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ARCADIS SUSTAINABLE CITIES WATER INDEX

SUSTAINABLE DEVELOPMENT FOR WATER WISE CITIES

The United Nation's Sustainable Development Goals:

- **Sustainable Development Goal 11** focuses on making cities inclusive, safe, resilient and sustainable.
- **Sustainable Development Goal 6** focuses on ensuring safe access to water and sanitation for all.

The Sustainable Cities Water Index offers insight to build a water wise city.

URBANISATION AND CITY WATER DEMANDS

NOW MORE THAN EVER, CITIES, THEIR WATERSCAPES AND WATER SOURCES FACE CHALLENGES AND THE RIGHT BALANCE IS A TOUGH ONE TO STRIKE

Resiliency

Efficiency

Quality

WHAT DO WE MEAN BY WATER SUSTAINABILITY?

TO ANALYSE THE MANAGEMENT OF WATER AND WHETHER IT IS SUSTAINABLE, WE ANALYSED WATER SUSTAINABILITY IN THREE CORE ELEMENTS

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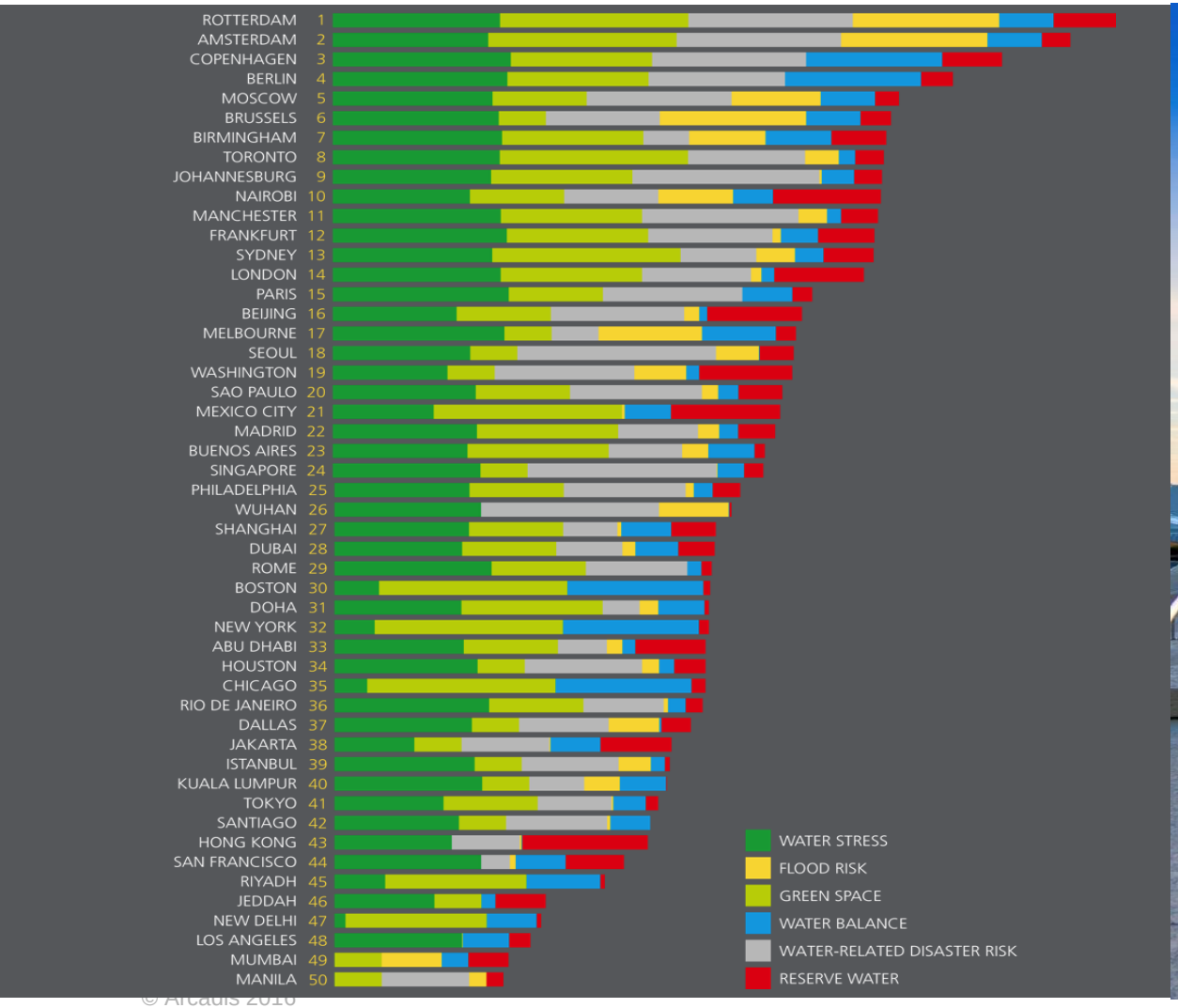
RESILIENCY SUB INDEX

A water resilient city is well prepared to overcome the challenges associated with both too little as well as too much water.

RESILIENCY SUB-INDEX



ROTTERDAM, THE NETHERLANDS

RESILIENCE RANKING #1

Rotterdam is a leading global city in urban resiliency and sustainability.

ROTTERDAM: Room for the River

ROTTERDAM: Innovative Public Water Plaza

COPENHAGEN, DENMARK

RESILIENCE RANKING #3

3

COPENHAGEN: Advanced Swale

RESILIENCE: UK & Europe Performance

Europe	Global	City
1	1	Rotterdam
2	2	Amsterdam
3	3	Copenhagen
4	4	Berlin
5	5	Moscow
6	6	Brussels
7	8	Birmingham
8	12	Frankfurt
9	13	Manchester
10	14	London
11	15	Paris
12	23	Madrid
13	31	Rome
14	40	Istanbul

WUHAN, CHINA

RESILIENCE RANKING #26

WUHAN: Sponge City

NEW YORK, USA

RESILIENCE RANKING #32

32

The shocking effects of Superstorm Sandy brought to the forefront New York's vulnerability to coastal flooding and its need for resilience. In response a competition was launched, resulting in a winning solution called the 'Big U'.

NEW YORK: The Big U

NEW YORK: The Big U

NEW YORK: The Big U

NEW YORK: CSO control

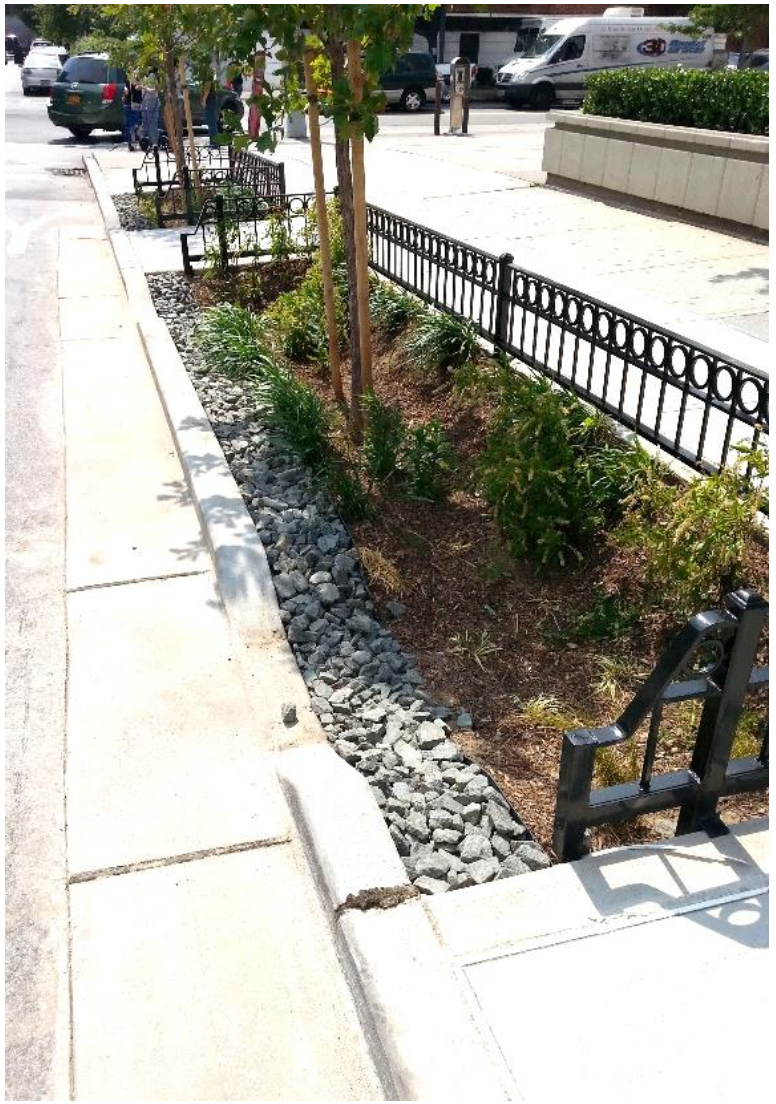
1.5 %

10 %

City-wide Impervious Area

2015

2030



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BICESTER, UK

HAMBURG, GERMANY

NIJMEGEN, NETHERLANDS

VEJLE, DENMARK

BICESTER: Integrated SUDS Planning

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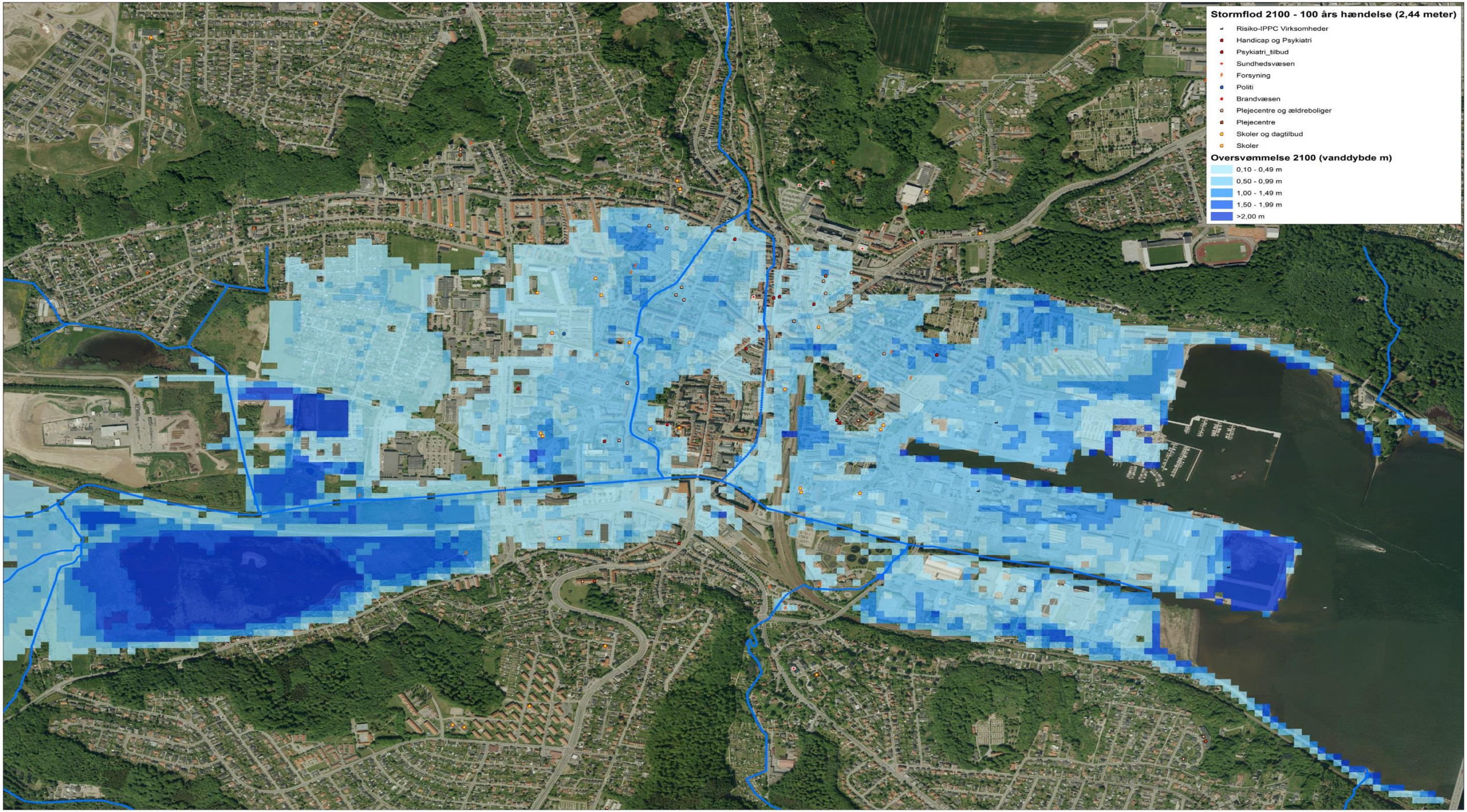
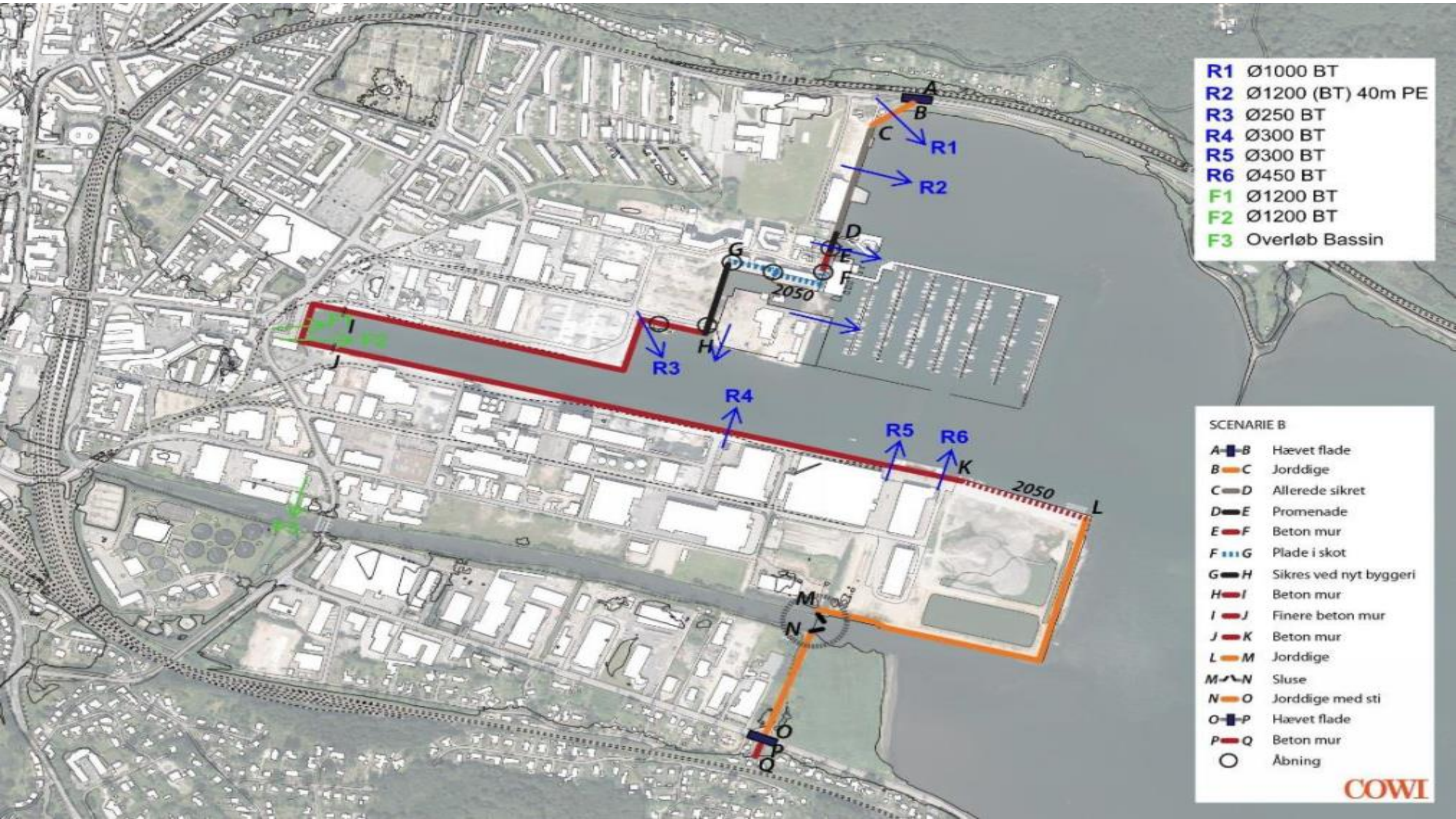
VEJLE: Fjord City


Stormflod 2100 - 100 års hændelse (2,44 meter)
Risiko-IPPC Virksomheder
Handicap og Psykiatri
Psykiatri_tilbud
Sundhedsvæsen
Forsyning
Politi
Brandvæsen
Plejecentre og ældreboliger
Plejecentre
Skoler og dagtilbud
Skoler
Oversvømmelse 2100 (vanddybde m)
0,10 - 0,49 m
0,50 - 0,99 m
1,00 - 1,49 m
1,50 - 1,99 m
>2,00 m


R1 Ø1000 BT
R2 Ø1200 (BT) 40m PE
R3 Ø250 BT
R4 Ø300 BT
R5 Ø300 BT
R6 Ø450 BT
F1 Ø1200 BT
F2 Ø1200 BT
F3 Overløb Bassin
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R1
R2
R3
R4
R5
R6
2050
2050
SCENARIE B
A–B Hævet flade
B–C Jorddige
C–D Allerede sikret
D–E Promenade
E–F Beton mur
F–G Plade i skot
G–H Sikres ved nyt byggeri
H–I Beton mur
I–J Finere beton mur
J–K Beton mur
L–M Jorddige
M–N Sluse
N–O Jorddige med sti
O–P Hævet flade
P–Q Beton mur
Åbning
COWI

HAMBURG: Appeaing Investments

Private Investment

80 projects

€ 6.6 billion

90% private investment

Return on Investment

Assets & land:

Purchase @ € 750 m

Sell @ € 2,000 m

NIJMEGEN: Moment of Change

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What is the common thread throughout these examples?

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HOW TO CREATE A SUSTAINABLE WATER FUTURE FOR CITIES

SUSTAINABLE STRATEGIES AND BEST PRACTICES

PLANNING

RESILIENCY AS A PATHWAY TOWARDS SUSTAINABILITY

The scope of resiliency is not just about structures and protection but also is about preparing to recover.

URBAN ADAPTIVE PLANNING

Modern planning practices have to be adaptive and risk-based, as well as flexible enough to account for unexpected circumstances or developments.

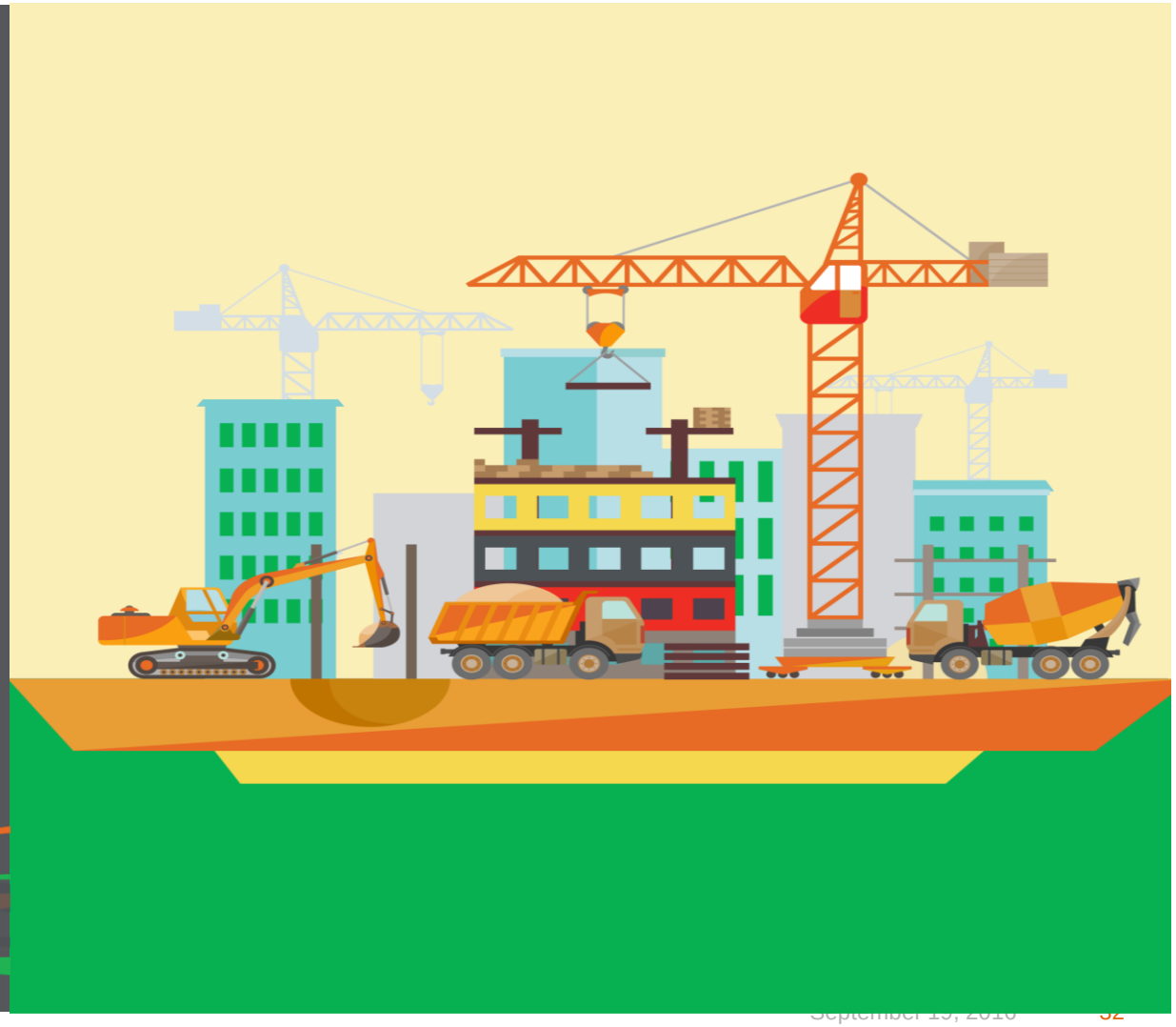
OPTIONEERING: MAKING INVESTMENT AN APPEALING CHOICE

This approach opens up additional opportunities to attract private funding, for instance green funds and climate bonds that generate return on investment.

CREATING

MULTI-PURPOSE URBAN SOLUTIONS

This approach requires water engineers and planners to be well connected to the other needs and ambitions of the urban communities and translate these in alternative, innovative designs.



MANAGING AND OPERATION

OPTIMISING URBAN WATER USE

Water sources along with treatment, delivery, and collection capacities, and challenges; as well as compliance and quality requirements are all necessary aspects that cities must consider when developing their "as-is" and "future" optimization blueprints.

URBAN ASSET PRESERVATION AND MANAGEMENT

The risk of foregoing improvements based on social, economic, and environmental consequences as well as the probability of failure can guide asset management decisions.

MANAGE STORMWATER

This approach is gaining popularity in many water scarce areas.

SEPARATE GREYWATER

While potentially proving costly in the first instance, due to requiring additional infrastructure, it does create a more easily reusable water source over the longer term.

REDEFINING

DESALINATION

It can be an option for cities looking to diversify their water supply and reduce water shortages.

WATER REUSE

Effectively reusing and transporting water in a cost effective and safe way can contribute considerably to water availability and can be crucial to meeting a city's long term demand.

Answering the Three Questions

1. How [water] infrastructure can become resilient to floods?

2. Are current research efforts enough to ensure a resilient future?

3. Are there any gaps that need to be filled in order to ensure the adequate dealing of repeated flooding events?

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***Arcadis** is the leading global **Design & Consultancy** firm for natural and built assets. We focus on the entire water cycle – from **source to tap and back to nature.** Through our wealth of experience in the water sector, Arcadis' Specialist teams of engineers, scientists and consultants around the globe are uniquely positioned to provide safe and secure water technology and innovations that are built to withstand the demands of a rapidly changing world.*

Giles Booth
Global Leader—Conveyance & Networks
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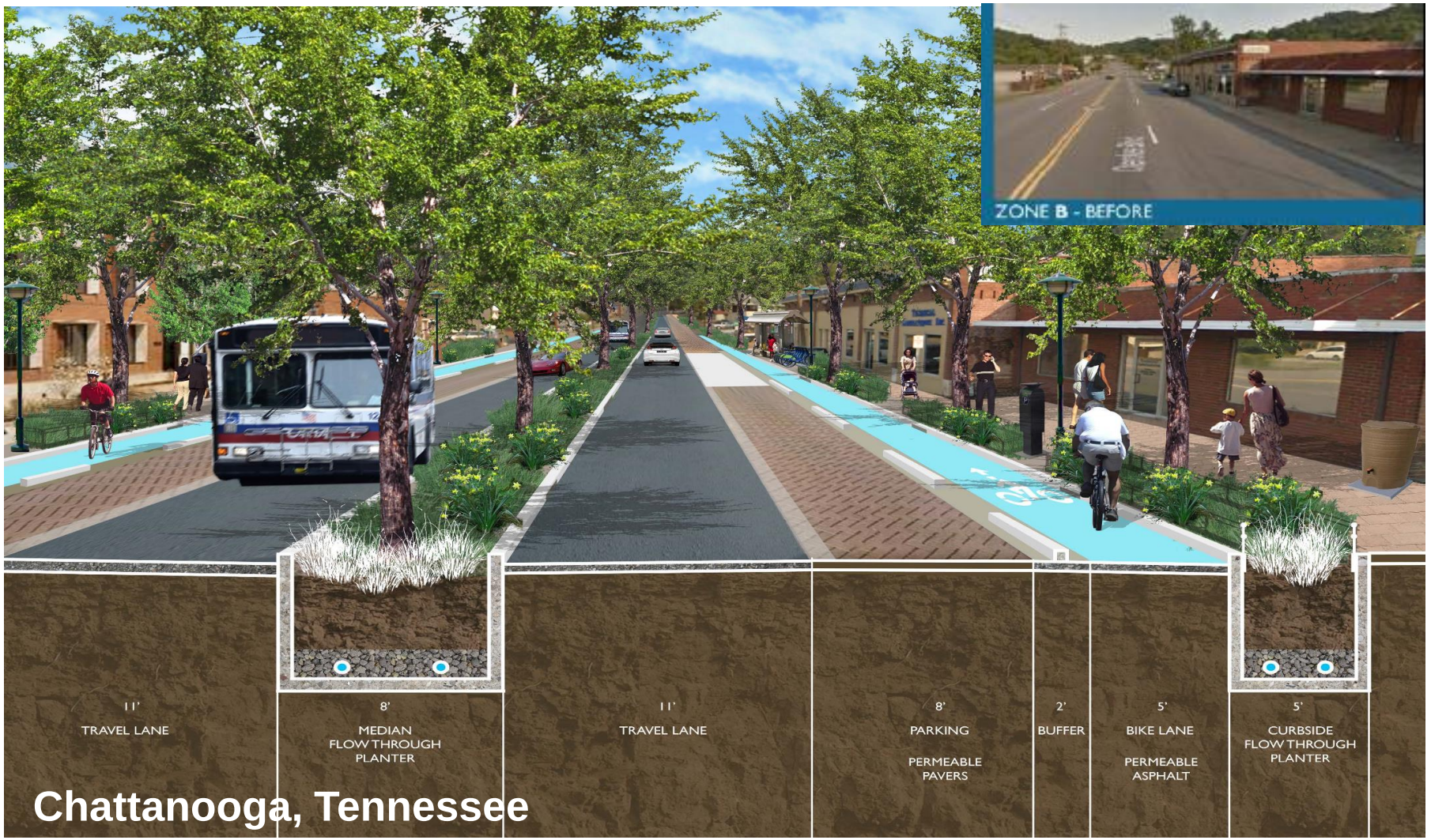
@GileskkBooth

3. SuDS Retrofitting

Washington DC

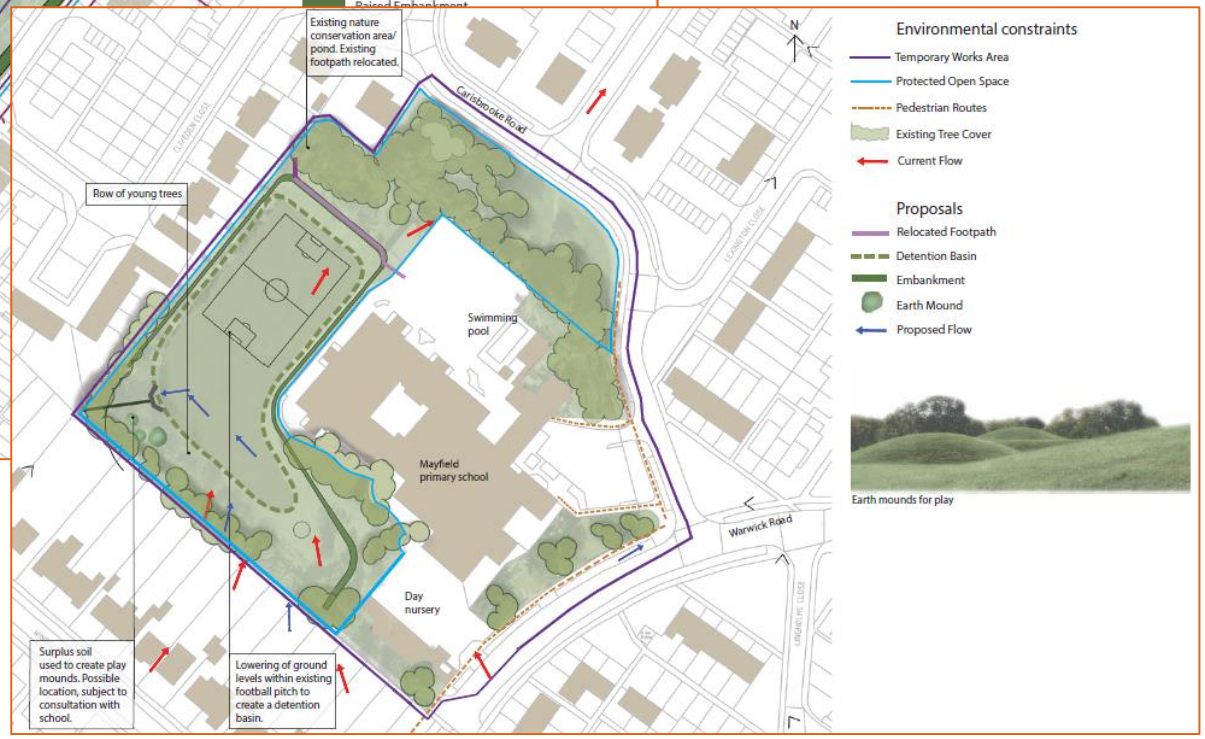
3. SuDS Retrofitting



3. SuDS Retrofitting

The Sports Field

The School



Cambridge, UK

Water Business Opportunities

Creating Water Sustainable Communities

RESILIENCY

- Creating sustainable environments that respond to local climate and context
- Adapting & protecting communities from climate change
- Enhancing a city's design environment to optimize recovery from stresses
- Diversifying water source portfolio incorporating reuse

QUALITY

- Ensuring water quality from source to tap and back to nature
- Increasing access to sanitation
- Developing critical infrastructure or repairing aging infrastructure
- Capturing stormwater runoff for beneficial reuse

EFFICIENCY

- Maximizing asset performance and output efficiency
- Transforming underperforming aspects to optimize value
- Balancing Capex + Opex = Totex lifecycle performance
- Capturing efficiency of revenues & funding sources

WHERE TO NEXT?

To succeed in an increasingly complex world, the world's cities need to focus on the opportunities that a healthy natural aquatic and municipal water system offers, and find answers to major challenges if they are to thrive and remain competitive over the coming decades.

At present, around ninety percent of the world's population has access to clean drinking water. This represents a significant improvement – we just need to prioritize greater investment and move faster from strategizing and goal setting into actions that improve quality of life.

AGING AND INADEQUATE INFRASTRUCTURE

LONDON

London's ranking for efficiency is relatively anomalous in terms of its overall ranking. Rates of water metering are very low by international standards. British utility companies are increasingly moving towards metered supply, but this remains unpopular with the public. London leakage rates are also fairly high as a result of underinvestment despite ongoing efforts to replace the city's aging Victorian sewers.

Despite ongoing improvements, pollution levels in the city's source water are still among the highest in the index. The Thames River is negatively impacted by upstream pesticide use in farming as well as combined sewer overflow.

Investment in projects such as the Lee Tunnel and Thames Tideway Tunnel will significantly improve water pollution in the city.

21

London is in a dynamic resiliency situation as rapid urbanization in the flood plains and an aging storm surge barrier system – increasing the vulnerability to future flooding.