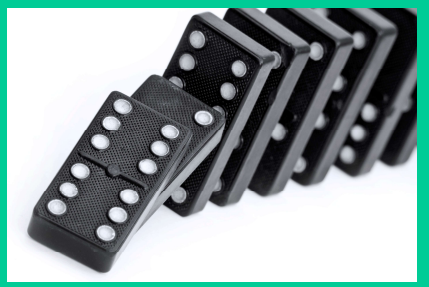
Deltares

Quantifying the cascading impacts of disrupted infrastructure

Kathryn Roscoe (together with many others)

November 3, 2021

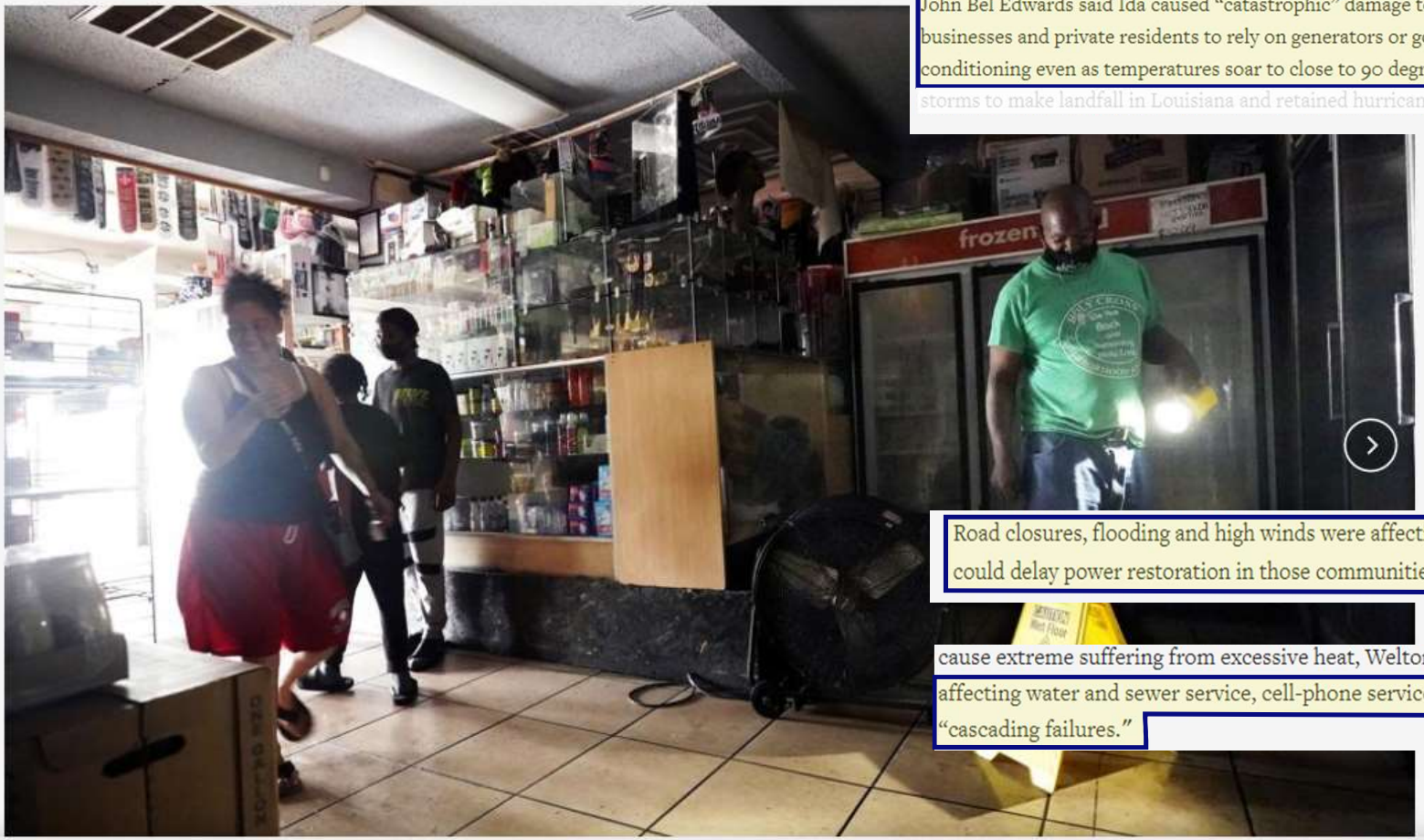
What are cascading impacts?



EXPLAINER: Hit by Ida, New Orleans faces weeks without power

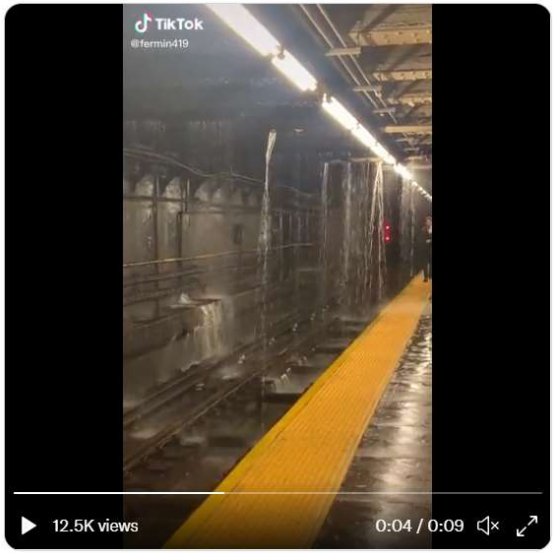
By MATTHEW DALY August 31, 2021

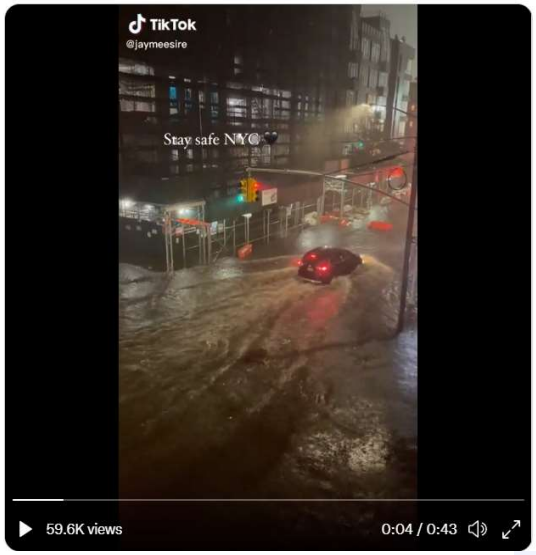
The hurricane blew ashore on the 16th anniversary of Katrina, the 2005 storm that breached New Orleans' levees, devastated the city and was blamed for 1,800 deaths. The office of Louisiana Gov. John Bel Edwards said Ida caused "catastrophic" damage to the power grid, forcing hospitals, businesses and private residents to rely on generators or go without refrigeration or air conditioning even as temperatures soar to close to 90 degrees. Ida was one of the strongest storms to make landfall in Louisiana and retained hurricane status nearly to Mississippi.



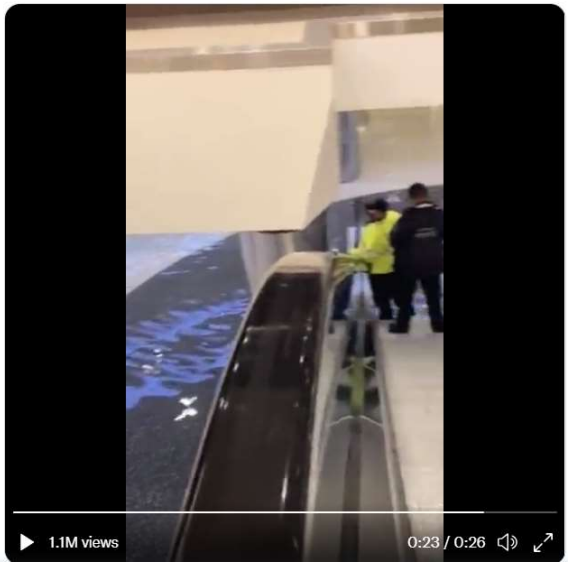
Road closures, flooding and high winds were affecting crews' ability to reach some areas and could delay power restoration in those communities, Entergy said.

cause extreme suffering from excessive heat, Welton and others said. The storm also was affecting water and sewer service, cell-phone service and even 911 service in what Welton called "cascading failures."

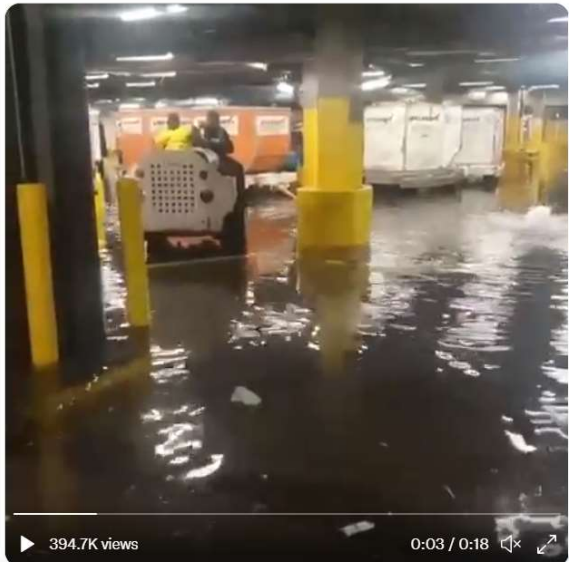


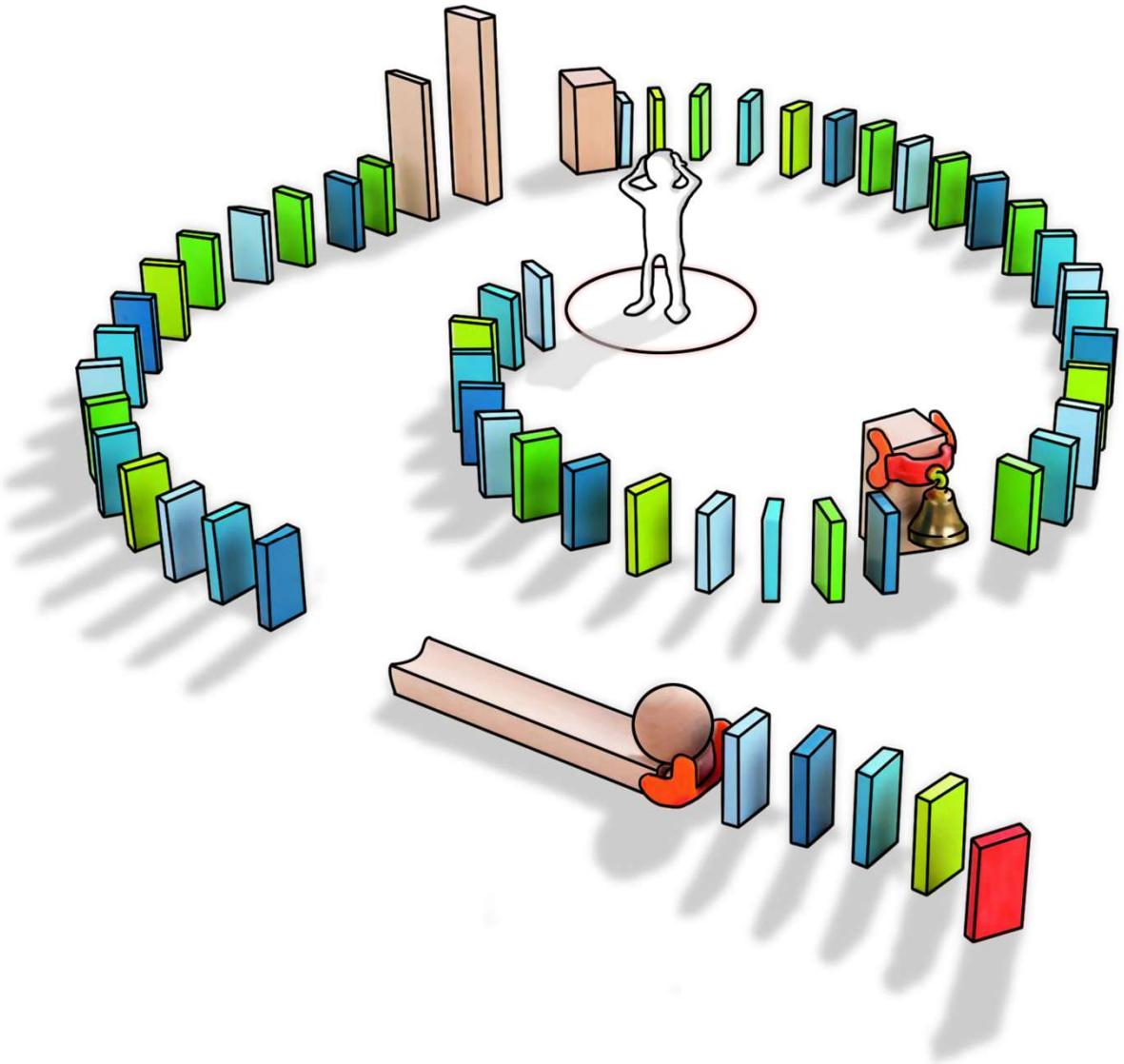


Newark airport



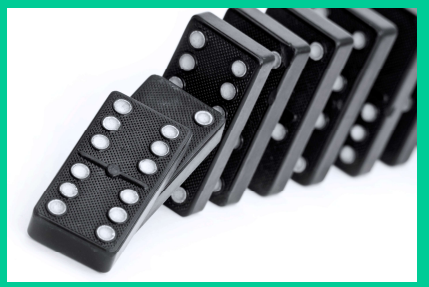
Flooding baggage area at newark airport





Deltares

Quantifying cascading impacts



Damage Functions

Direct Damage Model
(HAZUS)
(Delft-FIAT)

Existing Component

Direct Impacts

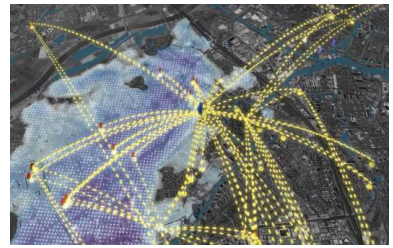
Flood hazard maps

Network maps

Criticality Tool

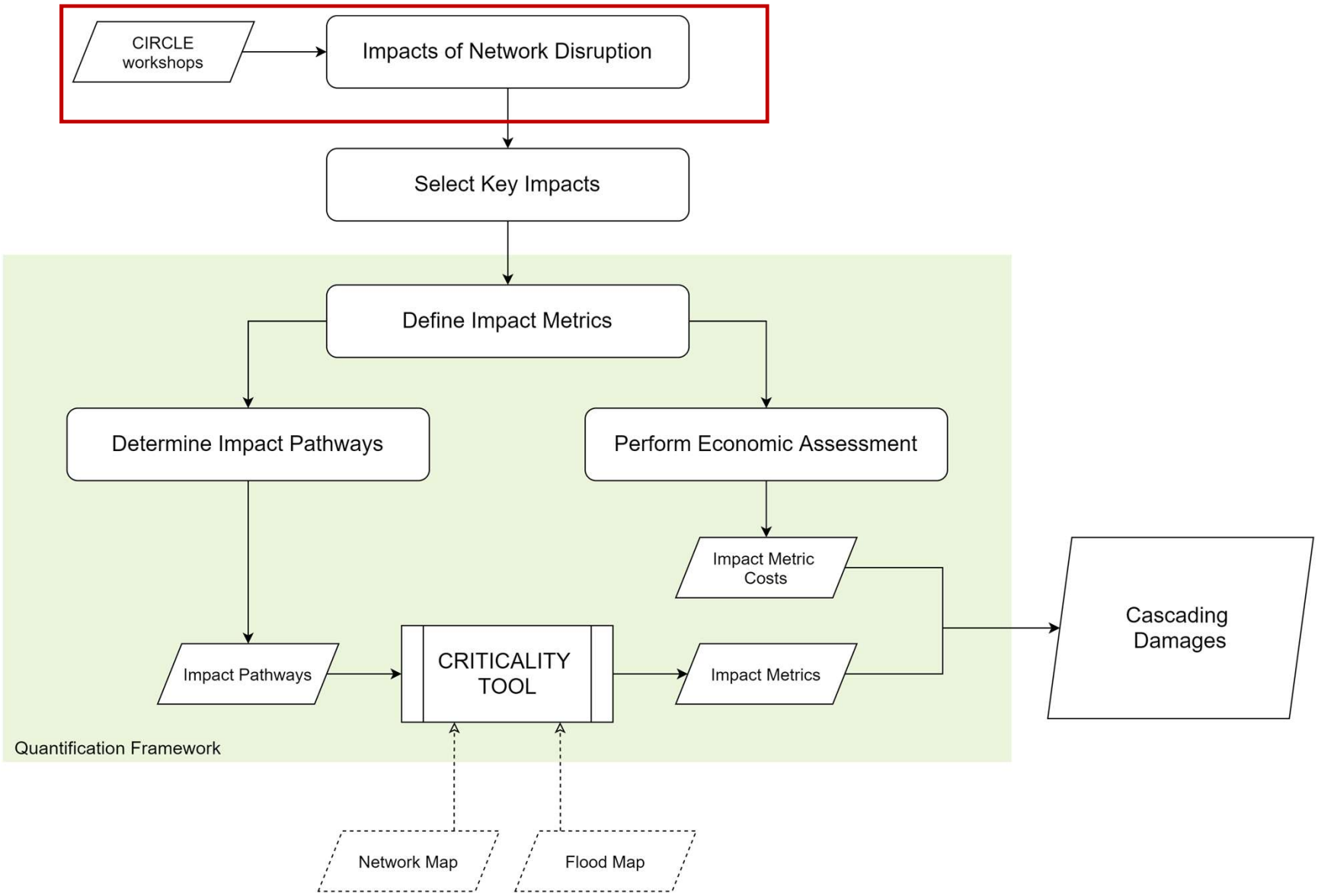
Consequence-cost relationships

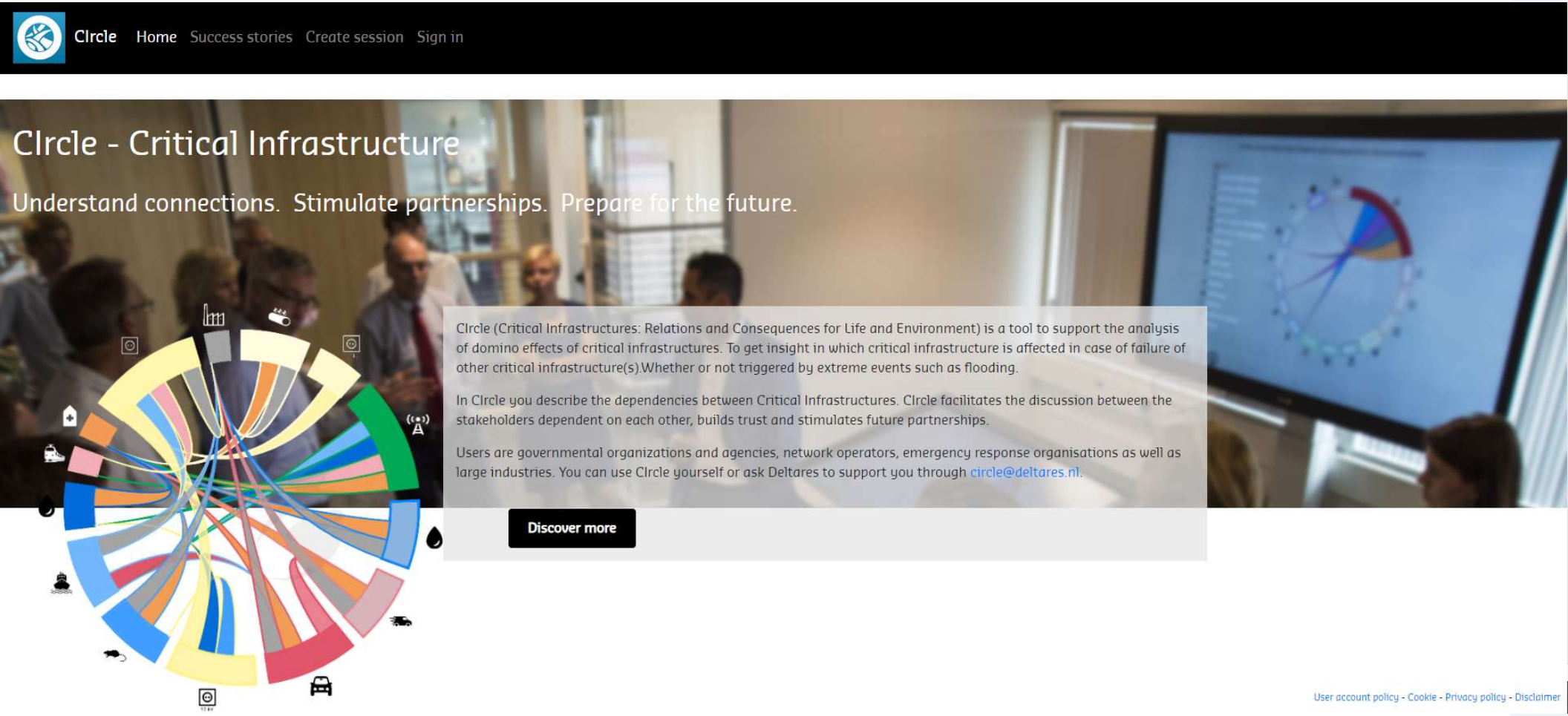
New Component



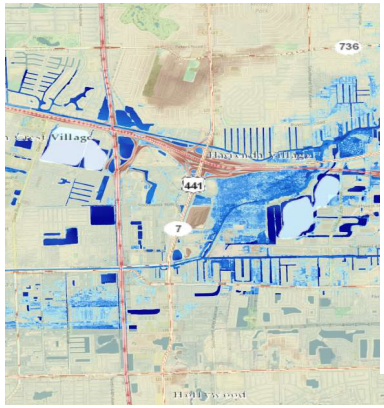
Cascading Impacts

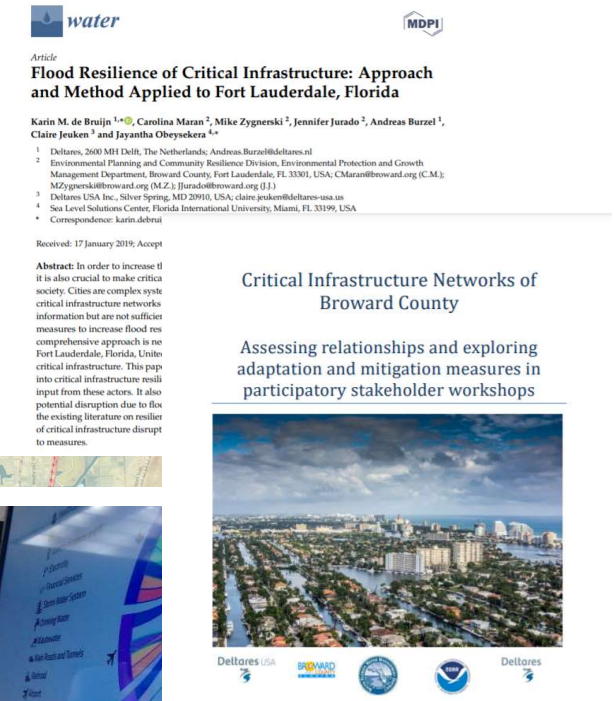
Methodology Overview





https://circle.deltares.org/




water

MDPI

Article

Flood Resilience of Critical Infrastructure: Approach and Method Applied to Fort Lauderdale, Florida

Karin M. de Bruijn [1,*], Carolina Maran [2], Mike Zygnerski [2], Jennifer Jurado [2], Andreas Burzel [1], Claire Jeuken [3] and Jayantha Obeysekera [4,*]

1 Deltares, 2600 MH Delft, The Netherlands; Andreas.Burzel@deltares.nl
2 Environmental Planning and Community Resilience Division, Environmental Protection and Growth Management Department, Broward County, Fort Lauderdale, FL 33301, USA; CMaran@broward.org (C.M.); MZygnerski@broward.org (M.Z.); JJurado@broward.org (J.J.)
3 Deltares USA Inc., Silver Spring, MD 20910, USA; claire.jeuken@deltares-usa.us
4 Sea Level Solutions Center, Florida International University, Miami, FL 33199, USA
* Correspondence: karin.debrui

Received: 17 January 2019; Accept

Abstract: In order to increase tl
it is also crucial to make critica
society. Cities are complex syste
critical infrastructure networks
information but are not sufficier
measures to increase flood res
comprehensive approach is ne
Fort Lauderdale, Florida, Unite
critical infrastructure. This pap
into critical infrastructure resili
input from these actors. It also
potential disruption due to flo
the existing literature on resilier
of critical infrastructure disrupt
to measures.

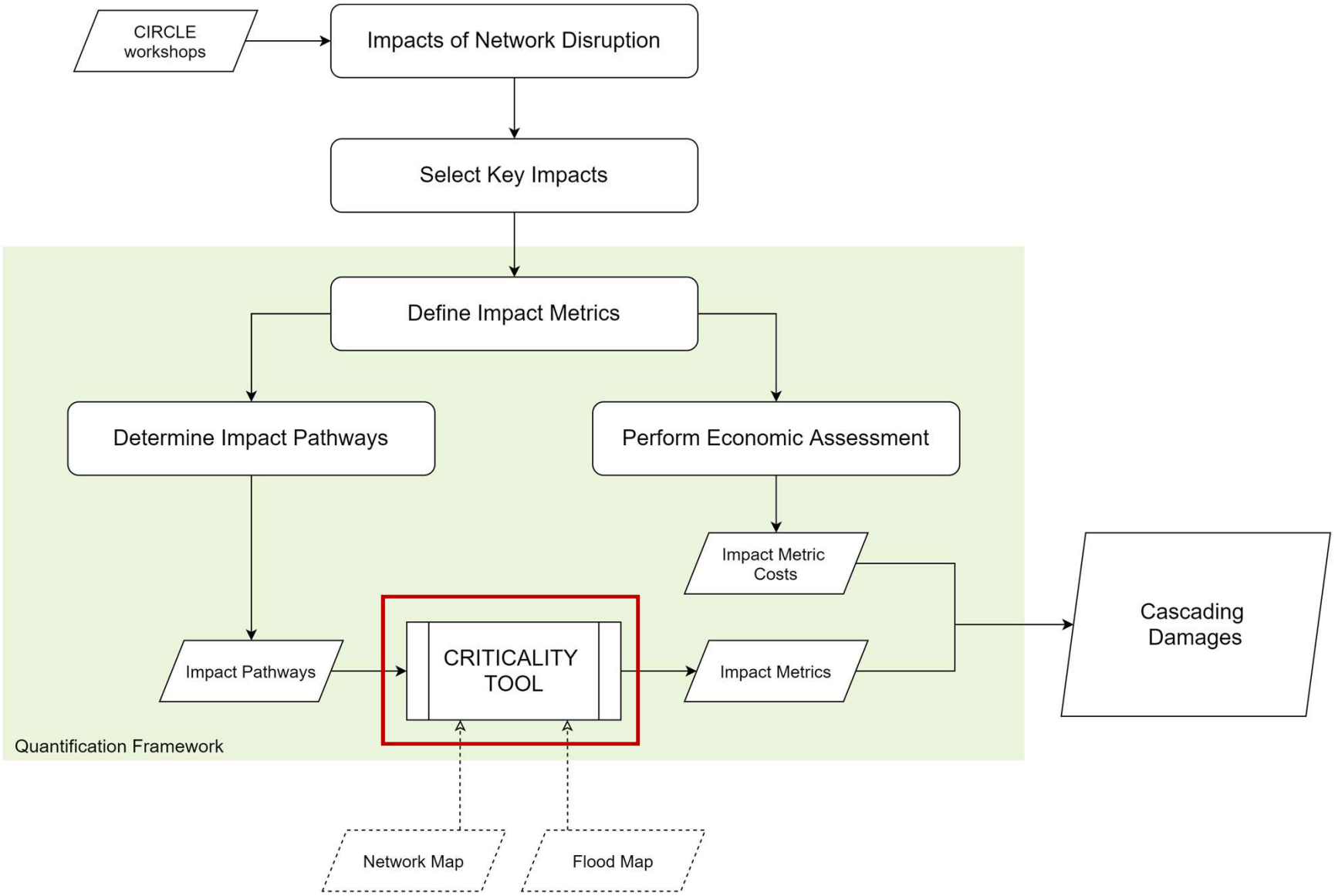
Critical Infrastructure Networks of Broward County

Assessing relationships and exploring adaptation and mitigation measures in participatory stakeholder workshops

Deltares USA

Deltares

Methodology Overview



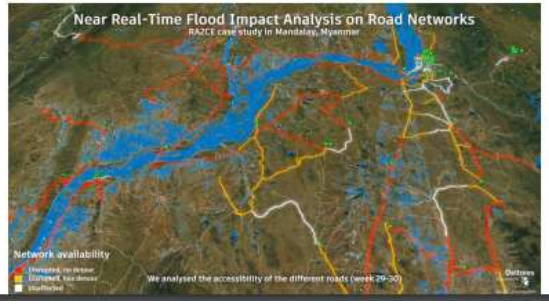
Dare to Share

Deltares

RA2CE - **R**esilience **A**ssessment and **A**daptation for **C**ritical infrastructur**E** helps to quantify resilience of critical infrastructure networks, prioritize interventions and adaptation measures and select the most appropriate action perspective to increase resilience considering future conditions.

The platform supports governments, intergovernmental agencies, IFIs and infrastructure owners to gain insight in long-term cost-beneficial investment strategies with the goal to make their infrastructure network resilient to natural and man-made hazards. RA2CE is globally applicable and has been applied for resilient investment planning in several settings such as the Netherlands, Philippines, Myanmar, Dominican Republic and Albania.

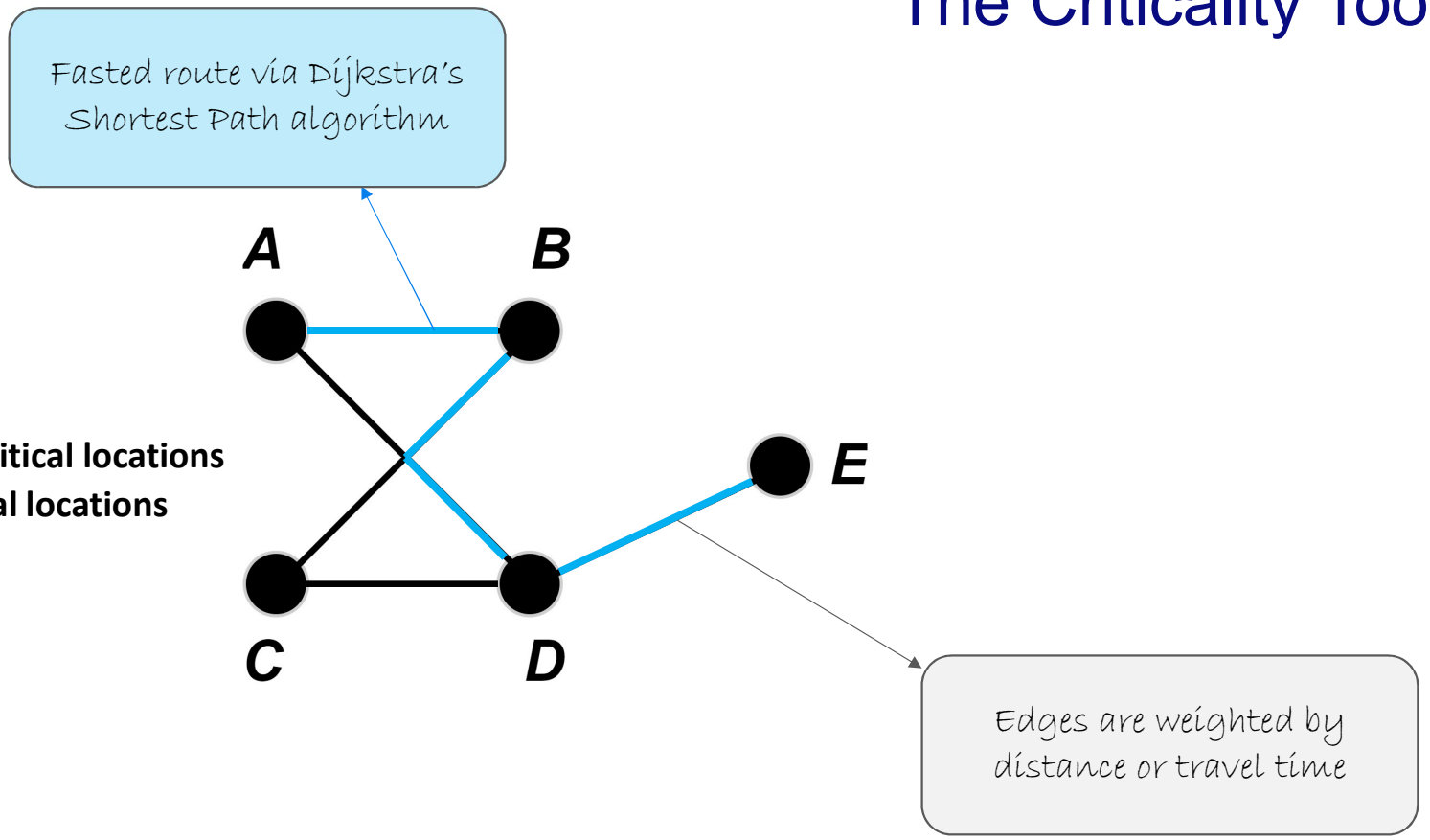
Map with locations where RA2CE has been applied.

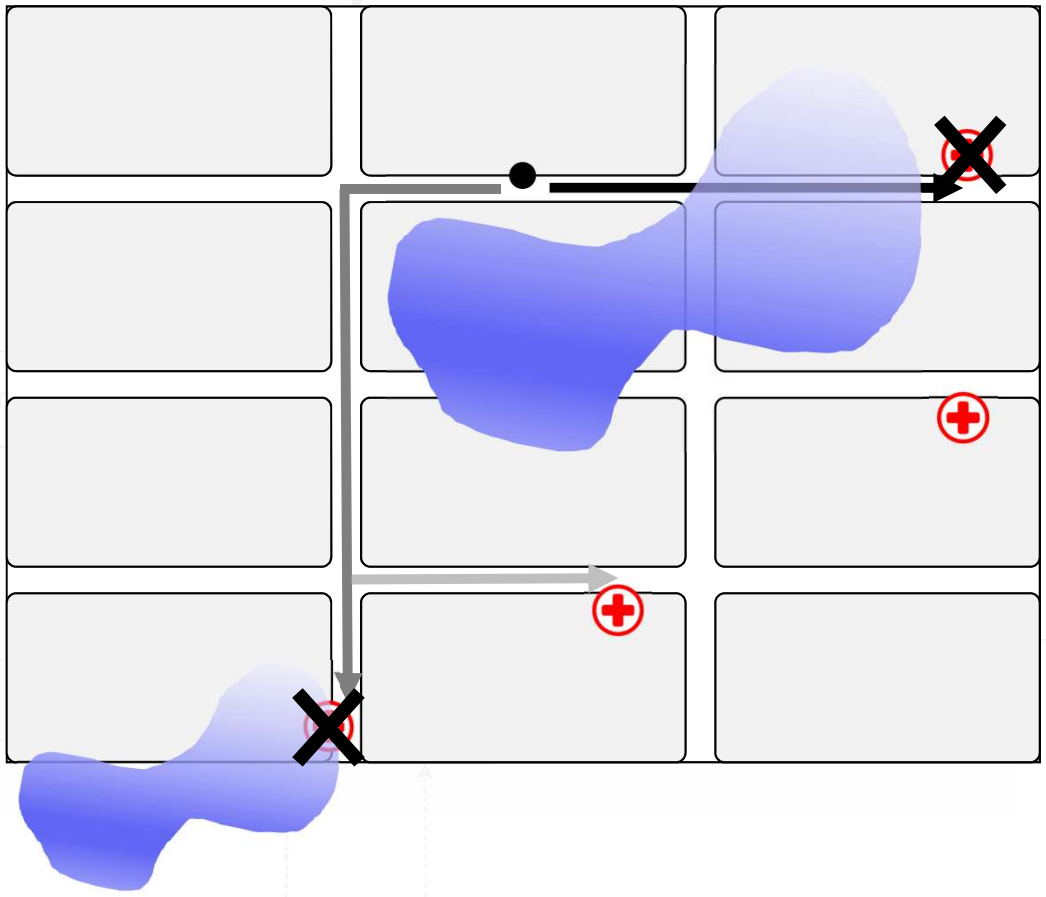


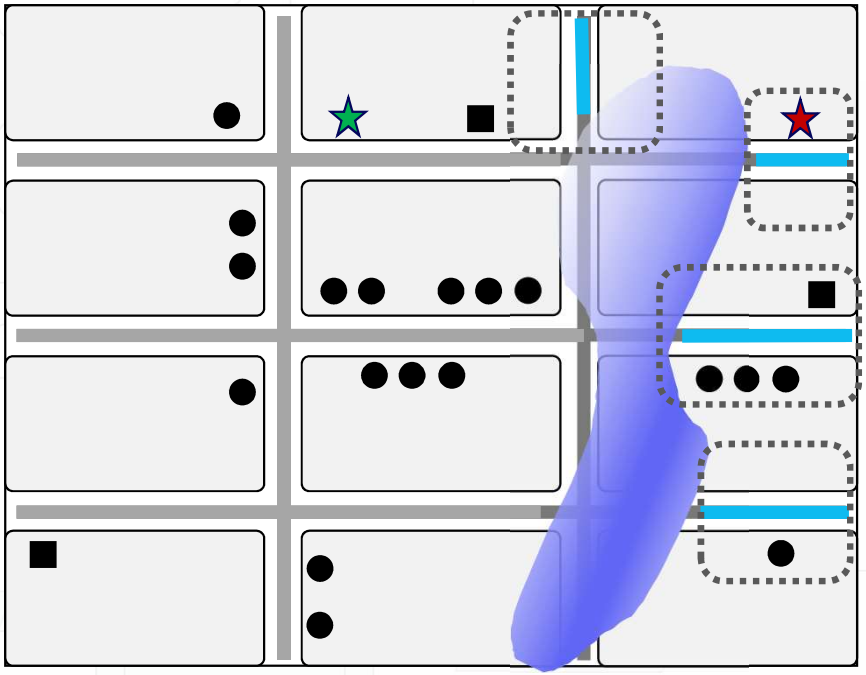
Application of RA2CE for near real time impact assessments during floods in Myanmar

The Criticality Tool

1. **Redundancy**
2. **Accessibility to critical locations**
3. **Isolation of critical locations**



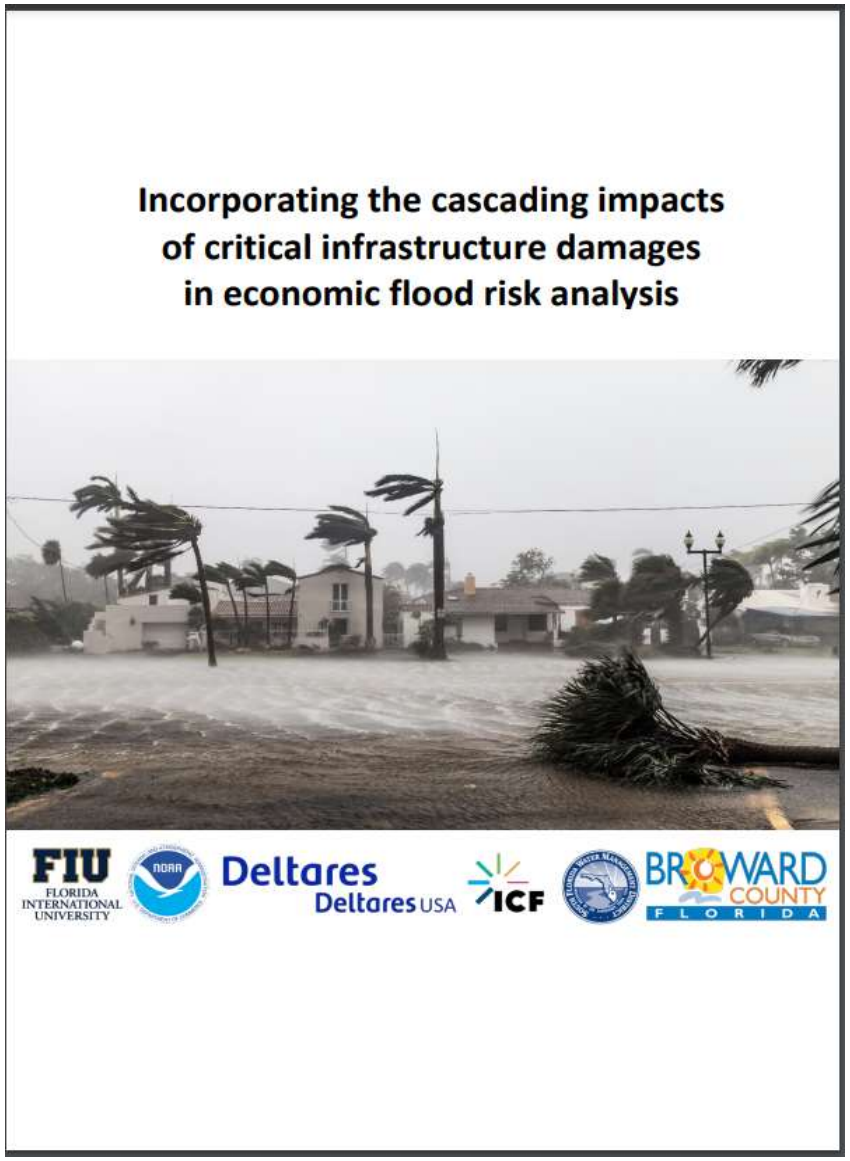




Full Story and Demo

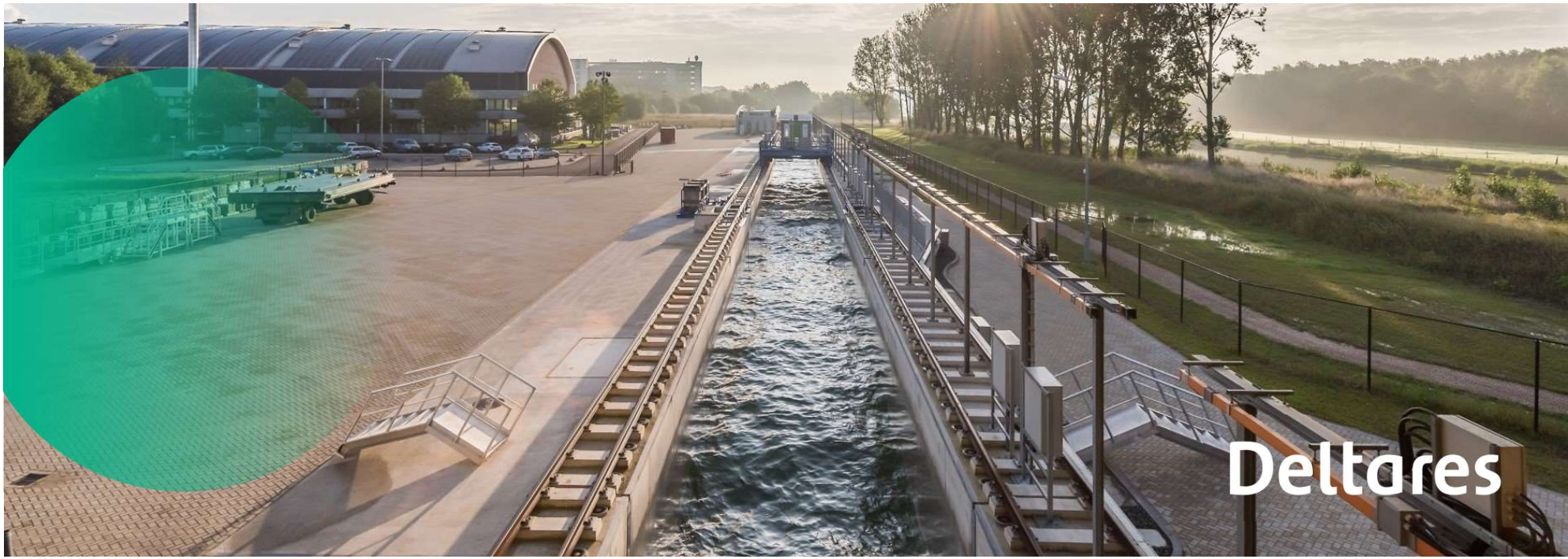
https://storymaps.arcgis.com/stories/14ed7fcf649648aa98c07d868b80d99b

https://storymaps.arcgis.com/stories/14ed7fcf649648aa98c07d868b80d99b



https://www.deltares.nl/app/uploads/2021/08/Incorporating-the-cascading-impacts-of-critical-infrastructure-damages-in-economic-flood-risk-analysis_FINAL.pdf

Contact

Kathryn.Roscoe@Deltares.nl

www.deltares.nl
@deltares
linkedin.com/company/deltares
info@deltares.nl
@deltares
facebook.com/deltaresNL