Case Study

Water Management

WM Case 1 Copenhagen, Denmark: Rain Water Harvesting Project Awarded

Problem to resolve: Globally, the impact of climate change is an issue that can no longer be ignored

Answer: Blue-Green Approach

Background. On the 2nd of July 2011, in less than two hours, Copenhagen was hit by an extreme 1000-year storm event – or Cloudburst – where 150mm of rain left large areas of the city under up to one meter of water. The 2011 event had been preceded by a 100-year storm in August 2010 and was hit again in 2014. Copenhagen realized that Cloudbursts were not a one-off occurrence; the threat compounds as harbour sea levels are predicted to rise one meter by 2110. In a city where many buildings and services are located below street level and where stormwater and sewage are in a combined pipe system, contaminated floodwater penetrated buildings and city infrastructure

"Following a 2011 Cloudburst that caused damage of approximately USD $1 billion, climate change mitigation solutions became an urgent focus for the city of Copenhagen. The flood's consequences transcended jurisdictional boundaries, necessitating a truly collaborative effort be established between planners, engineers, economists, citizens, utility providers, politicians, and investors to integrate Climate Adaptation within regulatory planning.

The result is the Copenhagen Cloudburst Formula, a flexible, universally adaptable model for mitigating increasingly common extreme flood events – or Cloudbursts – through Blue-Green solutions that integrate urban planning, traffic, and hydraulic analysis with sound investment strategies to improve the quality of cities' Liveability.

Existing city space is valuable. A cost-benefit analysis, conducted on the 10km2 catchment, concluded that the potential of implementing a surface-first approach to mitigating Cloudbursts over solely pipe-based systems reduced investment costs by over $200 million.

INNOVATIVE METHODOLOGY WITH PRAGMATIC SOLUTIONS:

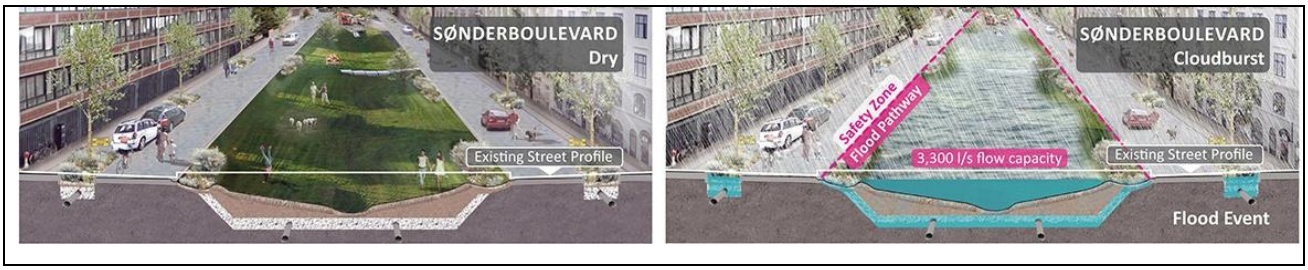
Traditional drainage solutions such as underground reservoirs are becoming less viable as utilities occupy more underground space. Extreme weather events cannot be managed by conventional pipe systems and their occurrence becomes more difficult to predict. Conventional infrastructure is considered to be generally technical, underground, hidden elements while Blue-Green solutions are low-tech, on the surface, and interactive. The Blue-Green Approach develops a synergistic relationship between the two, integrating climate adaptation solutions within the limited confines of urban space, encouraging a solution utilizing the best of both techniques.

The Copenhagen Concretization Plans were commissioned to combat climate change following 2011's flood. These integrated, multi-disciplinary plans bridge the gap between planning and site-specific solutions through the application of a typology-based Cloudburst Toolkit.

The process was formalized as the Copenhagen Cloudburst Formula, a six-step procedure for integrating the **Blue-Green Approach**:

1. Data and Investigation: The city investigated, identified, and ranked areas according to their overall threat due to Cloudburst risk indicators, their potential to stir investment and influence property value, and the viability of implementation affecting adjacent developments.
2. Modelling and Mapping: Municipalities divided their regions into stormwater catchments, undertaking large-scale hydrological models (including GIS, surface water, sewage, landscape character, and risk assessments) to map vulnerable areas. The conclusion - traditional piped solutions alone were not enough. The result - public water utility companies began financing solutions that integrated Cloudburst events.
3. Cost of Doing Nothing: An analysis undertaken by the city and consultants calculated that the effect of climate change was so large, that the cost of doing nothing would amount to approximately $60-90 million a year from now to 2110.

4. Design and Qualify: Hotspots were identified, transferring strategic planning to human-scale experiences as a model for how other cities can mitigate Cloudbursts and daily rain events. The “Cloudburst Toolkit” was developed as a palette of universally applicable, multi-functional, flexible elements.
5. Involvement and Iteration: Cloudbursts would influence each area of Copenhagen; an overall strategy for a public participation program was established to gauge the requirements of the citizens who would be affected.
6. Cloudburst Economics: A detailed socio-economic Cost-Benefit Analysis (CBA) tested two masterplan options. The option with the highest percentage of Blue-Green solutions and also the least additional infrastructural pipe improvements created a potential savings 50% greater than Conventional solutions alone. Additional qualitative social benefits, such as health, environmental, and urban spatial quality improvements resulting from the enhancements would potentially push this number even higher.[i]



Public-private engagement – lasting benefits. The Copenhagen Formula provides a structure for integrating built, existing context with retrofit Blue-Green solutions.

The implementable, pragmatic tools mitigate extreme storm events and improve our cityscapes. Private developers and homeowners alike become champions for local solutions where a multi-disciplinary, cross-agency collaboration engaged designers, planners, sociologists, economists, biologists, geographers, information specialists, and communication experts interacting with public utility companies, stakeholders, interest groups, local politicians, and investors.

Cloudburst solutions are often left out of upstream area planning where residents see no flooding problems. Yet water has no boundary. Municipal borders must be lowered to develop a common vision across disparate districts. A recent interactive workshop led by the Engineer and Landscape Architect in a suburb of Copenhagen engaged residents through a series of interactive sessions designed to raise awareness and survey desired citizen interests. Hydraulic function was presented in an engaging, educational sequence that involved the public interest with private development goals.

Cloudburst solutions can provide much more than just stormwater management. The strategic flood masterplan is the opportunity to safeguard Copenhagen while providing the foundations for a high quality city environment. Resilient urban ecological waterscapes are the foundation for vibrant public realm spaces that are culturally and socially significant and contribute to the economic longevity, quality of life, and well-being of cities.

Blue-Green Infrastructure represents the next generation of water infrastructure considerations where nature, city and recreational space are rolled into a holistic package. Cities around the world can look to the Copenhagen Cloudburst Formula as a model for implementing innovative, pragmatic, feasible measures within existing urban fabric.”

Credentials:

Copenhagen Cloudburst Masterplan. The case studies of “The Soul of Nørrebro” and “Enghaveparken” are part of the Masterplan that Ramboll Studio Dreiseitl developed together with Ramboll Water Copenhagen and the Municipality of Copenhagen, which have been awarded with an ASLA Award of excellence in the field of Analysis & Planning**.**

All Photos: Ramboll Sudio. https://www.asla.org/2016awards/171784.html
Principal authors: Martin Griffiths with contributions by Simon Spooner, Atkins, and Stefan Brueckmann and Dimitra Theochari, Ramboll Studio Dreiseitl.
Editors: Kosta Mathey and Florian Steinberg.

Sources and Further Reading

[i] Source: Text by Ramboll Studio Dreiseitl as submitted for the ASLA Award of Excellence in Urban Planning - https://www.asla.org/2016awards/171784.html

Source: Ramboll. 2016. Urban Development Project in Copenhagen Wins Nordic Award. 16 November. https://stateofgreen.com/en/news/urban-development-project-in-copenhagen-wins-nordic-award;

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