100RC Network Exchange Program

Rotterdam Exchange:

Water Management & Multi-Benefit Solutions

LESSONS LEARNED & TACTICAL GUIDANCE

RESILIENT ROTTERDAM

PIONEERED BY THE ROCKEFELLER FOUNDATION
100 RESILIENT CITIES

Gemeente Rotterdam

Rotterdam, the Netherlands
October 4-7, 2015

RESILIENT BANGKOK

RESILIENT BERKELEY

RESILIENT CIUDAD DE MÉXICO

RESILIENT NEW ORLEANS

RESILIENT NORFOLK

RESILIENT ROME

RESILIENT ROTTERDAM

RESILIENT SURAT

RESILIENT VEJLE

Executive Summary

The 100 Resilient Cities - Network Exchange Program offers Chief Resilience Officers (CROs) and members of their cities' resilience teams the opportunity to share knowledge, source innovation and discover new solutions to the pressing resilience challenges they face.

The overarching goal of all 100RC Network Exchanges is to drive implementation – so that participating CROs and team members take that knowledge, those innovations and those solutions back to their cities to reshape their resilience-building efforts now and in the future.

In October 2015, the CROs and resilience team members of Bangkok (Thailand), Berkeley (USA), Mexico City (Mexico), New Orleans (USA), Norfolk (USA), Rome (Italy), Rotterdam (Netherlands), Surat (India), and Vejle (Denmark) convened in Rotterdam for a Network Exchange on multi-benefit solutions to water management. This 3-day gathering was an opportunity for CROs and their resilience teams to share best practices, solve problems collectively, and craft an urban water agenda for the months and years ahead.

The living resilience laboratory of Rotterdam presented a powerful venue for resilience learning and collaboration. As a delta city situated primarily below sea level, Rotterdam has a long history of designing solutions that not only aim to reduce flooding in the city, but also connect water to economic opportunity, recreation, and beautification.

Through site visits, expert presentations, and multi-disciplinary workshops involving more than 30 local water experts, participants grappled with common challenges facing cities today – from flooding and sea level rise to water scarcity – and proactively shared knowledge about each other's successes and failures.

Most importantly, the Rotterdam Exchange catalyzed real and concrete action, and attendees returned to their cities to act upon the lessons learned and leverage the experiences of other CROs, Dutch experts, and 100RC Platform Partners.

At the time of publication:

- Member cities Norfolk, New Orleans and Rotterdam are collaborating around ideas for enhancing port resilience.
- Norfolk is evaluating piloting floating structures to help design the coastal community of the future.
- Mexico City and Rotterdam are exchanging technical information about how to implement water plazas in the Mexican capital.
- Vejle is reconceptualizing of a sluice project with a water-resilient lens.

And as more participating CROs advance through their resilience strategy process and into implementation, they will continue to translate the lessons learned into real action in their cities.

This handbook is Exchange attendees' gift to fellow CROs and colleagues that did not have the opportunity to participate in the Exchange. For members of the 100RC Network and beyond, this compendium offers:

- **REPLICABLE INNOVATIONS**: To inspire practitioners around the world, CROs describe key innovations explored in the classroom that is Rotterdam – from floating structures designed to respond dynamically to rising sea levels to 'sponge zones' for absorbing excess storm water.

- **SHARED TACTICAL APPROACHES AND TOOLS**: To help take similar action in other cities, participating CROs and resilience team members also articulate 8 key lessons learned around project ideation, design, and implementation. Each lesson is supported by a number of practical tactics discussed at the Exchange, case studies showing how these approaches have been employed in other cities, and 100RC Platform tools that can be used for implementing them.

- **MARKET NEEDS FOR RESILIENCE-BUILDING TOOLS**: Part of the conclusions directly address private sector providers and 100RC, signaling what kind of tools and services need to be created or scaled to sustain the resilient water agenda.

- **ACCESS TO FELLOW NETWORK EXPERTS:** Extensive background material – from expert presentations to the list of participants – is included in order to facilitate readers' independent connections and follow ups.

We have seen through our work that cities across the globe share common challenges, but often start from scratch in trying to solve them. By learning from Rotterdam's state-of-the-art innovations and connecting resilience practitioners from around the world, we hope to scale solutions and spark new ideas for our broad-based resilience movement.

Contents

SECTION 1

Introduction

Cities across the world are grappling with water – either too much or too little.

The 2015 World Economic Forum Global Risks Report identified water crises – droughts, floods, sea level rise and pollution – as the top risk with the largest expected global impact over the coming decade. And of the more 1000 applications received for membership in the 100 Resilient Cities network to date, 60% identified flooding as one of the top shocks they face, while 20% identified water shortage as their top stress.

FLOODING

Percentage of 100RC cities identifying challenge as top shock in the application

DROUGHTS

Percentage of 100RC cities identifying challenge as top stress in the application

ROTTERDAM EXCHANGE

By the Numbers

3 DAYS of site visits, peer review sessions, and planning for future collective action.

9 CITIES representing 7 countries and 3 regions.

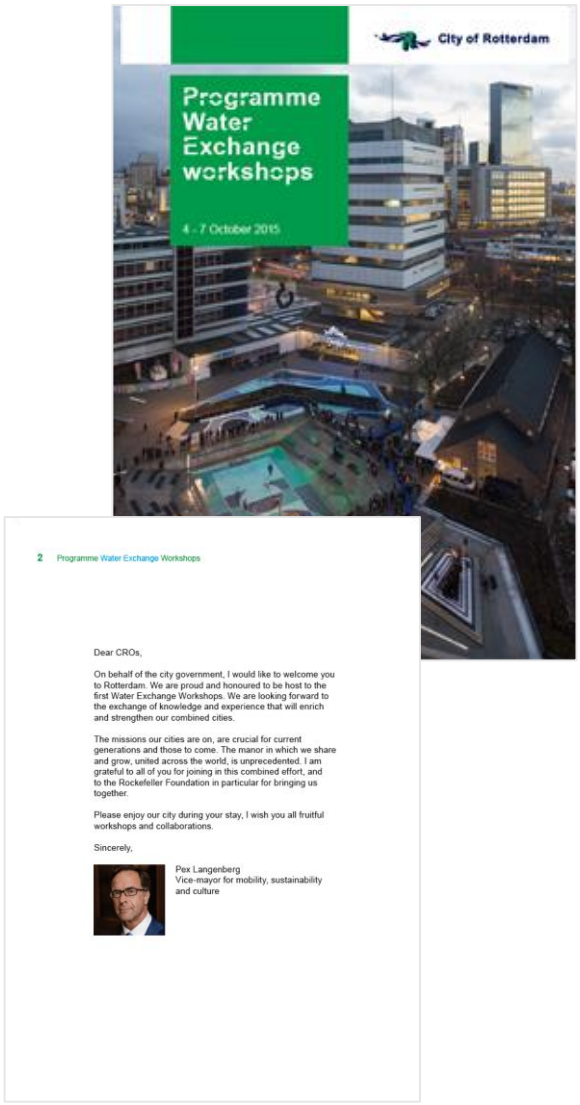
28 RESILIENCE PRACTITIONERS including 9 CROs and 19 support team members.

30 WATER EXPERTS from the private sector, NGOs, academia, and 100RC Platform.

Located squarely at the nexus of the compounding challenges of climate change, aging infrastructure, flood mitigation and community engagement, water management requires new approaches and innovative solutions that achieve multiple benefits for multiple stakeholder groups – especially in an increasingly resource-constrained environment.

In October of 2015, Chief Resilience Officers and city officials from 9 100RC member cities convened in Rotterdam with Dutch and global experts to share innovations, identify opportunities for collaboration and – in part through this handbook – inform the resilience planning and implementation efforts of their fellow member cities in the 100RC Network.

This handbook highlights the learnings from this three-day* Exchange and features tactical solutions and tools from both participating 100RC member cities and 100RC Platform partners.



**To learn more about the detailed program of the Rotterdam Exchange, please see the Appendix of this report.*

CONTENTS

The handbook is organized in five main sections:

- **Section 1** lays out the key goals and components of the Rotterdam Exchange.
- **Section 2** describes key innovations explored by CROs and their teams in the classroom that is Rotterdam – from floating structures designed to respond dynamically to rising sea levels to 'sponge zones' for absorbing excess storm water.
- **Section 3** describes the format and goals of the "Deep Dive Sessions" where Exchange participants addressed specific challenges through multidisciplinary peer review.
- **Section 4** articulates 8 key lessons learned around project ideation, design, and implementation. Each lesson is supported by a number of practical tactics discussed at the Exchange, case studies showing how these approaches have been employed in other cities, and 100RC Platform tools that can be used for implementing them.
- **Section 5** gives examples of concrete actions taken by participating CROs as a result of the Exchange, lists what kind of tools and services need to be created or scaled to sustain the resilient water agenda, and provides recommendations to other CROs wanting to host a 100RC Network Exchange.
- **The Appendix** includes extensive background material – from the Exchange's detailed program and CRO reports to the list of participants – to facilitate readers' independent connections and follow ups among practitioners interested in learning more.

The collective hope of the Exchange participants is that Chief Resilience Officers, their team members and other resilience practitioners will look to these lessons and tactics when confronting their cities' water management challenges – and contribute their own stories of success and failure to the 100RC Network conversation around resilient approaches to water.

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SECTION 2

Rotterdam as a Resilience Lab

As a delta city situated primarily below sea level, Rotterdam has always been in the vanguard of innovation in water management, with a long history of designing solutions that not only aim to reduce flooding in the city, but also connect water to economic opportunity, recreation, and beautification.

During the first day of the Network Exchange, CROs used Rotterdam as a living laboratory to experience how the Dutch live with water making it an integral part of their landscape, and to learn about key innovations in this space – from floating structures designed to respond dynamically to rising water levels, to 'sponge zones' for absorbing water.

© Romar LED

FLOATING PAVILION

To respond dynamically to the challenges of climate change and sea level rise, Rotterdam is planning to build floating sustainable districts. The solar-powered Floating Pavilion in the Rijnhaven is the first test of this concept. This structure consists of three connected hemispheres and serves as an exhibit space for the city's climate change plans. An initiative of Rotterdam Climate Proof, the 'bubbles' were commissioned to a collaborative and local design team from Deltasync and PublicDomain Architects.

To learn more, visit: http://www.drijvendpaviljoen.nl/

© Roel Dijkstra Fotografie

BENTHEMPLEIN WATER SQUARE

The Benthemplein Square is the world's first large scale water square, designed by Rotterdam-based landscape architects De Urbanisten and completed in December 2013. When the weather is dry, the square offers a variety of places lingering, sports and events. During heavy rainfall, three basins retain storm water from the square and the surrounding rooftops, adding redundancy to the overall system. During the design phase, De Urbanisten and the Municipality consulted extensively with local residents, students, and other tenants, making it a truly inclusive process.

To watch the Water Square live, visit:
http://www.urbanisten.nl/wp/?portfolio=waterplein-benthemplein

KEY FACTS

- Land area: 320 km2 (Metro area: 856.6 km2)
- City population: 623.956 (Metro population: 1,2 mln)
- Medium household income: € 21.700

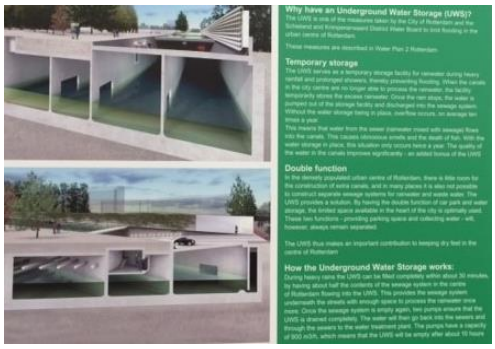
DAKAKKERS GREEN ROOFTOPS

© Roel Dijkstra Fotografie

DakAkkers is Europe's first large-scale urban agricultural rooftop. In 2012, Binder Groenprojecten and Zones Urbaines Sensibles reclaimed an old building in the center of the city and built the urban farm as a test site. Its green rooftops not only supply the city with sustainable vegetables and honey, but also aid in the collection and retention of excess rain water. More vegetation in the city also means lower carbon emissions, increased oxygen production and lower urban heat due to cooler roof temperatures.

To learn more, visit:
http://www.luchtsingel.org/locaties/dakakker/

MUSEUM PARK GARAGE



The car park near Rotterdam's Museum Park not only accommodates 1,150 cars, but also houses one of the largest underground water reservoirs in the Netherlands. As soon as the sewer system threatens to overflow, the hatch of the underground water reservoir opens. Within 30 minutes, the reservoir fills up with 10 million liters of water. When the downpour is over, the rainwater is pumped into the sewer and discharged in the usual manner. Because of its success, this concept has been applied to other garages in the city.

To learn more, visit:
http://www.greenplanetarchitects.com/en/project/commercial/museumpark

DAKPARK [ROOF PARK]

© Arnoud Molenaar

To simultaneously offer a green space for residents and create growth opportunities for local businesses, the Municipality of Rotterdam created the Dakpark, Rotterdam's largest 'green' roof. Located on a shopping boulevard, the Dakpark has a Mediterranean herbal garden, a playground, and a communal garden maintained by local residents. At the park it is also possible to attend yoga classes and other workshops.

To learn more, visit: http://www.bigshops.nl/

THE BIGGER PICTURE

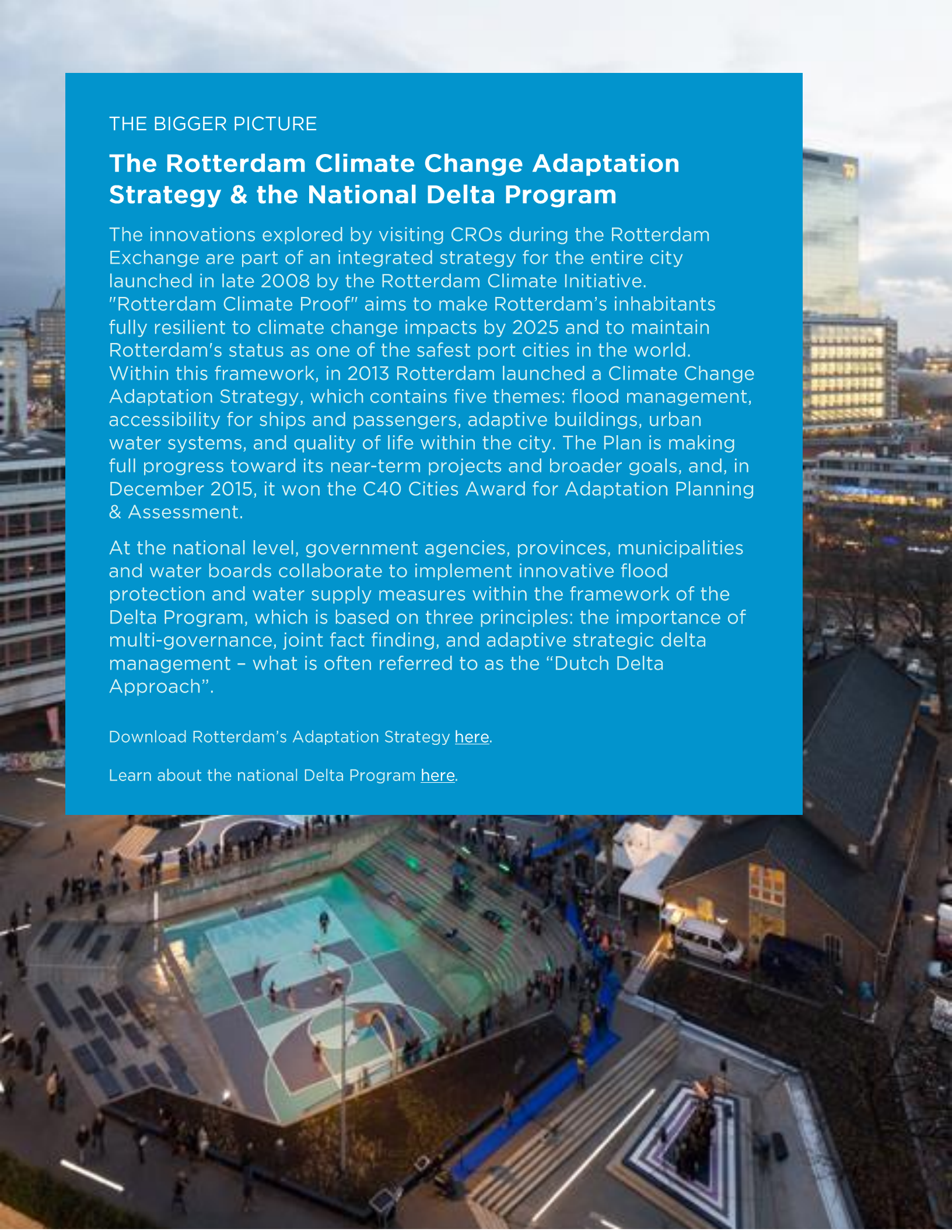
The Rotterdam Climate Change Adaptation Strategy & the National Delta Program

The innovations explored by visiting CROs during the Rotterdam Exchange are part of an integrated strategy for the entire city launched in late 2008 by the Rotterdam Climate Initiative. "Rotterdam Climate Proof" aims to make Rotterdam's inhabitants fully resilient to climate change impacts by 2025 and to maintain Rotterdam's status as one of the safest port cities in the world. Within this framework, in 2013 Rotterdam launched a Climate Change Adaptation Strategy, which contains five themes: flood management, accessibility for ships and passengers, adaptive buildings, urban water systems, and quality of life within the city. The Plan is making full progress toward its near-term projects and broader goals, and, in December 2015, it won the C40 Cities Award for Adaptation Planning & Assessment.

At the national level, government agencies, provinces, municipalities and water boards collaborate to implement innovative flood protection and water supply measures within the framework of the Delta Program, which is based on three principles: the importance of multi-governance, joint fact finding, and adaptive strategic delta management – what is often referred to as the "Dutch Delta Approach".

Download Rotterdam's Adaptation Strategy here.

Learn about the national Delta Program here.




© Roel Dijkstra Fotografie

SECTION 3

Deep Dive Sessions

On the second day of the Network Exchange, experts from the Rotterdam Centre for Resilient Delta Cities (RDC) hosted a facilitated discussion to help CROs and resilience team members creatively address the water-related challenges they decided to bring to the group for peer review.

In preparation for the session, CRO ambassadors sent their case studies to help RDC to form expert groups and create illustrative posters.

After briefly presenting their challenge, participants were split into groups of 2 CROs each. Each peer group featured a number of subject matter experts (SMEs), including RDC representatives, Rotterdam government officials, local private sector experts, and Platform Partners*. Each breakout group was intentionally diverse to provide multiple points of view and a cross-disciplinary perspective. The role of SMEs was to leverage their collective expertise and experience to help CROs refine their problem statements, clarify diagnostic questions, and brainstorm new ideas, approaches, and solutions.

The hope was that each CRO would leave with a stronger understanding of how to approach their challenge, and a range of potential resources to draw from once they returned to their cities.

These intensive brainstorming conversations laid the foundation for putting forward non-traditional ideas and collaboratively designing solutions that were innovative and at the same time realistic for each city. In some cases, the process revealed different challenges than initially identified or anticipated by CROs, who ultimately experienced a mind-shift on possible strategies and roadmaps to solutions.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** For a detailed list of participants, please see the Appendix of this report.*

Rotterdam Centre for Resilient Delta Cities

The Rotterdam Centre for Resilient Delta Cities (RDC) is a public-private network organization which aims to accelerate the transition towards safe and sustainable delta cities worldwide. RDC members have an extensive track record in realizing innovative concepts in delta cities. Together they develop strategies for integral solutions which enhance safety and add value in terms of spatial and ecological quality, social outcomes and economic potential.

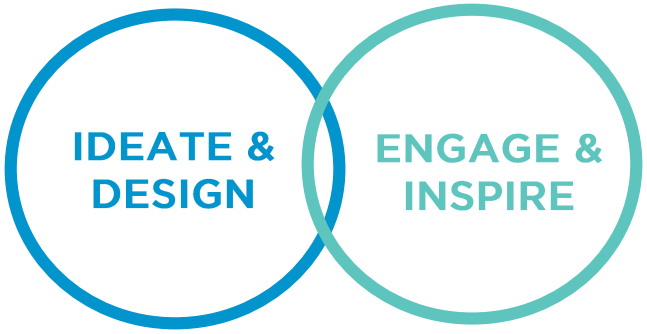
Learn more at: http://rdcrotterdam.com/

SECTION 4

Key Lessons Learned

On the third day of the Network Exchange, CROs shared key lessons learned and specific action points to take back to their cities*. They also participated in a collective brainstorming session where they agreed on 8 key general takeaways to share with the rest of the 100RC Network.

These lessons learned are summarized in the framework below and spelled out in the remainder of this chapter. For each lesson, participating CROs shared a number of tactics, tools and examples for applying it in other cities facing climate change- and water-related challenges.



1. **Define your Problem**
2. **Explore Integrated Solutions**
3. **Incorporate Innovative Finance**
4. **Promote Equitable Outcomes**

1. **Share Ownership**
2. **Educate and Train**
3. **Articulate your Vision**
4. **Tell a Great Story**

**To learn more about individual challenges and takeaways from this experience, you can find the 9 City Pages submitted by CROs and their teams in the Appendix of this report.*

1. Define your Problem

Before jumping to solutions, it's important to understand and articulate the water-related challenge you want to address.

Framing the problem is the toughest part of any ideation process. Often risks are framed too narrowly, and cities end up addressing only the symptoms of the problem without treating its underlying causes. On the other hand, questions that are framed too broadly can facilitate dialogue but risk not being actionable. For example, the question "How can my city's water system become more resilient?" is too general, while "How do I strengthen my city's seawalls?" is too narrow and may prevent the exploration of alternative solutions, such as replacing deteriorating seawalls with dunes or mangroves.

Simple, well-framed problem statements can help maximize the scope of possible solutions. This in turn can unlock funding streams that might not have been available beforehand, as well as solicit broader support among stakeholders.

"

"Working with private partners and other peers during the workshop was invaluable! Their expertise was incredibly helpful in reframing our discussions toward practical solution development."

Jeff Hebert, CRO of New Orleans, United States of America

Tactics for applying this lesson in your city:

- **Participate in multisector peer reviews.** Ideation workshops involving an interdisciplinary mix of experts and stakeholders can help frame (or in many cases reframe) questions from different angles and reveal new connections or otherwise unrecognized risks and opportunities.

INNOVATIONS FROM THE 100RC NETWORK

The Resilience Garage

The Resilience Garage harnesses the collective wisdom of experts across a variety of fields and applies it to intractable problems faced by organizations in both the private and public sectors. The first day of the workshop is preparation and includes Nexus!, a resilience board game and a masterclass on resilience practice. The second day is the Garage itself, which is best held in an inspiring space, such as an industrial loft or indeed a garage. Two unique complex challenges are tackled simultaneously, a civic case from a 100RC member city and a corporate case from an organization sponsoring the event. The outcomes from the Garages have proven invaluable to problem definition, identifying linkages across disciplines, identifying unseen hurdles, and providing direction that leads to pragmatic approaches and solutions.

The first Resilience Garage was held in 2014 at a historic shipyard in Amsterdam, and was sponsored by Shell in the context of the "Resilience Action Initiative" involving a number of high-profile companies. In this Garage, resilience "mechanics" from the private industry, government, nonprofits and academia, addressed the dilemma that Christine Morris, CRO of Norfolk, Virginia, posed to them: "in the face of sea level rise that causes persistent flooding, how can you motivate people to invest collectively in strategies that result in better water management practices?"

Read Christine Morris' blog here.


© Roland Kupers Consult

- **Use water modelling tools.** Innovative modelling of water systems can help provide data-based evidence to help validate initial hypotheses, explore root causes, and identify priority areas.

© Deltares, http://oss.deltares.nl/

INNOVATIONS FROM THE 100RC PLATFORM

Water Modeling Tools: Deltares - Delft3D Coastal and River Systems Modeling

In contexts where local risk data is unavailable or of poor quality, this 3D modelling suite is a useful tool for producing risk profiles that, especially when integrated with additional city data, can help identify and better understand water-related challenges. Interactive animations also allow for better communicating identified risks and scenarios to relevant stakeholders.

http://oss.delft3d.nl

2. Explore Integrated Solutions

When moving to solution design, try to rethink the conventional and explore comprehensive approaches that address multiple challenges simultaneously.

Whether your city is grappling with too much water, or trying to cope with too little, there is a great opportunity to shift to more integrated and cost effective solutions that can not only meet multiple current needs, but are also poised to better address unknown future challenges.

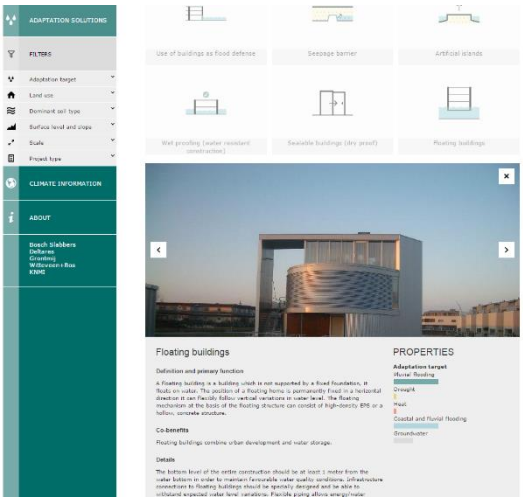
From the Rotterdam Network Exchange it emerged that it may not be obvious, or easy, to find the right solutions for your unique context. But, through multidisciplinary brainstorming and ideation with experts and cities that have walked the same path, you can maximize your exposure to innovative ideas and approaches in this space.

> *"Engineering solutions are not sufficient. We have to live and work with nature, not against it. Planning processes have to be integrated."*
>
> **Kamlesh Yagnik, CRO of Surat, India**

> *"The Exchange reinforced the need to take a systems approach to water management in complex watersheds. For example, by combining hard infrastructure with sponging green spaces."*
>
> **Christine Morris, CRO of Norfolk, United States of America**

Tools for applying this lesson in your city:

Here are some tools and resources that can help you explore a number of integrated solutions to water-related challenges, before diving into a more in-depth analysis of your unique challenges.



Screenshot of the Climate Adaptation App, available at www.climateapp.org

INNOVATIONS FROM THE 100RC NETWORK

The Climate Adaption App – Multisector Partnership (Rotterdam, Bosch Slabbers, Deltares, Grontmij, Witteveen+Bos, KNMI)

The Climate Adaption App gives urban planners, engineers and other practitioners looking for climate adaptation measures a comprehensive snapshot of current innovations targeting coastal, fluvial and pluvial flooding, groundwater, droughts and heath waves.

Users can filter solutions by climate adaption target and local conditions, such as soil type, land use, landscape conditions, and other user preferences. The App then ranks 120 different measures based on their total score and selected criteria. For each solution, the user can not only access more details about its primary function, but also learn about possible co-benefits.

This user-friendly tool can inspire new thinking about possible measures and their trade-offs, which then can be supplemented by more in-depth research and technical consultations.

Because the App will generate the list of feasible measures in less than a minute, this tool can be easily used during ideation workshops and trainings.

www.climateapp.org

INNOVATIONS FROM THE 100RC PLATFORM

The Nature Conservancy Urban Water Blueprint

'Green infrastructure' investments are one approach that often yields multiple benefits and builds city resilience. The Urban Water Blueprint is a new water mapping tool developed for cities by 100RC Platform Partner The Nature Conservancy. It analyzes the state of water in more than 2,000 watersheds and 530 cities worldwide to provide science based recommendations for natural solutions that can be integrated alongside traditional infrastructure to improve water quality. Applied strategically to reduce nutrient flows and sedimentation in water sources, these methods could save hundreds of millions of dollars in operations costs for city water supply systems.

The Blueprint has an online component with an interactive web page and also is available to be downloaded as a report. TNC can provide support on how to make the best use of the report findings and provide guidance on next steps to be taken as a result of understanding the outcomes of the report.

http://water.nature.org/waterblueprint

3. Incorporate Innovative Finance

Leverage innovative financial instruments and strategies to stimulate greater private and public investments in water-resilient solutions.

Despite the growing interest in water efficiency projects, green infrastructure, coastal protection measures, and other initiatives, most investments are still directed towards traditional infrastructure. This is partly because the costs and benefits of integrated water solutions are not always easy to capture across systems. To meet the increasing demand for resilient solutions in the water management space, consider approaches that realign incentives and monetize resilience dividends to send clearer messages to the market. As you move forward with the implementation of innovative projects and ideas, value-capturing and creative finance will be key to scale and overall implementation.

Tactics for applying this lesson in your city:

- **Leverage value capture financing mechanisms.** Consider bond models to retrofit commercial and residential properties or create tax incentives for residents investing in water adaptive measures.
- **Incorporate financing considerations and strategies into solution design.** The focus on finding innovative finance solutions as part of the design process can help you reduce internal concerns about resources and funding demands.

INNOVATIONS FROM THE 100RC PLATFORM

Innovative Finance: the Swiss Re and Veolia Partnership

Cities rarely have financial plans in place to protect critical assets against shocks before they occur, and in the aftermath of such events, cities must determine what is damaged, how it will be fixed, who can fix it and how to fund these repairs, which can take months or years.

Under a partnership agreement brokered by 100RC, Platform Partners Swiss Re and Veolia will work with cities to understand the risk exposure of critical assets under current and future climate scenarios. Based on these assessments, cities can implement resilience plans to lessen the risk of these assets being affected, and simultaneously reduce their risk exposure over time. By planning ahead for major shocks and stresses, cities not only strengthen the resistance of their vital infrastructure; they can also limit economic interruption; and begin to quickly repair damage without waiting for prolonged government reimbursements, complicated insurance assessments, payouts, and solicitations for repair proposals.

The initiative will first launch with a pilot in New Orleans. The pilot will focus on some of the city's infrastructure, including critical water and wastewater systems.

http://www.swissre.com/
www.veolia.com

INNOVATIONS FROM THE 100RC PLATFORM

Incorporate Financing into Solution Design: MWH Global Water Advisory Support

MWH Global is an engineering, consulting and construction firm focused on water and natural resources. MWH Global provides 100RC cities with individualized assistance to assess and prioritize water and wastewater infrastructure-related challenges and enhance flood management systems. As a preliminary step to developing solutions that are tailored to meet cities' unique needs, MWH consultants play a key role in helping CROs refine their problem statements and incorporate financing considerations and funding strategies into solution design.

www.mwhglobal.com

Home elevations and water permeable cement, seen here by CROs who visited New Orleans for the 2014 Summit, are examples of ways homeowners can invest in risk reduction.

4. Promote Equitable Outcomes

Prioritize approaches that promote equitable outcomes lessening the burden on poor and vulnerable populations.

The localized impacts of climate change, ranging from extreme heat to rising sea levels, tend to disproportionately affect the poor and the vulnerable, such as the elderly, renters, low-income residents, people with pre-existing medical conditions, and those without health or home insurance. At the same time, underserved communities, where green infrastructure can both capture storm water and lower childhood asthma rates and costs, offer the greatest opportunities for combining and capturing multiple benefits.

Besides actively striving for solutions that benefit the poor and the vulnerable, it's important to evaluate project ideas and possible trade-offs against this lens.

For example, if you're developing a storm water fee on residential properties in flood prone areas, you should also consider balancing any possible burden on poor populations living in these areas through subsidies and other "solidarity measures".

"A major reminder that will serve to guide implementation moving forward is a focus on vulnerable populations. In New Orleans, like in many cities around the world, those facing the greatest flood risks are also the most socially and economically vulnerable. As the City considers new regulations and strategies to encourage private property adaptation to living with water, those most affected would be the most vulnerable, so it is imperative that their tax burden is mitigated through "solidarity" financial measures."

Jeff Hebert, CRO of New Orleans, United States of America

© NOLA Resilience Strategy p. 41

5. Share Ownership

Integrated water management design and implementation require the engagement of multiple stakeholders. Make sure to partner with them from the outset of your journey!

Internal and external champions with the power to act can turn an abstract idea into an implementable solution. Similarly, departmental heads with competing agendas or community members uncertain of the consequences of your project on their day-to-day life can become critical detractors able to turn the best plan into a theoretical exercise collecting dust on a shelf.

To make your vision a reality, identify stakeholders within and outside city government that can support your cause and engage other champions throughout the process.

Tactics for applying this lesson in your city:

- **Connect agendas and opportunities across multiple disciplines and sectors.** Generating actions that cut across sectors and address multiple priorities can help different city departments see beyond their portfolios and support projects with clear gains for their agency or business within a larger set of benefits. Tactics to reduce internal competition for resources within municipalities include:
  - Celebrating other departments' work at speaking events or meetings where you're presenting your initiative.
  - Collaborating on grant applications or other joint efforts.
  - Inviting possible detractors to participate in steering committees, boards, or other governance bodies.
  - "Connecting the dots" between different agendas and programs (e.g. Smart Cities, Sustainability or Circularity agendas).

"Involve local industries, developers and other stakeholders in urban water planning processes, including potential detractors who might even become champions."

Kamlesh Yagnik, CRO of Surat, India

INNOVATIONS FROM THE 100RC NETWORK

Integrated Water Governance – The Surat Climate Change Trust

As the most flood-prone city in the Indian state of Gujarat, Surat joined the Rockefeller Foundation's Asian Cities Climate Change Resilience Network (ACCCRN) in 2008 to learn best practices from cities facing similar challenges in the region.

Based on the lessons learned from ACCCRN, in 2012 the Surat Municipal Corporation (SMC) established the Surat Climate Change Trust, a multi-stakeholder body including representatives from the SMC, the Chamber of Commerce, the State Government, the Gujarat State Disaster Management Authority, elected representatives, the Citizens' Council, Technology and Medical Colleges, the Center for Social Studies, and more. The Surat Climate Change Trust is directly supported by the SMC both in terms of infrastructure and funding.

Through this integrated governance body, the city of Surat was able to improve coordination across silos, foster wide-spread buy-in among diverse stakeholders, and sustain the implementation of innovative climate- and water-related projects. "Everyone decided to work together in this area," said Kamlesh Yagnik, CRO of Surat. A major result was the inclusion of a budget line specifically for climate change in the Surat Municipality budget that signaled cross-departmental commitment and support for resilience-building actions.

As Surat's CRO Office is situated in the same premise of the Trust, both offices will collaborate closely in the implementation of Surat's resilience-related efforts, including the city's first-ever Resilience Strategy.

To learn more about ACCCRN, visit: https://www.rockefellerfoundation.org/our-work/initiatives/asian-cities-climate-change-resilience-network/

- **Collaborate with local partners to build community awareness and ownership.** To engage local champions, you need to communicate concepts of resilience and water-related risks in a language that is understood and valued by community members. Strategies to better connect with the community include:

  - Using design competitions or other creative methods to crowdsource ideas from the community.
  - Testing project ideas with surveys capturing people's desires and concerns.
  - Creating ownership at the neighborhood level by leveraging existing local skills and experience for day-to-day management.
  - Partnering with "community ambassadors" to communicate the benefits of pilots you want to scale to other city neighborhoods.

"Find and use leadership in neighborhoods to connect, to identify skills, to create awareness and ownership. Link interventions with skills and jobs we need. For example, leverage local entrepreneurship skills to manage the maintenance of raingardens, rather than outsourcing."

Arnoud Molenaar, CRO of Rotterdam, the Netherlands

INNOVATIONS FROM THE 100RC NETWORK

A Participatory Approach to Design - The Benthemplein Water Square

The first attempt to develop a water plaza in Rotterdam - similar to the Benthemplein Square visited by CRO ambassadors during the Exchange - was not successful, as local communities actively resisted the implementation of the project in the area originally selected.

Based on this experience, Dutch architecture firm De Urbanisten decided to involve the community for the design of the Benthemplein Square right from the start to ensure buy-in early on in the process. This participatory approach involved three consecutive workshops with teachers, students, theater and gym representatives, church members, and local residents. Together they defined various functions of the square and devised the concept by using playing cards and other interactive methods.

"This image-based design process created ownership and helped to incorporate concrete ideas brought up by the community. Today, the Bethemplein water square is the symbol of the Rotterdam Approach 'Urban Climate Resilience by Design'." Arnoud Molenaar, Chief Resilience Officer of Rotterdam, the Netherlands.

http://www.urbanisten.nl/wp/?portfolio=waterplein-benthemplein

6. Educate and Train

To sustain implementation of innovative approaches across time, help your city create a culture of awareness and competence among practitioners, citizens, and leaders of tomorrow.

The fact that resilient water management solutions exist doesn't necessarily mean that those people who implement, manage, and benefit from these new approaches are aware of them or necessarily convinced of their applicability to unique city contexts. For example, often the very engineers that control the design and implementation of urban water infrastructure may be skeptical of new, more integrated solutions, in no small part because complex cross-sector projects have less clear lines of ownership and may challenge existing views or methods learned through years of training and experience.

By spurring, inspiring, and encouraging concepts of water resilience at all stages of life (from in-classroom education to professional trainings), you will develop a critical mass of people who are empowered to take active roles in implementing resilience initiatives instead of resisting them.

> *"I'd like to manage storm water in Berkeley in a way that educates our community members about local ecosystems and how storm water affects them."*
>
> **Timothy Burroughs, CRO of Berkeley, United States of America**

INNOVATIONS FROM THE 100RC NETWORK

Water Education: The Dutch Approach

For the Dutch, learning how to coexist with water and adapting to their changing environment start at a young age.

The beautiful canals that flow through Rotterdam constantly remind residents of the value and power of water. Children's books illustrate lessons about canals, and students compete in public sand castle building competitions tutored by expert engineers to see whose structures can resist to the pressure of waves for the longest time. Some schools incorporate rainwater basins that collect and store water, and at the same time constitute a natural area of the school, allowing for a number of outdoor educational activities.

Environmental awareness and education is well-taught and ongoing - as important to Rotterdam's water-resilience as dikes and water squares.

Dutch school kids participating to the Battle of the Beach near Noordwijk, Netherlands.

Tactics for applying this lesson in your city:

- **Use your city as a laboratory to teach students about water-related risks and opportunities.** Long-lasting, generational change starts at a young age when children are exposed to the value and potential of water. To help new generations better understand their changing environment and lead efforts in this space, partner with educators to incorporate themes of water literacy into traditional curricula and leverage sites outside schools as spaces for water education and experience – from interactive museums to water parks.

- **Develop exchange programs and other trainings to improve practitioners' expertise in resilient water management approaches.** Bring in engineers, architects, urban planners and other practitioners at the outset of project ideation and implementation, and build their awareness and expertise in water resilience thinking and practice. This way, they will be better positioned to not only co-own any new visions for your city's resilient water management future, but also take action upon it. In this space, exchange programs that involve a range of practitioners – from policy-makers to engineers to politicians - are an efficient way to inspire new thinking and best practice sharing.

"There is a need to change experts' culture from focused on large infrastructural projects to a more integrated thinking - for example by encouraging exchanges among experts from different parts of the world."

Arnoldo Matus Kramer, CRO of Mexico City, Mexico

INNOVATIONS FROM THE 100RC NETWORK

Practitioner-focused Exchanges: The "Dutch Dialogues"

The "Dutch Dialogues" are practitioner-focused exchanges where Dutch engineers, urban designers, landscape architects, urban planners, academics and government officials workshop with host city counterparts to explore creative solutions and holistic concepts to water management. These multidisciplinary workshops embrace an integrated approach to water management acquired by the Dutch over centuries of living in proximity with water and recognizing water as a central asset with growing value.

The Dutch Dialogues were initiated by Dale Morris from the Royal Netherlands Embassy in Washington DC and David Waggoner, a local New Orleans architect.

In New Orleans, the Dutch Dialogues led to the development of the award-winning Greater New Orleans Urban Water Plan, and in New York this approach informed the Rebuild by Design Competition. Drawing from ideas explored during the 2015 Virginia Dutch Dialogues, the City of Norfolk played a leadership role in developing a recent proposal submitted by the Commonwealth of Virginia to the Department of Housing and Urban Development for funds to build resilience to community threats, including flooding.

www.dutchdialogues.com

Dutch Dialogues in Hampton Roads, Virginia (USA)

7. Articulate your Vision

Create a compelling vision to give a bigger picture of what a water-resilient city can look like.

Having a strong vision will help you motivate action, attract champions, and ensure continuity and consistency in the process to create wins along the way.

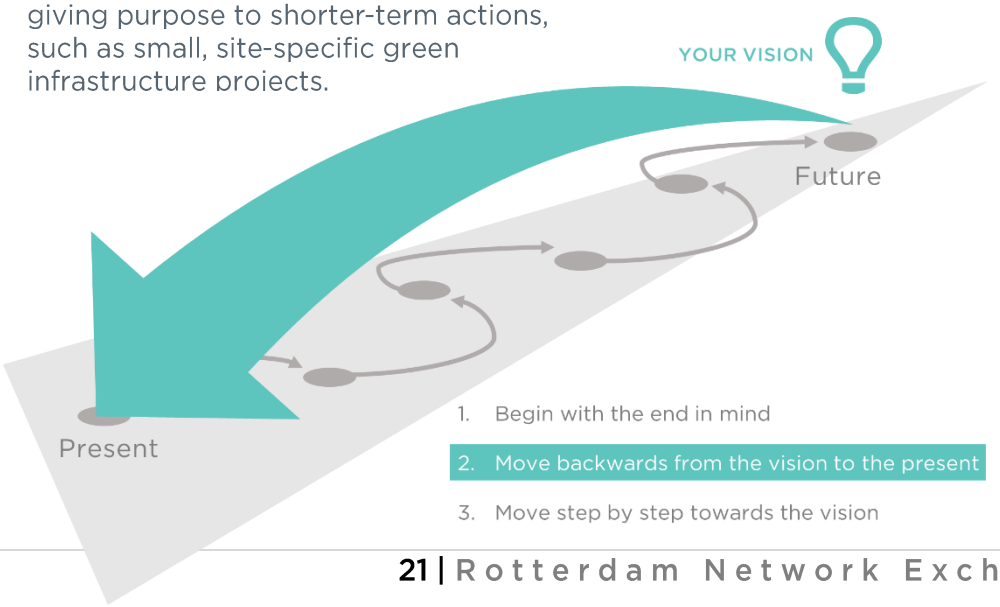
Tactics for applying this lesson in your city:

- **Frame your city's water-related challenges in asset-based rather than deficit-based terms.** Whether the problem is that there's too much water - in the face of sea level rise or recurrent flooding - or too little water, your vision should emphasize the unique, abundant opportunities that a resilient approach to water management can bring to your city for economic, societal and cultural gain.
- **Be both pragmatic and aspirational.** The best way to lead people into the future is to connect them to present opportunities. But innovation and adaptation are long-term activities, and maintaining a three-month horizon inhibits the creativity and investment needed to build a resilient water management system. Long-term scenarios can help you clarify and articulate ultimate objectives while giving purpose to shorter-term actions, such as small, site-specific green infrastructure projects.

> *"It's not enough and it's not inspiring to community members to only talk about deferred maintenance and budget short falls. City leaders need to articulate a vision for what's possible and how improved storm water management can create multiple benefits for the community."*
>
> **Timothy Burroughs, CRO of Berkeley, California**

> *"Witnessing Rotterdam's relationship with water really impacted us. They don't see water as a problem. They are convinced that water itself is the source of their city's value, and as such, they handle water as a positive resource."*
>
> **Jonas Kroustrup, CRO of Vejle, Denmark**

> *"Design short, medium and long term solutions, without becoming dependent on immediate needs and short-term objectives."*
>
> **Kamlesh Yagnik, CRO of Surat, India**



8. Tell a Great Story to Your Stakeholders

Use creative approaches to tell an effective story about the benefits of resilient water management solutions.

Unlike some traditional infrastructure projects, such as seawalls, which have clearly visible functions and benefits, the multifaceted advantages of resilient projects are not always visible or immediate. For example, the efficacy of coastal green infrastructure alternatives (as well as their added ecological, economic and social benefits) might be less self-evident, especially in the short-term.

Creative and evidence-based storytelling will help you celebrate successes and convey long-term objectives to decision makers, local communities and implementers, ultimately creating a virtuous cycle for developing and investing in resilient water solutions in your city.

Tactics for applying this lesson in your city:

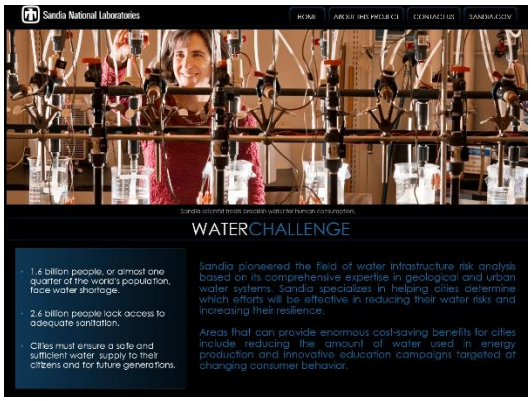
- **Capture the value of existing or future resilient water management solutions.** Whether you're monitoring existing projects or creating future scenarios, use data to quantify the added value of resilient water management approaches (e.g. the added value to real estate created by greening the neighborhood for sponge function). At the same time, try to quantify indirectly-created benefits, such as savings from water efficiencies and avoided losses from storm or flood damages. And when possible, use proxies to determine the added value of non-financial outcomes, such as the social, health or ecological returns to green infrastructure solutions for coastal protection.

INNOVATIONS FROM THE 100RC NETWORK

Calculate the Risk of Inaction to Economic Assets: The Norfolk-Sandia Partnership

The City of Norfolk, Virginia, partnered with Sandia National Laboratories, a 100RC platform partner, to assess the potential economic impact of a storm on Norfolk's key assets and the resultant economic impact on the city and the nation as a whole. The analysis will help understand the interdependencies between critical infrastructures that lead to increased sea level rise/flood risk and economic assets, and make a case for regional and national partnerships for more investment in resilient protective measures.

http://www.sandia.gov/cities/



http://www.sandia.gov/cities/waterNEEDS.html

"We need tools that help us quantify the value of resilient water management approaches to support our visions and narratives for the future of our cities."

Arnoldo Matus Kramer, CRO of Mexico City, Mexico

- **Use advanced technologies to tell stories about risks and opportunities.** Modeling, simulation and visualization technologies can enhance understanding of your city's water-related challenges and identify the best solutions to address them, but also support your storytelling efforts - whether you want to convey a story about the imminence and urgency of a problem, or a story about a better, water-resilient future. For example, interactive simulations allowing citizens to view scientific data and explore climate change projections at any scale in their own neighborhood, can help them understand these often abstract phenomena at a local scale. The visualization of alternative long-term scenarios can connect different stakeholders to mutual problems, enhancing awareness and collaborative problem-solving at all scales of society and government.

"We need to shift the narrative from risks to opportunities and involve people in "playing with water" through modelling, simulations and other tools."

Alessandro Coppola, CRO of Rome, Italy

- **Use pilots and demonstrations.** Smaller-scale projects can not only help you test cutting-edge water technologies at a relatively lower risk, but also allow you to collect useful data on performance to foster future investments and scaling. Complementing these efforts with demonstration sites and museum-like exhibits can help you engage residents and cultivate a well-informed, supportive public for the implementation of your broader vision.

INNOVATIONS FROM THE 100RC PLATFORM

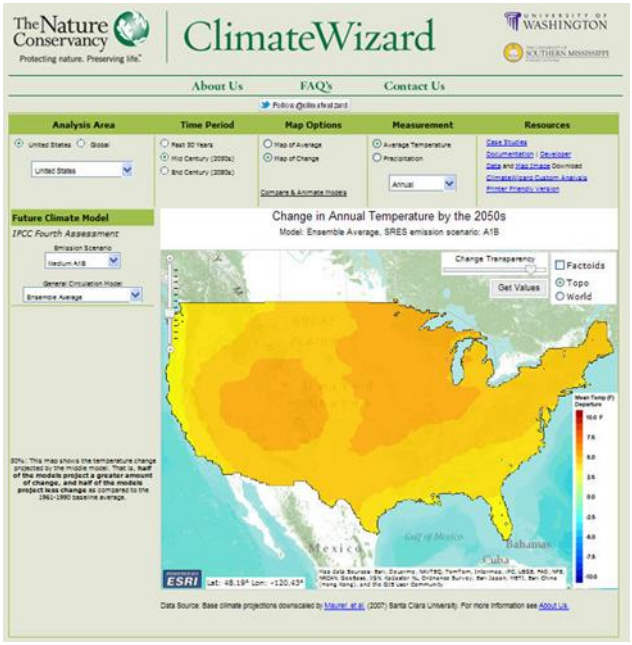
Scenarios and Simulations: The Nature Conservancy's Climate Wizard Tool

The Nature Conservancy's Climate Wizard Tool represents the first time ever the full range of climate history and impacts for a landscape have been brought together in a user-friendly format. This web-based program allows the user to choose a state or country and both assess how climate has changed over time and to project what future changes are predicted to occur in a given area.

The Climate Wizard tool is suited for:

- Helping cities understand the potential impacts future climate conditions may have on a variety of conservation targets
- Help evaluate the future ecological conditions of water resources and develop resilient management strategies
- Help cities understand the significance in variables of temperature and precipitation
- Enabling cities to visualize and better communicate the impacts of climate change.

http://www.climatewizard.org/



Because smaller-scale projects are not an end in itself but a means to scale solutions and achieve broader goals, it's important to integrate them with larger plans and ongoing efforts – always keeping the bigger picture in mind.

INNOVATIONS FROM THE 100RC NETWORK

Green Infrastructure Demonstration Projects: The New Orleans Urban Water Plan

The New Orleans Redevelopment Authority (NORA) and Sewerage & Water Board of New Orleans (SWBNO) are building a series of green infrastructure demonstration projects to show the public how underutilized spaces can be developed to detain storm water and designed to make neighborhoods more attractive. NORA is transforming vacant lots into rain gardens that draw runoff from the street, store it temporarily, and capture many of the pollutants it carries. SWBNO is funding innovative green infrastructure solutions such as green roofs bios wales, and pervious pavement. These projects show us what is possible and how infrastructure can not only protect us but also beautify our communities.

These projects are part of the Greater New Orleans Urban Water Plan, a new approach that focuses on ways to detain and store water within city limits to help slow subsidence and alleviate some of the stress on New Orleans drainage network. The New Orleans Urban Water Plan was awarded the National Planning Excellence Award for Environmental Planning by the American Planning Association (APA).

https://www.planning.org/awards/2015/environmental

- **Monitor and communicate progress on a regular basis to keep your story alive.** To keep your vision in the mind and heart of your community requires constant communication. Use data collection, monitoring, and evaluation to track progress along the way and communicate it in a way that is user-friendly and well understood by the community. Whether you share this data through regular news releases or more creative channels, such as websites, social media and Apps, the key is to ensure that a reliable and digestible stream of information on your progress is communicated to the public. At the same time, you should keep the lines of dialogue open and encourage ongoing input and comments from the public. This will allow you to maximize opportunities for iterative feedback and refinement within the process, as well as increase overall transparency and engagement.

"To keep your plan alive, you should publicize progress and successes along the way. For example, in Berkeley we collect monitoring data on the performance of the City's Climate Action Plan, we develop stories and infographics, and we share them to keep the people aware and involved."

Timothy Burroughs, CRO of Berkeley, United States of America

"In some circumstances, it is more practical to start with small-scale projects to prove the success of the solution before moving to big scale."

Tantikom Supachai, CRO of Bangkok, Thailand

INNOVATIONS FROM THE 100RC NETWORK

Communicate Progress to the Community: the Delta City Rotterdam App

Rotterdam launched the Delta City Rotterdam App, providing its community members and visitors with an innovative tool to explore the city and learn about the actions it has taken to protect itself against flooding – a key climate adaptation risk. "Hotspots" on the App allow users to discover the broad network of solutions the city has implemented, such as multifunctional dykes, smart spatial design, water plazas and the Maeslant Barrier. At each point, the App offers insight on how and why these measures work and how they are part of an integrated strategy for the entire city.

Screenshot of the Delta City Rotterdam App, available for download here.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SECTION 5

Conclusions

This first-ever 100RC Network Exchange offered a critical learning and network-building moment for participating CROs and resilience practitioners. By engaging in an intensive learning experience around a common resilience challenge, participants had the opportunity to go deep and share the type of knowledge, insights and lessons that they can bring back to their resilience-building work in their own cities. The Exchange also paved the way for future inter-city cooperation around resilient water management. Member cities Norfolk, New Orleans and Rotterdam are already collaborating around ideas for enhancing port resilience, while Mexico City and Rotterdam are dialoging on the implementation of water plazas in the Mexican capital. And as more participating cities advance through their resilience strategy process and into implementation, they will continue to translate the lessons learned through the Exchange into real action in their cities, whether that's through Vejle's reconceptualization of a sluice project with a water-resilient lens or other programs, policies or projects.

© Vittoria Zanuso

As important as these lessons for participants are, it is the collective insights and practices shared through this handbook that will ensure that the impact of these three days reverberates throughout the 100RC Network and beyond.

In addition to the tactical solutions and tools from both participating 100RC member cities and 100RC Platform partners put forward in this report, the Rotterdam Network Exchange offers valuable insights for the broader 100RC Network and offers a road map for those considering future Exchange proposals to 100RC:

- **Value of multi-sectoral participation**: Among the key insights gleaned was the importance of collaborating not only with fellow CROs and city officials from participating member cities, but with members of private, non-profit and academic sectors. The breadth of perspectives brought by this diverse group of participants led to a rich exchange of valuable information.

- **Depth of city participation:** The Exchange also offered host city of Rotterdam the chance to galvanize their important resilience stakeholders from the public sector in support of the convening, giving the CRO and his team the opportunity to elevate the resilience work and the power of the 100RC Network and at the same time provide ambassador CROs and officials with the chance to talk in depth with project managers and leaders of a variety of initiatives and perspectives.

• **Balance of sharing both successes and struggles:** Exchange participants expressed the importance of learning not only from successes of their respective cities, but also the real challenges they have experienced. Learning from what has not worked in the past or what is not working presently can be as valuable as what might be considered a best practice.

• **Diversity of member city participation:** While the participation of nine member cities certainly made coordination more challenging, the diversity of cities engaged in the Exchange enriched the experience and brought a range of perspectives that opened new lines of inquiry among participants. Future Network Exchange proposals should consider diverse composition of participants – from a geographic, city-size and other perspectives.

• **Creation of space for 'mind-shift' moments:** Across all participating CROs and resilience practitioners, a constant refrain following their participation in the Exchange was the mind shift or change in perspective that came as a result of the three-day immersive experience. The Exchange made all member city participants re-evaluate their approaches to long-standing challenges in their cities and brought a greater appreciation for the power of peer collaboration in getting to solutions.

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CRO AMBASSADORS' Asks to the Network*

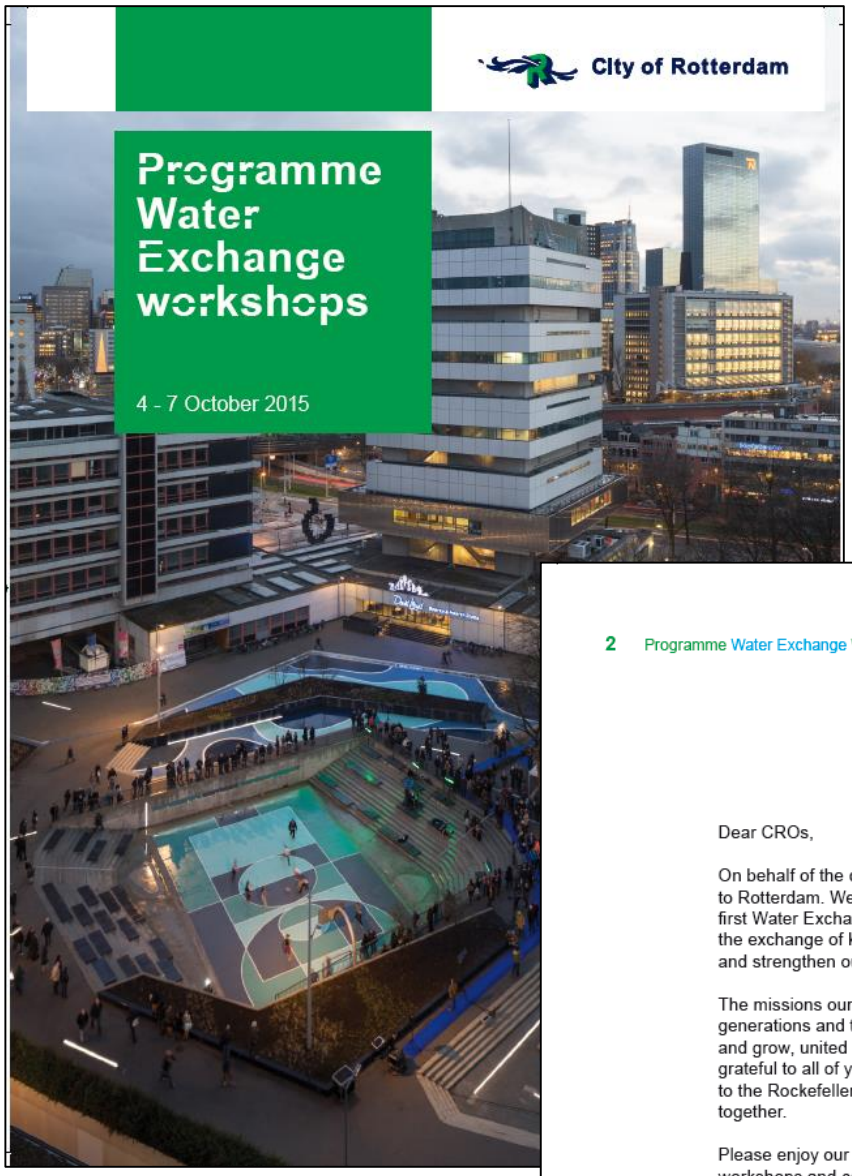
- Modelling, storytelling and simulation tools to support problem definition and illustration
- Innovative financing mechanisms and tools
- Technical assistance in green infrastructure design
- Tools to capture and communicate the direct and indirect value of multi-benefit solutions (including non-monetary co-benefits)
- Successful methods to scale demonstration projects across districts
- Best practices in community engagement and awareness building around resilient water management
- Advice on how to integrate the resilience agenda with existing narratives e.g. smart city or sustainability
- Best practices in urban water governance that build long-term sustainability across departments and sectors
- Green mapping tools to identify what areas can be used for water storage
- Best practices in water literacy curricula and partnerships with schools and knowledge institutes
- 100RC influence on national, regional and international decision-makers and bodies to bring attention to the 'resilient water agenda'

*The Network is broadly intended as the collective of practitioners interested in building resilience globally – from fellow CROs and member cities facing water-related challenges, to international organizations, private sector providers, and other external stakeholders innovating in this space.

The power of the Rotterdam Network Exchange and future proposed Exchanges lies in the potential for lessons learned, insights gained and solutions shared through these intensive learning moments to be taken up and applied to the long-term resilience-building efforts of both participating member cities and all member cities of the 100RC Network. The dialogue initiated in Rotterdam will enrichen the Network-wide conversation on resilient water management and multi-benefit solutions and help shape the future of the 100RC Network water agenda.

Appendix

A I Detailed Program



Dear CROs,

On behalf of the city government, I would like to welcome you to Rotterdam. We are proud and honoured to be host to the first Water Exchange Workshops. We are looking forward to the exchange of knowledge and experience that will enrich and strengthen our combined cities.

The missions our cities are on, are crucial for current generations and those to come. The manor in which we share and grow, united across the world, is unprecedented. I am grateful to all of you for joining in this combined effort, and to the Rockefeller Foundation in particular for bringing us together.

Please enjoy our city during your stay, I wish you all fruitful workshops and collaborations.

Sincerely,

Pex Langenberg
Vice-mayor for mobility, sustainability and culture

Day 1 / 4 October

SUNDAY		
TIME	WHERE	WHAT
16.00 - 16.30	Inntel Hotel	Register
16.30 - 18.00	Inntel Hotel	Informal meeting for CROs, Rotterdam crew, 100 RC reps and international city reps
18.00 - 21.30	Euromast	Informal dinner for CROs, Rotterdam crew, 100 RC reps and international city reps


Tantikom, Supachai
CRO Bangkok


Burroughs, Timothy
CRO Berkely


Matus Kramer, Arnoldo
CRO Mexico City


Herbert, Jeff
CRO New Orleans


Morris, Christine
CRO Norfolk


Coppola, Allesandro Gianni
CRO Rome


Arnoud Molenaar
CRO Rotterdam


Kamlesh Yagnik
CRO Surat


Kroustrup, Jonas
CRO Vejle

Day 2 / 5 October

MONDAY		
TIME	WHERE	WHAT
09:00 – 09:15	Floating Pavilion	Welcome
09:15 – 12:00	Floating Pavilion	Presentations by **Jeff Herbert**, **Christine Morris**, and the City of Rotterdam and partner organizations, introducing and explaining the Rotterdam Climate Change Adaptation Strategy in all its aspects.
12:00 – 13:00	Floating Pavilion	Lunch
13:00 – 17:00	Site visits	Visits to several examples of the Rotterdam strategy, including the Benthemplein water square, ZoHo district, Westersingel promenade, the underground water storage facility at the Museumparkgarage and the RDM Campus.
17:00 – 17:15	RDM Campus	Water Taxi
17:30 – 21:30	Inntel Hotel	Networking event: Walking dinner with stakeholders

Key guest speakers of the day: **Paula Verhoeven** (director Urban Planning), **Peter van Veelen** (City of Rotterdam, Technical University of Delft), **Gijs van de Boomen** (RDC), **Dirk Peijper/Florian Boer** (Urbanisten), **Paul van Roosmalen** (City of Rotterdam), **John Jacobs** (City of Rotterdam)

Day 3 / 6 October

TUESDAY		
TIME	WHERE	WHAT
09:00 – 10:30	Inntel Hotel	Deep Dive Sessions: • Welcome and opening • Explanation the logistics and goals • All 9 cities: **3 minute pitch** of their case and challenge (in front of their poster)
10:30 – 12:00	Inntel Hotel	First group Deep Dive sessions (4 groups, each 2 cases and Rotterdam): enrich your cases; several methdologies will be applied like 'Charettes', 'Design sessions', elaborating mains of building blocks towards resiliency, capacity building. All aligned to your specific needs.
12:00 – 12:30	Inntel Hotel	Plenary feedback (1)
12:30 – 13:30	Inntel Hotel	Lunch
13:30 – 16:30	Inntel Hotel	Second group Deep Dive sessions (4 groups, each 2 cases and Rotterdam): enrich your cases; several methdologies will be applied like 'Charettes', 'Design sessions', elaborating mains of building blocks towards resiliency, capacity building. All aligned to your specific needs.v
16:30 – 17:00	Inntel Hotel	Plenary feedback (2)
17:00 – 17:15	Inntel Hotel	Closing the Deep Dive Session

Moderators: **Wynand Dassen** (City of Rotterdam), **Gabriëlle Muris** (Urban Impact), **Eric Schellekens** (Arcadis)

Day 4 / 7 October

WEDNESDAY		
TIME	WHERE	WHAT
09:00 – 13:00	Inntel Hotel	Finalize Deep Dive Sessions and wrap up. Identify the results, insights gained and lessons that need to be exchange with other 100RC members
13:00 – 14:00	Inntel Hotel	Lunch
14:00	Inntel Hotel	End

B I Participants List

CHIEF RESILIENCE OFFICERS

Tantikom Supachai
CRO Bangkok

Timothy Burroughs
CRO Berkeley

Arnoldo Matus Kramer
CRO Mexico City

Jeff Herbert
CRO New Orleans

Christine Morris
CRO Norfolk

Alessandro Coppola
CRO Rome

Arnoud Molenaar
CRO Rotterdam

Kamlesh Yagnik
CRO Surat

Jonas Kroustrup
CRO Vejle

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Paul Nelson
Network and Learning Director

Vittoria Zanuso
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Head of Special Projects Mexico City

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Project manager soil investigation and decontamination / CRO team Rotterdam

Lydia Hameeteman
Project Manager Sustainability, Rotterdam

Ella van der Hout
Advisor geotechnics and hydrogeology / CRO team, Rotterdam

John Jacobs, Advisor Water Management and Climate Change
Rotterdam

Wim de Jager
Team leader / CRO team, Rotterdam

Ruben Lazos Valencia
Head of Environment Regulation Government Mexico City

Joep van Leeuwen
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Jaap Nederlof
Head of Engineeringscompany , Rotterdam

Jorg Pieneman
Civil Engineer, Rotterdam

Pierluigi Potenza
CRO team Rome

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Advisor Green Roofs and sustainability, Rotterdam

Peter van Veelen
Advisor Water- and Spatial planning, Rotterdam

Francesco La Vigna
Geologist Rome

Ron Williams
Deputy City Manager Planning and Infrastructure

EXPERTS

Ronald Albers
Team Manager TNO Knowledge for Climate, University Utrecht

Florian Boer
Urban designer & founder, De Urbanisten

Gijs van den Boomen
Director urban design, landscape and architecture, Kuiper Compagnons

Peter Bosch
Project leader TNO, Knowledge for Climate, University Utrecht

Nanco Dolman
Leading Professional Water Resilience in Urban Areas, Royal Haskoning DHV

Rutger de Graaf-van Dinther
Director and founding partner, Deltasync

Hans Gehrels
Expert advisor/manager Sustainable Cities, Deltares

Arthur Gleijm
Director, Rebel Group

Lupe Jimenez
Royal HaskoningDHV

Frank van der Heijden
Business director urban climate adaptation, Arcadis

Marjan Kreijns
Head Project Management Department, Valorisation Centre TU Delft

Jos Maccabiani
Director Professional Services , SkyGeo

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Enrico Moens
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Owner, Urban Impact

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Bas van de Pas
Senior advisor Watermanagement and Spatial Planning, Deltares

Dirk van Peijpe
Urban designer & founder, De Urbanisten

Michiel Pols
Project Developer, InnovationQuarter

Bas Reedijk
Head Coastal Engineering BAM Infraconsult, Delta Marine Consultants

Bart Roeffen
Water Pioneer at Blue 21, Partner at Deltasync

Eric Schellekens
Program Manager Climate Change, Arcadis

Steven Slabbers
Managing Director, Bosch Slabbers

Tim van der Staaij
Back Office Manager, Rotterdam Centre for Resilient Delta Cities

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Economic Specialist. Arcadis

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Ass. Professor at Hogeschool Rotterdam
Senior Advisor and Program Manager Port of Rotterdam

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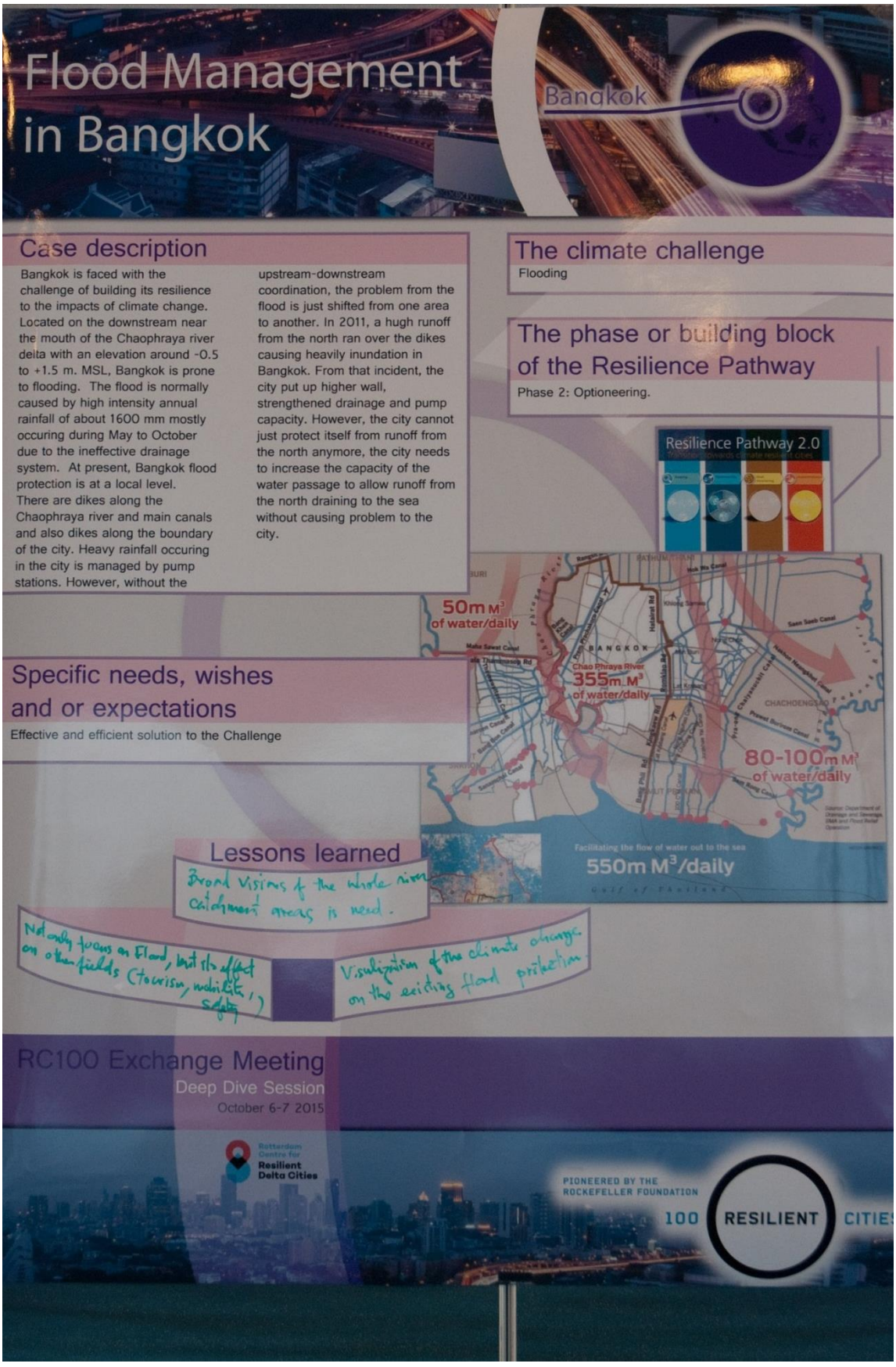
Managing Director, Beladon

Chris Zevenbergen
Professor UNESCO-IHE & TU Delft
Strategic Advisor Dura Vermeer, Member of the Board of Clean Tech Delta


Flood Management in Bangkok
Bangkok
Case description
Bangkok is faced with the challenge of building its resilience to the impacts of climate change. Located on the downstream near the mouth of the Chaophraya river delta with an elevation around -0.5 to +1.5 m. MSL, Bangkok is prone to flooding. The flood is normally caused by high intensity annual rainfall of about 1600 mm mostly occuring during May to October due to the ineffective drainage system. At present, Bangkok flood protection is at a local level. There are dikes along the Chaophraya river and main canals and also dikes along the boundary of the city. Heavy rainfall occuring in the city is managed by pump stations. However, without the upstream-downstream coordination, the problem from the flood is just shifted from one area to another. In 2011, a hugh runoff from the north ran over the dikes causing heavily inundation in Bangkok. From that incident, the city put up higher wall, strengthened drainage and pump capacity. However, the city cannot just protect itself from runoff from the north anymore, the city needs to increase the capacity of the water passage to allow runoff from the north draining to the sea without causing problem to the city.
The climate challenge
Flooding
The phase or building block of the Resilience Pathway
Phase 2: Optioneering.
Resilience Pathway 2.0
50m M³ of water/daily
Chao Phraya River
355m M³ of water/daily
80-100m M³ of water/daily
Facilitating the flow of water out to the sea
550m M³/daily
Specific needs, wishes and or expectations
Effective and efficient solution to the Challenge
Lessons learned
Broad visions of the whole river catchment areas is need.
Not only focus on Flood, but the affect on other fields (Tourism, mobility, safety)
Visualization of the climate change on the existing flood protection
RC100 Exchange Meeting
Deep Dive Session
October 6-7 2015
Rotterdam Centre for Resilient Delta Cities
PIONEERED BY THE ROCKEFELLER FOUNDATION
100 RESILIENT CITIES

BANGKOK - CRO NOTES	
Challenge	Water Management. Bangkok Flooding Master Plan: The plan was over 25 years old and did not take into account the effect of climate change, sea water rising and land subsidence. Also the area outside the protection dyke have been transformed to urban area.
Lessons Learned	- The engineering sollution only cannot solve the city flood problems - In some circumstance, it is more practical to start with a small scale to proove the success of the solution before moving to big scale - Water is not the problem but is the opportunity to have a good life - Long term planning, including climate change effect, is important - Almost every city has the same problems of outdated infrastructures. It is impossible to replace all those infrastructures, hence the proper operation and maintenance are essential in water management
Mind-Shift	- Think of multipurpose solutions - Public participation is the key success factor
Next Steps	- Vulnerablity assessment - Capacity building - Technology

Berkeley

Flooding due to aging storm water infrastructure and climate change

Case description

The City of Berkeley has approximately 100 miles of 100-year-old storm water pipes. The storm water system is degrading over time, and the challenge is exacerbated by a combination of sea-level rise and extreme rain events. The result is periodic flooding, especially in west Berkeley near the San Francisoco Bay. The flooding disproportionatly affects low-income residents.

The climate challenge

Sea-level rise and unpredictable, extreme rain events exacerbate existing challenges assocated with aging infrastructure.

The phase or building block of the Resilience Pathway

The City of Berkeley is active in all phases of the "Resilience Pathway 2.0" and is interested in learning more about effective strategies for each phase.

Specific needs, wishes and or expectations

Innovative financing/funding, design, and engineering for projects that mitigate flooding and create other community benefits

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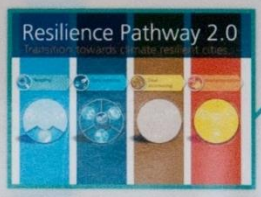

Lessons learned

Define the problem

Think outside the box

Develop scenarios to compare costs/benefits
- short and long term

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BERKELEY - CRO NOTES	
Challenge	I was motivated to participate in the exchange to learn innovative, multi-benefit techniques designed to help cities manage storm water and mitigate flooding. Rotterdam is world-renowned for its water management engineering, so I wanted to learn from the best. The challenge I brought to Rotterdam was Berkeley's degrading storm water infrastructure, which is a problem that is exacerbated by sea-level rise and more unpredictable rain storms. My city experiences regular flooding in its western neighborhoods, where many low-income residents live and some of our oldest businesess. The risk associated with flooding in Berkeley are largely economic and social. There are significant costs to the City, residents and businesses associated with floods. In Berkekey, these costs disproportionately affect low-income residents and older, smaller businesses. There are also environmental impacts of flooding, as storm water carries pollutants into the San Francisco Bay and Berkeley's streams. Opportunities exist to capture storm water and reuse it for other purposes. Opportunities also exist to reduce the volume and velocity of storm water in order to minimize flooding and protect property and ecosystems. I'd like also to manage storm water in Berkeley in a way that educates our community members aboout local ecosystems and how storm water affects them.
Lessons Learned	1. It's important to understand, articulate and illustrate the problem. I will apply this lesson learned in Berkeley by doing additional modeling of the storm water system and the associated flows, and using the modeling to tell a more effective story about the risks. Modeling also helps identify opportunities for interventions. 2. It's important to identify short- and long-term scenarios for advancing storm water management. Longer-term scenarios help to clarify and articulate the ultimate objectives while giving purpose to shorter-term actions, such as a small, site-specific green infrastructure projects. This guiance is useful for Berkeley as we embark soon on a Stormwater Management Plan as well as the Resilience Strategy. 3. Think outside the box. The Dutch are wonderful at implementing creative ways to manage storm water, and their techniques often result in multiple benefits. Historically in Berkeley our approach as been to get storm water out to the Bay as fast as possible. I'm now inspired to think more creatively about ways to capture storm water, or at least slow it down, rather than focusing on running it to the Bay. 4. Articulate a vision. It's not enough and it's not inspiring to community members to only talk about deferred maintenance and budget short falls. City leaders need to articulate a vision for what's possible and how improved storm water management can create multiple benefits for the community. This takeaway will guide my approach to how I frame the need and opportunities in Berkeley. 5. Leverage successes. Berkeley has many green infrastructure projects in the ground already. We can do a better job at monitoring and reporting the benefits of those projects, in order to leverage them for future funding proposals.
Mind-Shift	The focus of the exchange on storm water management was both inspiring and practical. It was also extremely useful (and therapeutic) to spend time with fellow CROs who are working on similar challenges and working through a common 100RC process. I left the exchange inspired and energized to regroup with my Berkeley storm water team and facilitate a process of identifying some innovative solutions to flooding in West Berkeley. Going into the exchange, my objecitve was to find ways to get that flood water to drain out the the Bay. After the exchange I am more interested in capturing that storm water in creative and visible ways, such as the Water Plaza that was implemented in Rotterdam. The team at Rotterdam took what is frequently an invisible problem that is hidden underground, and they shined light on it through innovative water retention interventions. I'm inspired to try similar efforts in Berkeley.
Next Steps	One of my key takeaways was the need to better define, articulate, and illustrate the storm water challenge in Berkeley. Platform Partners that can do this modeling and story telling are very helpful. I know both MWH and Deltares have this expertise (and I am working with MWH now). I think cities also need assistance with infrastructure design, specifically green infrastructrue. Financing is always a challenge. Cities are falling behind on infrastructure maintenance, let along capital improvements. We need scalable solutions that help us to start making a dent in deferred maintenance and captial improvement needs. Ongoing sharing across cities within the network on the topic of storm water management would also be useful. Cities and other agencies (public or private) could report on best practices for the benefit of the network, with the goal of generating project ideas that could be pursued in individual cities or across multiple cities.

Xochimilco resilient water management in times of climate change

Case description

Xochimilco is a World Curtural and Environmental Heritage Site by UNESCO. Home to the remainings of the lake of the Valley of Mexico, a place of water channels and of traditional agricultural plots from the Aztecs time, called Chinampas.Xochimilco suffers from high environmental degradation and pressure from the expansion of illegal settlements with poor urban services affecting the conservation natural protected area.

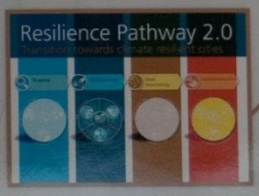
Urban sprawl and current water management practices affect the quality of water and environmental services provided by Xochimilco (agriculture, tourism, etc.). Despite its rich historical, cultural and environmental services that this site provides to the city, this area is facing an existencial treath. There is a need for a transformational adaptation change centred in the relation of Xochimilco with water.

The climate challenge

There are two dimensions of Xochimilco in relation to climate change. First, the existensial treath of Xochimilco would affect local climate of Mexico City and reduce the overall water resilience of the city. Second, Xochimilco, is also affected by different climate change impacts such as climate extreme events like droughts and extreme rains causing floods.

The phase or building block of the Resilience Pathway

Phase 2: Optioneeing. This phase is quite relevant for Xochimilco given that the master plan to make Xochimilco an area of strategic management for the city. This will be implemented in the next 12 months.



Specific needs, wishes and or expectations

To understand better approaches to integrate externalities and co-benefits in ithe value of water resources. To get inspired by green infrastructure to enhance water urban resilience and adaptation to climate change. To understand governance approaches for long-term planning for water resources at the city level.

Lessons learned

Use the narrative related to an urgent moment of change:
- Do nothing scenarios
- Long-term scenarios

Create value for water:
- For redevelopment/vulture
- Climate change adaptation

Connect across sector opportunities
- Social housing
- Transport
- Water quality (tourism/agriculture/etc.)

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MEXICO CITY - CRO NOTES	
Challenge	To understand better approaches to integrate externalities and co-benefits in ithe value of water resources. To get inspired by green infrastructure to enhance water urban resilience and adaptation to climate change. To understand governance approaches for long-term planning for water resources at the city level. The case study is Xochimilco resilient water managemet in times of climate change 1. Mexico City is built in a lake-basin 2. Xochimilco is an UNESCO world heritage site 3. Illegal settlements in Xocimilco cause high environmental degradation and affect the natural protected area. Urban sprawl and current water management practices affect the quality of water and environmental services provided by Xochimilco (agriculture, tourism, etc.). Xochimilco is a World Curtural and Environmental Heritage Site by UNESCO. Home to the remainings of the lake of the Valley of Mexico, a place of water channels and of traditional agricultural plots from the Aztecs time, called Chinampas. Xochimilco suffers from high environmental degradation and pressure from the expansion of illegal settlements with poor urban services affecting the conservation natural protected area. Urban sprawl and current water management practices affect the quality of water and environmental services provided by Xochimilco (agriculture, tourism, etc.). Despite its rich historical, cultural and environmental services that this site provides to the city, this area is facing an existencial treath. There is a need for a transformational adaptation change centred in the relation of Xochimilco with water.
Lessons Learned	1. Combine the needs for this area with the goals for all Mexico City. Integrate this concept in the desing of the new Mater Plan for Xochimilco. 2. Create a do-nothing scenario, for use in the narrative on the cities' vision on the future. UNAM is developing a large research project where they have modeled the impact in local climate and environment if Xochmilco dissapears. The Resilience Office will follow up with UNAM the possible creation of a do-nothing scenario. 3. There is a need to change the expert's culture form focused on large infrastructural projects to more integrated thinking. E.g., by getting experts in tough with experts from over the world and start pilots. Find a business model that integrates the diversity of water sources with possible new economies. It is very important to consolidate a consulting team able to have an integrated thinking process. This is work in process. 4. Generate a narrative and ideas on why it is important to give space to the lake. It is on the agenda, only on a low level. Use the CRO Summit and the Resilience Strategy to create this narrative and increase the attention for water in the city agenda. 5. There is a need of making a coalition of stakeholders. E.g., water authorities have yet to be convinced of integrated approach. We are considering the use of future scenarios (degradation of the aquifer / drought) to create a multi-stakeholder and cross-sectoral process to build a water resilience agenda. 6. Use the transformation of the airport area as an opportunity to make water part of the development. We will have a Resilience Garage to discuss the project of the airport in the next months.
Mind-Shift	1. Use narrative related to an urgent moment of chance: do nothing scenarios and long term scenarios 2. Create value for water: for redevelopment/culture and for climate change adaptation 3. Connect across sector opportunities: social housing, transport, water quality (tourism/agriculture/etc.)
Next Steps	Come out with specific demands for 100RC and Platform Partners is a critical outcome that needs to come out of Exchange Network Workshops. For water resilience is important to get the following support: • Tools and methods to model water basins and its relation with the urban built environment under different scenarios (for example of urbanization, climate change, etc.). • Support for innovative finance and development of water projects with multiple co-benefis (social, economic, flood risk reduction, climate change, etc.). • Best practices of urban water governance to built long-term sustainability and resilience.

New Orleans

Gentilly Resilience District: Comprehensive water management from curb to coast

Case description

Creating a comprehensive vision for a resilience district in one of the lowest-lying and flood-prone areas of the city to serve as an example of great urbanism for the rest of the city and its future development. This includes transforming infrastructure like outfall canals, streets, pumping stations, and the electric grid into amenities for residents and robust and reliable systems during during and outside of crisis events.
This is also an opportunity to improve the urban design and aesthetic features of the district, demonstrating that urban water management can contribute to larger goals of good urban development.

The climate challenge

All of the above. New Orleans, a series of coastal polders where much of the land area is below sea level, is facing rising seas, increasing temperatures, and uncertain weather patterns. The Gentilly area is one of the lowest-lying areas in the city, and the fluctuation of groundwater levels has led to considerable land subsidence, while its position near the sea levee also makes it vulnerable to storm surge.

The phase or building block of the Resilience Pathway

For this project, all of the aspects of the pathway need more development. We are designing a vision and a series of key interventions to achieve it, but options for project selection, prioritization, and benefit calculation are still required.

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Specific needs, wishes and or expectations

- Exploration of connections between hydrologic and social systems.
- Scales and systems work – defining the narrative
- Creative incentives for private property owners
- How to manage/capture/measure benefits for whole system

Lessons learned

CAPACITY BUILDING / COLLABORATION
CURRENT / FUTURE PROFESSIONAL + COMMUNITY COLLABORATION BETWEEN SPATIAL PLANNING + ENGINEERING, DESIGN + OPERATIONS / MAINTENANCE
ACADEMIC EXCHANGE: STUDENTS / INSTRUCTORS FOR FUTURE
· PILOT NEIGHBORHOOD EXCHANGE

TRIGGER / IMPLEMENTATION

PLANNING / DESIGN

CONNECTING COMMUNITY DESIRES TO PROJECT OUTCOMES (SURVEY, DEMONSTRATION)
USE NEIGHBORHOOD AMBASSADORS TO TRIGGER IMPLEMENTATION OPPORTUNITIES ELSEWHERE.
ADDITIVE -VS- SUBTRACTIVE

FINANCING

VALUE CAPTURE FROM INCREASED PROPERTY VALUES NEAR INTERVENTIONS. REVIEW LIFE CYCLE COSTS / MAINTENANCE BUDGETS OF PROJECTS.
· WHEN DEVELOPING TAXING SCHEMES, DEVELOP WATER MGMT. SUBSIDIES FOR VULNERABLE POPS. (SOLIDARITY)

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NEW ORLEANS - CRO NOTES	
Challenge	New Orleans is cultivating its position as a water city to help solve major urban challenges, but it requires a transformative vision for neighborhoods that includes the reintroduction of water into the urban landscape. Challenge: Creating a comprehensive vision for a resilience district in one of the lowest-lying and flood-prone areas of the city to serve as an example for future development. Anchoring the transformative vision is a series of interconnected water management projects to demonstrate that living with water can also contribute to larger goals of good urban development through thoughtful urban design and economic development. The team was interested in exploring more the connections between hydrologic and social systems to maximize benefits for residents.
Lessons Learned	Planning/Design: Capacity building/colaboration: Current and future professional and community collaboration between spatial planning, engineering, design, and operations and maintenance. Academic exchange is a key opportunity, especially working with instructors and potential ambassadors. Trigger/Implementation: Connecting community desires to project outcomes through surveys and demonstrations, through a focus on a framing of additive benefit rather than replacement or subtraction from the current state. Use neighborhood ambassadors to trigger implementation opportunities in other areas. Financing: Value capture from increased property values near interventions. Review life cycle costs and maintenance budgets of projects. When developing taxing schemes, focus on subsidies for vulnerable populations (the principle of solidarity).
Mind-Shift	A major reminder that will serve to guide implementation moving forward is a focus on vulnerable populations. In New Orleans, like in many cities around the world, those facing the greatest flood risks are also the most socially and economically vulnerable. As the City considers new regulations and strategies to encourage private property adaptation to living with water, those most affected would be the most vulnerable, so it is imperative that their burden is lessened. Additionally, it is crucial for the message of the importance of comprehensive water management as a community development tool to emanate from the community. Developing community ambassadors to champion the development of water management solutions and to spread the word of their multiple benefits will be a focus for New Orleans' projects moving forward. We also were driven to reconsider the ultimate focus of tearing down the canal walls first. The workshop participants challenged our initial thoughts—demonstrating that the best first step might be to work with the walls, adapting them to serve new purposes. Eventually, it might be best to remove the floodwalls, but initially, to seed behavior change around experienceing and living with water, the walls could be a key to community understanding. Another challenge was to our ideas of what the community was fearing. We came to the workshop with the preconceived notion that community members in areas near canals are afraid of changes to the flood infrastructure, but we were reminded that no comprehensive market testing or polling has been conducted recently. Community ambassadors will be key to doing this testing.
Next Steps	As we move forward with the implementation of these projects and ideas, creative finance will be key to scale and overally implementation. Finance is the next step and needs to be more present in the urban water work.

Norfolk

Flooding in Lafayette River Watershed—Structures of Coastal Resilience (Impacts 25% of City's parcels)

Case description

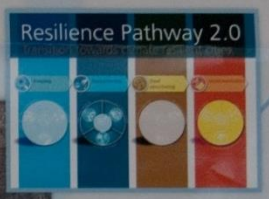
Norfolk is strategic, economic, cultural and ecological important because of the presence of Naval Station Norfolk, the Port of Virginia, a tourist economy and its position at the mouth of the Chesapeake Bay. In storm events, but increasingly during regular rain, people in Norfolk are caught between high seas, particularly in a time of high tide, and rain backing up in creeks and stormwater drains. The city is considering walls, gates and pumps in various locations. But this can only be a short-term solution.

The climate challenge

Flooding: Sea-level rise is unusually high, amplified by land subsidence. In the last 80 years seas rose by 14.5in (36.8cm)

The phase or building block of the Resilience Pathway

Optioneering—Multiple options--small sea walls, creating fingers of high ground, retreat are proposed. High costs require innovative financing.



Specific needs, wishes and or expectations

Consideration of fingers of high ground concept and other options combined with likely financing methods.

Lessons learned

- No Big Barrier - Layers
- Smaller Scale Solutions to distinct Land
- Engage Residents with Strategies + Toolboxes

- Hague - Sponge in the Watershed
- Adapted Sea Wall - Water Storage
- Maintains Tidal Flow

- Ward Step - Layers
- Map Possible Solutions
- Create possible Tool Box
- Start Talking with Residents

Create Apps to Test - Create Opportunity to Test

- Next Step Hague
- Map possible Sponge Areas
- Wi storm water Flow - Moon
- Explore Park - Barrier Solution
- Start Talking w/ Neighbors

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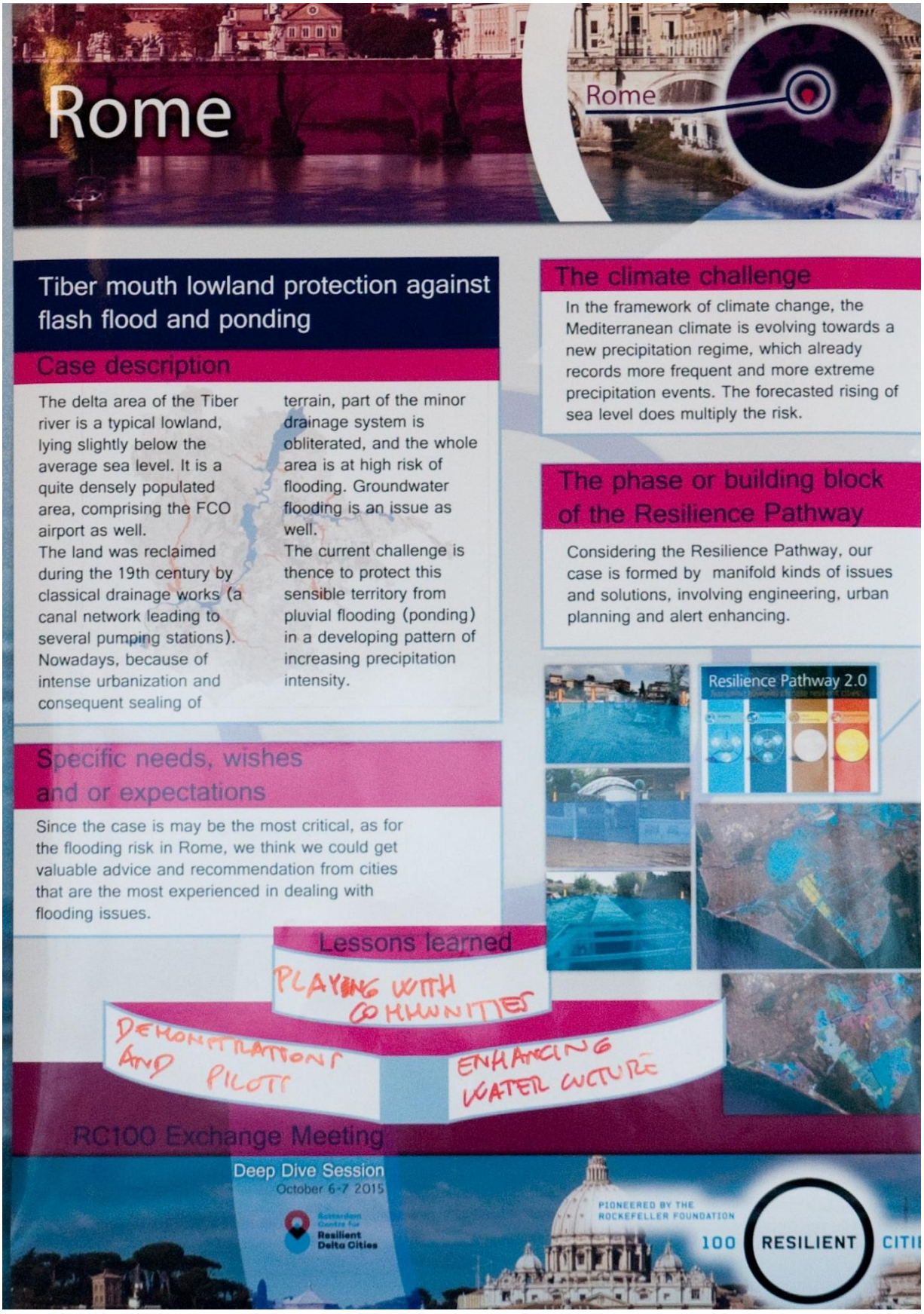
NORFOLK - CRO NOTES	
Challenge	The City of Norfolk has made it a practice to engage with experts from around the globe to investigate innovative practices for managing increasing stormwater and resultant flooding. Since 2008 Norfolk has engaged with Timmons and Fugro Atlantic, The US Army Corps of Engineers, Rockefeller Foundation's RE.invest, RE.bound and Structures of Coastal Resilience projects, participated in a Resilience Garage sponsored by Resilience Action Network, an Urban Land Institute Resilience Technical Panel sponsored by the Kresge Foundation, and hosted a Virginia Dutch Dialogues with Royal Netherlands Embassy. Norfolk brought two challenges—flooding in the Lafayette River watershed and in the Hague/Ghent neighborhood. Both of these areas experience significant nuisance flooding during high-tide events and large precipitation events. The Lafayette Watershed contacts 25% of the cities parcels. The Hague watershed contacts some of the most expensive real estate in the city. Repetitive flooding claims are causing flood insurance rates to climb across the city. This has an adverse impact on real estate values. Finding innovative mitigation methods to reduce flooding in these areas was the main goal of our participation in the exchange.
Lessons Learned	Lafayette River Watershed: 1. Barriers are unlikely to work because of the longterm impact of sea level rise. 2. Need to map the edge conditions to determine the opportunity for building up the coastal edges to decrease flooding from innundation. 1. Hague/Ghent Neighborhood 2. Look at mitigating inside the current tidal basin using a combination of structures: a. Creating a box to hold runoff in the tidal basin b. Create two gates connected to the water storage box c. Working within the current tidal basin rather than outside reduces the depth needed, significantly decreasing the cost. (4 ft vs. 20 ft) 3. Combine hard infrastructure with sponging green spaces in the watershed—take a close look at Stockley Gardens and other parks in the neighborhoods. 4. Use parcel level retention wherever possible.
Mind-Shift	1. The exchange reinforced the need to take a systems approach to water management in complex watersheds. 2. The exchange reinforced the need to think about mitigation in both a time and scale perspective. We can use practices that work for shorter time spands, don't always need to be looking for the 100 year fix. Scale is critical. Not all solutions are large scale. A combination of medium and small scale innovations can be more successful. 3. Always think about parcel level action, use existing spaces more impactfully, focus on a system of systems approach.
Next Steps	1. Capacity to map the Lafayette Riverand the Hague/Ghent watersheds at the parcel level to understand water flow from storms and tidal innundation. 2. Test of the potential efficacy of the smaller scale water gate in the existing tidal basin.


Rome
Rome
Tiber mouth lowland protection against flash flood and ponding
Case description
The delta area of the Tiber river is a typical lowland, lying slightly below the average sea level. It is a quite densely populated area, comprising the FCO airport as well.
The land was reclaimed during the 19th century by classical drainage works (a canal network leading to several pumping stations). Nowadays, because of intense urbanization and consequent sealing of terrain, part of the minor drainage system is obliterated, and the whole area is at high risk of flooding. Groundwater flooding is an issue as well.
The current challenge is thence to protect this sensible territory from pluvial flooding (ponding) in a developing pattern of increasing precipitation intensity.
The climate challenge
In the framework of climate change, the Mediterranean climate is evolving towards a new precipitation regime, which already records more frequent and more extreme precipitation events. The forecasted rising of sea level does multiply the risk.
The phase or building block of the Resilience Pathway
Considering the Resilience Pathway, our case is formed by manifold kinds of issues and solutions, involving engineering, urban planning and alert enhancing.
Resilience Pathway 2.0
Specific needs, wishes and or expectations
Since the case is may be the most critical, as for the flooding risk in Rome, we think we could get valuable advice and recommendation from cities that are the most experienced in dealing with flooding issues.
Lessons learned
PLAYING WITH COMMUNITIES
DEMONSTRATIONS AND PILOTS
ENHANCING WATER FUTURE
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ROME - CRO NOTES	
Challenge	Since the Network Exchange was held in Rotterdam – a city rightly considered as a number one in water management – our goal was to profit and learn from some of the best practices already put in place. Another significant purpose was the sharing and the comparison of knowledge on some new participative aspects in water management (i.e. involvement of diverse stakeholders, initiatives addressed to the general population to improve literacy on water issues). More, we were intested in the experience conveyed by other participant cities, knowing that solutions to similar problems can vary a lot in different city governments and cultural framework. As a final appraisal of our participation to the Network, we can assess that our expectation has been completely satisfied, and we encourage the Foundation to go ahead with such initiatives in other resilience-related issues.
Lessons Learned	As for the lesson learned, we can summarize our understanding as follows: • Climate change is confirmed as the most serious concern in any aspect of water management, from flooding risk to drought, to water resources, up to the very existence of low-lying cities, worldwide. • As a consequence of above, urban planning must be improved, considering water (in general) no longer as an independent item, but envisaging wide and sudden variations in the water cycle as a compulsory factor of whatsoever water-related project. • Knowledge sharing/transfer, awareness, participation are all essential components of a modern concept of water management. Solutions often can arise from ordinary people: technology is nowadays almost everywhere, and engineering competence is more available than in the past.
Mind-Shift	Recalling our assessment in the section above, resilient water management in Rotterdam (and in the Netherlands in general) is real history. Actually, to find top experts in this sector is not a problem there… As for our needs, we have found that the implementation of a public awareness initiative on water is the most valuable idea we should develop in Rome. Our city, in fact, doesn't consider the Tiber river as an asset for both commercial and recreational purposes. Rotterdam does, and this is a new vision we have to develop. But, we must say that geography is quite different here, and that a situation like that of Rotterdam can be seen only at the mouth of the river, while problems related to water into the city are of different nature (e.g. flash floods). For this particular matter we have anyway set useful consultations with other CROs: this can confirm again the value of the Exchange initiative.
Next Steps	Given the high level of experts and stakholders invited to this Exchange, we think there are several other focus areas that can be deepened by means of this valuable tool. We think, for example, that in the case of Rome an Exchange on historic and cultural heritage would bring high value to the 100 RC initiative in a sector we consider crucial for the resilience assessment of our city: our case would help other cities to better protect and evaluate their own heritage (as well as to give us noteworthy advice). But the same can be said for other cities of the network, where specific best expertise can be found because of local settings or culture.


Rotterdam
Rotterdam
Climate proofing Zomerhofkwartier and upscaling to other districts
Case description
In 2013 Rotterdam finalized the Rotterdam Climate Change Adaptation Strategy (RAS). This strategy is the guideline for climate proofing the city. So far Rotterdam has undertaken lot's of technical measures all over the city. Nowadays 220.000 m2 of green roof have been developed. Two water squares, several underground water storage facilities etc.. Now as part of the implementation we are upscaling this to district level, starting with the Zomerhofkwartier district (ZOHO). The trigger for ZOHO was the Bethemplein water square. This functioned as a catalyst.
Residents and entrepeneurs came with their own ideas. The proces to coordinate this was facilitated by the city government. Several new small scale measures have been initiated. One could say that Climate Adaptation has been a trigger for sustainable development of this district. But there is still a way to go.
What is the best mechanism to create a climate resilient district? How to finance this? And how to translate these experience to other districts on the south bank where social challenges are a much higher priority?
The climate challenge
Excessive rainfall
The phase or building block of the Resilience Pathway
Optioneering investment opportunities, combine this with social challenges and creating a more attractive living environment.
Resilience Pathway 2.0
Specific needs, wishes and or expectations
Experiences in other cities of climate proofing on district level. How to combine this with social resiliency. How to finance this and how to upscale this.
Lessons learned
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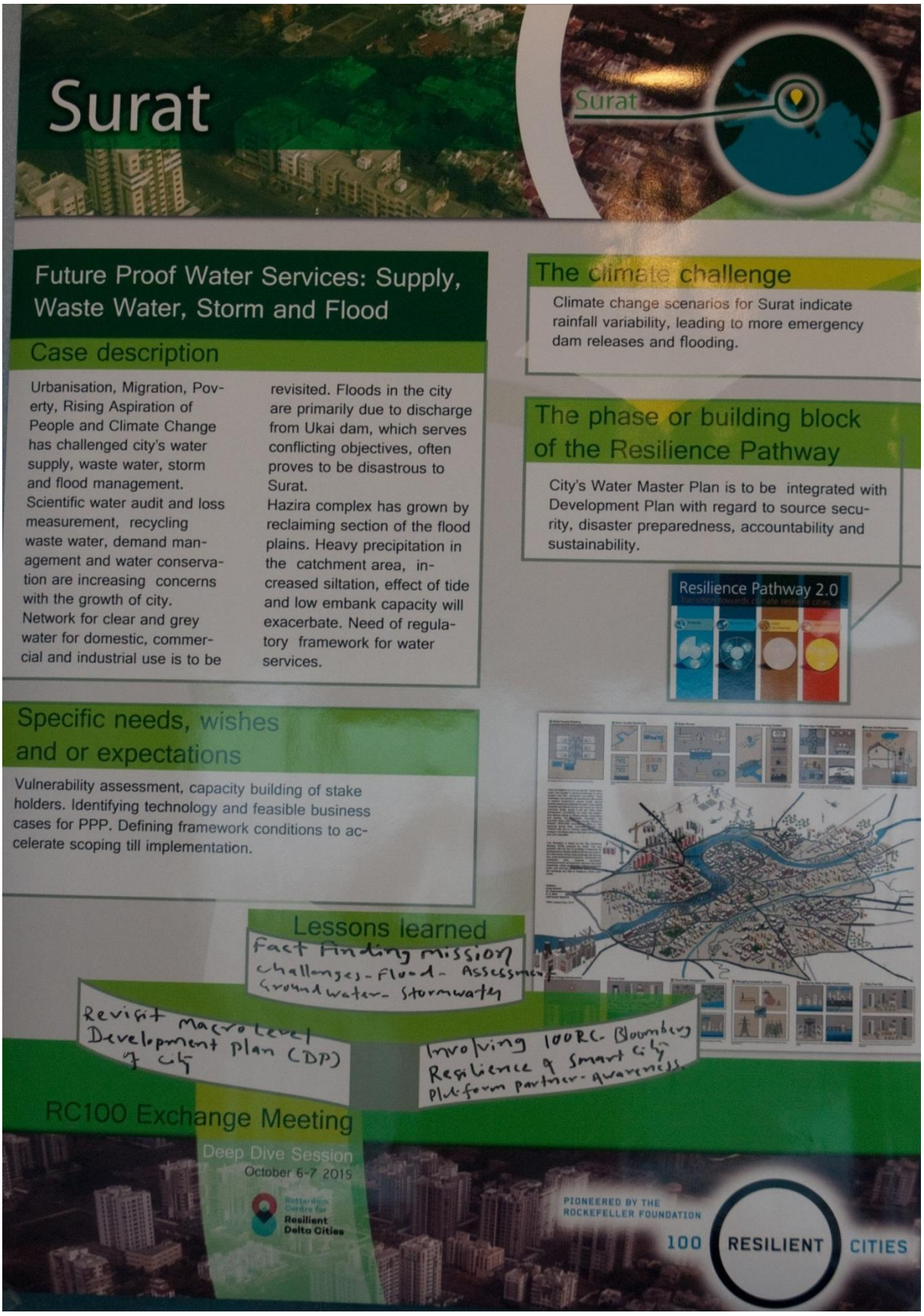
ROTTERDAM - CRO NOTES	
Challenge	Motivation: I was motivated to participate in the exchange to exchange ideas regarding implementation of our climate resilient strategy, specifically about the following challenge/case: In 2013 Rotterdam finalized the Rotterdam Climate Change Adaptation Strategy. Lot's of technical measures have been undertaken all over the city. The challenge for Rotterdam is to implement the strategy: Internal: how to get the strategy implemented in the organization; how to institutionalize the four P's: People, Process, Programs and Performance; External: How to get communities involved: we need a narrative to create awareness and get communicties involved; Scaling up: How to scale up indivdual measures to a district level, starting with de Zomerhofkwartier district (ZOHO). The water square at Benthemplein functioned as a catalyst for new small scale measures. One could say that Climate Adaptation had been a trigger for sustainable development of this district. For scaling up to a district level we want to find out what's the best mechanism to create a climate resilient district, how to finance this and how to translate these experience to other districts on the south bank where social challenges are a much higer priority. The risks Financial risk: we need to find financial arrangements to implement the strategy; There are a lot of other programs running. Every program wants to be the umbrella of all the other programs. We need to incorporate resilience within the other programs. Therefore we need to show the added value. The opportunities The Rotterdam Resilience Program (RRP) can serve as a framework to address resilience topics such as cyber resilience, critical infrastructure and governance; RRP helps finding synergy between Water-Climate-Infra isuues; RRP helps finding spatial synergy IN the city on district level!
Lessons Learned	1. Find and use leadership in neighbourhoods to connect, to identify skills, to create awareness and to create ownership. Link measures with skills and jobs we need. On the level of neigbourhood: raingardens maintenance, entrepeneurship; 2. Use student model Norfolk: find symbioses students – residents, involve HRO (University for Applied Sciences) and the so called "Field Academy"; 3. Story telling is crucial: develop a roadmap, develop awareness to get citizens involved, but find the right angle to do this. 4. On North bank climate resilience can serve as a driver for social cohesian, however on the South bank it's probably the other way round! 5. Indentify what project on the South bank could serve as a catalyst on neighborhhood level, like the Water Plaza did in ZoHo?
Mind-Shift	1. Deep dive discussions about real questions regarding climate resilience strategies and the implementation helps developing and even changing your mindset and inspires to come up with new projects and solutions; 2. We try to combine social resilience and climate resilience, but we can even work on a higher level of synergy: in Rotterdam we will explore the ideas of a catalyst project where we can combine social cohesian, water storage, health, greening and public space quality. Urban resilience by design: an open air gym in a wadi park...?.
Next Steps	• Looking for creative and affective ways to get involvement of all the stakeholders for resilience; • looking for and experimenting with connections to schools and universities and knowledge institute; • Set up a pilot in a low income area where we use social resilience as a trigger for climate resilience; • Support to get follow-up exchange operational: Rotterdam-Nola (on neighborhood activities, critical infrastructure, floating development); Rotterdam-Mexico (water plaza development); Rotterdam-Surat (capacity building, develping an integrated strategy); Rotterdam-Rome (Water resilience by design), etc.


Surat
Surat
Future Proof Water Services: Supply, Waste Water, Storm and Flood
Case description
Urbanisation, Migration, Poverty, Rising Aspiration of People and Climate Change has challenged city's water supply, waste water, storm and flood management.
Scientific water audit and loss measurement, recycling waste water, demand management and water conservation are increasing concerns with the growth of city.
Network for clear and grey water for domestic, commercial and industrial use is to be revisited. Floods in the city are primarily due to discharge from Ukai dam, which serves conflicting objectives, often proves to be disastrous to Surat.
Hazira complex has grown by reclaiming section of the flood plains. Heavy precipitation in the catchment area, increased siltation, effect of tide and low embank capacity will exacerbate. Need of regulatory framework for water services.
The climate challenge
Climate change scenarios for Surat indicate rainfall variability, leading to more emergency dam releases and flooding.
The phase or building block of the Resilience Pathway
City's Water Master Plan is to be integrated with Development Plan with regard to source security, disaster preparedness, accountability and sustainability.
Resilience Pathway 2.0
Specific needs, wishes and or expectations
Vulnerability assessment, capacity building of stake holders. Identifying technology and feasible business cases for PPP. Defining framework conditions to accelerate scoping till implementation.
Lessons learned
Fact finding mission
challenges - Flood - Assessment
Groundwater - Stormwater
Revisit macro level Development Plan (DP) of city
Involving 100RC - Bloomberg Resilience & Smart City Platform partner - awareness
RC100 Exchange Meeting
Deep Dive Session
October 6-7 2015
Rotterdam Centre for Resilient Delta Cities
PIONEERED BY THE ROCKEFELLER FOUNDATION
100 RESILIENT CITIES

SURAT - CRO NOTES	
Challenge	Motivation Main motivation of participating in an Exchange was its focus on Climate Change Adaptation, Flood Management and Multi-benefits Solutions. As only cities with a water related issues were to participate in an exchange generated sufficient interest in Surat City 100RC team resulting into participation in an Exchange. What did I Want to Learn? : • Multi-benefit solutions based on water sensitive spatial design • How smart climate adaptation can add urban quality to cities • Integration of various plans of the city with water plan regard to source security, disaster preparedness, accountability and sustainability is a challenge. • The full range of solutions, from large infrastructural solutions to small scale, more technical eco-based solutions on local level; • The multi-stakeholder involvement and development; • Financial aspects and governance during different phases of strategy development and implementation; • Risks & opportunities : • The combination of urbanization, migration, poverty, rising aspiration of people and climate change challenges the city's water management. The water system needs to keep pace with the city growth. A regulatory framework for water services is needed. • In dry periods more fresh water is need to be available for industries. Conflicting objectives of dam management and salt water intrusion. The industries are affected negatively by the lack of fresh water. • In wet periods to much rainfall causes flooding, drainage (storm water) system is to be more robust for these amounts of water in a short term.
Lessons Learned	1. A better understanding of the hydrologic system, including land use policies and original geography and also the social structure and (potential) stakeholders. 2. The engineering solutions are not enough; we have to live with nature and have to learn this again. Planning processes have to be integrated. 3. Need of fact finding mission to assess the challenges of Surat. 4. Involve local industries, urban developers and other stakeholders in urban and water planning process; including potential distractors who may even become champions. 5. Aligning resilient efforts with Government of India's 100 Smart Cities initiative. 6. Create awareness about climate change and resilience along all government levels and departments, citizens and politicians.
Mind-Shift	1. Design short, middle and long term solutions including a roadmap planning, without becoming dependent only on short term solutions. 2. Need of Revisit current macro level Surat Development Plan making it a Resilient Plan. 3. Be very precise and specific while dealing with issues. Project designs that not only mitigate flooding, but also reduce water pollution, minimize maintenance costs, and improve community livability by beautifying a neighborhood and activating public space; 4. Water as an opportunity to create a better city by living with water instead of fighting against it. 5. Improving the cities' ability to identify multi-benefit solutions;
Next Steps	• Vulnerability assessment • Capacity building of stakeholders • Identifying technology/measures and feasible business cases for PPP • Defining framework conditions to accelerate scoping till implementation • Combining resilience efforts with smart cities in Indian context

Vejle

How can we protect the city of Vejle against flooding by the fjord? How can we do it so it makes more than a technial solution?

Case description

In The City of Vejle we have challenges with flooding. We have the fjord (Vejle Fjord) and streams running through the City of Vejle. Especially one of the streams (Grejs Å) gives us some challenges because the landscape among the Grejs Å is very hilly. When we get heavy rainfall in the area, then the water is coming very fast down the hills to the Grejs Å and to the City of Vejle. This with a combination of a high water level in the fjord gives us challenges with flooding in the middle of the City of Vejle. Just now we are planning and designing a sluice and a pump system to protect an area in the middle of the City of Vejle to prevent the city from flooding. But in the long term it is not enough, we have to protect the City of Vejle from the risen sea level and storm surge.

We have three proposals to protect the City of Vejle from flooding by the fjord.

- Building a dam and a sluice and dikes
- Building a barrier along the wharf
- Building a barrier inside the harbor

The proposals is illustrated.

We would like to have some coments to the proposals and maybe you can give us a new way to find solutions for our challenges.

The climate challenge

The challenge is flooding from the fjord

The phase or building block of the Resilience Pathway

Building block high level solutions of the optioneering phase

Specific needs, wishes and or expectations

Enrichment and comments upon first ideas

Lessons learned

VEJLE - CRO NOTES	
Challenge	The risk of flooding and the negative impact on urban areas and peoples life is a global challenge. Our motivation for participating in the exchange was to focus on the how resilience thinking would leverage the way we approach this challenge in Vejle and to build a common understanding in 100 RC and a practical approach to holistic solutions with added value for cities and its citizens and businesess. We chose to foucs on rainfall in combination with the elevated landscape that causes vast discharge and high water levels in local streams. During storm events the water level in the Fjord makes it impossible to discharge the water of these streams. In the end this leads to flooding in the city centre. In the decades this will have a very critical impact on the city. The field opportunity is to integrate resilience in the rebuilding process and expansion of habour and coastal area over the coming the years.
Lessons Learned	1. Confirmation of vision; the resilience strategy is the right and most opportune direction. 2. Connect water safety challenge with other urban and social challenges, economic perspective and other goals 3. Long term and multi perspective process with enhancement of political interests 4. Develop short term no regret measurements, this creates time for the long term vision/strategy
Mind-Shift	The key learnings was the “Dutch Dialogue” as a co-creation method for a holistic and value oriented approach to climate apadation. The method was both simple and yet able to create abstractions for new insights. Furthermore, Rotterdam as a “living lab” is the optimal setting for such conversations and learnings to take place. I also gained a lot from insights in the Norfolk case during our workshop together.
Next Steps	1. Possibilities by shifting towards a broader perspective, not only climate adaptation but a far more holistic long term vision 2. Develop various scenarios (e.g. economic, leisure, industry) based on the interest of the different stakeholders 3. Start with capacity building: connect important stakeholders, create awareness and sense of urgency among politicians and change the “traditional” attitude. 4. Perform more research regarding flood and inundation risks, frequency, consequences, economic damage and bottlenecks 5. Develop a strong and attractive vision that suits to Vejle and its future direction, whereby challenges and thearts are transformed towards opportunities

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