

COPENHAGEN URBAN LAB

EXECUTIVE SUMMARY



2017



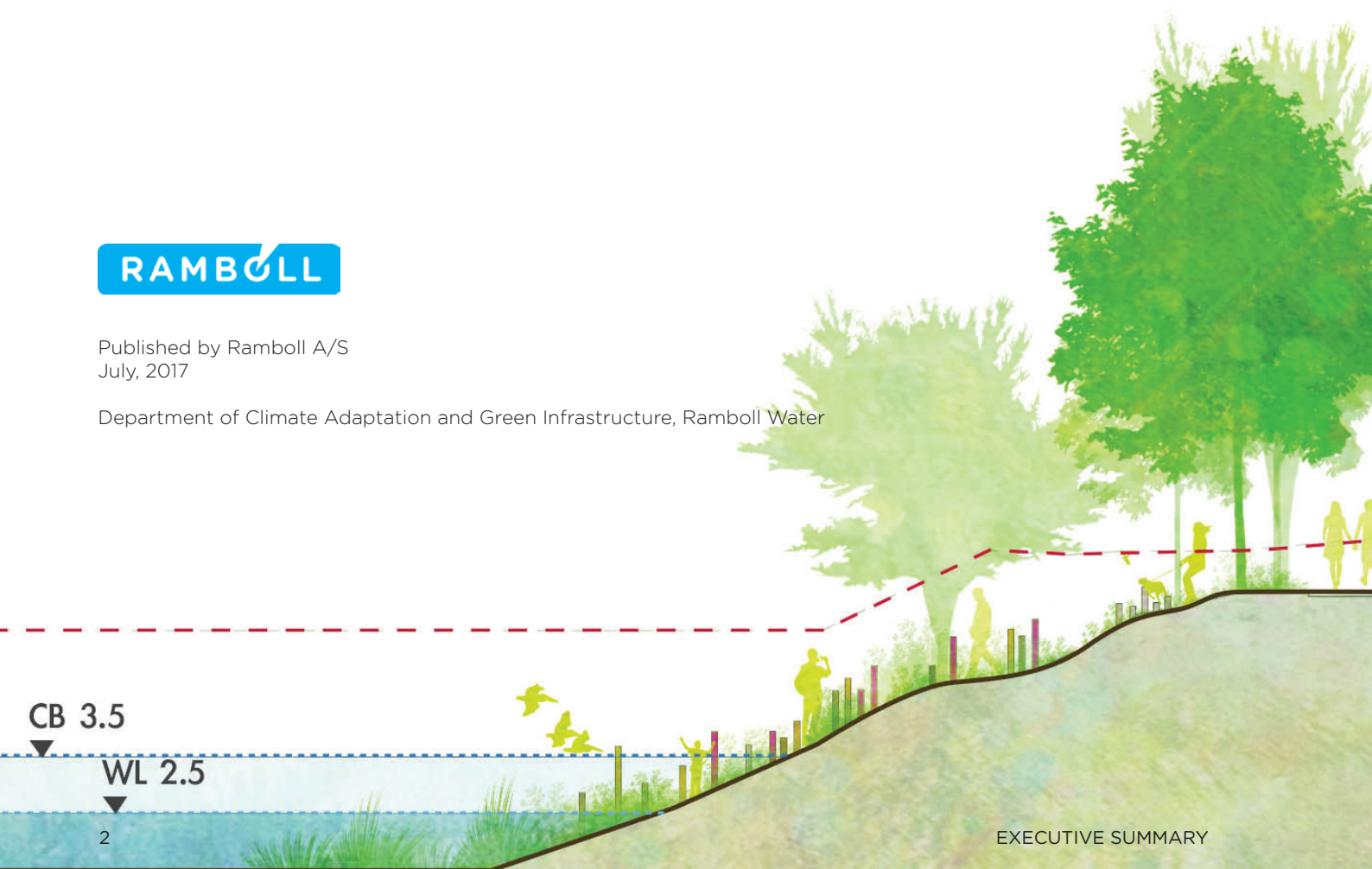
UNIVERSITY OF COPENHAGEN





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CONTENTS

BACKGROUND & CONTEXT	4
CHALLENGE	6
HOSTS & SPONSORS	8
PROGRAMME	9
TEAM	11
PROCESS & FINDINGS	12
CONCLUSION	34



BACKGROUND & CONTEXT

FOREWORD

The idea of an Urban Lab was introduced by International Water Association (IWA) as part of the vision for Water-Wise Cities under the Cities of the Future programme. In 2020 Copenhagen will host the IWA World Water Congress and Exhibition under the theme *Water for smart liveable cities*. The conference programme builds on three overall legacy elements: the Urban Water Charter, the Water, Food & Energy charter and Securing Recruitment. The idea of an Urban Lab embeds naturally to the Securing Recruitment legacy element coordinated by an large through the Young Water Professionals Denmark (YWP-DK).

The initiative to host an Urban Lab thus sprung from ongoing collaboration between IWA and Rambøll on the Water-Wise Cities and across the Danish water sector in general as a result of teaming efforts in relation to hosting the IWA World Water Congress & Exhibition in 2020. The aspiration is to continue the Securing Recruitment legacy by repeating an Urban Lab each year leading up to the conference in 2020, where all Urban Lab participants are invited to share their experiences and reunite in a special Urban Lab Session.

For the Copenhagen Urban Lab 2017, a group of six talented, young urban planners, water engineers and landscape architects were selected to

exchange knowledge and combine professional expertise within neighbourhood resiliency planning on the case of Sankt Jørgens Sø in the inner city of Copenhagen. The group was tasked with developing a new conceptual cloudburst design for the area building on existing visions, challenges and plans. The team had nine intense days in Copenhagen in June 2017 to build their design!

This executive summary presents the background, setup, process, findings and conclusions from their experiences participating in the Copenhagen Urban Lab 2017. It is prepared by the team and reflects their understanding of challenges and solutions. I hope, that their ideas will be further reviewed by the stakeholders and utilised for their project implementation at the Sankt Jørgens Sø. I will like to complement the team on extraordinary team effort, collaborative skills, openness and drive and to congratulate them with their exceptional outcome. I look forward to continued collaboration in the future.

I would also like to thank everyone, who contributed to making the urban lab a reality. I look forward to the next one. On behalf of the entire team behind the Copenhagen Urban Lab 2017,

Trine Stausgaard Munk

IWA WORLD WATER CONGRESS & EXHIBITION COPENHAGEN 2020



BACKGROUND & CONTEXT

BACKGROUND & REASONING

A very severe rain event, also known as a **cloudburst**, hit Copenhagen on the 2nd of July 2011 which resulted in large portions of the city being flooded. The event nearly paralysed the city and caused significant damages to the infrastructure and functions in the inner parts of Copenhagen and Frederiksberg.

The serious consequences associated with this cloudburst event, coupled with the probability of more intense cloudbursts in the future as a result of climate change, have led the municipalities of Copenhagen and Frederiksberg to collaborate together and initiate a forward thinking cloudburst resiliency planning scheme. This is aimed at highlighting potential cloudburst projects effective in mitigating flooding and reducing damages related to cloudbursts in the future.

Proposed solutions for cloudburst management comply with the service level for cloudbursts in Copenhagen and Frederiksberg, i.e. allowing for a maximum of 10 cm of water on terrain during a 100-year storm event.

Additionally, in accordance with the intentions and visions set out in the Cloudburst Plan for Copenhagen and Frederiksberg from 2012, proposed solutions developed are to include elements that provide added value and benefits, which contribute to making the city more green, more blue, more attractive and more liveable.

The Cloudburst Masterplan for Ladegårdså, Frederiksberg East & Vesterbro prioritises four catchments based on an assessment of flood risks in the individual catchment.

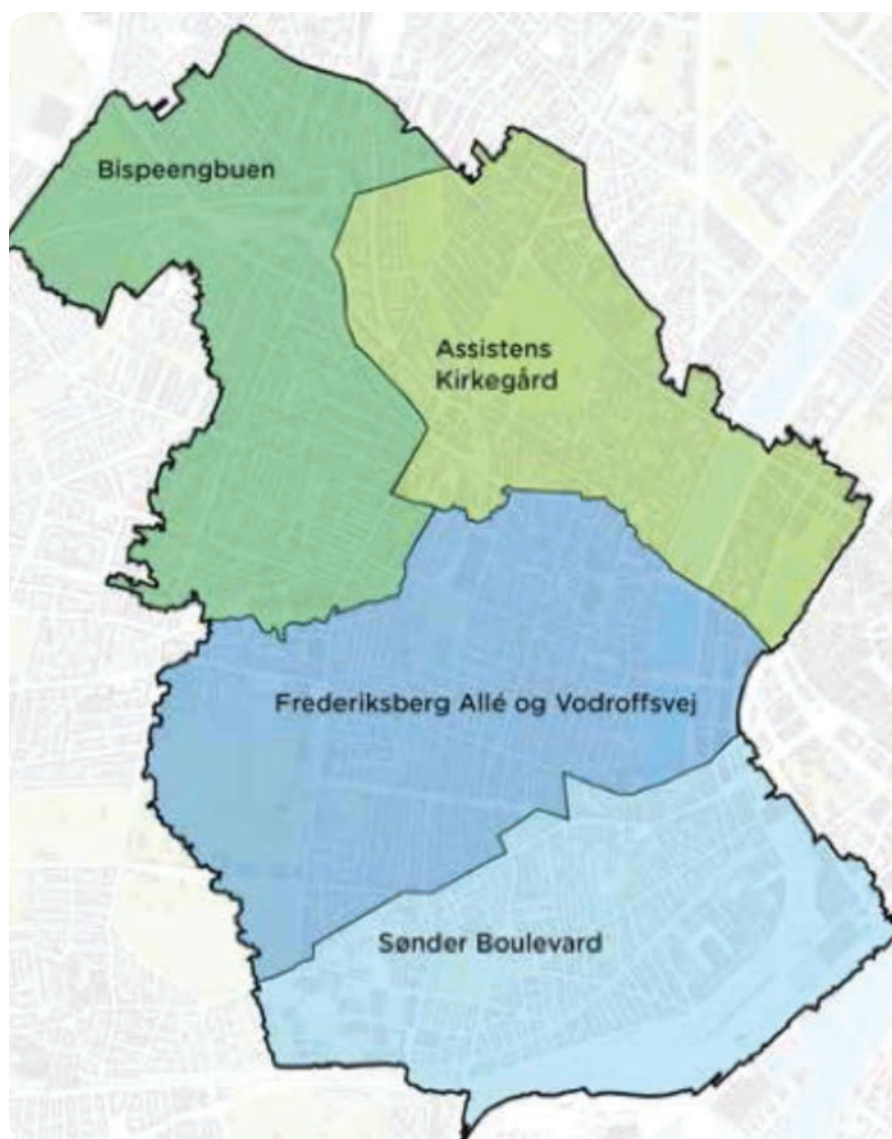


Figure 1
Water catchment of Ladegårdså,
Frederiksberg East & Vesterbro ^A

CHALLENGE

SUBCATCHMENT OF FREDERIKSBERG ALLÉ

Copenhagen is a frontrunner in climate adaptation and cloudburst management planning. Resiliency planning saw the city be divided and rationalised into several water catchment areas and localised sub-catchments. Each sub-catchment has undergone detailed cloudburst management planning focused on blue-green terrain-based solutions which can add value to the city not only through hydraulic functions for flood mitigation, but also in terms of recreational, environmental, social and economic values.

The Copenhagen Urban Lab project focused on the subcatchment of Frederiksberg Allé in the

low-lying and popular historic neighbourhood of Vesterbro in Copenhagen. This neighbourhood was severely flooded during the 2011 event.

The Cloudburst Masterplan in this subcatchment deploys blue-green infrastructure to detain as much stormwater as possible in upstream areas and convey it downstream through robust cloudburst roads draining the water via Sankt Jørgens Sø followed by a cloudburst pipe directed towards the harbour.



Figure 2
Cloudburst masterplan for
the subcatchment of
Sønder Boulevard^B

CHALLENGE

SANKT JØRGENS SØ

One of the projects in the Frederiksberg Allé subcatchment is the Sankt Jørgens Sø detention project. This project is intended to detain and convey water from the upstream areas to a large cloudburst pipe leading the water to the lake and eventually to the harbour in cloudburst situations.

The lake needs to accommodate between 47,000 m³ and 75,000 m³ during cloudburst events. Achieving this requires substantial terrain modifications and lowering the water table in the lake.

Our task was to address the complexity of the current plans for the lake, both in scale and technicality and to bring new ideas to the planning processes in close cooperation with key stakeholders.

We worked within the hydraulic catchment of Sankt Jørgens Sø in order to address the following issues and challenges:



Figure 3
Illustration showing the transformation and urban landscape qualities proposed for Sankt Jørgens Sø

CHALLENGES

1. Need for stormwater storage - How much volume and how?
2. Terrain modifications for stormwater to reach the lake and discharge from the lake - if we alter the water table, which is the optimum level for the future lake?
3. To which degree can we rely on gravitation for this part of the system and how much pumping will we have to add?
4. How do we integrate the water quality of the lakes into the design?
5. How do we integrate our design into existing profile of the neighborhood, both in terms of landscape, traffic and culture?
6. Which added benefits and values do we prioritise in our design?

HOSTS & SPONSORS

Denmark has a very strong water sector known for innovative partnerships and cooperation. The Danish water sector is increasingly becoming international and interdisciplinary through new political agendas especially related to green initiatives, streamlining of services and processes and through climate resiliency initiatives. The links between water management and other aspects of urban planning are strengthening and integrated planning approaches are increasingly applied by both public and private actors. Joint efforts across traditional planning corridors are provoking a transformation towards more liveable cities. Copenhagen is a great example of such efforts with city wide strategies, catchment specific masterplans and co-created projects at the local level.

The Urban Lab is jointly funded by the City of Copenhagen (Lykke Leonardsen), the Municipality of Frederiksberg (Dorte Nilsson and Niels Kaalund), the Utility for Greater Copenhagen HOFOR (Jes Clauson-Kaas), the Utility of Frederiksberg (Henrik Bay), the University of Copenhagen (Marina Bergen Jensen), IWA Denmark (Miriam Feilberg), the Young Water Professionals Denmark (YWPDK) and Rambøll (Christian Nyerup Nielsen and Trine Stausgaard Munk).



PROGRAMME

The **Urban Lab** took place from **June 1st to June 9th 2017**. The host organisation behind the Copenhagen Urban Lab is a welcomed the team in Copenhagen on June 1st. The team worked on one of the most contemporary challenges in the city: building resilient neighbourhoods. The purpose of the Urban Lab was to reflect on how to apply and improve current integrated planning approaches by focusing on the case of the Sankt Jørgens Sø in the inner city of Copenhagen.

Sankt Jørgens Sø is a signature project with-in cloudburst resiliency planning in Copenhagen. The ideas, designs and proposed solutions could be of high value to the city and reflections in the process likewise.

The 9-day programme included informal lectures, guided tours, discussions, presentations and dinners with various stakeholders and with-in the group itself in preparation for a final presentation on the 9th June.

June 1st - Arrival, welcome and introduction

- 16.00 Arrival at Rambøll Head Office
- 16.15 Welcome and team introduction
Trine Stausgaard Munk, Project Manager, Rambøll
- 16.30 Rambøll as host and as driver for change in urban planning practices
Christian Nyerup Nielsen, Director, Rambøll
- 17.00 Programme of the week, tour of the building, contacts and materials
- 18.00 Dinner at Restaurant Rasoi

June 2nd - Setting the scene

- 8.30 Breakfast with the Rambøll climate adaptation departments
- 9.00 Introduction to the full masterplan developed by Rambøll:
Jesper Rasmussen, Project Director, Rambøll
- 10.00 Introduction to climate adaptation work
Lykke Leonardsen, Program Director for Resilient and Sustainable City Solutions, City of Copenhagen
- 10.45 Introduction to the Cloudburst Management Plan
Lykke Leonardsen, Program Director for Resilient and Sustainable City Solutions, City of Copenhagen
- 11.30 Introduction to Sankt Jørgens Sø
Rikke Hedegaard Christensen, Urban Planner, City of Copenhagen
Niels Kaalund Jensen, Civil Engineer, Frederiksberg

- 12.30 Lunch at Rambøll
- 13.00 Stormwater management and urban development
Marina Bergen Jensen, Professor MSO, University of Copenhagen
- 13.30 Questions/discussions on aspects, clarifications
- 13.45 The role of green infrastructure in water management
Li Liu, Post Doc, University of Copenhagen
- 14.15 Questions/discussion on aspects, clarifications
- 14.30 Understanding of the task and preparing for meeting with HOFOR
- 19.00 Dinner at Von Fressen on Vesterbro

June 3rd - Catchment day

- 9.15 Arrival at Frederiksberg Station where we met Morten Plesner Hansen from HOFOR
- 9.30 Presentation of the Frederiksberg cloudburst system draining to Sankt Jørgens Sø
- 10.00 Presentation of the Copenhagen cloudburst system draining to Sankt Jørgens Sø
- 10.30 Walk to Lindevang Park
- 10.45 Frederiksberg presents the climate project in Lindevang Park
- 11.15 Walk with HOFOR to cloudburst roads in Frederiksberg Allé subcatchment and to Sankt Jørgens Sø
- 14.00 Lunch with HOFOR
- 15.00 Field work at Sankt Jørgens Sø
- 18.00 Dinner at Bevar's on Nørrebro

June 4th - Urban liveability

- 8.30 Breakfast and self-study
- 10.30 Urban liveability, urban aesthetics, changes over time, and aspects on water in the urban space, Bettina Lamm, Associate Professor, University of Copenhagen
- 11.15 Questions/discussions on aspects, clarifications
- 11.30 Discussions of group project
- 12.00 Lunch
- 13.00 Self-study – research
- 18.30 Dinner at Mothers in the meatpacking district

PROGRAMME

June 5th - Adding value

- 8.30 Breakfast
- 9.00 Adding values and building the business case, Jonathan Leonardsen, Senior Consultant, Rambøll
- 10.00 Group work – building our concepts
- 12.00 Lunch
- 14.00 Group work – building our concepts
- 18.00 Tour and dinner at Papirøen with Kirsten Prismo and Marco Sempreviva Lund from YWPDK

June 6th - Feedback day

- 9.00 Breakfast
- 9.30 Presentation of initial findings to Rambøll and Jes Clauson-Kaas, HOFOR
- 10.30 Discussions and feedback
- 11.30 Lunch at Rambøll
- 12.30 Group work – how can we use the feedback?
- 14.00 Hydraulic session, Toke Sloth Madsen, HOFOR
- 18.00 Dinner with Rambøll and other stakeholders at Pegasus on Vesterbro

June 7th - Building statements

- 9.00 Breakfast
- 9.30 Building our statements, Marina Bergen Jensen and Bettina Lam, University of Copenhagen
- 12.30 Lunch at Rambøll
- 13.00 Building our statements, Li Liu and Ole Fryd, University of Copenhagen
- 18.00 Dinner with HOFOR at BOB Bistro

June 8th - Finalising plans

- 8.30 Breakfast
- 9.30 Finalising our plans and preparing our presentations
- 13.00 Lunch at Rambøll
- 15.30 1-hour tour of the canals of Copenhagen with YWPDK and Jes Clauson-Kaas, HOFOR
- 18.00 Dinner at Halifax Nørrebro

June 9th - Presenting results

- 8.30 Breakfast
- 10.00 Final presentation of our findings to key stakeholders
- 12.00 Lunch at Rambøll
- 13.00 Official end of Lab

June 12th to 14th - Embrace the Water a Cities of the Future Conference, Göteborg Sweden

Oral and poster presentation of the Copenhagen Urban Lab



TEAM

LANDSCAPE



Ana Panoias

Master student
Landscape Architecture &
Urban Design
University of Copenhagen,
Denmark Portugal



Paula Curmi

Landscape Architect
Grant Associates
UK

URBAN



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WATER



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Research Specialist
Regional Centre on Urban
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URBAN



Simon Roberts

Civil Engineer
E2DesignLab
Australia



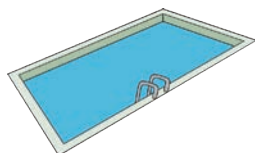
PROCESS & FINDINGS

CLOUDBURST SOLUTIONS

The challenge

How can we provide 47,000 m³ to 75,000 of CLOUDBURST STORAGE in the lake?

47,000 to 70,000 m³
19 – 30 Olympic Pools^c



The process

The team explored multiple options, both prior and after consulting with key stakeholders, including HOFOR. The short amount of time, the limited availability of data and many preconditions framed the discussions to be at a conceptual level based on overall hand calculations of flows and volumes. Proposed designs should be validated through detailed hydraulic modelling.

Below a list of discussed options:

- Gravity drainage from cloudburst streets into ‘cloudburst parks’ that are dry for the majority of time but fill up during cloudburst events. This is a low energy solution but would require significant lowering of the wall along the western edge of the lake.
- Extension of the cloudburst tunnel. A smaller diameter pipe could be used to transfer regular flows directly to the Harbour but still allow for surcharge during large cloudburst events. This could avoid the need for gravity drainage of the adjacent cloudburst streets as all flows from these catchments could discharge into the cloudburst pipe extension. This could also minimise the need for lowering the wall along the western edge of the lakes (if the hydraulic energy is sufficient – more investigations are needed).
- Consider using one lake or both lakes for storage. By using two lakes the changes to the lake water level and boundaries can be reduced and the length of cloudburst tunnel can be reduced (saving significant costs).

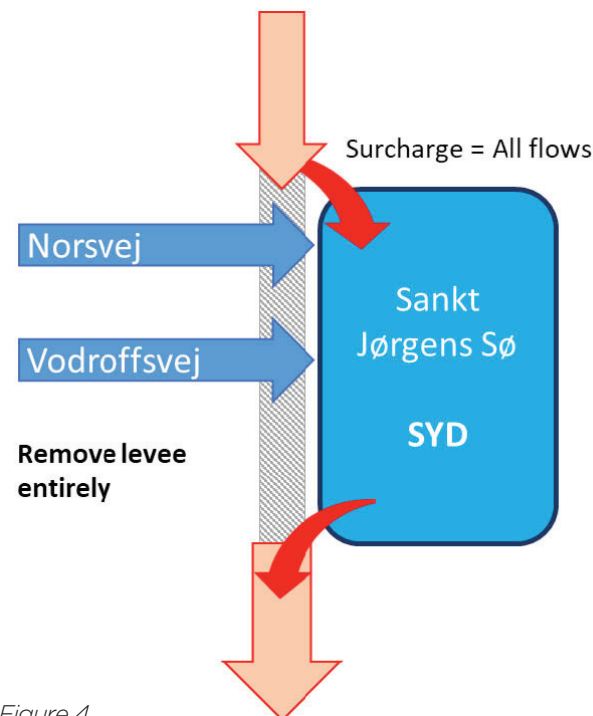


Figure 4
Use one lake and
surcharge all flows

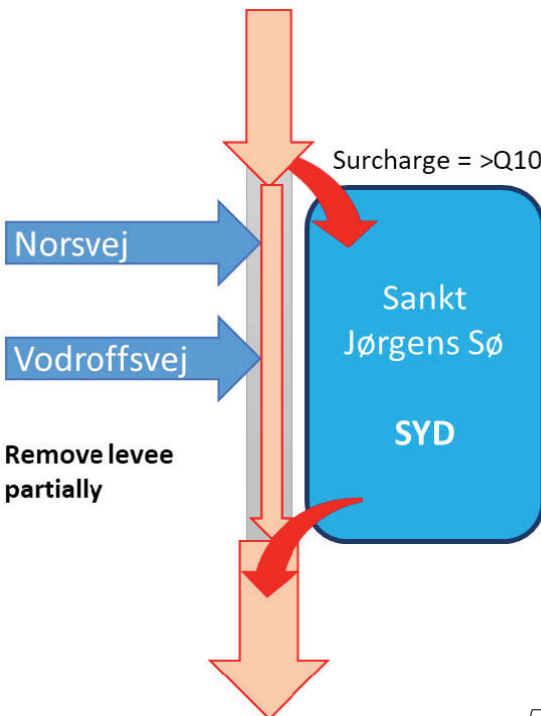
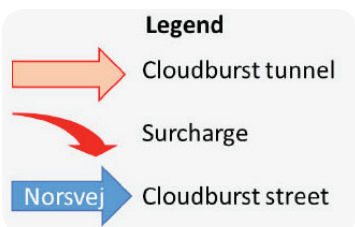


Figure 5
Use one lake but include an ex-
tension of the cloudburst pipe
to accommodate low flows



PROCESS & FINDINGS

CLOUDBURST SOLUTIONS

The outcome

The proposed approach utilises gravity drainage from the western cloudburst catchments into local parks that becomes storages during cloudburst events. Both lakes are used for storage to minimise the height of the wall separating the new parks and the lakes. This also allows for future flexibility as the storage of the lakes could be increased by raising the wall.

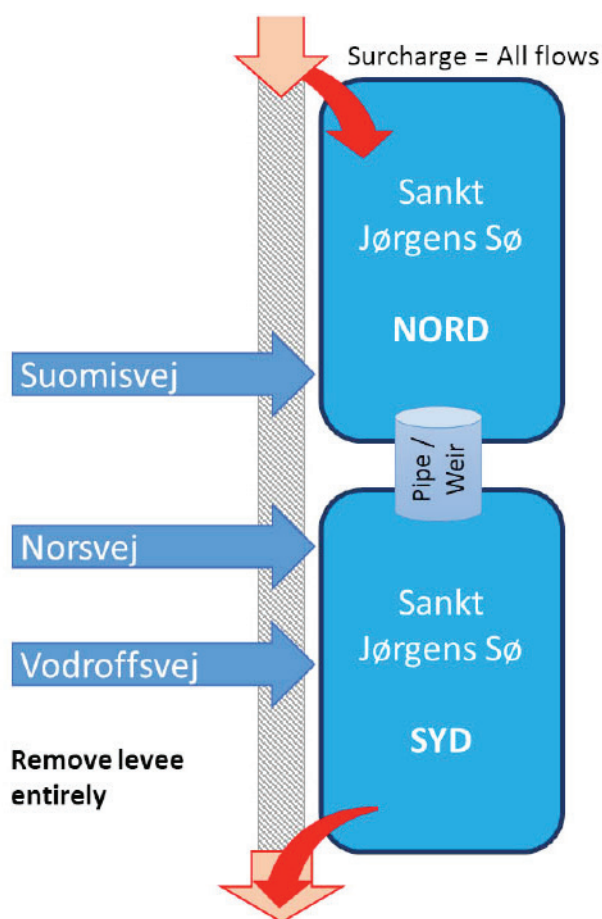


Figure 6
Use two lakes and surcharge all flows

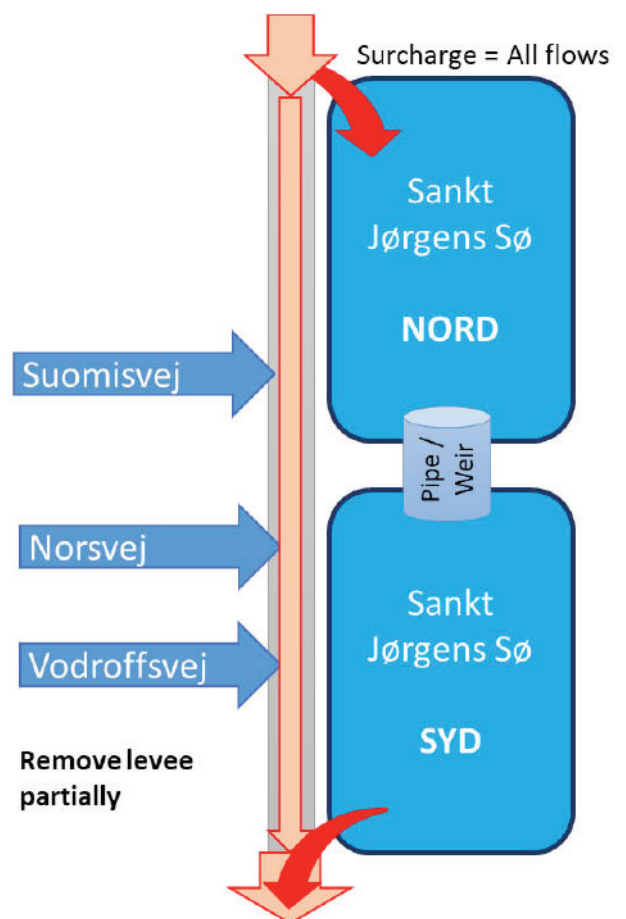
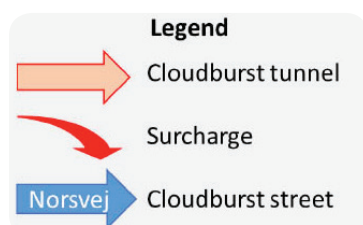


Figure 7
Use two lakes but include an extension of the cloudburst pipe to accommodate low flows



PROCESS & FINDINGS

CLOUDBURST SOLUTIONS

The initial proposal - lake

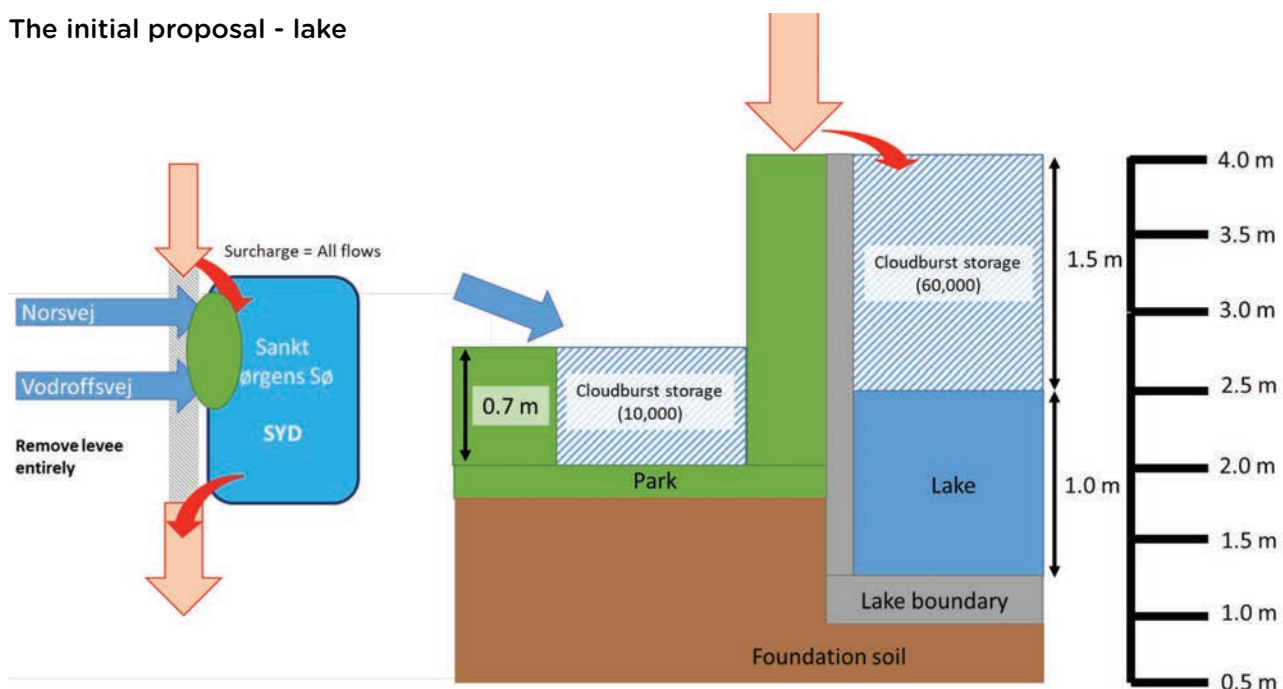


Figure 8

The initial proposal utilised one lake to achieve the required cloudburst storage volume. This proposal also includes some storages in parks connected to cloudburst streets along Norsvej and Vødrøffsvej (parks are dry during everyday rainfall events but provide storage during cloudburst events). Only using one lake for storing surcharge flood water from the cloudburst pipe means that the wall separating the park and lake needs to be 2.0 m high

The new proposal - lakes

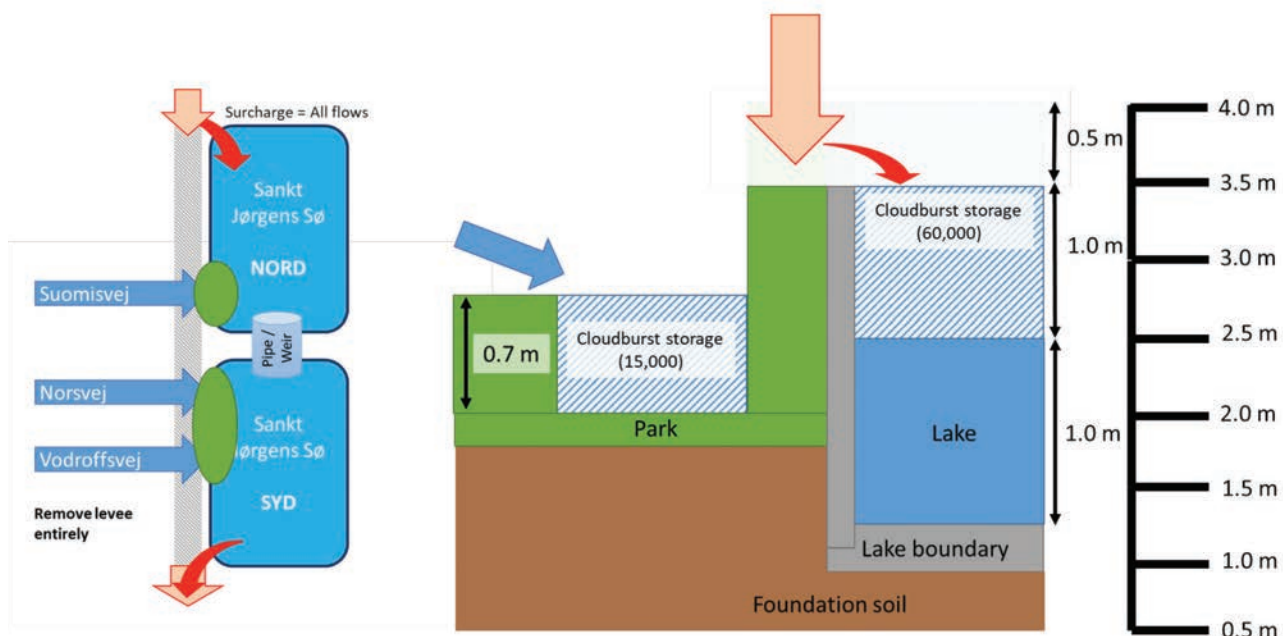


Figure 9

The new proposal presented by the urban lab team utilises two lakes to achieve the required cloudburst storage volume. This has the benefit of reducing the level change in the lakes during cloudburst events from ~1.5 m to 1.0 m. It also means that the wall separating the lakes from the adjacent parks used to stormwater from local cloudburst streets can be reduced to 1.5 m. This proposal also has greater flexibility. For instance, if more cloudburst storage is required in the future the height of the wall separating the parks and lakes could be increased to provide more storage

PROCESS & FINDINGS

WATER QUALITY SOLUTIONS

The challenge

How can we improve the water quality in the lake(s) as well as the water quality from cloudbursts tunnels and streets?

This requires consideration of the first flush phenomenon (i.e. high level of pollutants during the first period of runoff, especially from roads), high phosphorus concentrations that can lead to algal blooms and the challenge of managing runoff contaminated by salt during winter periods.

The process

We explored multiple options, including:

- Natural treatment options (e.g. wetlands and rain gardens) both within the lakes and in new 'green' boulevards along the eastern edges of the lakes.
- More traditional treatment options, such as Alum dosing or even a biological/chemical treatment plant.
- The potential for a 'natural pool' system that combines treatment through vegetation and filtration to improve the water quality enough to allow for swimming. This option would only be provided in an isolated part of the lakes where the number of swimmers could be controlled and wildlife interactions (e.g. swans) regulated.



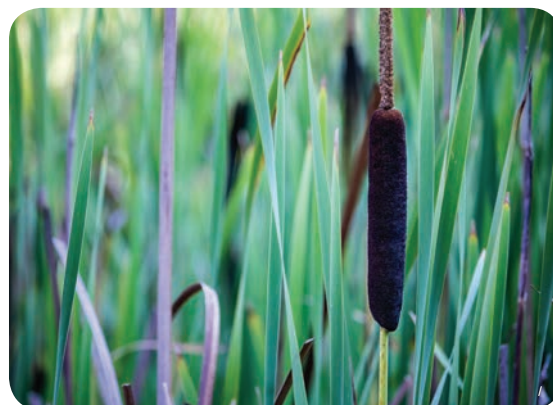
PROCESS & FINDINGS

WATER QUALITY SOLUTIONS

The outcome

The proposed approach utilises natural treatment wetlands both within the lakes themselves and in the boulevard running along the eastern edges. This solution was adopted because:

- Retaining some treatment and vegetation within the lakes themselves is important as it reflects the current more, natural' feel of these lakes relative to the very formal and unvegetated edges of the northern lakes.
- Providing treatment within the boulevard brings water and nature into the streetscape and allows for greater interaction with nature. This also allows for the amount of vegetation within the lakes to be reduced, this is an important outcome as it preserves the existing open water views which provide an important amenity function.
- Locating treatments within the boulevards also simplifies maintenance as it allows for easy access and regulation of the vegetation in separate cells. This is considered to be easier than maintaining the more natural and unvegetated wetland systems proposed within the lake,



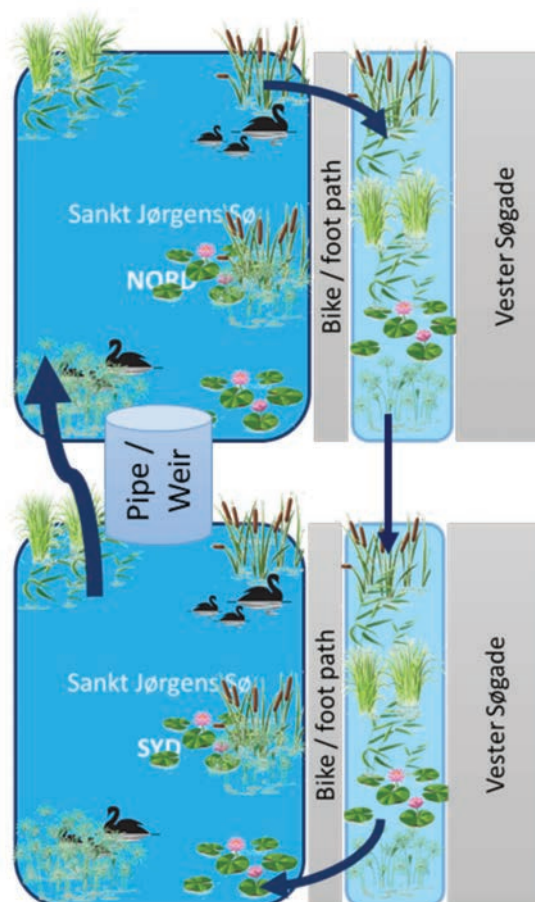
If this approach is adopted the management of mosquitos will need to be considered as part of the design. This should be easily achieved by ensuring a constant flow within the boulevard treatment systems and/or designing sub-surface treatment wetlands that minimise standing water.

The proposed solution requires water to be pumped from the northern lake to the boulevard. From the boulevard water can flow by gravity to the southern lakes. This also provides an opportunity for disconnection of adjacent residential downpipes into the boulevard treatment systems. Once the treated water has returned to the southern lake it will then need to be lifted by a pump into the northern lake to keep the circulation going. This treatment system will help improve the water quality in the lake on an everyday basis.

The cloudburst streets have been kept separate from the lakes to avoid the risk of regular first flush, phosphorus and salt pollution. During a cloudburst polluted water will enter the lakes from the cloudburst tunnel and drain out over an extended period. These cloudburst flows will receive minimal treatment prior to discharge to the lake.

Figure 10

Water is treated using natural vegetated systems in the lakes and boulevards. Water is recirculated from the upper lake (pumped), through the boulevards (gravity), to the lower lake (gravity) and then back to the upper lake (pumped). The pipe or weir connecting the two lakes will only be engaged in cloudburst events



PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS

The challenges

Challenge 1

The group discussed the following questions in trying to approach the Urban Landscape response:

- Should the approach be driven by the critical need to implement a cloudburst project and be therefore technically driven? **VOLUME**
- Should it be driven by the urgent need to improve the water quality of Sankt Jørgens Sø and be therefore technically driven? **WATER QUALITY**
- Should it be driven by ambitious thoughts to improve the existing limitations found in the immediate and surrounding urban landscape and be therefore aspirationally driven? **URBAN-LANDSCAPE**
- What is the order of priority of the three main elements?
- Should there be a priority list or is each aspect equally important?

These questions required serious consideration and agreement as they began to form the rules and restrictions behind the integrated design solution as well as the multiple benefits that can be achieved alongside any chosen solution. **As a group the agreed stance would be to adopt a realistic yet aspirational approach by weighing out the multiple benefit opportunities or lack thereof across the solutions.**

The reality is that the Urban Landscape needs to work hard, the question was **how hard?**

Challenge 2

The team also discussed how to make the Urban Landscape work hard in providing space for:

- People (residents, surrounding locals)
- People (visitors)
- Commuters & Lingerers
- Programable / Passive Activities
- Additional Water Volume (space for segregated volumes and different frequencies)
- Formal & Informal Vegetation that provides opportunity for:
 - wildlife to develop and thrive,
 - people to connect with nature
 - water cleansing functions

Challenge 3

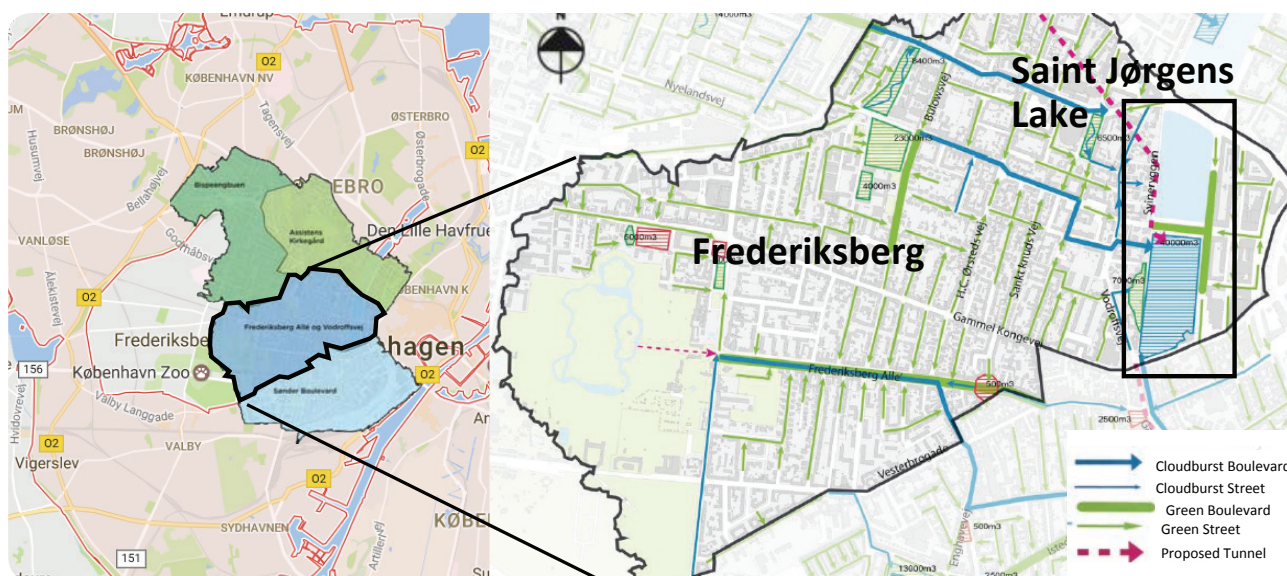
How to resolve / integrate the implications of the lake modification to accommodate the Cloudburst volume:

- Resultant high wall
- Significant drop in level and how to reach the water safely

Challenge 4

How to resolve / integrate the implications of Water Quality and the potential variations.

Figure 11
The Project Area in its immediate & wider urban context



PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS

The process

The group kept in mind the planning policies and ambitions for the whole of Copenhagen and identified the opportunities and constraints of the site:

- The project area forms part of a wider complex piece of urban landscape with a strong identity.
- Sankt Jørgens Sø is one of several lakes that all share a historical background.
- The lakes are an important identifiable element to the City of Copenhagen. They depict a very formal edge, resonating a particular moment in their history.
- The character of the vegetation changes along various stretches of the banks.
- The water as an element is the factor that binds all the lakes together. There is no other urban landscape element that unifies the lakes.
- Sankt Jørgens Sø feels very separate due to the existing road. Connectivity across both visually and physically is rather poor.



Figure 12
The City of Copenhagen published documents

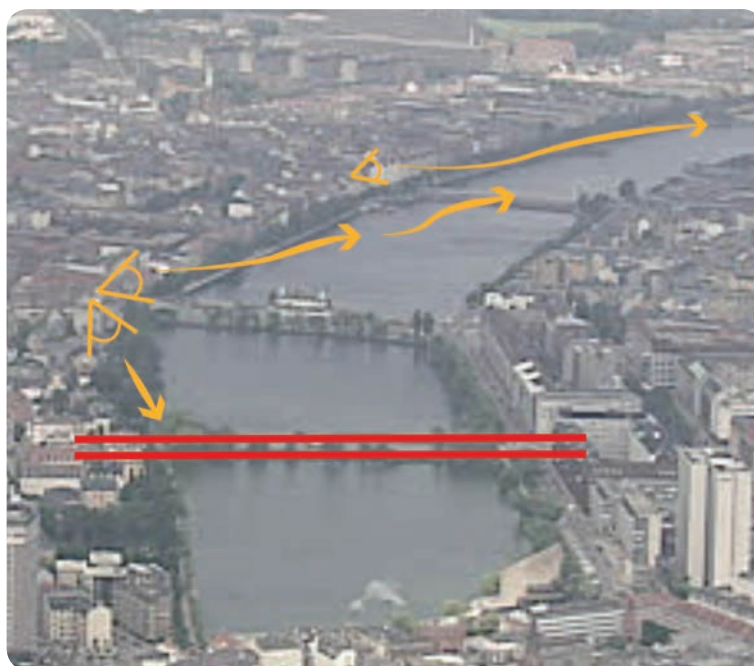
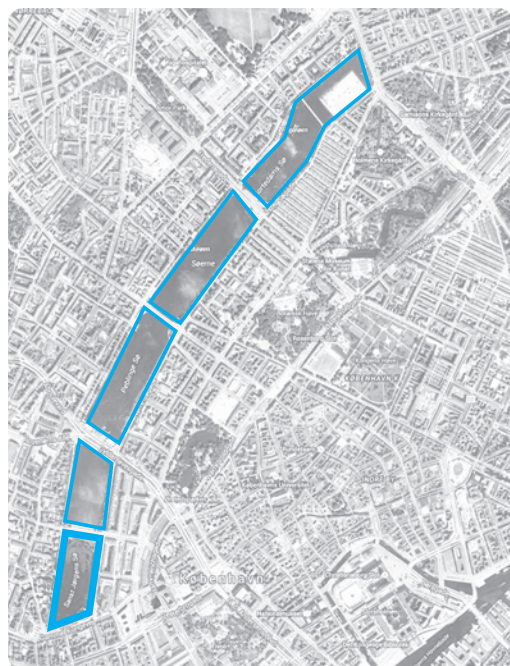


Figure 13
The Project Area in its immediate & wider urban context

INTEGRATED URBAN LANDSCAPE SOLUTIONS


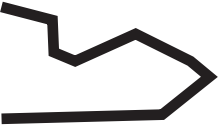








EXECUTIVE SUMMARY

PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS

LEGEND:

-  Physical & visual barriers
-  Existing buildings FFL currently lower than Water Level
-  Existing road with under-used potential
-  Existing landform and/or change in level
-  Cycle Lane & pedestrian walkway
-  Existing vegetation that largely creates a barrier between the people and the water
-  Limited opportunities to come close to the water
-  Water quality concern due to algal bloom

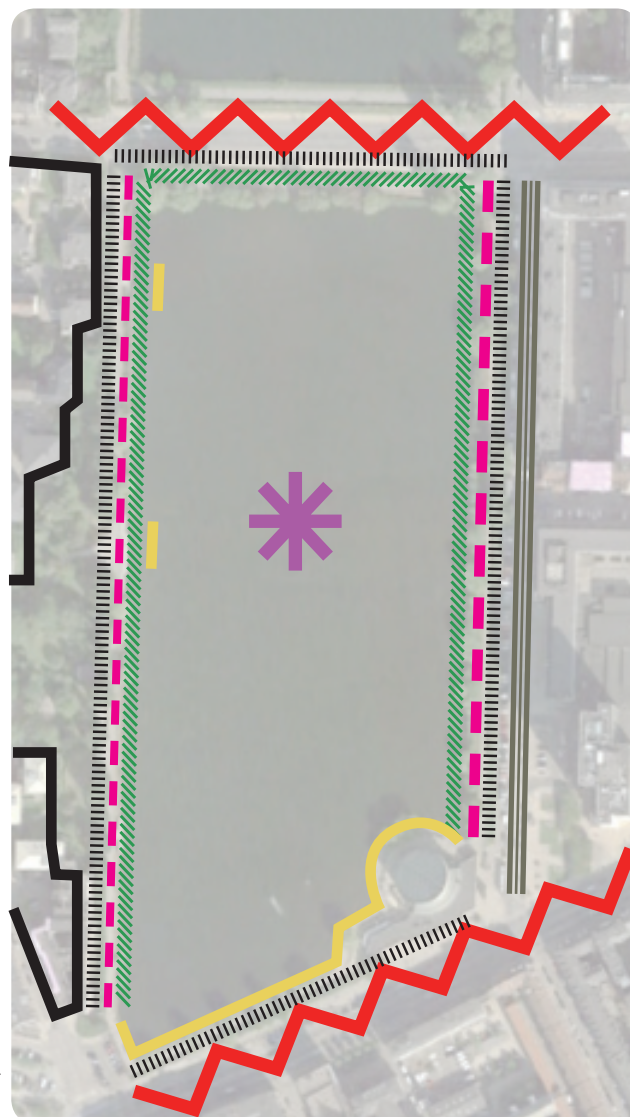


Figure 16
The Project Area

Explored various criteria with the intention to create a defined brief. Discussed and challenged:

- The benefits of taking into consideration the immediate streets surrounding the lake?
- The integration of the cloudburst street that transports water to Sankt Jørgens Sø?
- The potential for looking at the bigger picture in which Sankt Jørgens Sø sits, the relationship between one lake and the other and how these can begin to work together?
- The role of the surrounding streets as mainly car transporting means?
- The degree of change/modification to the lake edges, depth and overall character is considered acceptable?
- The balance between a formal/informal character, if any?
- Sankt Jørgens Sø as a water body. Shouldn't it still read as a water body?

PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS

In context with the *City of Copenhagen Cloudburst Management Plan, 2012*, Sankt Jørgens Sø needs to provide sufficient cloudburst storage volume.

A 'simple' technical check in comparing the existing volume vs required volume (to ensure provision for cloudburst resiliency) indicated that:

- the water level needs to drop significantly
- additional excavation is required to retain the lake as a water body

This scenario would give way to an increased detachment between:

- the water body and the people
- the water body and its immediate context

The outcome

Water volume calculations & checks indicated that it was beneficial to accommodate the cloudburst volume across two of the lakes.

Therefore, it was the technical planning aspects that informed the decision to extend the project area.

This gave rise to an opportunity to develop an idea that can begin to form the basis of a wider aspiration for all of the lakes.

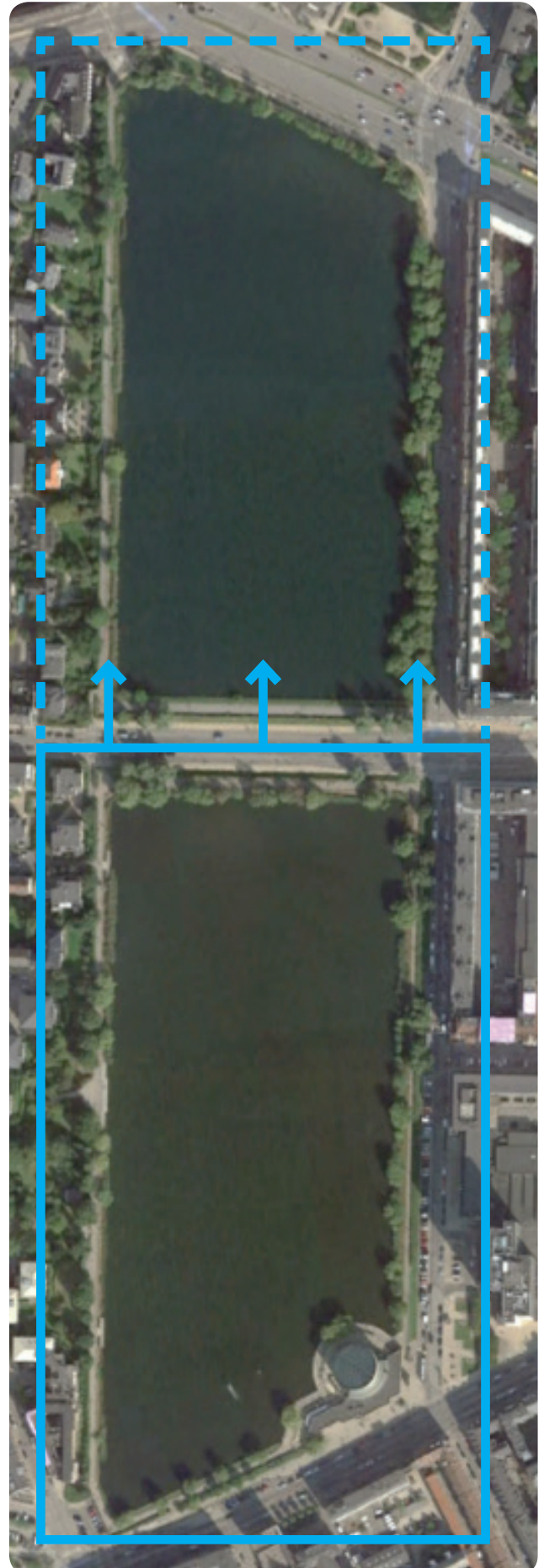
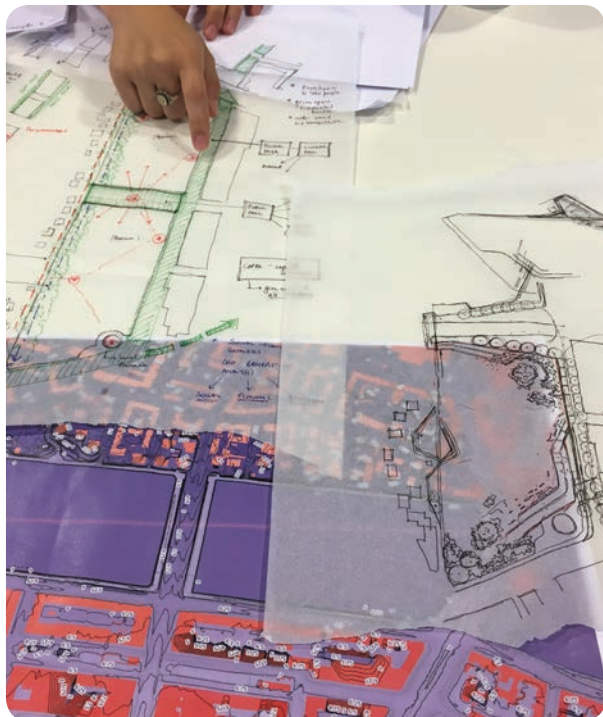


Figure 17
The Extended Project Area

PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS



Design considerations

- The extended project area is not isolated.
- It is a piece of a wider, complex puzzle of green-blue infrastructure.
- Its design needs to connect on the micro scale as well as on the macro scale.
- The elements in the urban landscape need to connect up to a wider existing and future planned green infrastructure that can begin to work harder.
- The hydraulic function is active 1 in every 100 years - what about the other...

99 years???

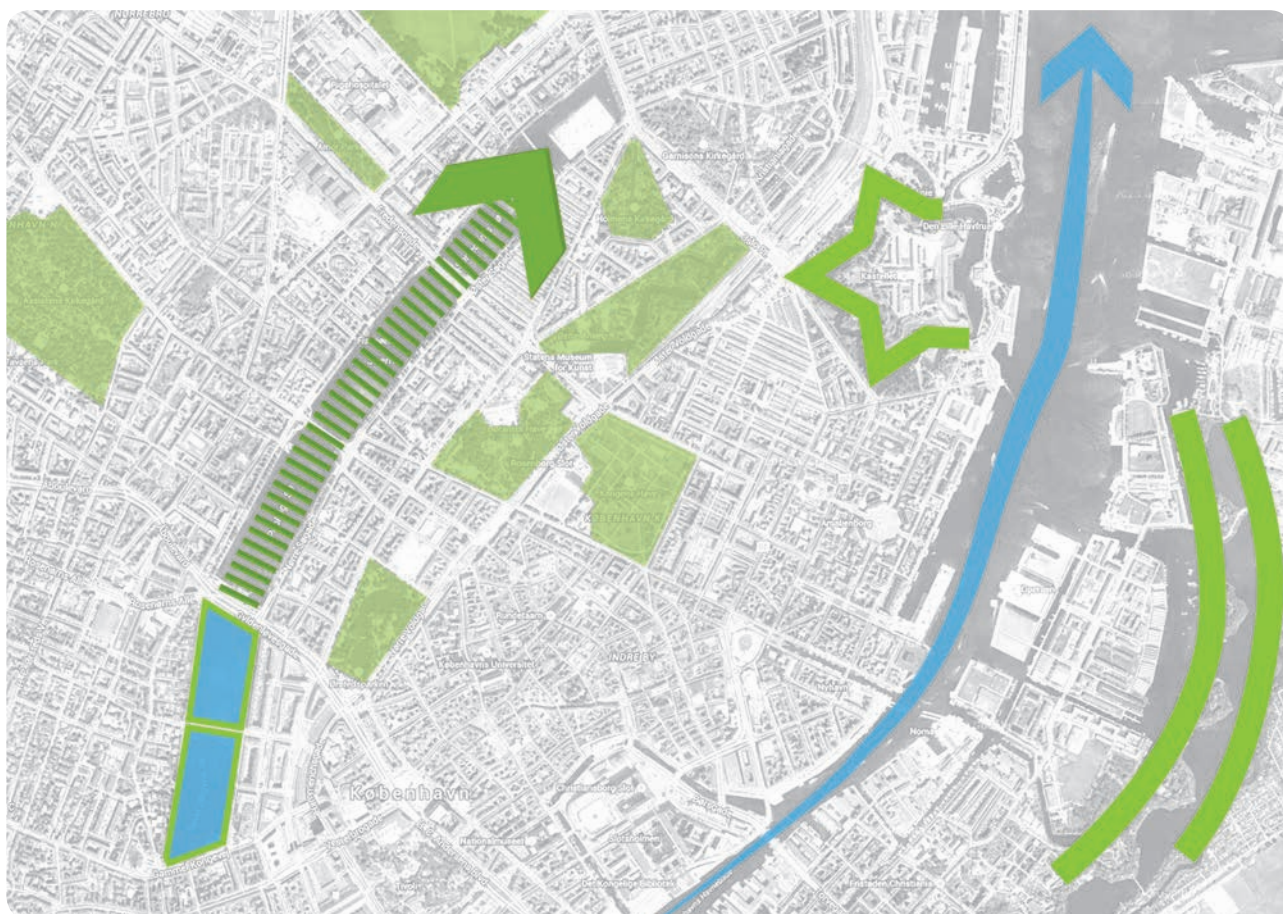


Figure 18
The Extended Project Area in its immediate
& wider urban context

PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS

• The everyday park

- A park for 99 years
- A resilient solution for 1 in 100 years
- Sankt Jørgens Park!



Figure 19
The Proposal: Everyday Lake

PROCESS & FINDINGS

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Manipulate the topography

Lowered the existing landforms that create a visual/physical barrier around the edges of both lakes.

Maintained and/or created a formal edge (reflecting the identity & character of the current lakes) balanced by complex undulating topography that creates:

- opportunity for habitat
- increased contact between plant material & water for improved water quality treatment
- varied connection between people & the water

Retained a select number of existing trees that due to their size and character provide cultural & natural benefits to the local environment.

Formed 'basins' which segregate the lake water from more frequent rainfall. The structure walls supporting these basins are integrated and hidden behind the undulating topography providing a gradual soft decent into the water.



Figure 20
The Proposal: Physical changes

PROCESS & FINDINGS

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Accommodate the cloudburst volume

A- 30,000 m³

B- 30,000 m³

C- 5,000 m³

D- 15,000 m³

TOTAL VOLUME:
75,000 m³

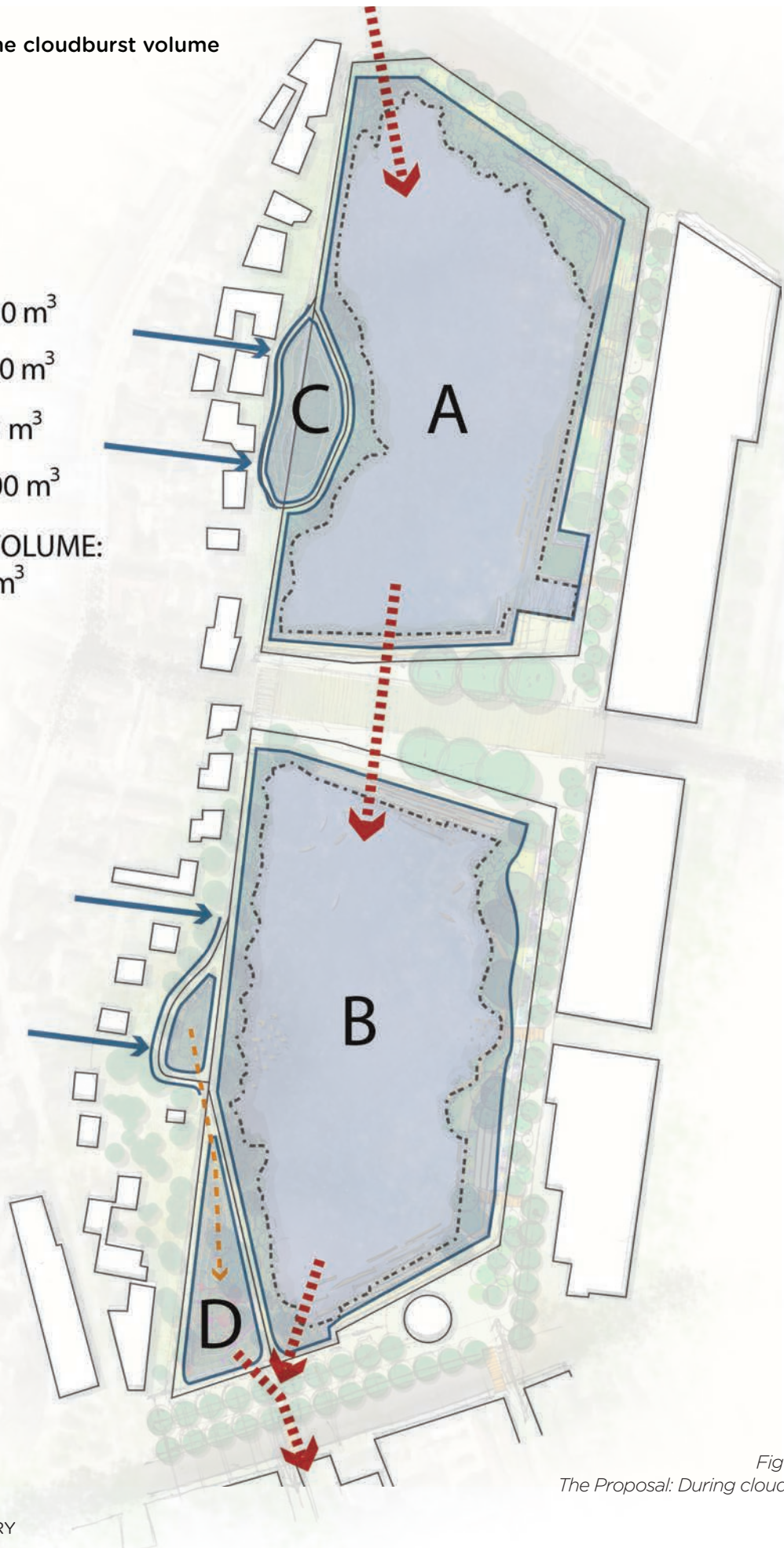


Figure 21
The Proposal: During cloudburst

PROCESS & FINDINGS

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Reclaim the streets

Transformed the existing adjacent street into a multi-functional boulevard that opens up onto the view of the lakes, thereby taking advantage of the site orientation and creating an active front along the sunnier side of the site.



The boulevard will provide space for:

- a cycle lane
- pedestrian avenue
- urban-nature
- programmable spaces for people & children
- additional water cleansing facility

Transformed, (temporarily or not), the road separating the two lakes into a 'Stage on the Water' animated by people, activities and life.

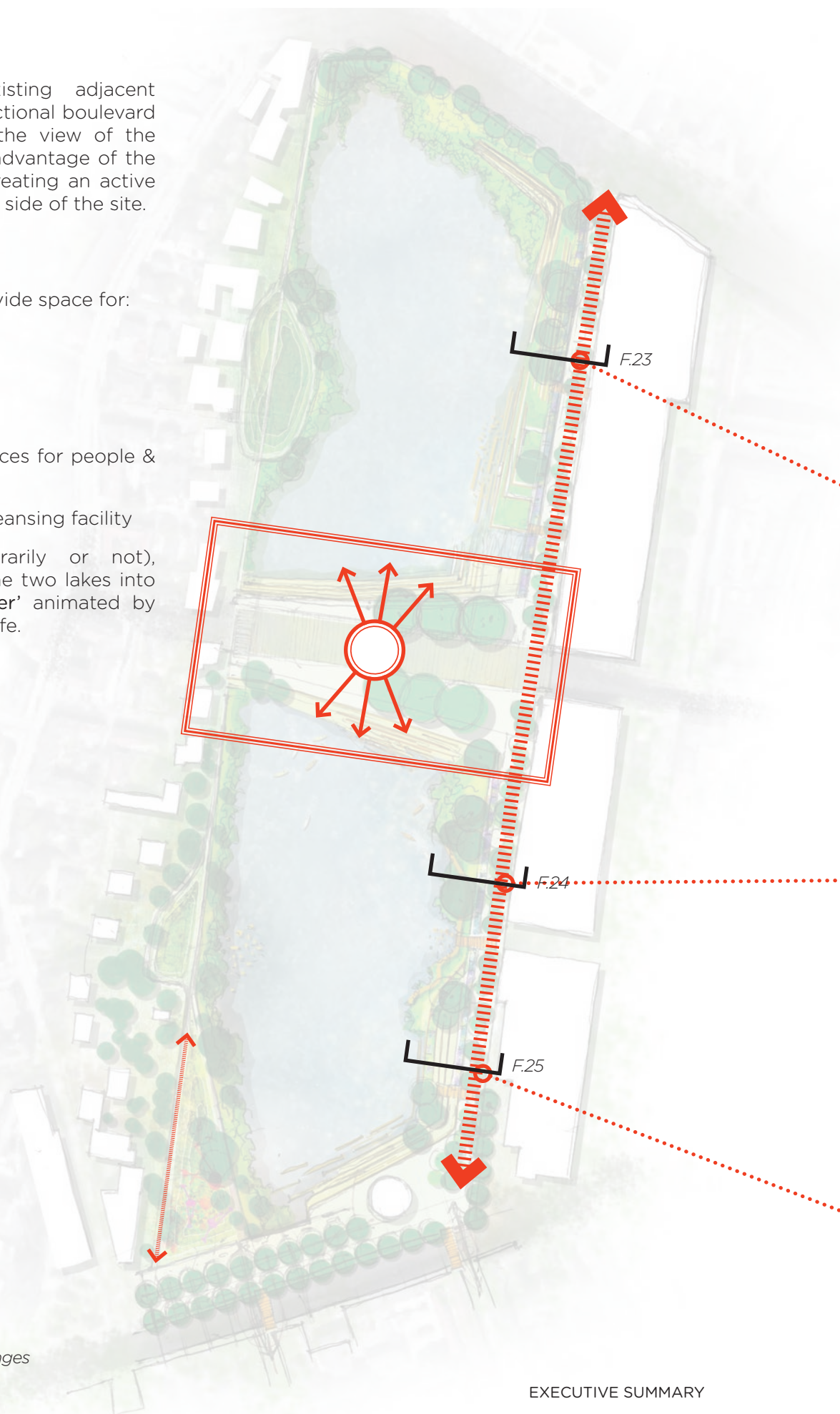


Figure 22
The Proposal: Physical Changes

PROCESS & FINDINGS

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Illustrations showing:

1. Complex, varied waters edge
2. Urban nature boulevard
3. Cut-through cycle route
4. Water cleansing feature
5. Programmable spaces

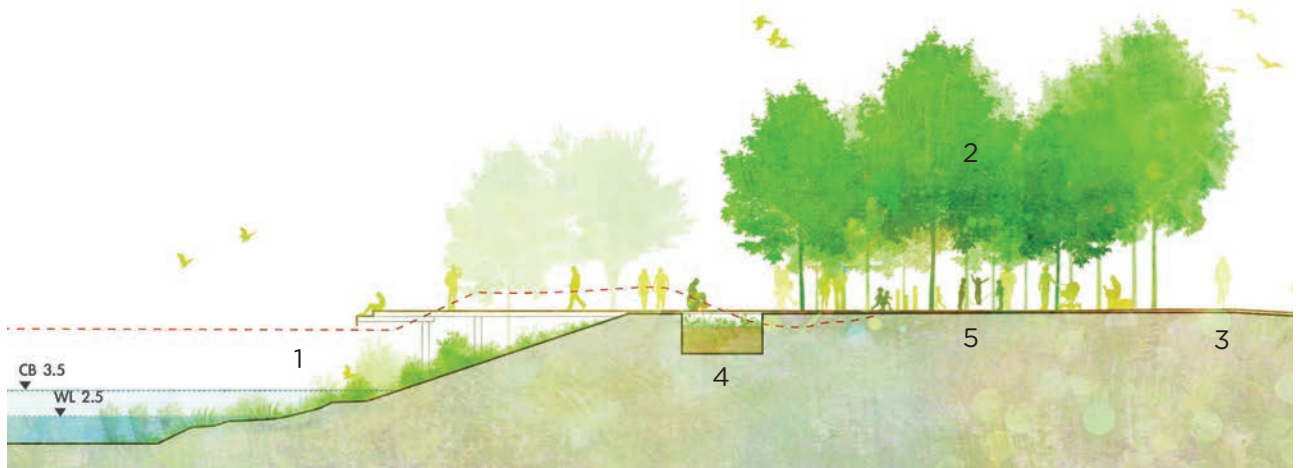


Figure 23

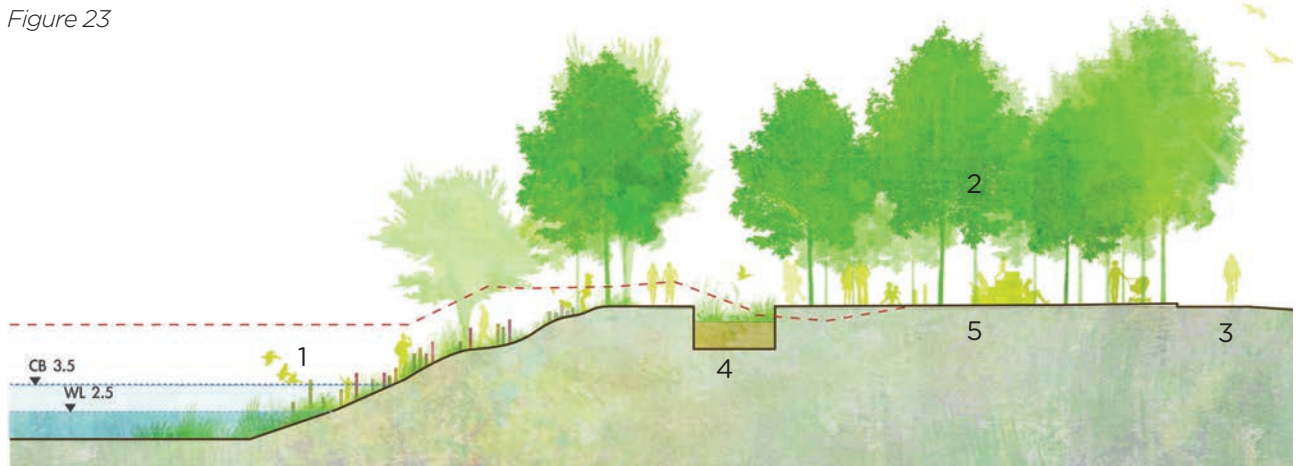


Figure 24

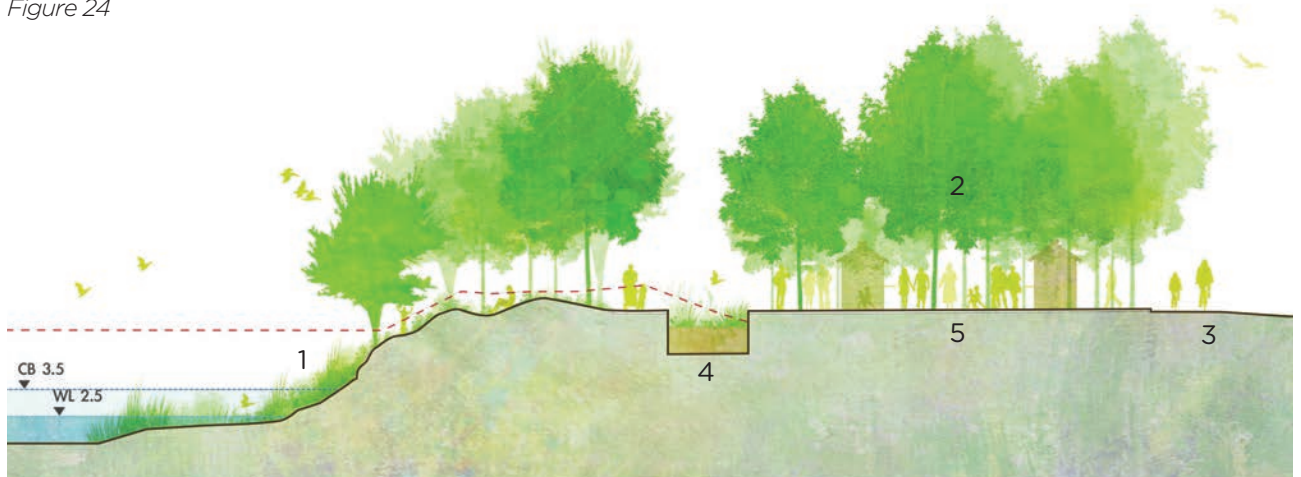


Figure 25

INTEGRATED URBAN LANDSCAPE SOLUTIONS

In creating the boulevard we are providing more space for people rather than for cars.

This will be a benefit to:

- the houses along the western edge of the lakes
- the public who can enjoy a relaxed stroll whilst away from the activity on the eastern edge
- wildlife to find quieter, undisturbed habitat to nest in

This space can, initially temporarily, close on a weekly or monthly basis, eventually permanently, become a 'Stage' on water where the people become the main 'actors' of the space. It will be characterised by:

- visual connection across the lakes
- landmark trees
- stepped connection to the water
- events and organised activities

Figure 26
The Proposal: Proposed Uses

PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS



PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS

Urban public outdoor life

The boulevard is a quite wide, long area for opportunities related to active public outdoor life.

It is interspersed with a variety of programmable spaces that give opportunity for people of all age groups to enjoy. Some offer passive use, others more active.

There is space to:

- read alone
- sit in groups and chat
- listen to music
- take shelter from the sun
- play
- enjoy the feeling of wild urban-nature
- set up stalls for public events/ markets

Thoughts have been discussed on the potential of this stretch of land to be transformed into an active, lively boulevard-promenade if the ground floor of the adjacent buildings are also transformed into more public uses such as: cafes, bars, restaurants, playschool etc.

The scheme also provides quieter, more relaxed edges on the western side of the lakes which overlook onto the water.

The basin located on the southwest side of the south lake is designed to collect and transfer water. When it is dry, it doubles up as a lively, natural play area with fun opportunities and play elements for children that take advantage of the bowl-like topography.

Thoughts have been discussed in how the play elements in this area can be designed in such a way that they link into the use of the existing building nearby, the *Tycho Brahe Planetarium*.

While this area is essentially a depression in the ground, it is quite large and views into it and through it will be maintained to ensure safety and overlooking by the childrens parents.



Figure 27
The Proposal: Proposed Uses
EXECUTIVE SUMMARY

INTEGRATED URBAN LANDSCAPE SOLUTIONS



Figure 28
Multi-functional Urban-Landscape

PROCESS & FINDINGS

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Connection to the water & urban nature

The waters edge is designed to accommodate a gradation of planting characters that allow various and diverse plant communities to co-exist: formal, semi- formal, wild. This vegetation complexity coupled with the variations in topography will create areas of different character, interest, access, proximity and interaction with a dynamic waters edge.

People are invited to move through, explore and get lost in, experience moments enveloped by the vegetation, moments at an elevated view point enjoying views across the lake, and moments close to the open water.

There are areas where the vegetation is the element that connects people to the water, in other instances it may be a playful urban element poking out of the water or even nature (birds) itself.

Access to the water is also varied. In some cases the connection is faster, through steps or platforms, whereas in other occasions the approach is slower. There are also moments along the edge where accessibility by people is purposely restricted which, if supported by a limited/ careful maintenance and management strategy, will make for an undisturbed habitat for biodiversity and wildlife to thrive. These areas are mostly on the western edges and close to the water.

The boulevard adopts the urban nature theme, is characterised by a stretch of tree groupings planted at irregular spacing and for resiliency purposes consists of trees of different age and species.

The boulevard is also flanked by a formal, linear wetland that receives storm water run off from the decoupled buildings along its length as well as the boulevard itself. It is an important element integrated in the scheme that circulates and cleans the water of the lakes and brings an additional layer and richness to the theme of Urban-Nature in the City of Copenhagen.

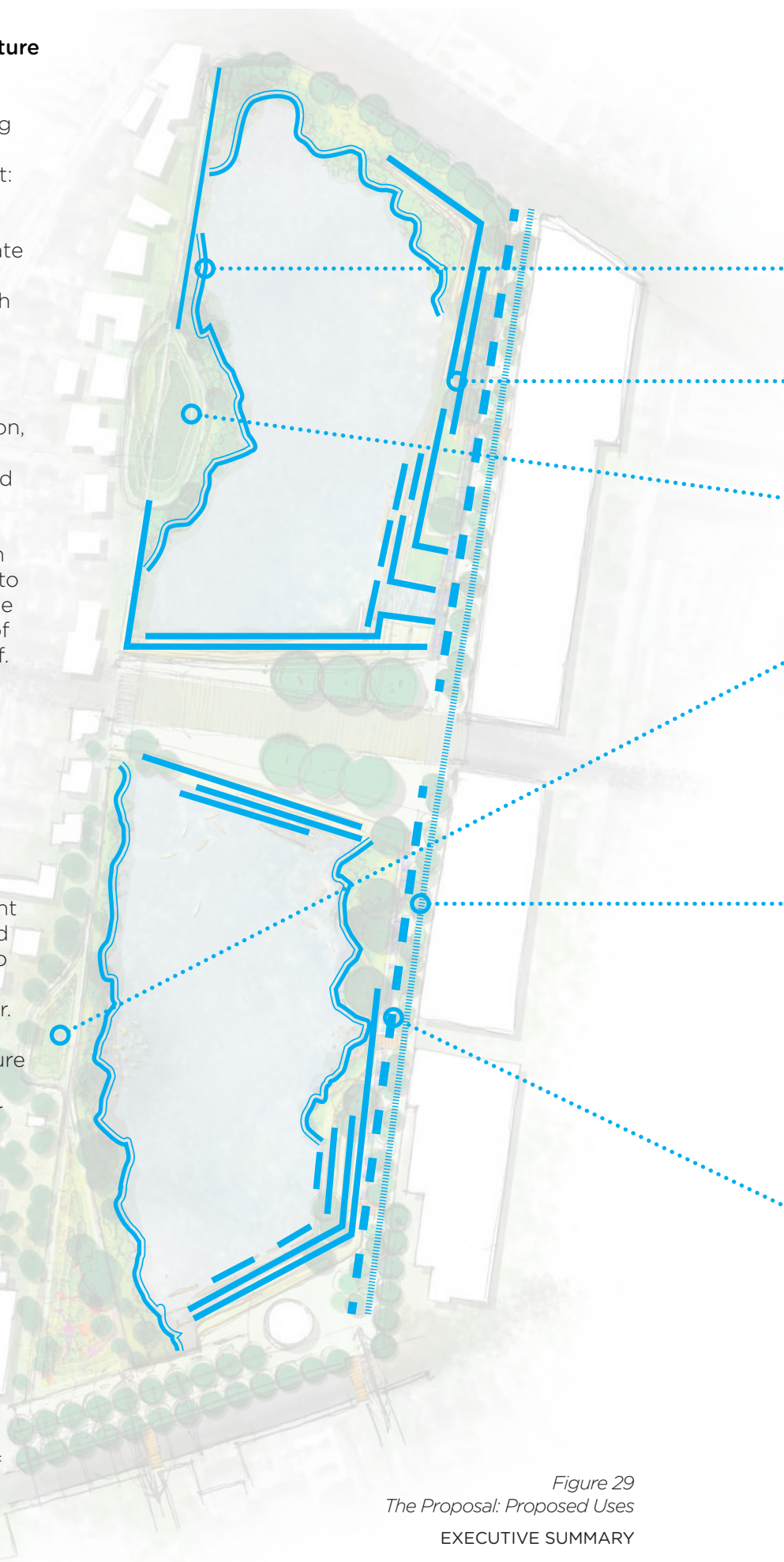
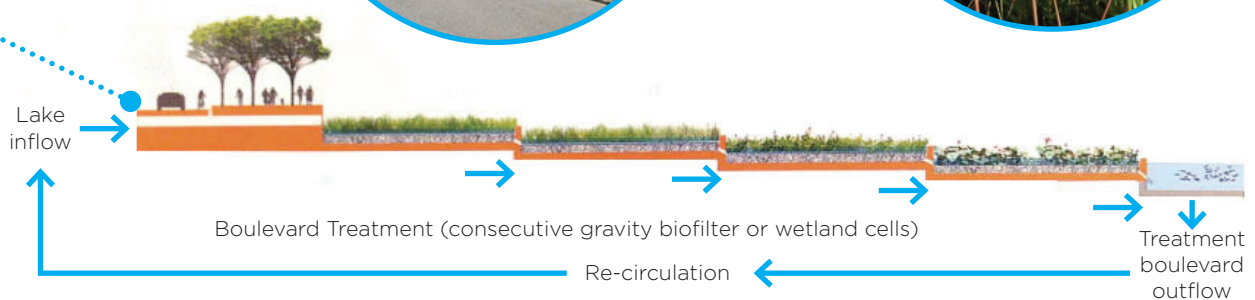


Figure 29
The Proposal: Proposed Uses
EXECUTIVE SUMMARY

PROCESS & FINDINGS

INTEGRATED URBAN LANDSCAPE SOLUTIONS



CONCLUSION

The Copenhagen Urban Lab ended with very positive feedback and interest received from key stakeholders involved as well as the audience at the **Embrace the Water Conference** in Göteborg. This executive summary was prepared as a response to their request to be able to further review our work and experience.

Our vision was to transform Sankt Jørgens Sø in a way that it can handle the cloudburst storage of 47,000 m³ to 75,000 m³ and simultaneously, on a daily basis, function as an Everyday Park.

In doing this, there were various limitations we had to deal with, the biggest constraint being time to effectively think across the disciplines, try out various options and resolve one further. As a result, we chose to focus our time on creating a vision for a place, identifying ideas, principles and key moves which can then be resolved in further detail if this study is taken forward.

Another challenge was to find the balance between being creative, uninhibited by the practical/physical constraints, even utopian ideals and concepts, and ensuring the functionality and feasibility of the hydraulic solutions in the urban-landscape design.

The team faced difficult challenges both in the project complexity and group work within the members from different countries. We helped each other catch up with the programme progress and discussions and brought unique project examples and experiences from our own country in the hopes of delivering outcomes that would exceed stakeholders' expectations. Having dinner together on our own as well as with stakeholders was a precious time to get

to know each other faster and better. It also provided for an informal setting to review lectures, discussions and findings of the day. Casual conversations sometimes led us to good ideas that became a base for our discussions on the following day.

Programme deliverables and the stakeholders' expectations became clear as the programme progressed, feedback and advice was provided by the respective stakeholders and Trine Stausgaard Munk, Project Manager, when needed. Within this short programme, each member gained valuable experience and learned important lessons about the world's leading cloudburst management plans and projects that are highly embedded in the theme of liveability.

We hope that this executive summary gives an overview of our process, learnings and outcomes as part of the Copenhagen Urban Lab. We also hope that the lessons learned during this programme will be applied to the next Urban Lab.

We would like to once again express our great gratitude and appreciation to the hosts and sponsors of this event. We hope, that we will be able to share our experiences with other Urban Lab participants and meet once again at the IWA World Water Congress & Exhibition in 2020!

Simon, Paula, Fumi, Meivis, Ana & Niloofar

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Neil Goring Rambøll
Camilla Julie Hvid Rambøll
Miriam Feilberg DANVA



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<i>Cloudburst Masterplan for Ladegårdså, Frederiksberg East & Vesterbro, City of Copenhagen.</i>	
^B Cloudburst masterplan for the subcatchment of Sonder Boulevard	6
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^H Urban wetland	16
<i>Viewed July 2017. https://cdn.pixabay.com/photo/2016/11/07/17/43/wetland-1806378_960_720.jpg</i>	
^I Cattail reed pond plant	16
<i>Viewed July 2017. https://pixabay.com/en/cattail-reed-pond-swamp-plant-2382057/</i>	
^J Photographer at viewpoint	29
<i>Viewed July 2017. https://pixabay.com/en/photographer-tourist-snapshot-407068/</i>	
^K Outdoor stage	29
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<i>Viewed July 2017. https://upload.wikimedia.org/wikipedia/commons/a/a6/Wave_deck.jpg</i>	
^M Concert	29
<i>Viewed July 2017. https://commons.wikimedia.org/wiki/File:20140706-TFF-Rudolstadt-We-Banjo-3-6341.jpg</i>	
^N Street performance	29
<i>Viewed July 2017. https://upload.wikimedia.org/wikipedia/commons/thumb/d/dd/Baq-street-ballet.jpg/640px-Baq-street-ballet.jpg</i>	
^O Boardwalk	29
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^Q Chess	31
<i>Viewed July 2017. https://pixabay.com/en/chess-chess-board-game-outdoors-167024/</i>	
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<i>Viewed July 2017. https://pixabay.com/en/children-creek-nature-play-vacation-2007869/</i>	
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<i>Viewed July 2017. https://pixabay.com/en/binoculars-child-uniform-796423/</i>	
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<i>Viewed July 2017. https://pixabay.com/en/couple-bench-sitting-togetherness-1508931/</i>	
^V Playground	31
<i>Viewed July 2017. https://pixabay.com/en/pay-play-playground-children-hop-919676/</i>	
^W Boardwalk in swamp	33
<i>Viewed July 2017. https://pxhere.com/en/photo/261436</i>	
^X Duck	33
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"The Copenhagen Urban Lab was an invaluable and great experience!"

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