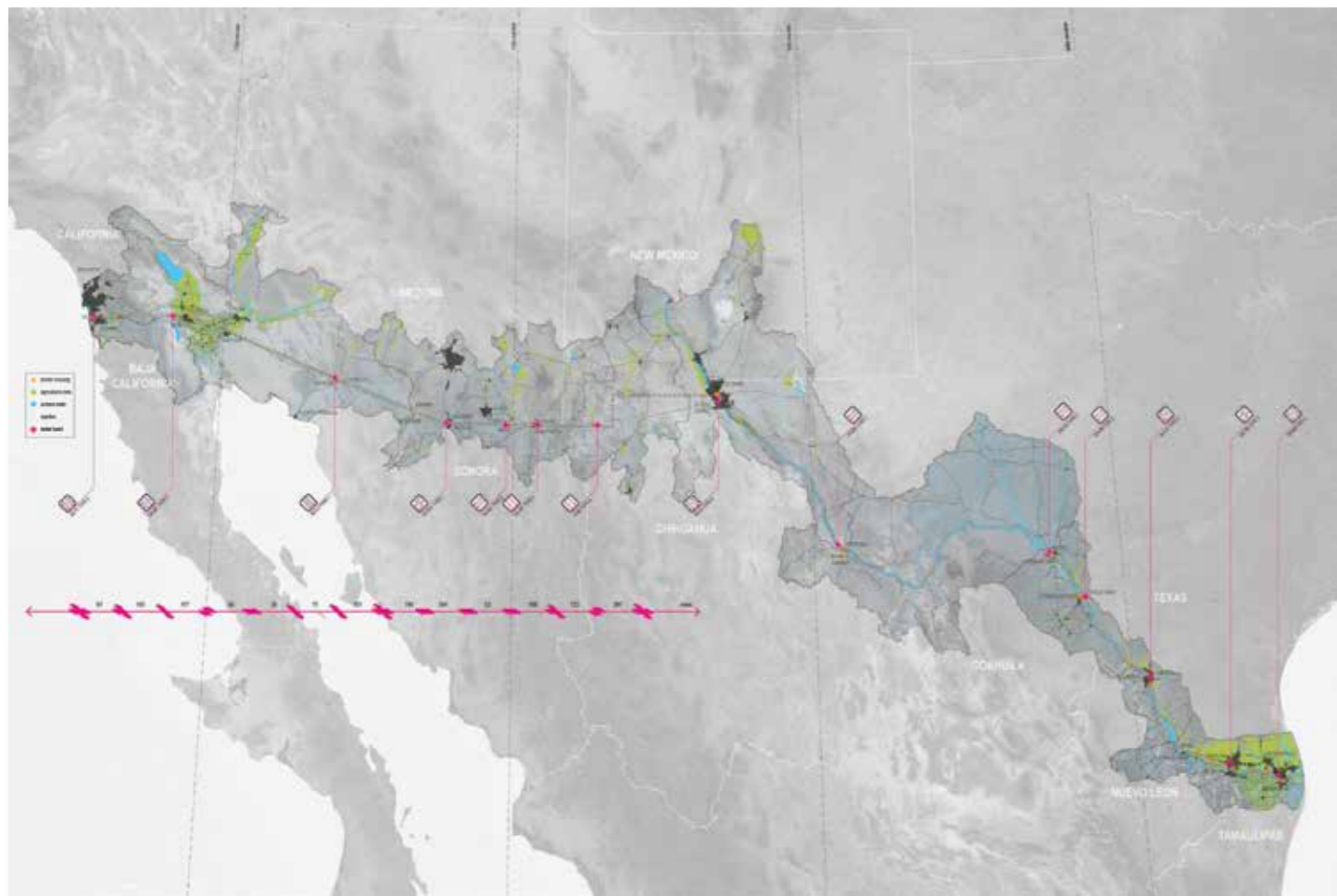
Local Office Landscape Architecture, Miracle Mile streetscape, Coral Gables, Florida, 2017

Blue streets: green infrastructure supplementing existing hard infrastructure.

Lateral Office,  
Banking on the Border,  
Regional study of US-Mexico border,  
2012

below: Section through various water border conditions. Banking on the Border imagines water banks, water markets and soft water treatment, forming a new, discontinuous 'wet' border between the US and Mexico.

bottom: A survey of water, urbanism, and agriculture along the US-Mexico border. In some instances, water banks are paired with current border crossings, shifting from border control to border exchange and cooperation.



### Resilient Design in Extreme Conditions

Lateral Office, based in Toronto, also works in extreme environments where conditions are changing rapidly, but the founders take a deliberately experimental approach. Mason White and Lola Sheppard are both trained architects but position their practice as a 'lateral' endeavour by working along a scale-less continuum from public art to urban design. The partners operate in that creatively liberating space just outside the confines of expertise, which allows them the latitude to look at wildly divergent systems and conditions.

From the Canadian Arctic to the US-Mexico border, their explorations attempt to uncover opportunities hidden in complex problems. In 2011 Lateral Office created the *Arctic Food Network* to address the indigenous population's increasing vulnerability to climate change and its impact on food scarcity. Lateral conducted a similar exploration looking at water scarcity along the US-Mexico border for a design competition in 2012 by the Drylands Institute, which they titled *Banking on the Border*.

Both projects are premised on the idea that applying a scientific methodology to experimental ideas through modelling and simulation is critical to uncovering leverage points within interdependent systems. For example, while some Americans are clamouring for a massive border wall between the US and Mexico, *Banking on the Border* seeks to create a water harvesting and storage system along the border to promote conservation as well as ease political tensions while producing new landscapes, public realms, and sites of economic exchange.

Waggonner & Ball Architects,  
Proposed condition of London Canal,  
Greater New Orleans Urban Water Plan,  
New Orleans,  
Louisiana,  
2013

The Greater New Orleans Urban Water Plan provides a new science-, engineering- and design-based framework to make the region resilient and sustainable at all scales. It works in tandem with the existing levee system and Louisiana's 2012 Coastal Master Plan, but offers a paradigm shift from conventional water management towards a system that values water as an asset.



### Resilient Design and Financing

On the more traditional end of the spectrum is Waggonner & Ball, a seasoned firm with a core practice of historical restoration and modern institutional work. But as a New Orleans-based company with urban design experience, when Hurricane Katrina hit in 2005, the firm's founding partners became deeply involved in resilient design. In 2011, the State of Louisiana's Disaster Recovery Unit provided funding to develop a water management plan. The firm led a team that developed a multifaceted resiliency approach, the Greater New Orleans Urban Water Plan, released in November 2013, which imagined water as a resource for the city as opposed to a problem to be kept out. The team took a decidedly science-based, place-based and adaptable approach that shifts the paradigm from 'piping and pumping' to slowing, storing and reusing.

Building on this work, the practice has since won several resiliency competitions from Louisiana to Virginia and Connecticut. David Waggonner voices frustration that the need for these solutions is so great while the financial resources are so scarce. Translating this systems-based expertise to other communities requires intensive research into local conditions, which can wipe out a budget. He is adamant that, in the absence of national resources, if cities and states are going to be the driving engines of resilient design, they had better learn how to contract for it.

### Everything is Connected

Taking stock of some of the most innovative resiliency projects and ideas in North America, a few patterns emerge. Many of these projects, as already noted, are led by small, interdisciplinary firms that embody this systems thinking

approach. Large-scale projects tend to arise from design competitions with little promise of funding behind them, while the built projects are smaller yet hold the potential for regional applicability.

Of course, the representation of these firms in the practice of resilient design is not a complete picture. There are big practices executing large-scale, mostly engineering-related resiliency developments. But the practices employing a systems thinking approach are at the vanguard of both built and experimental projects. These firms are nimble enough to lead interdisciplinary teams and problem solve at the interface of complex systems; in other words, able to design in the context of constant change.

Related to the idea that change is constant is another concept also introduced by Heraclitus: that everything is connected. He had a word for this: *Logos*. Heraclitus believed the *Logos* – the oneness of humans, nature and the cosmos – to be an absolute truth, but most people fail to recognise it. 'Although intimately connected with the Logos, men keep setting themselves against it.'<sup>3</sup> ▢

#### Notes

1. Jesse M Keenan and Claire Weisz (eds), *Blue Dunes: Climate Change By Design*, Columbia Books on Architecture and the City (New York), 2017.
2. This and other personal opinions of individuals featured were recorded in interviews with the author.
3. Heraclitus, Fragment 72.

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