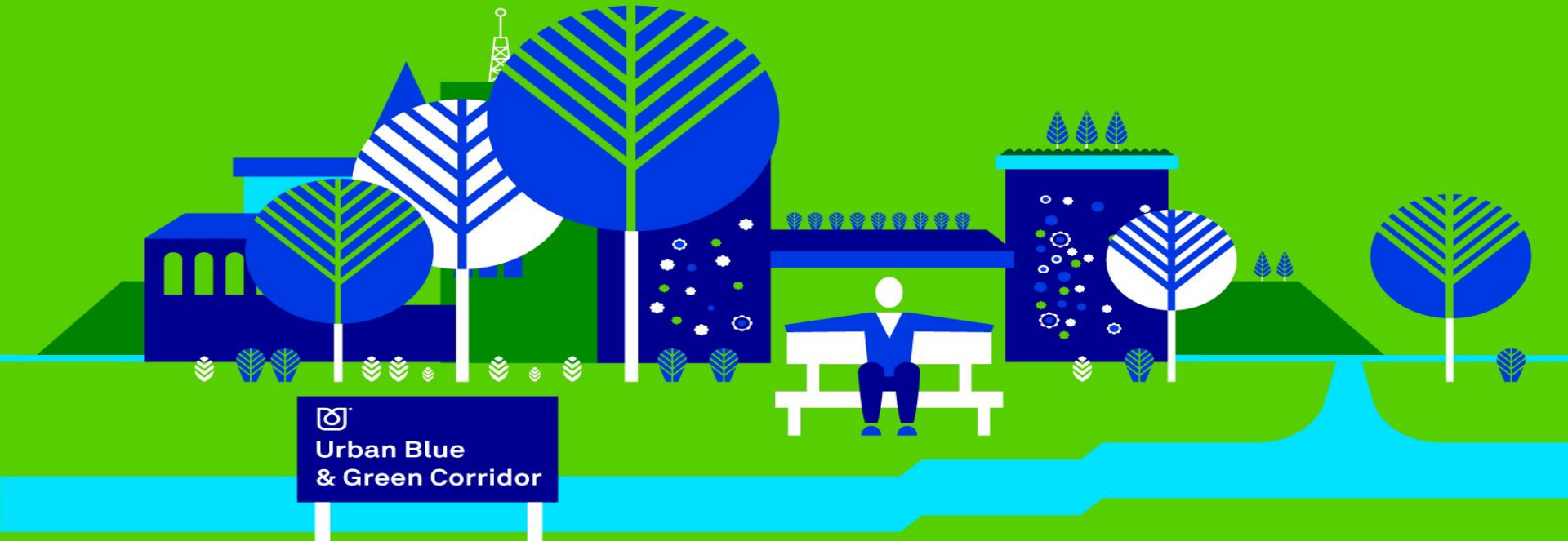
Integrated BGS (Blue Green Solution) for Advanced Urban Planning for Sustainability and Resilience- Beyond Fake News

Prof Cedo Maksimovic, Imperial College / BGG, London

Ranko Božović, EnPlus, Belgrade

SDEWES Conference, Novi Sad, Serbia, June -July 2018



Blue Green Solutions

Since the Launch Event, May 2, 2017

South Kensington (London),1851 Estate – Proposed BGD hub

Our beautiful planet Earth

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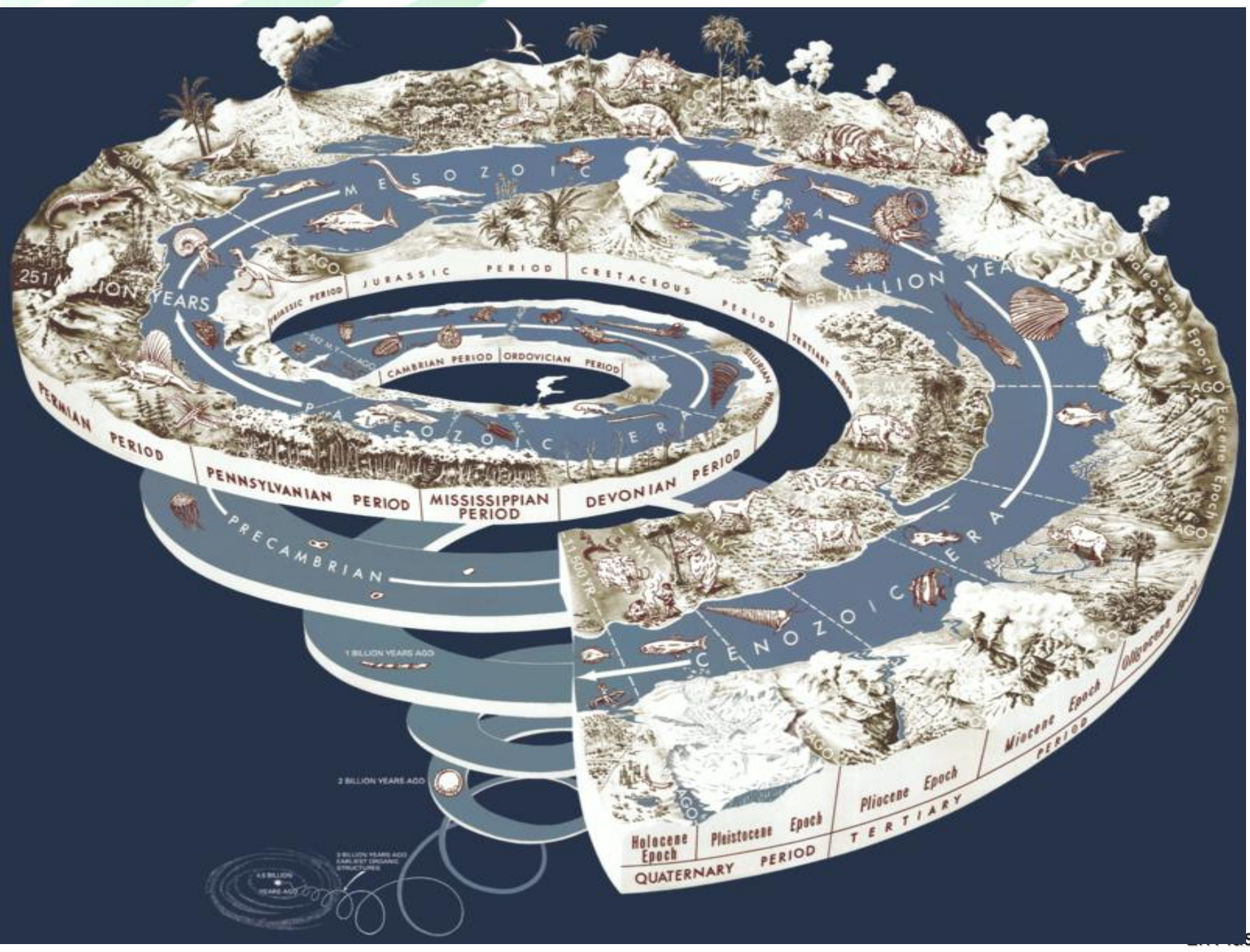
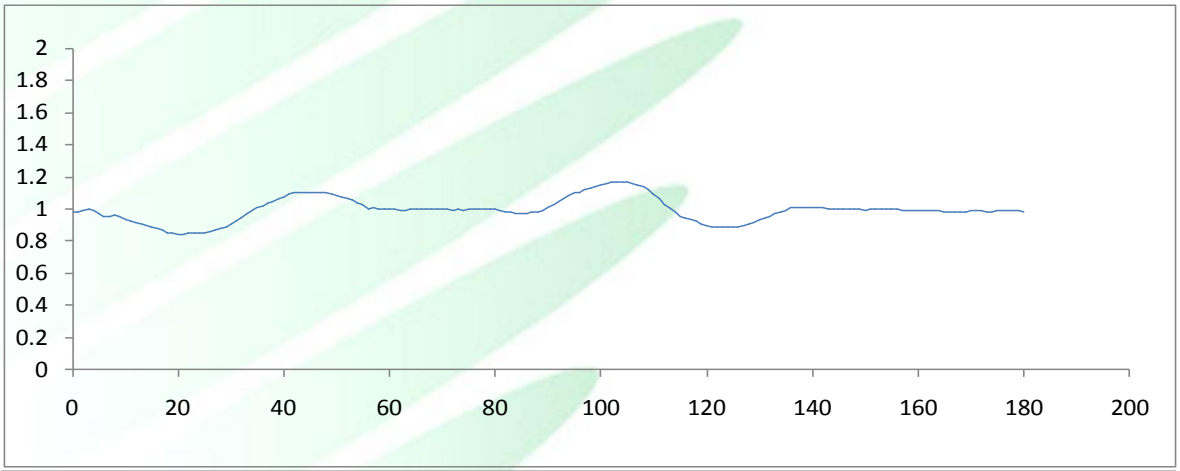
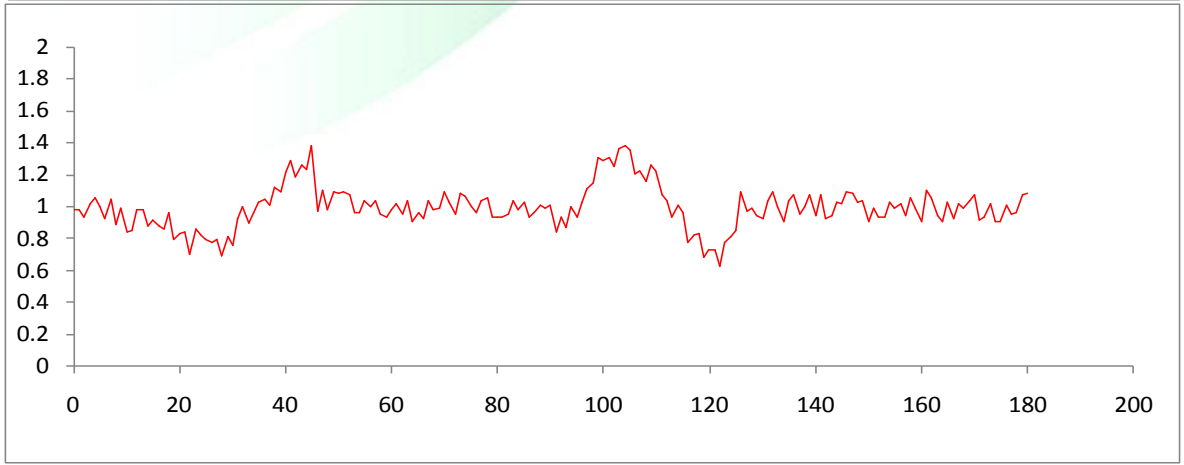

MESOZOIC ERA
JURASSIC PERIOD
CRETACEOUS PERIOD
TERTIARY PERIOD
65 MILLION YEARS AGO
CAMBRIAN PERIOD
ORDOVICIAN PERIOD
SILURIAN PERIOD
PALEOZOIC ERA
PERMIAN PERIOD
PENNSYLVANIAN PERIOD
MISSISSIPPIAN PERIOD
DEVONIAN PERIOD
PRECAMBRIAN
1 BILLION YEARS AGO
2 BILLION YEARS AGO
CENOZOIC ERA
Paleocene Epoch
Eocene Epoch
Oligocene Epoch
Miocene Epoch
Pliocene Epoch
TERTIARY PERIOD
Holocene Epoch
Pleistocene Epoch
QUATERNARY PERIOD

Towards next generation [illegible] in water indus[illegible]





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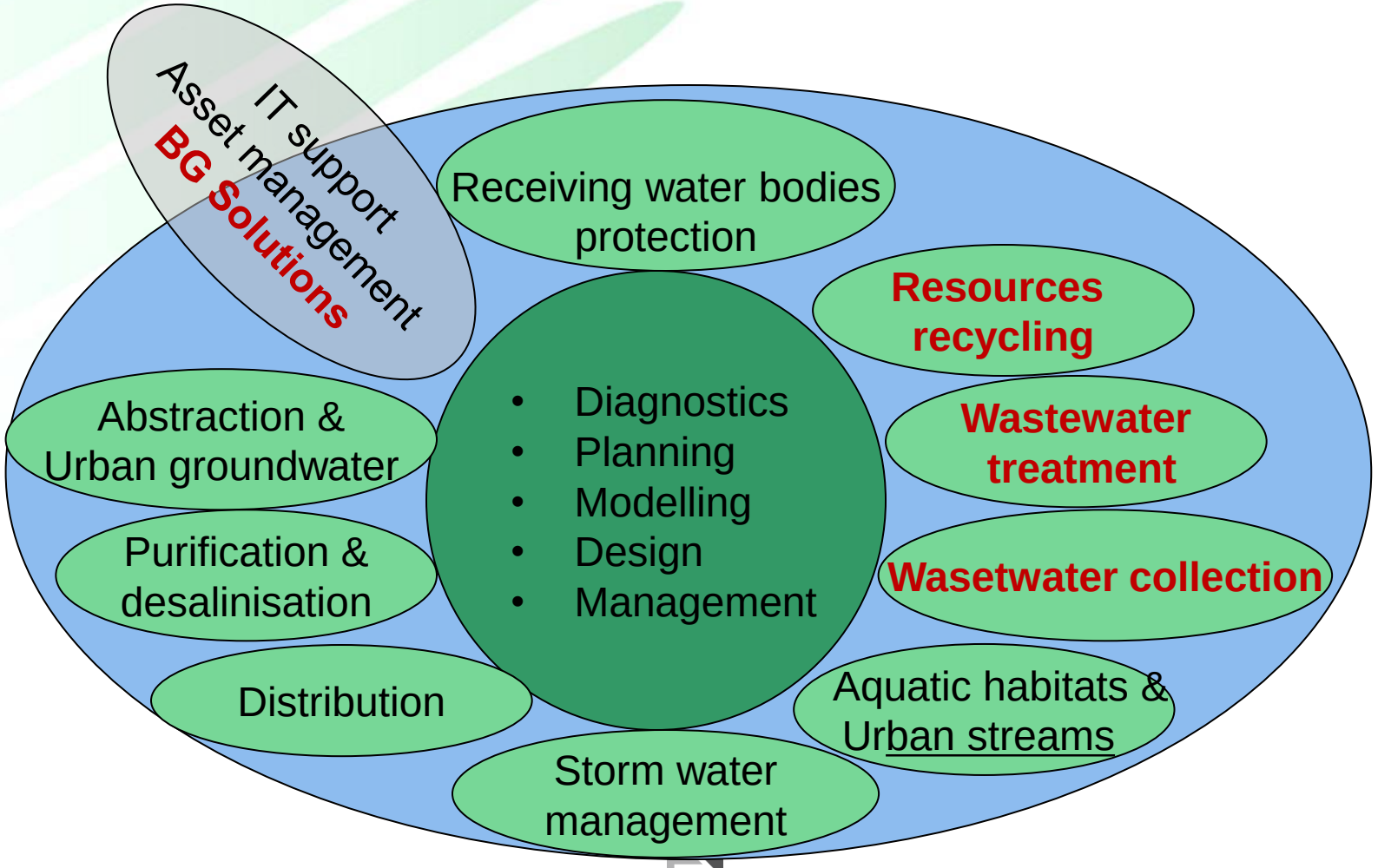
Integrated Urban Water Solutions of the UWRG–Urban Water Research Group, Imperial College London

Headed by Prof. Čedo Maksimović



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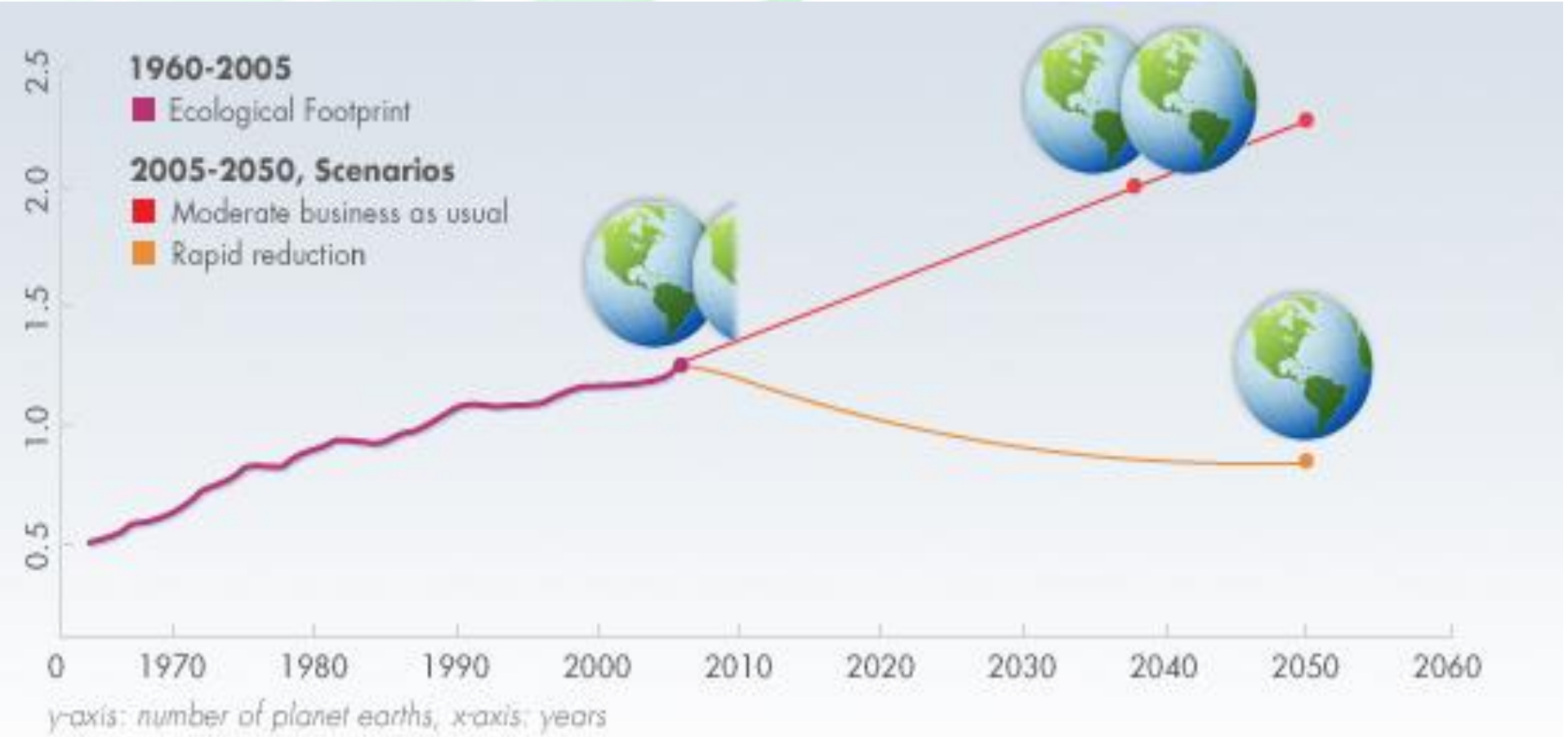
This presentation introduces the NB-BGS *(Nature Based Blue Green Solutions).*
Developed in the project BGD *(Blue Green Dream).*
Coordinated by ICL (*Imperial College London).*
And funded by the EIT (*European Institute for Inovations and Technology*).
Under the program: *Climate_KIC (Knowledge Innivative Communities*).
For which the BGD team won the „*Business Green Technology Award 2015, R/D Program of the Year – London*“ .

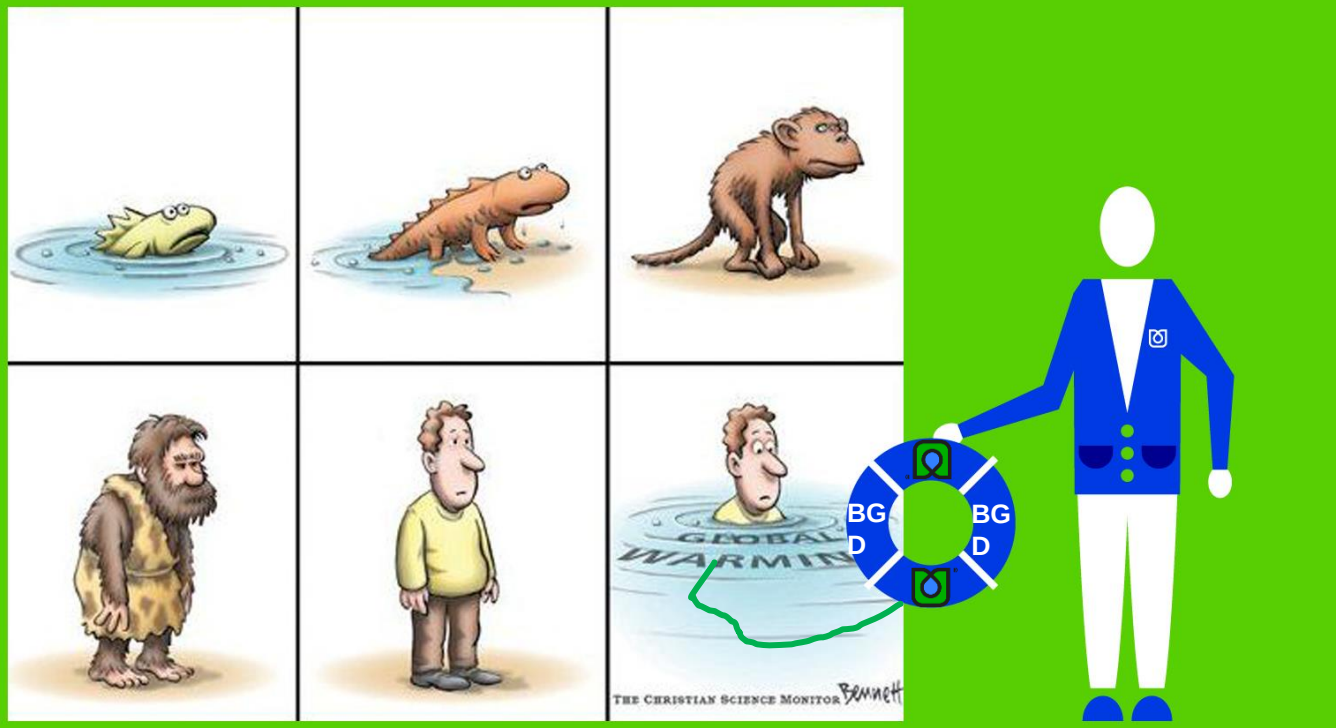
businessGreen TECHNOLOGY AWARDS 2015 WINNER

Lack of focus on resource efficiency

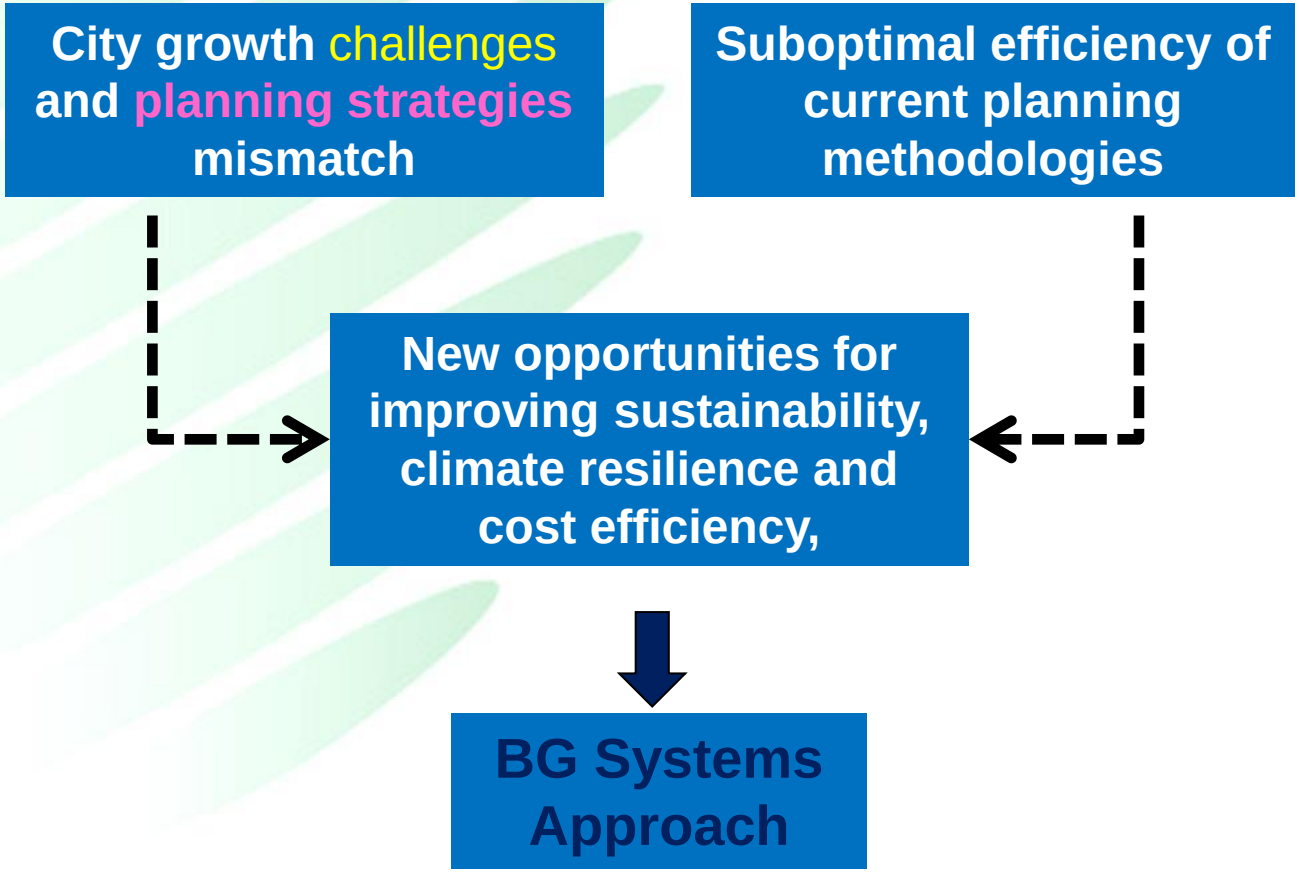
Ecological footprint in 2050 - need more than 2 planets



Why BGD?
The threat of Climate Change…

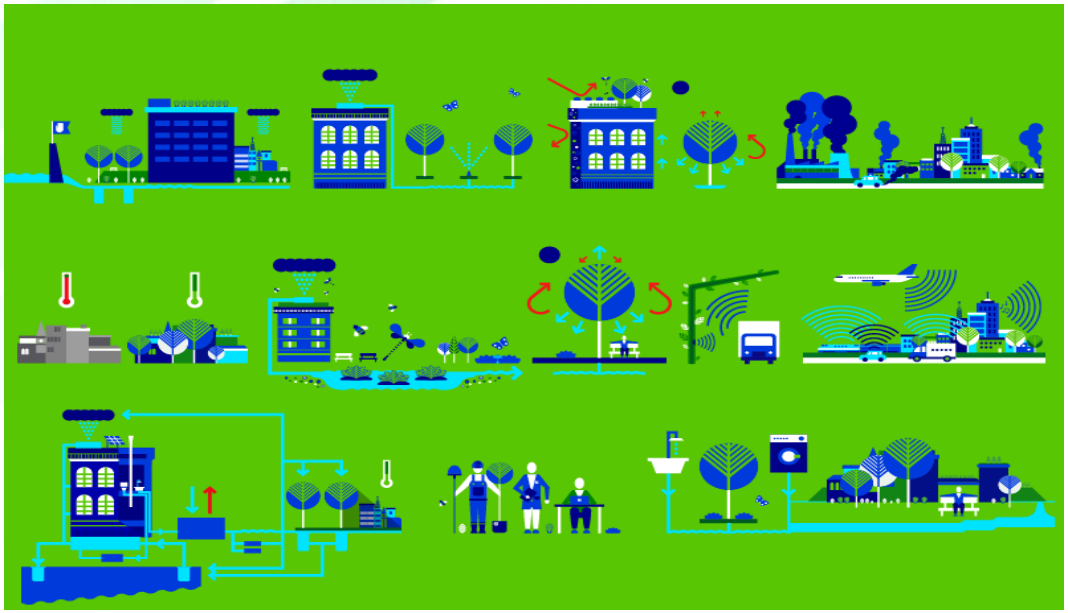


Why BGS


City growth challenges and planning strategies mismatch
Suboptimal efficiency of current planning methodologies
New opportunities for improving sustainability, climate resilience and cost efficiency,
BG Systems Approach

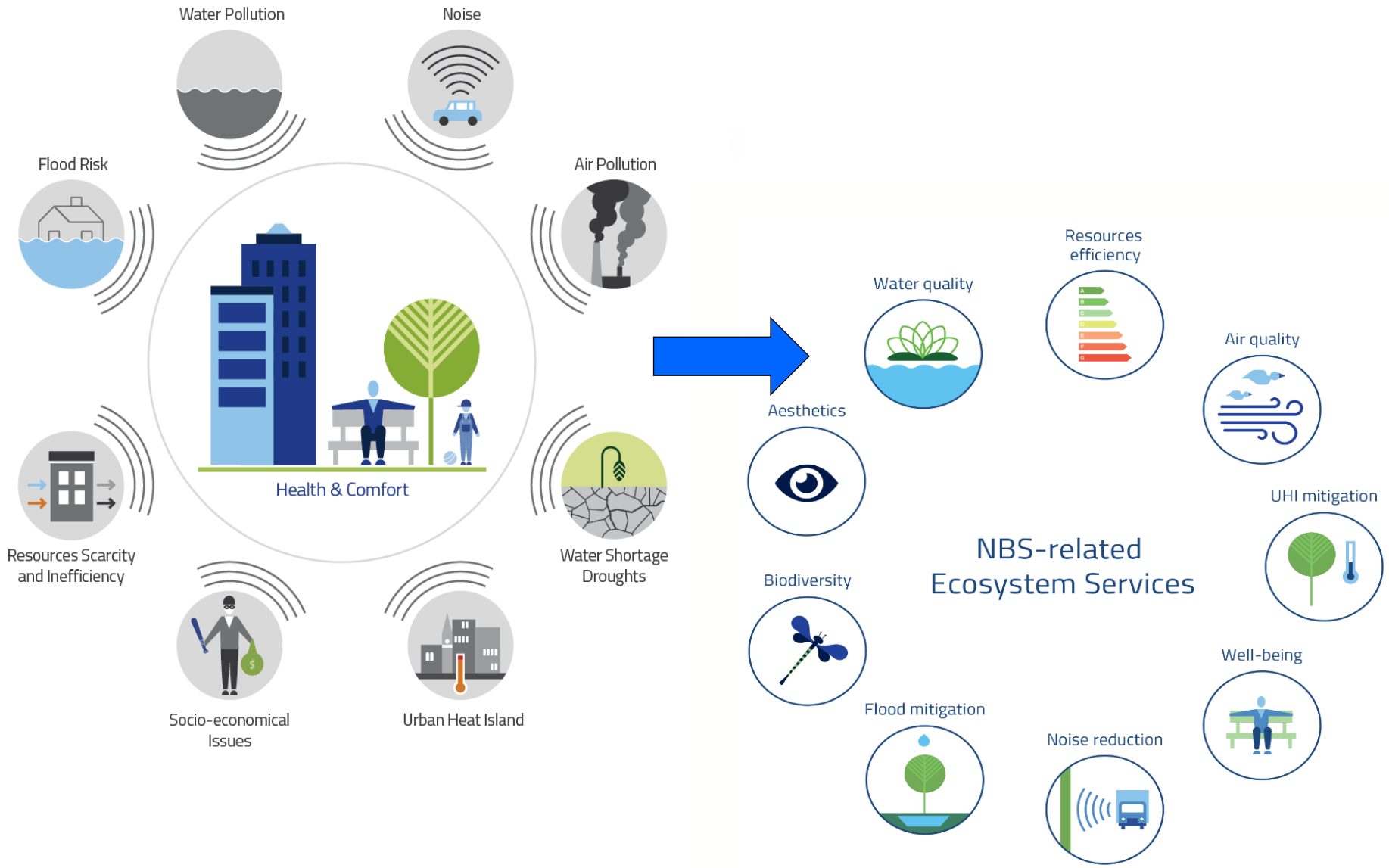
Blue Green Solutions

THE INNOVATIVE ADVANTAGE OF BGS METHOD IS THE FACT THAT INTERACTIONS BETWEEN COMPONENTS OF URBAN CATEGORIES ARE QUANTIFIED, ENABLING THE DESIGN TEAM TO OPTIMIZE COMPLETE PROJECT, BASED ON PARAMETRIC RESULTS (ANALYSIS); WITH DIRECT IMPLICATION ON COST AND QUALITY.



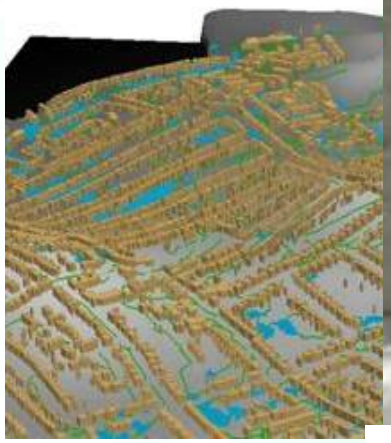
BGD IS INTRODUCING ENGINEERING DESIGN MENTALITY THAT DEALS WITH PROBLEM PREAMPTION, NOT PROBLEM SOLVING > SYSTEMATIC PRE DESIGN ANALYSIS + INTEGRATION OF ANALYSIS RESULTS IN TO MASTER PLAN

Urban challenges and BG/NB Solutions

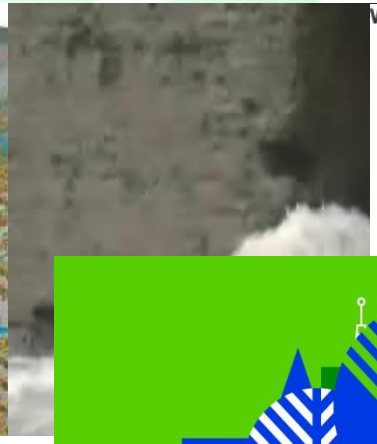


Some issues tackled by Blue Greening

Flooding



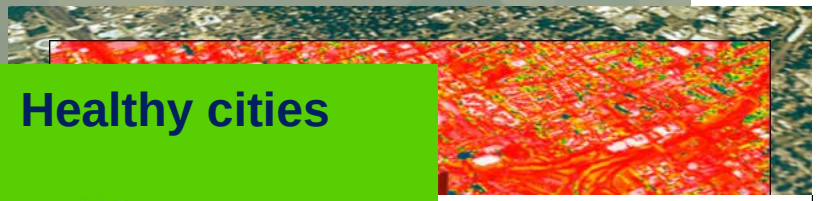
Water pollution



Droughts

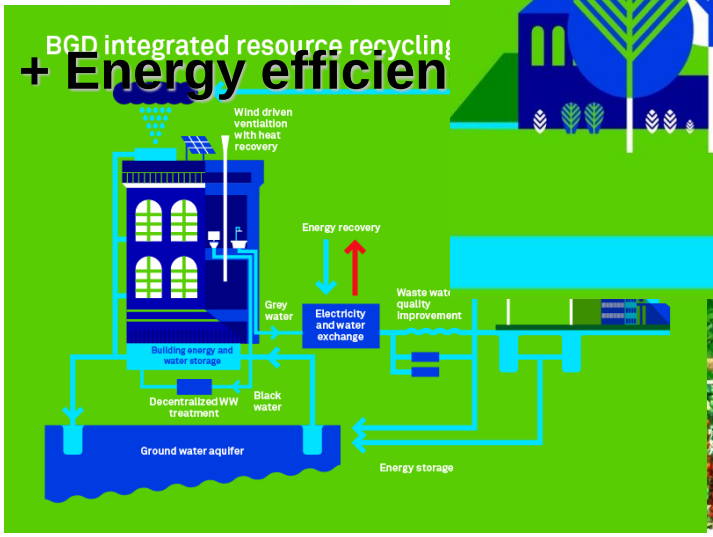
Air pollution

Heat island

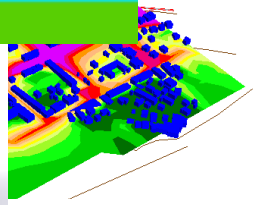


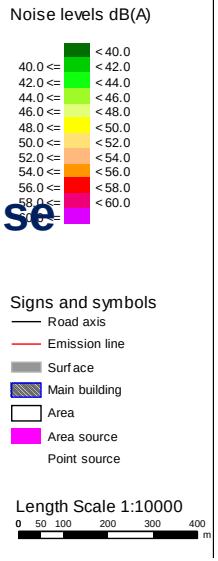
Healthy cities

+ Energy efficien



Noise





Urban agriculture

Crime

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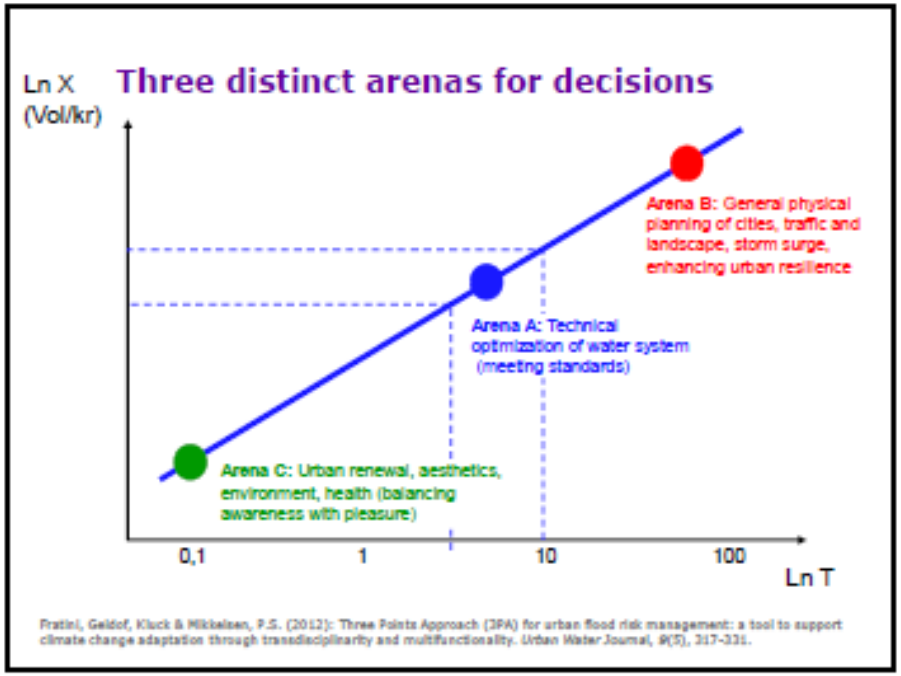
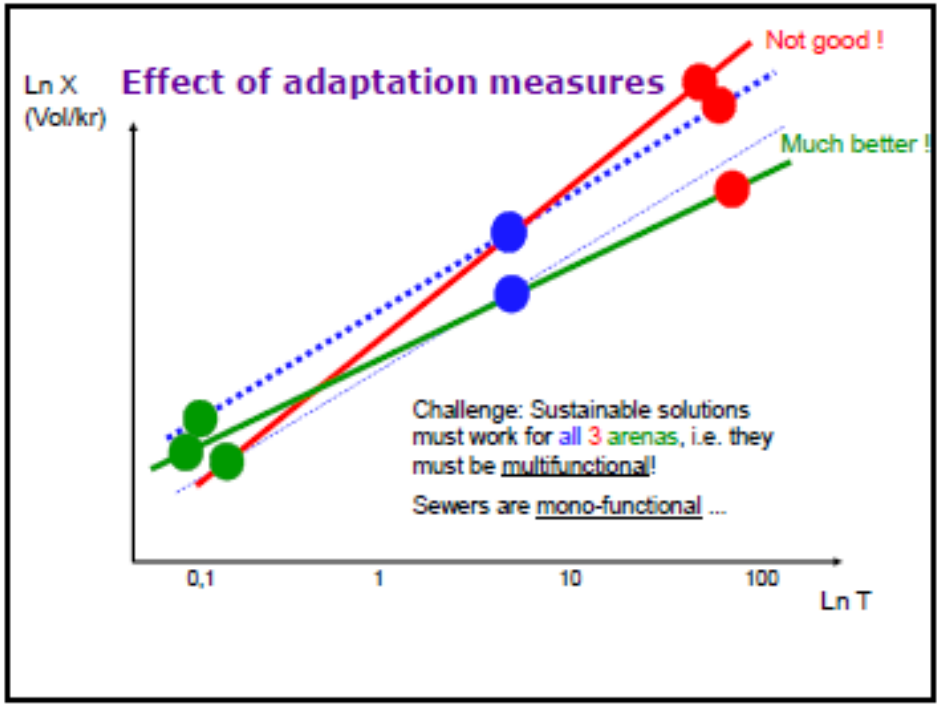
Scenarios and adaptation

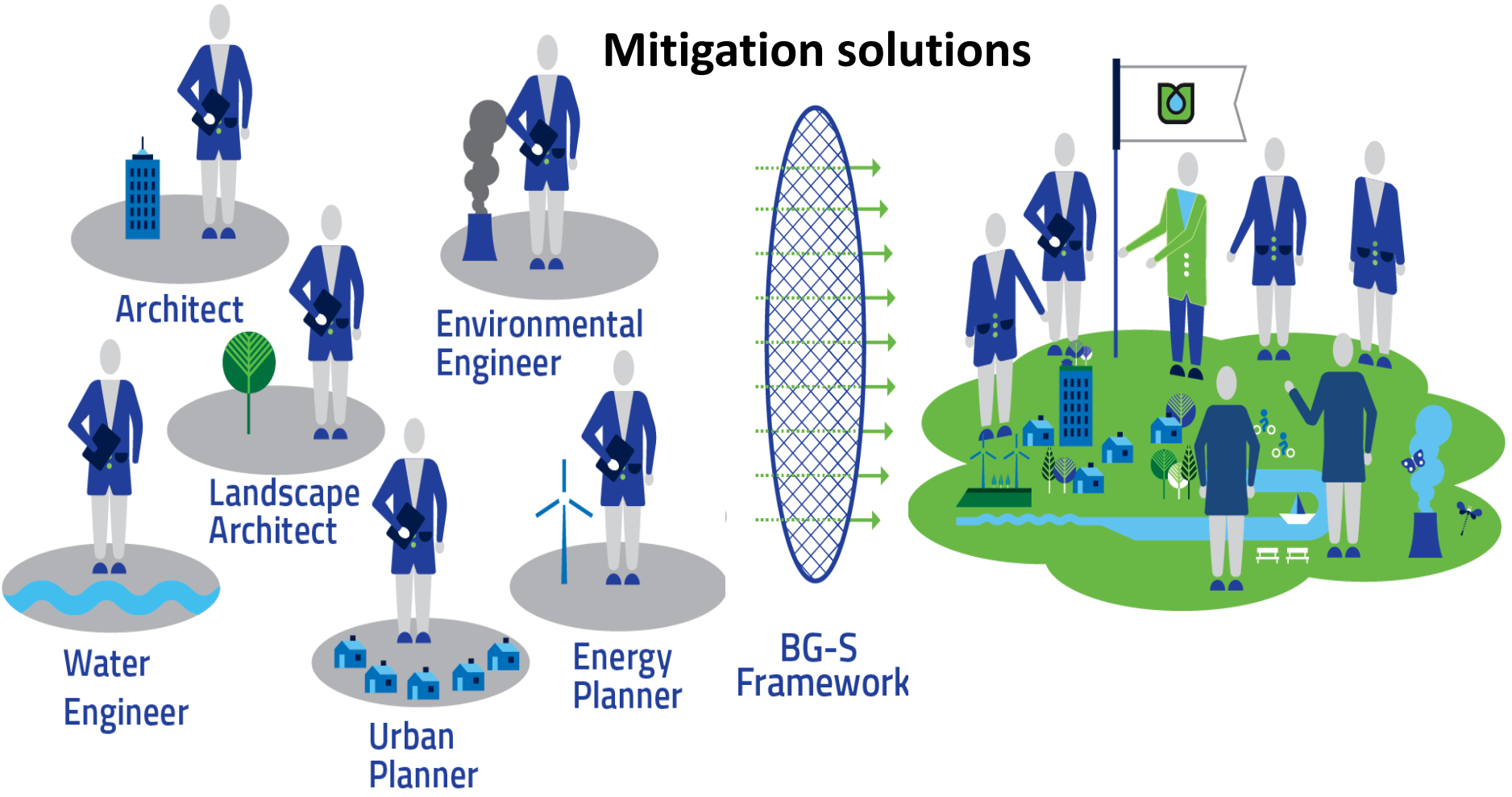
Climate change will render existing systems vulnerable - vital to improve their resilience

Courtesy P. S. Mikkelsen, DTU





THE RESULT:
PLANNING MINDSET CHANGE



An example of multiple functions, interactions and benefits of trees

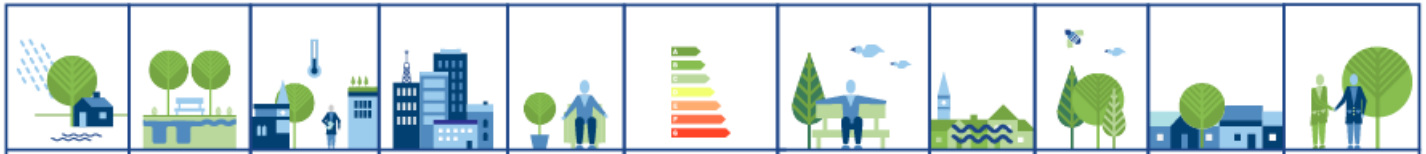
URBAN SYNERGY EXAMPLE

TREE FUNCTIONS

Acer ginnala	Quercus robus	Acer platanoides	Acer sp.	Sophora japonica	Juglans nigra	Quercus lyrata	Tilia cordata	Pinus sp.

SHADOW PEDESTRIAN	SHADOW HEAT ISLAND	SHADOW BUILDINGS	ADIABATIC COOLING	AIR PURIFICATION	EVAPO-TRANSPIRATION	ANIMAL CORRIDORS	SOCIALIZATION ZONES	WIND BARRIER

INTERACTING WITH

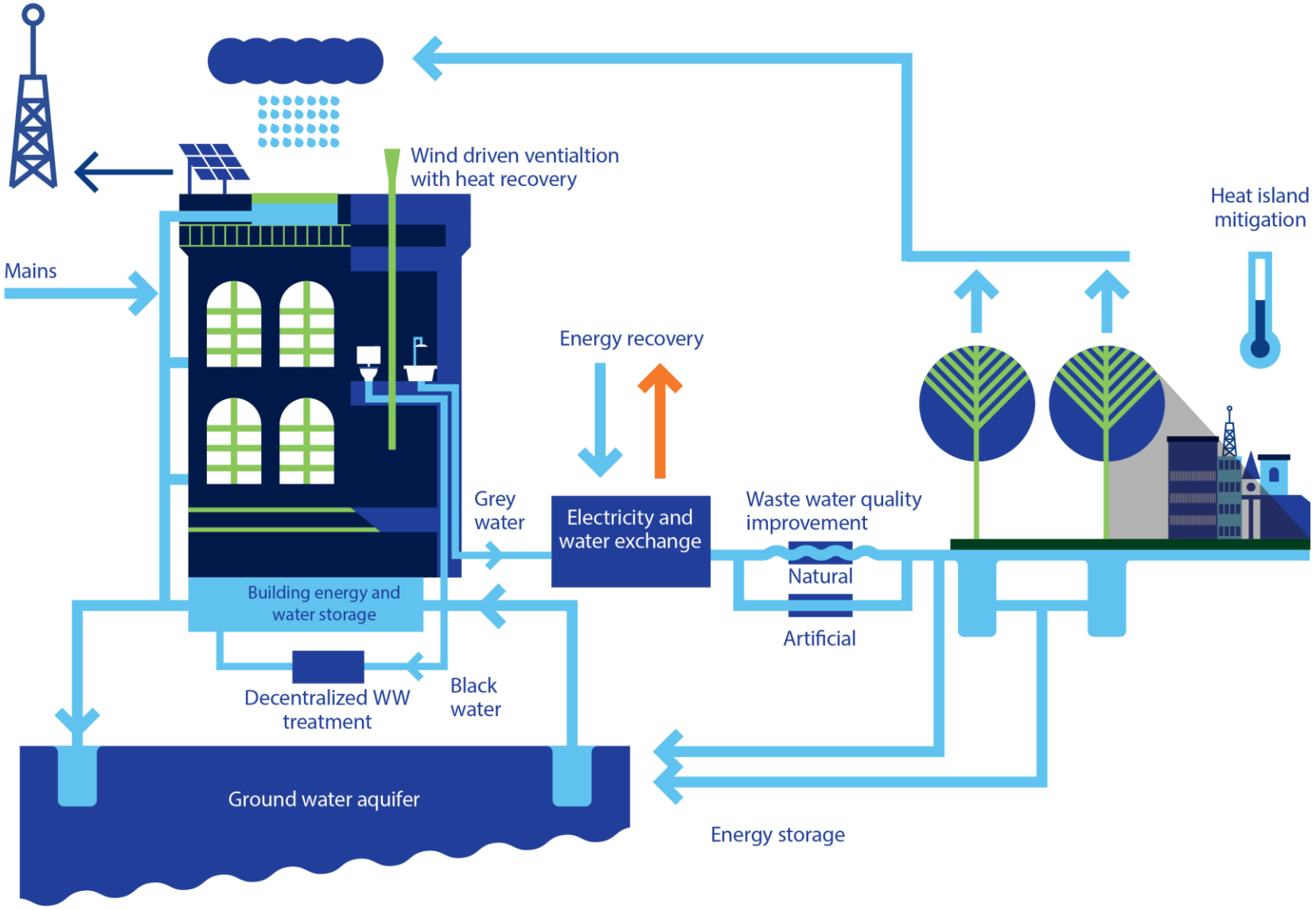


SURFACE WATER	GROUND WATER	MICRO CLIMATE	BUILDING MASSING	INDOOR COMFORT	ENERGY CONSUMPTION	OUTDOOR ENVIRONMENT QUALITY (OEQ)	FLOODING RISKS	BIO-DIVERSITY	NEIGHBOUR-HOODS	CITIZENS SOCIALIZING

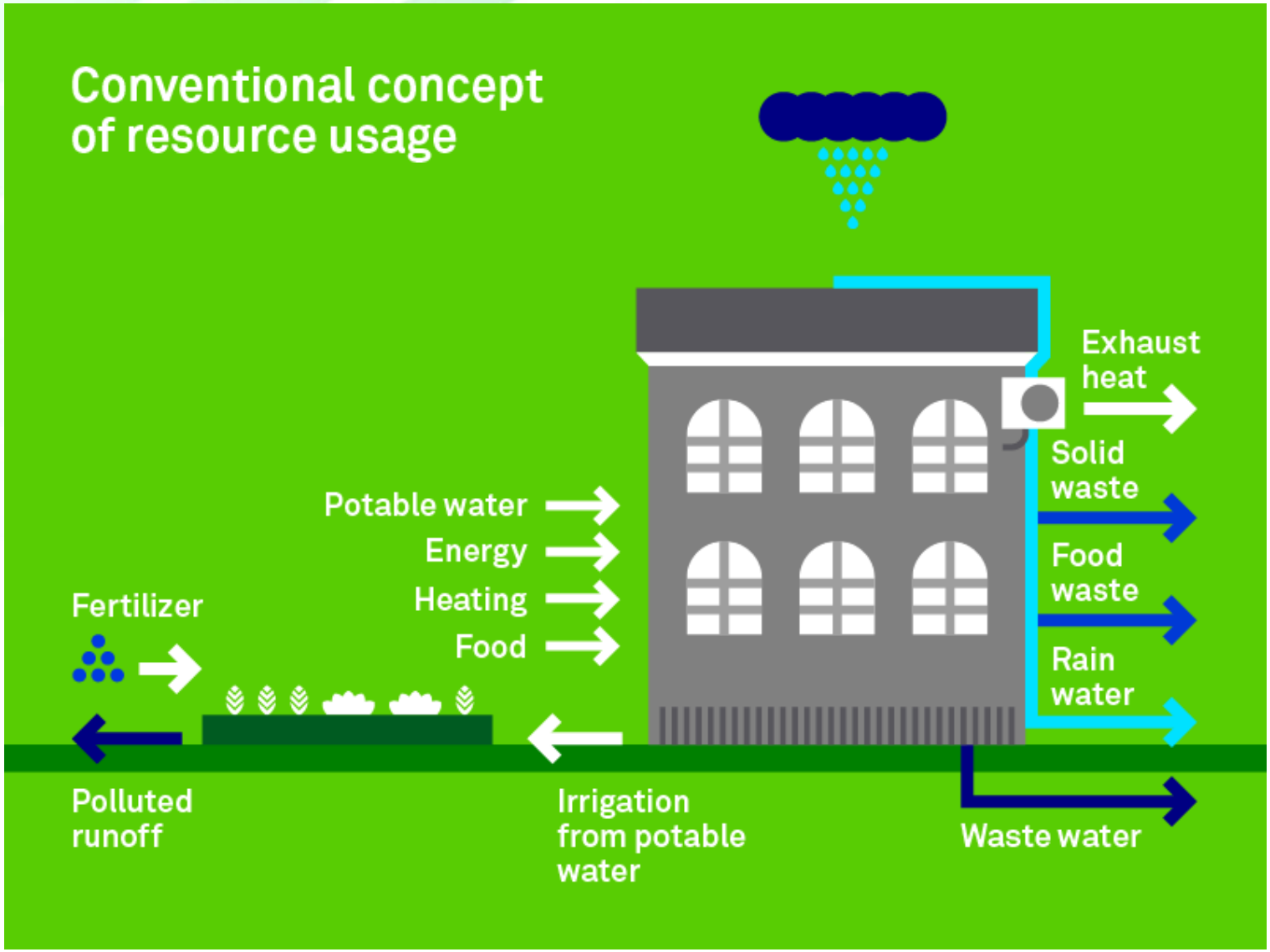
RESULTING SYNERGY BENEFITS

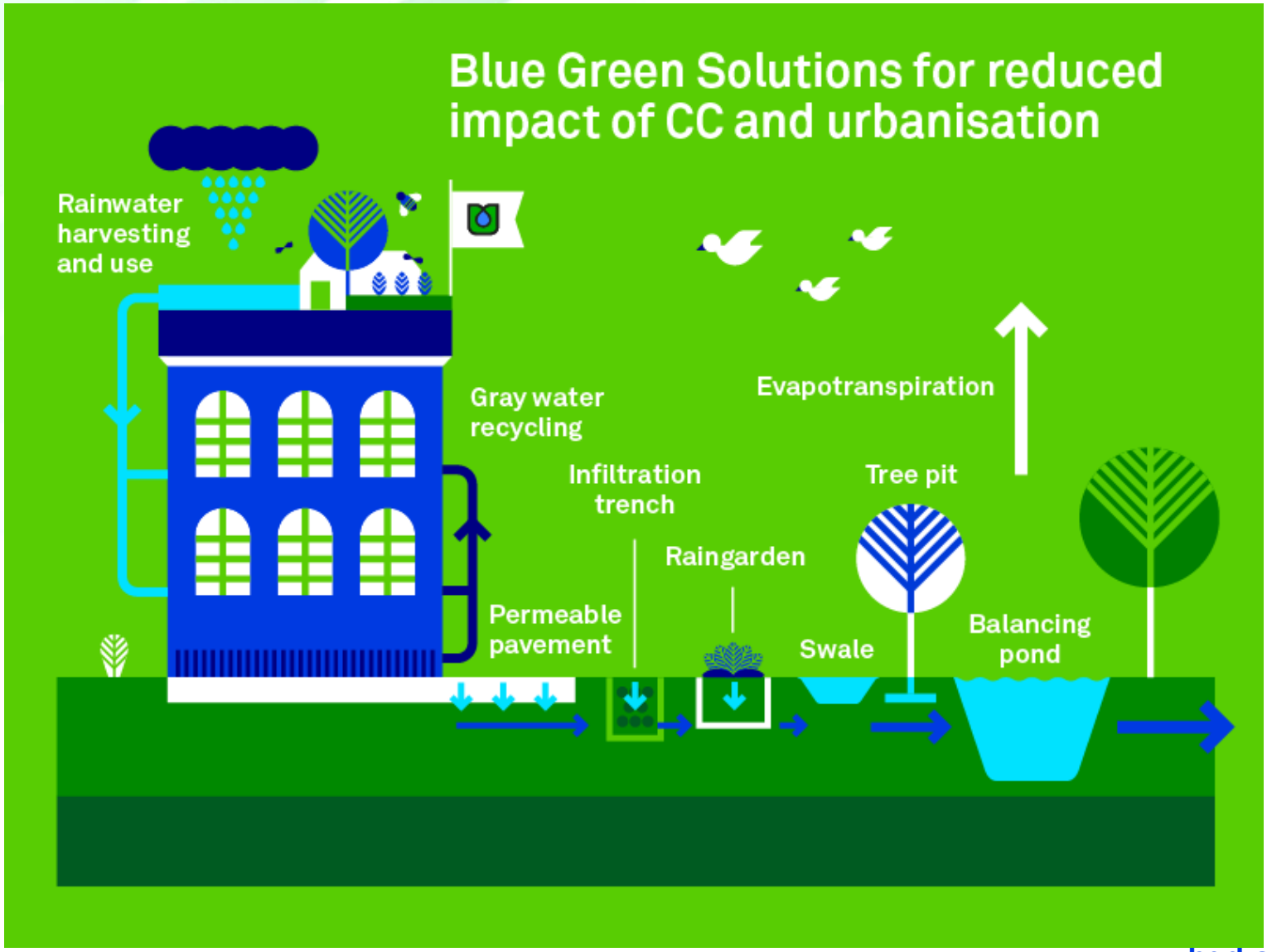
HEAT ISLANDS EFFECT REDUCED	BUILDING ENVELOPE CHEAPER	OEQ HIGHER	WATER INFRASTRUCTURE AND TREATMENT CHEAPER
OUTDOOR AIR EVAPORATIVE COOLING	BUILDING SERVICES CHEAPER	BETTER CONDITIONS FOR PEDESTRIAN TRANSPORT	CITY RESILIENCE IMPROVED
BUILDINGS MORE COMFORTABLE	HIGHER PROPERTY VALUE	SOCIALIZING MORE INTENSIVE	GROUND WATER ENERGY USE RELIABLE
BUILDINGS USING LESS ENERGY	HUMANS HEALTHIER	IMPROVED SURFACE WATER MANAGEMENT	SURFACE FLOOD RISK REDUCTION

University Campus Borongaj, Zagreb – Integrated / multufynctional water cycles



a. **Systematic analysis of city requirements**
   Goal Driven Matrix systematically define requirements and resources.**The result: Detailed interactive planning brief**
b. **Interactions between urban components** + ecosystem services.
c. **Capital cost interactions**
   The result: Potential capital cost reductions identified.
d. **Resilience to weather extremes defined.**
e. **BGS Business Initiation.**
f. **Detailed design brief.**


Conventional concept of resource usage
Exhaust heat
Solid waste
Food waste
Rain water
Potable water
Energy
Heating
Food
Fertilizer
Polluted runoff
Irrigation from potable water
Waste water



www.bgd.org.uk

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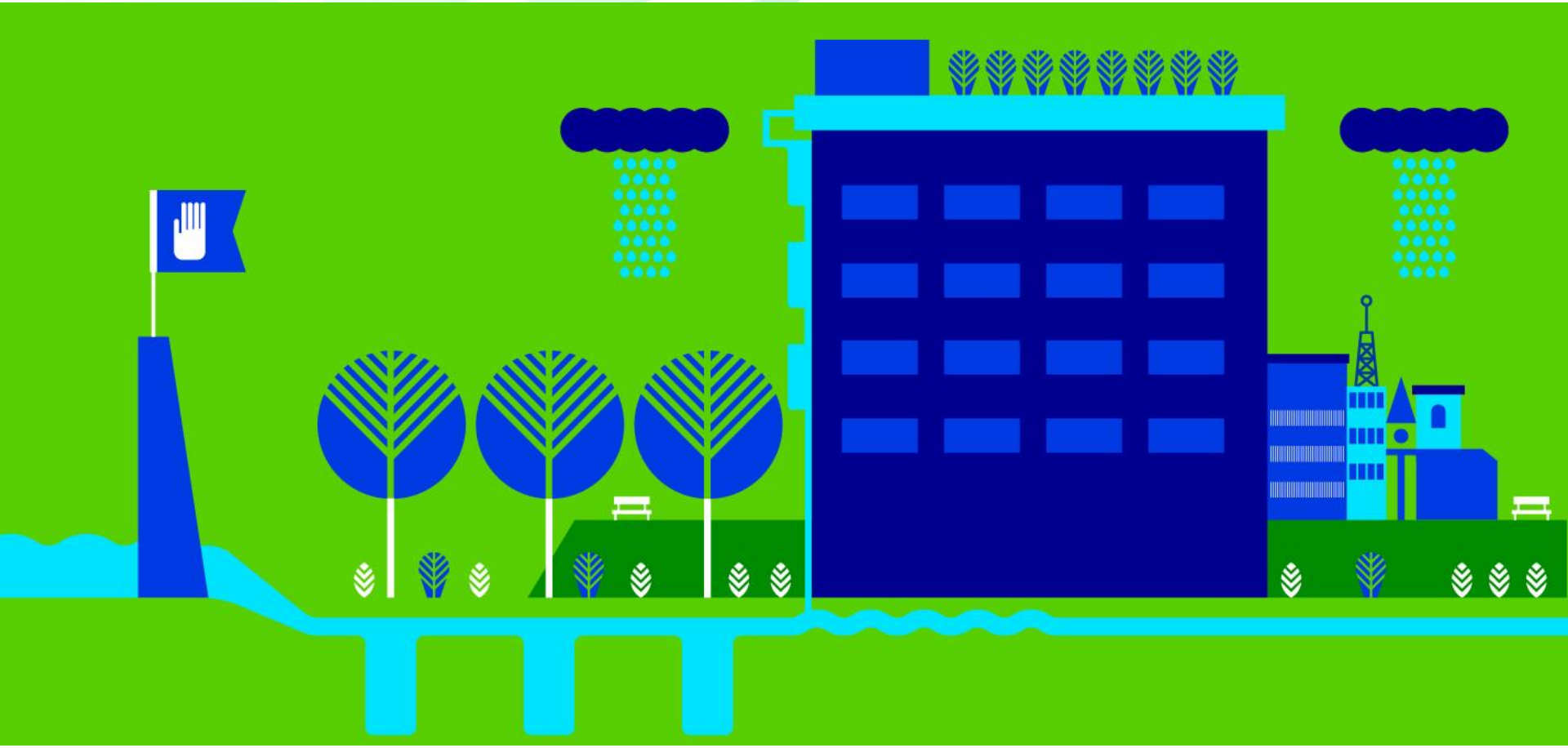
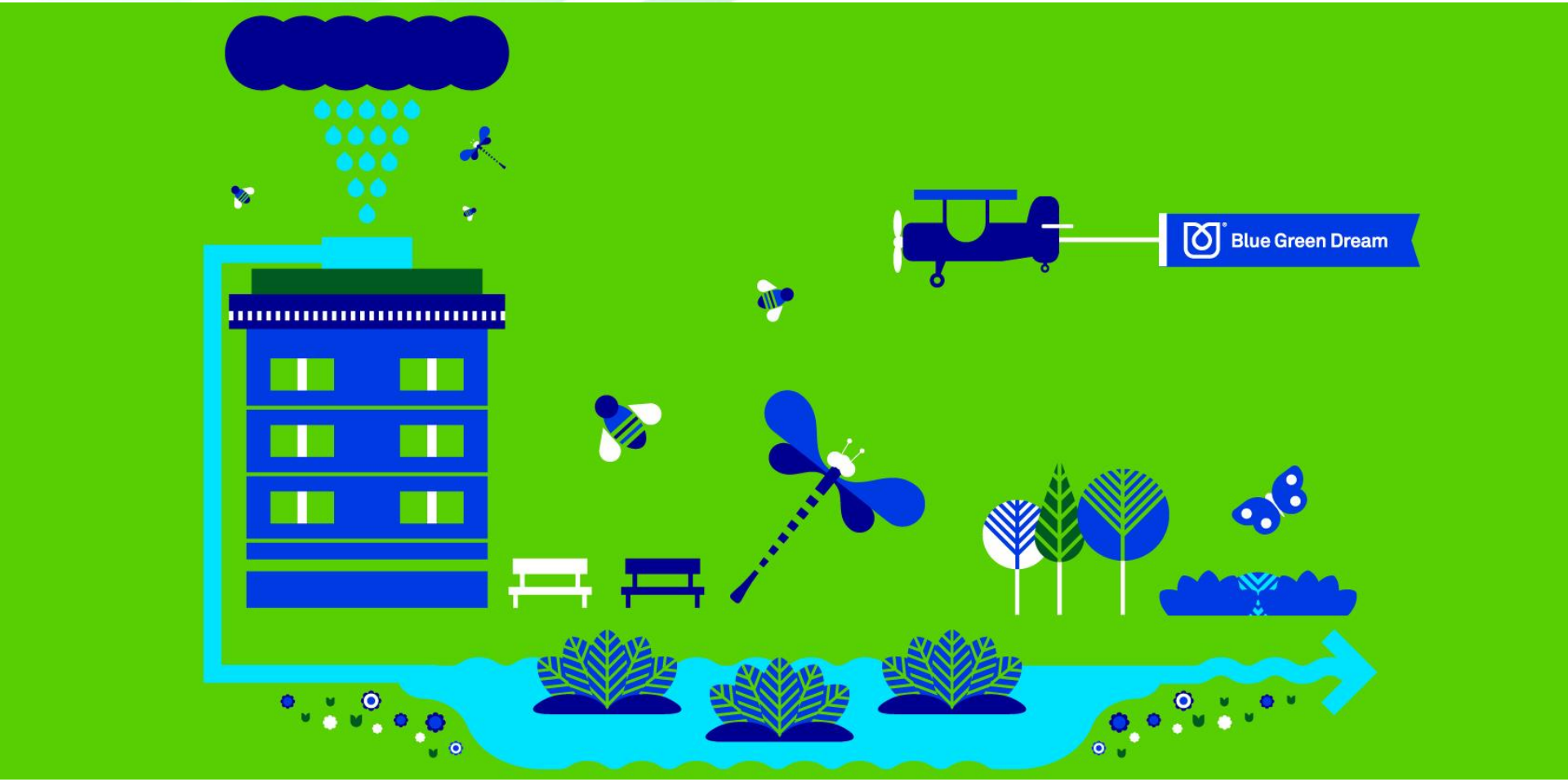
An example of multifunctional use of interaction of urban vegetation and harvested storm runoff used as water resource



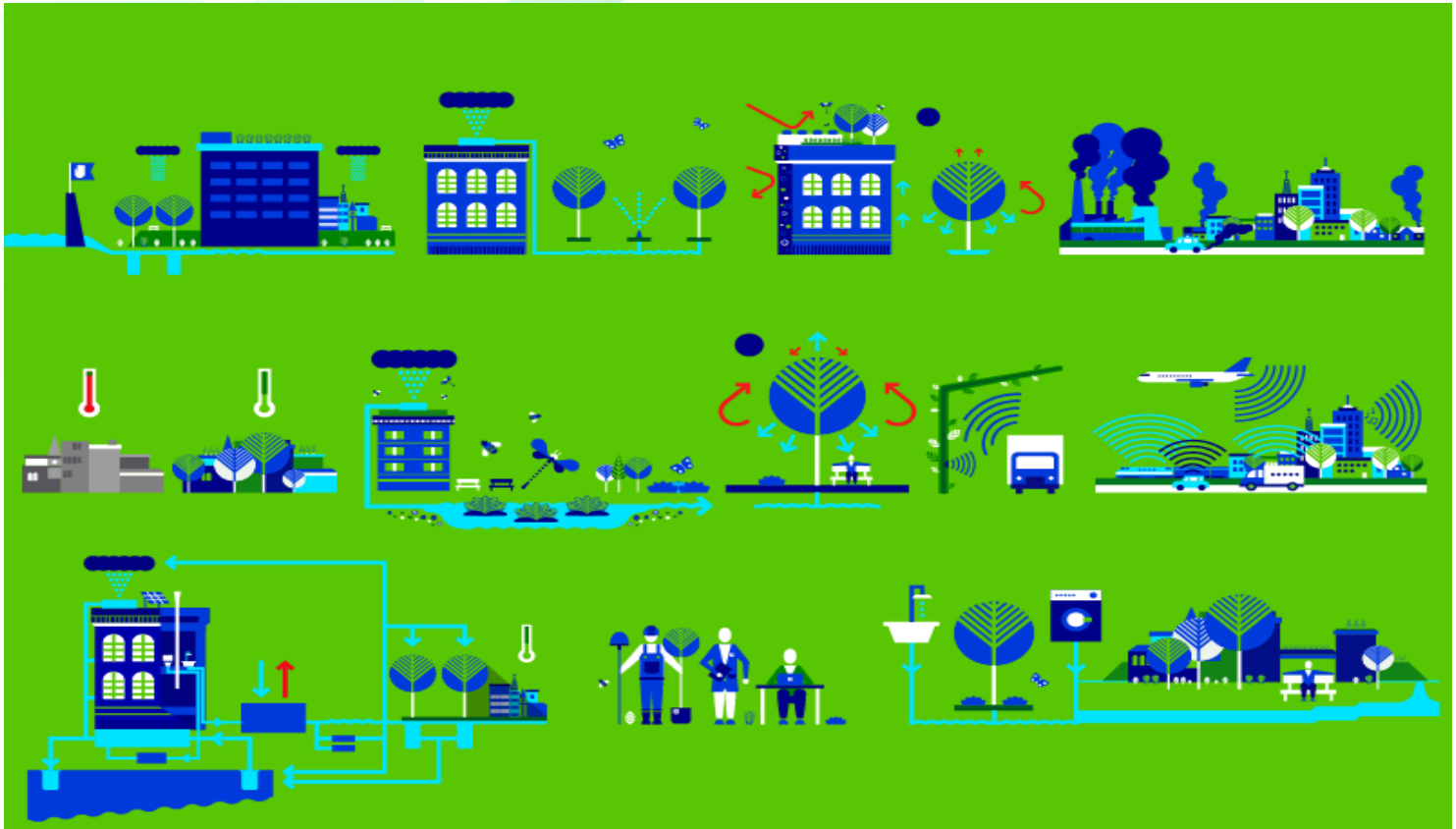
Enhancement of Biodiversity



Blue Green Solutions

*Blue Green Solutions call for **rethinking** existing ways of planning, designing, constructing, operating and maintaining urban water systems (blue assets), urban vegetated areas (green assets), buildings, energy, air quality and city behaviour under climate extremes, not as separate systems but in combination.*

*The **innovative** advantage of this method is the fact that interactions between components of urban categories including Ecosystem Services,are **quantified**, enabling the design team to optimize complete project, based on **parametric** results (analysis); with direct implication on **cost and quality**.*



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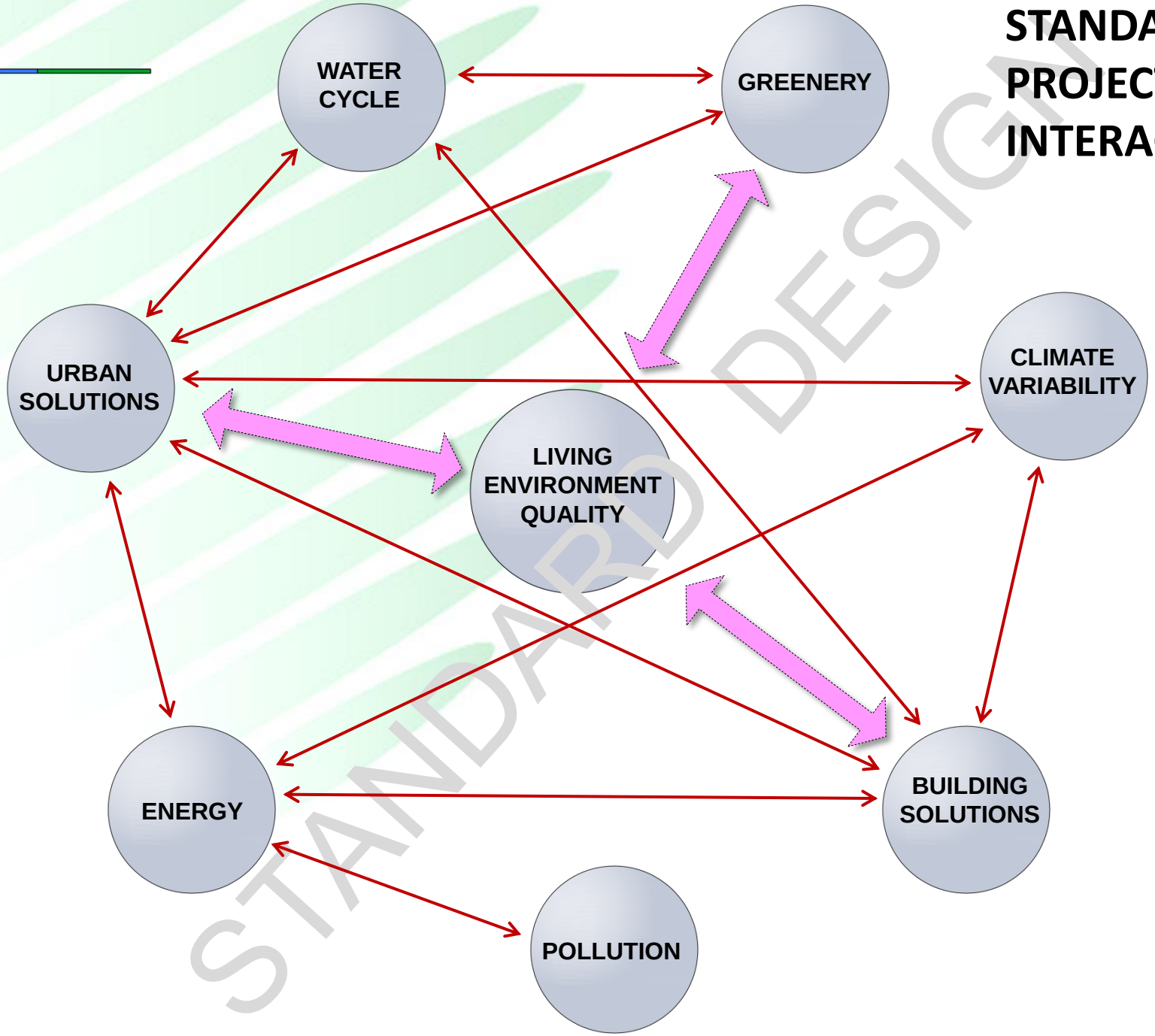
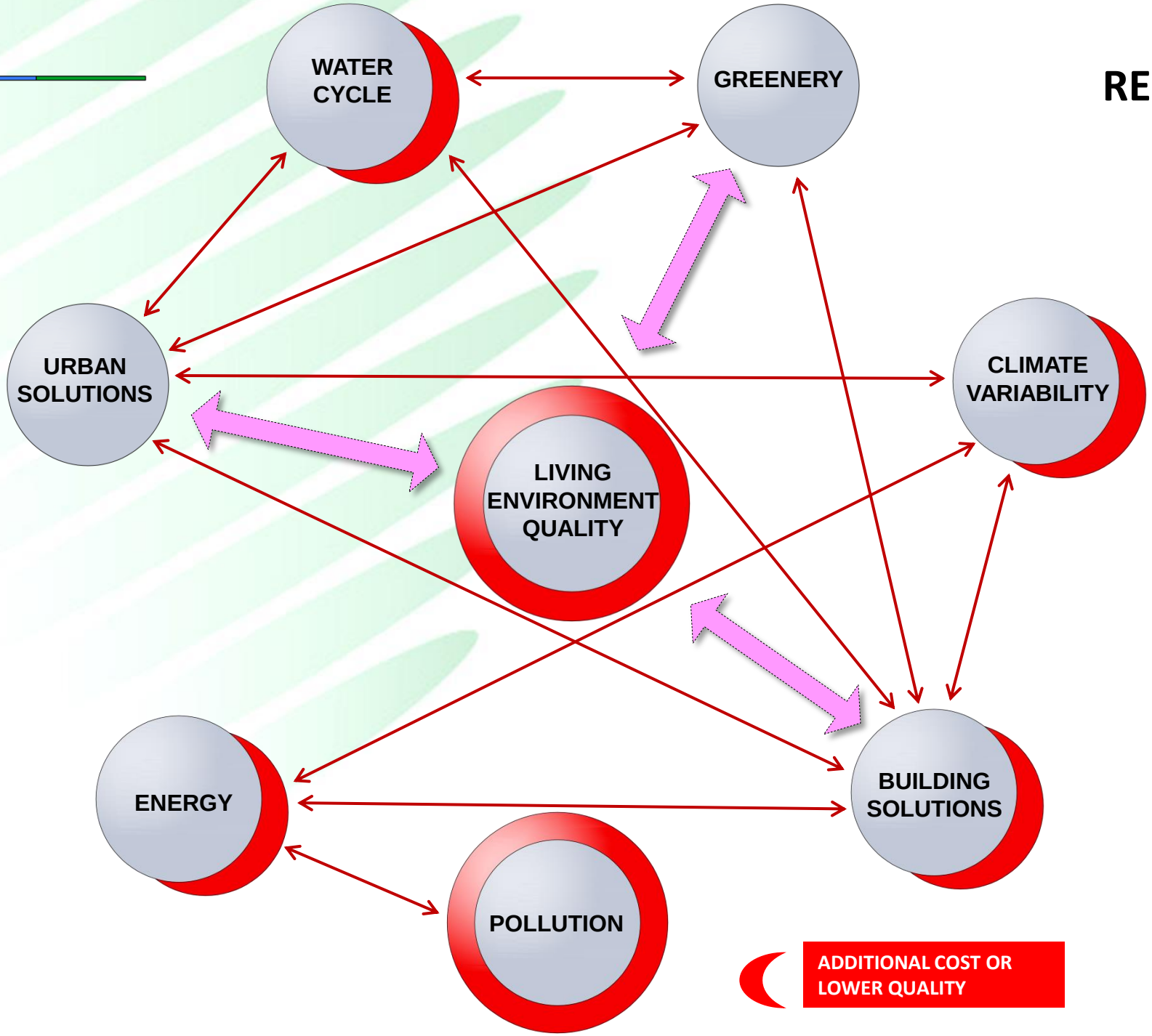
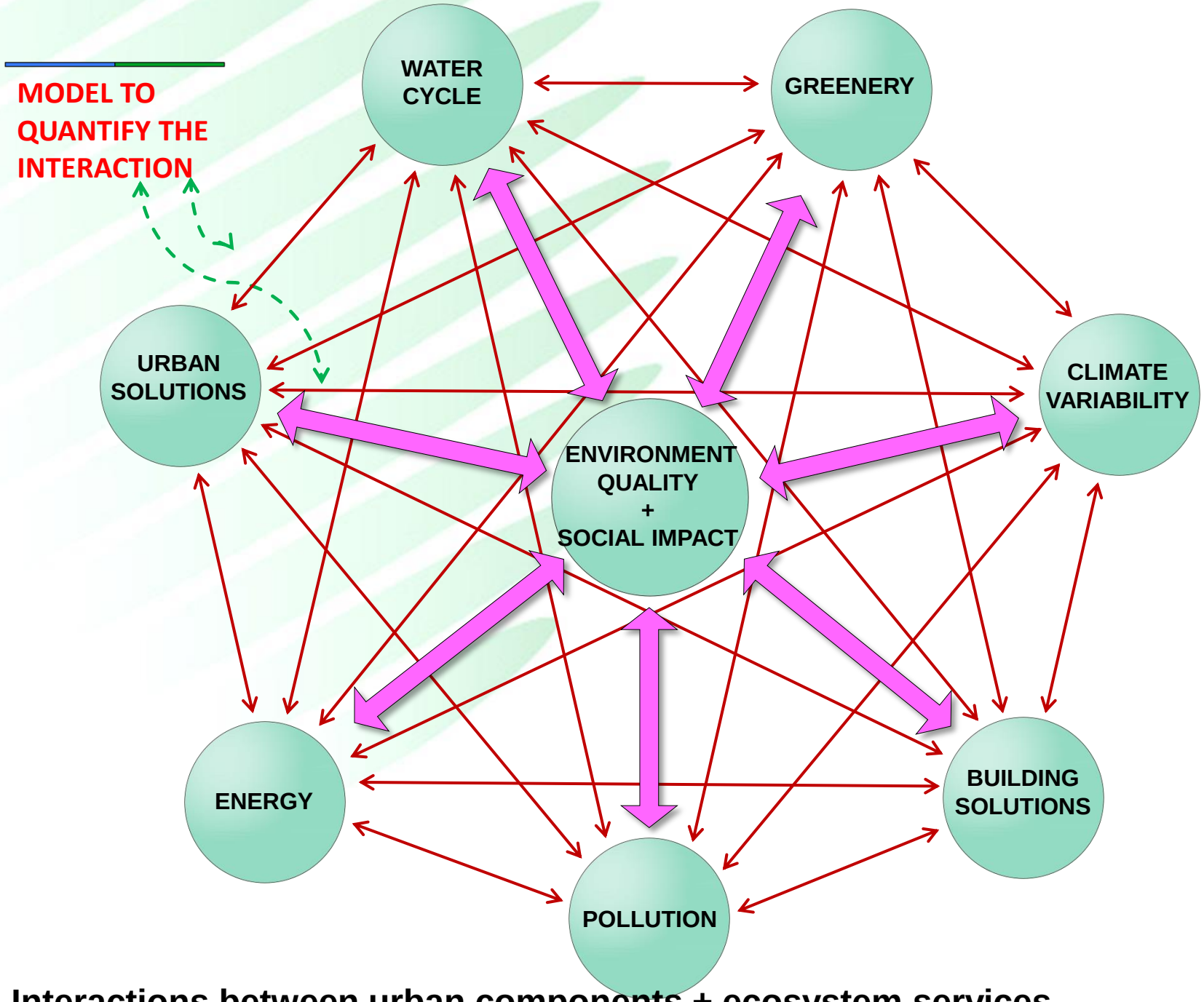
STANDARD PROJECT INTERACTIONS



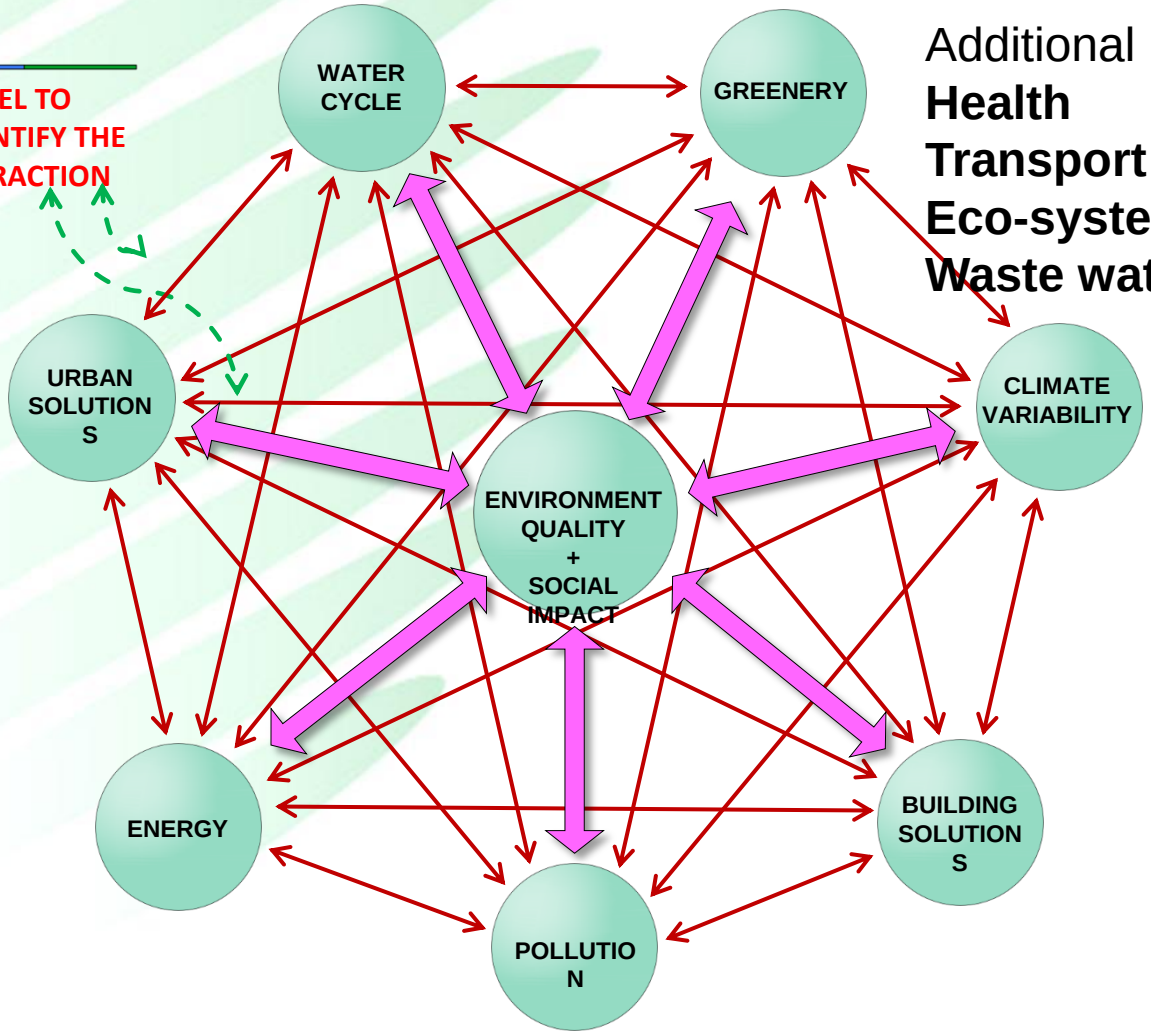
THE RESULT


WATER CYCLE
GREENERY
URBAN SOLUTIONS
CLIMATE VARIABILITY
LIVING ENVIRONMENT QUALITY
ENERGY
BUILDING SOLUTIONS
POLLUTION
ADDITIONAL COST OR LOWER QUALITY



b. Interactions between urban components + ecosystem services

MODEL TO QUANTIFY THE INTERACTION



Additional interactions:

Health

Transport

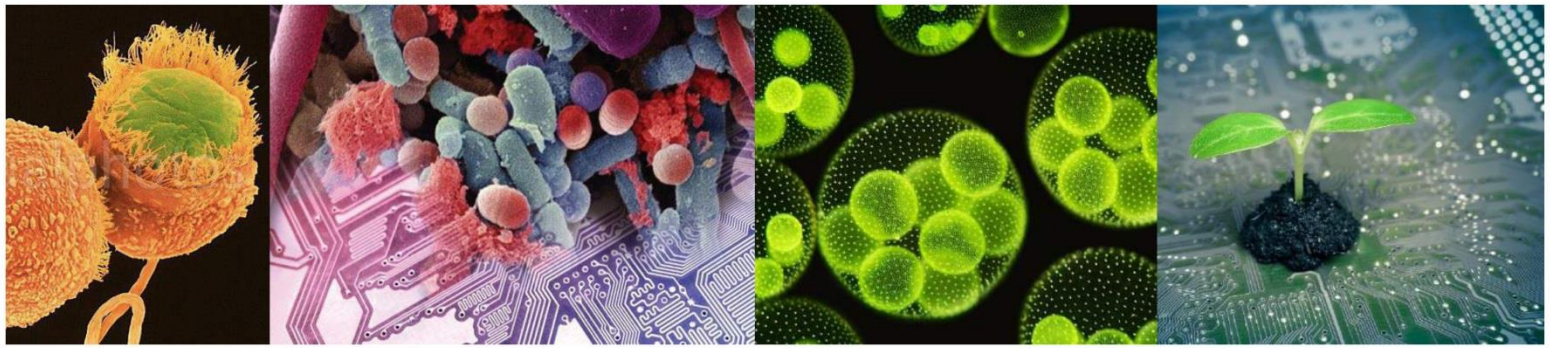
Eco-system services

Waste water treatment

Our BGS spatial units
From micro organisms to several Chinese provinces

Biopolus: Engineering Urban Ecosystems

Combining the Intelligence of Humans & Nature for Integrated Urban Solutions



Metabolic Hubs = **Engineered Ecosystems, which perform various functions to transform urban areas into smart circular economies**

Blue Green Global Ltd

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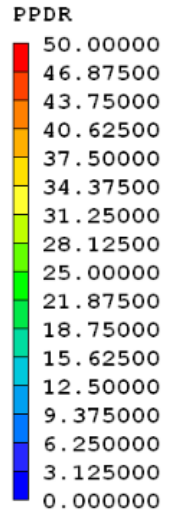
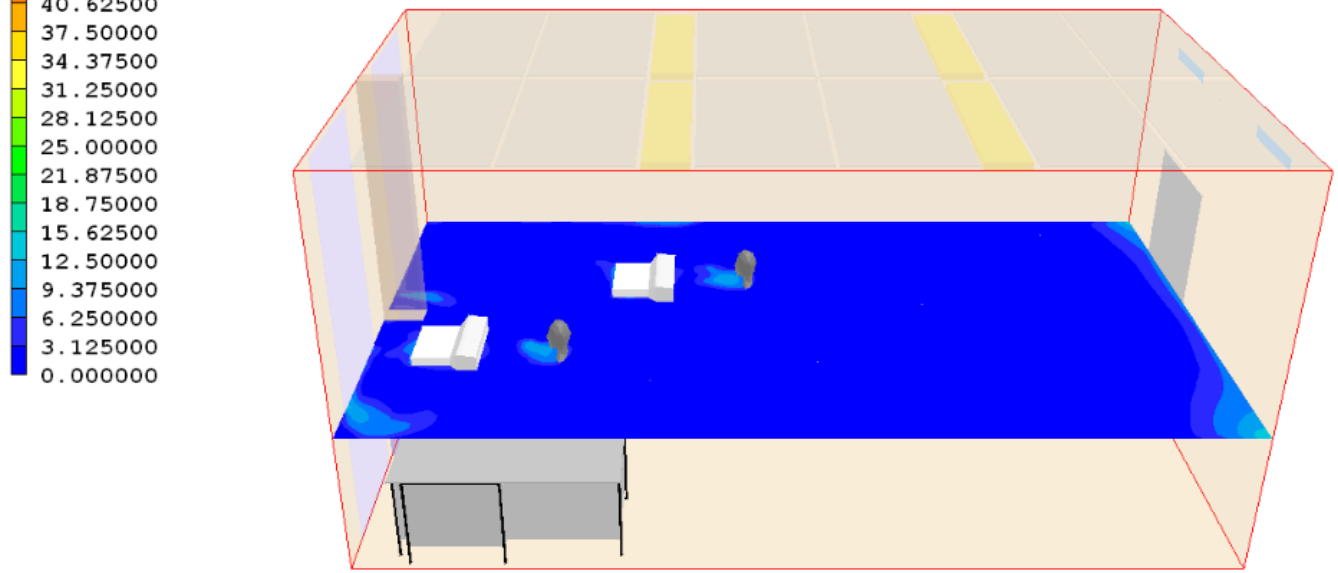
in harmony with nature

NEXT GENERATION BUILDING DESIGN

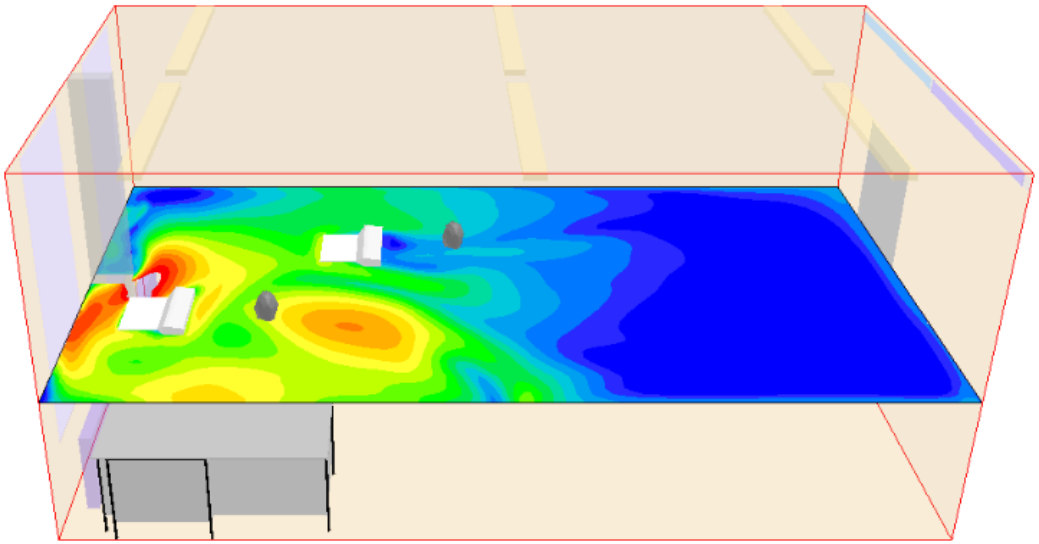
www.enplustech.com

PPDR in an office space





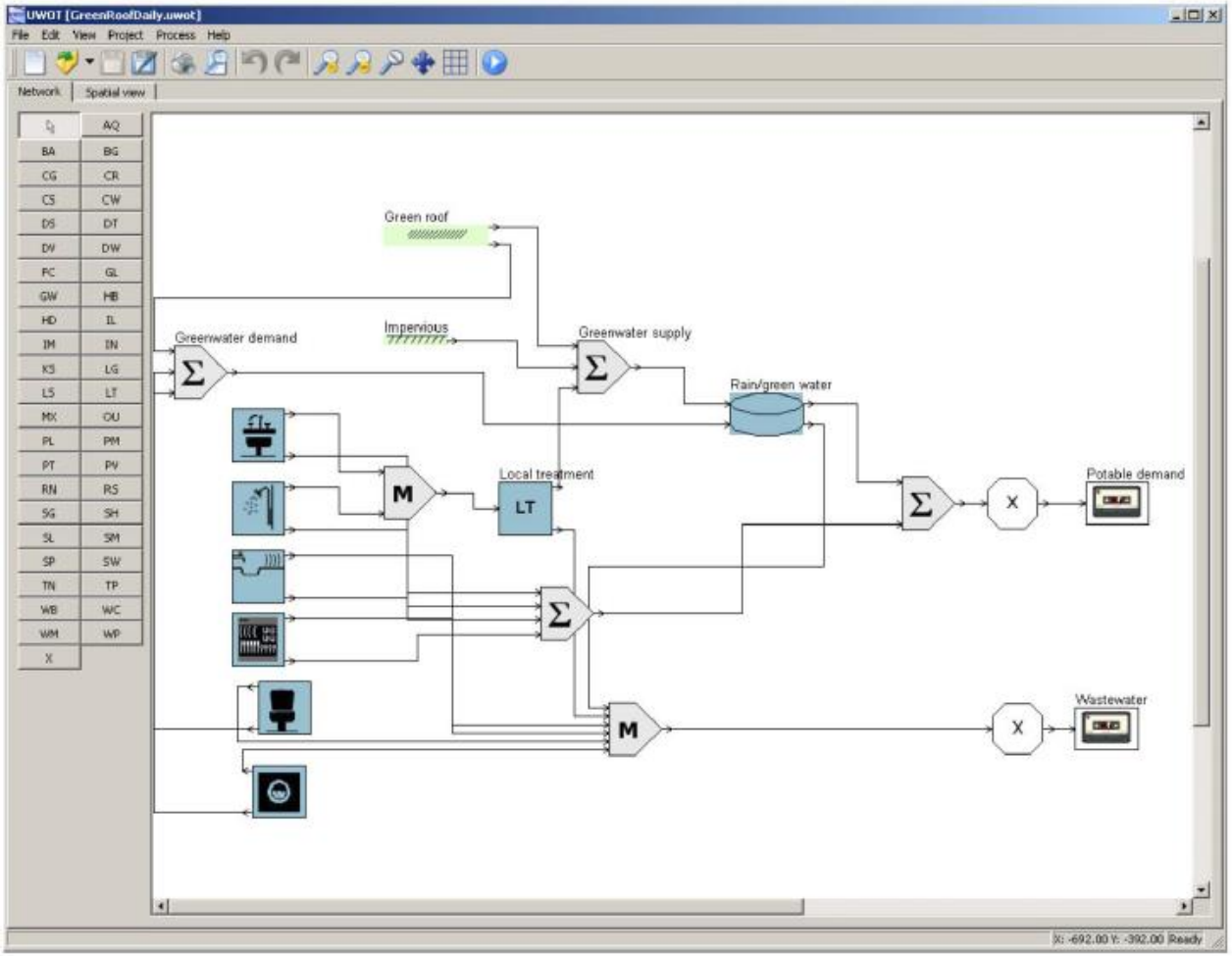
Paris Office: Case EnPlus_Summer



Paris Office: Current Case_Summer

BGD Tools and Services - UWOT example

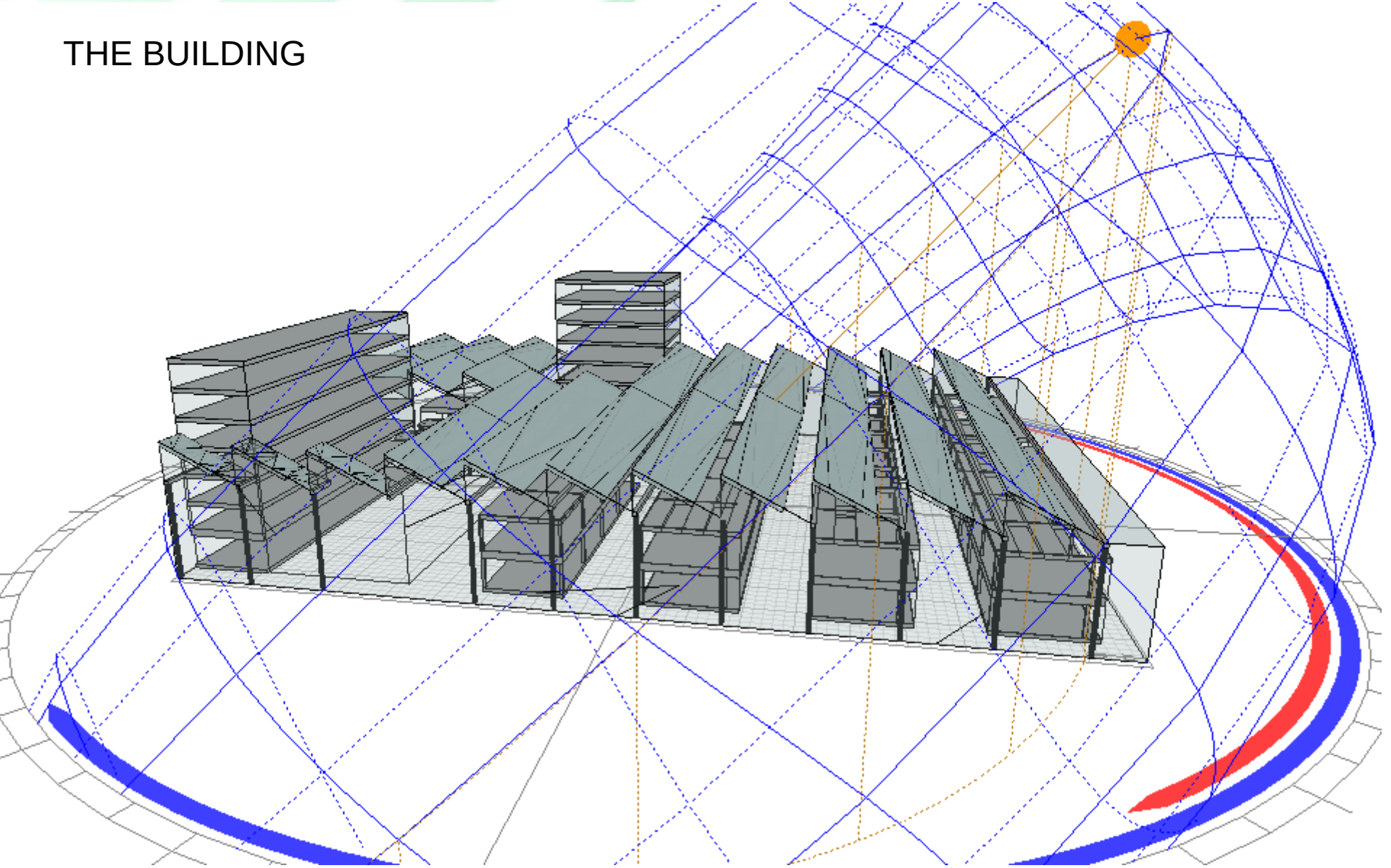
UWOT – intermediate level tool: networks of buildings/households



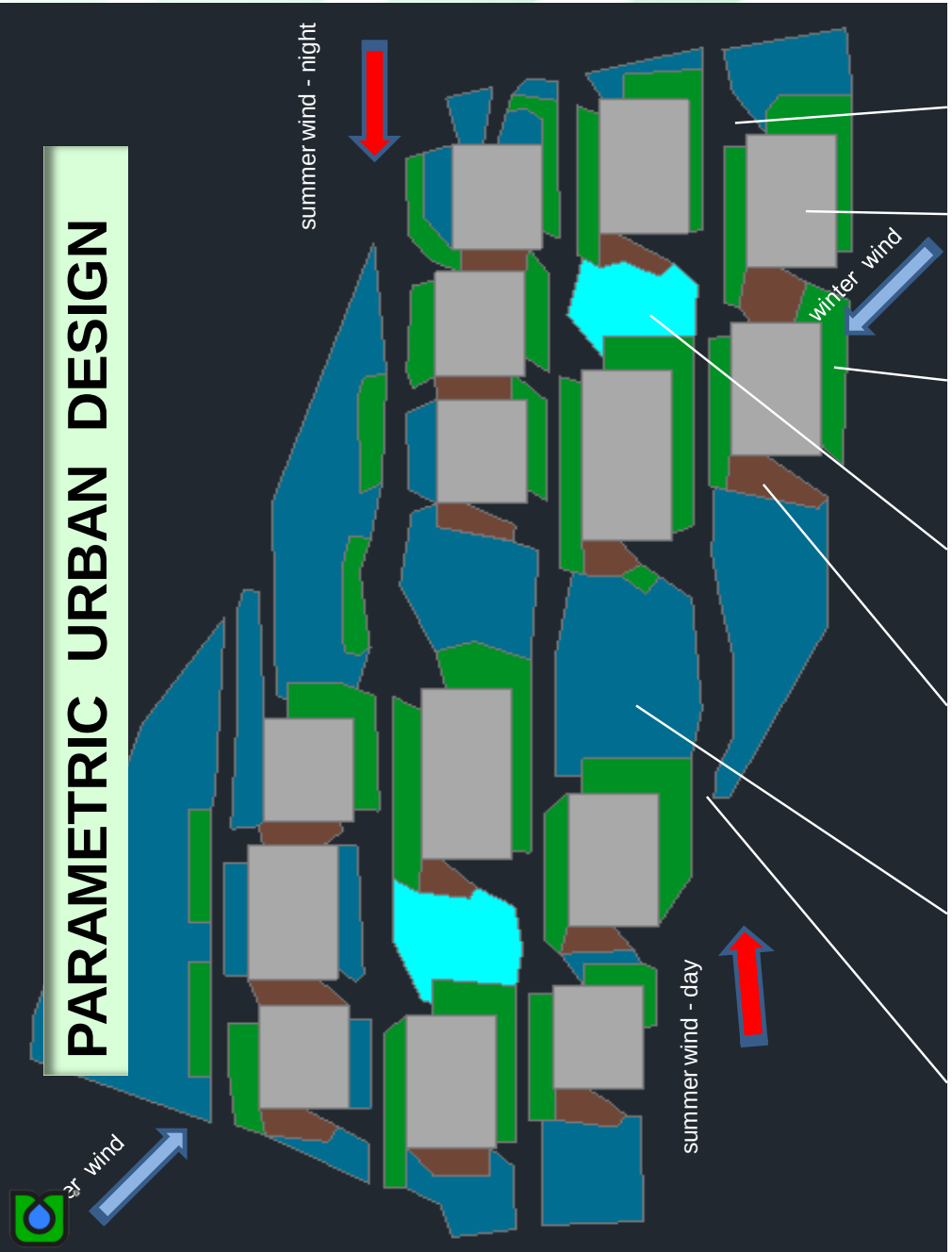
- Simulates effects of BG Solutions on networks of buildings
- Predicts water/energy savings for different future scenarios, including climate change and population growth
- Output parameters include reduction in waste water generation, potable demand, energy consumption.


Borongaj University campus – Zagreb

THE BUILDING



APPLIED NBS SOLUTIONS – University Campus Borongaj



Wind corridor for the building free cooling - summer night

Clusters orientation – south /north to maximize passive heating and sun energy harvesting by PV and Solar collectors

Winter wind barrier - evergreen threes
-existing - *Picea abies*, *Taxus baccata*, *Pinus* sp., *Pseudotsuga* sp.
-new - Pinus nigra, Thuja columnaris,
-Juniperus communis „Hibernica“

Semi open space - for social activities central zone threes - high treetop(3-4m)
- *Celtis Australis, Rhustiphina, Betula verrucosa*

Passive heating - threes that loose leafs first week in October
- *Acer platanoides*, *Alnus glutinosa,*

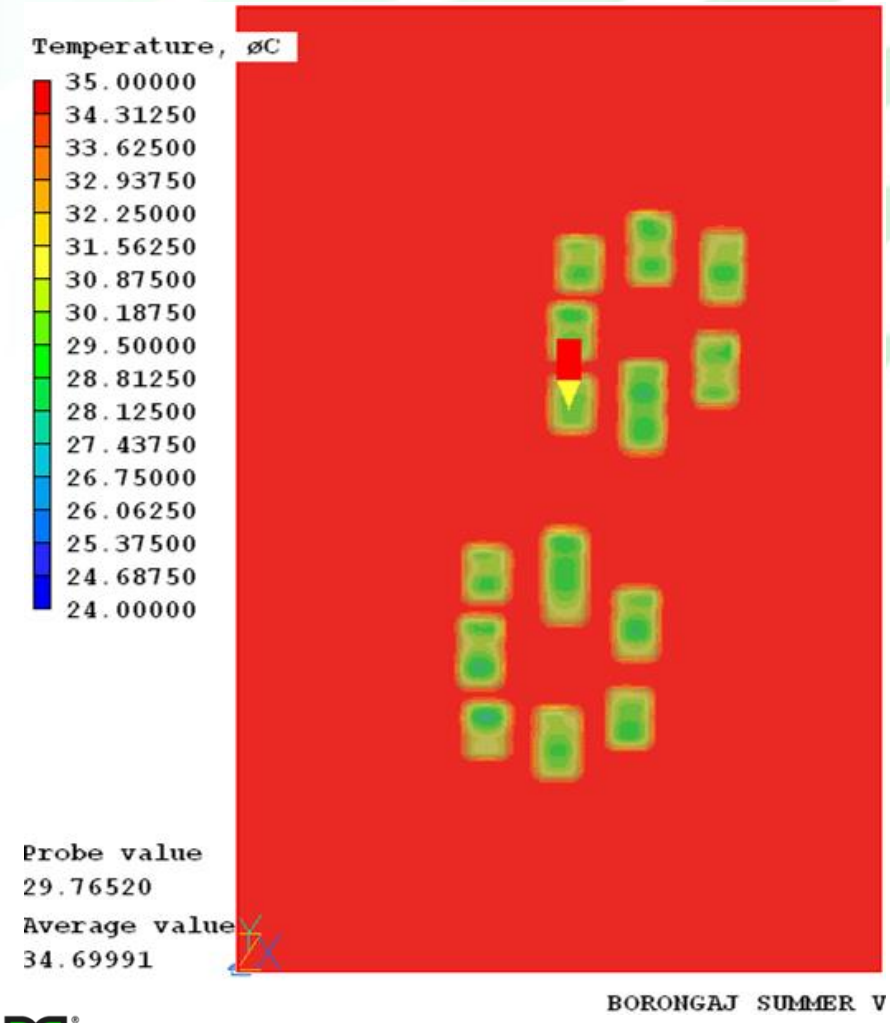
Urban adiabatic cooling – particular selectic of deciduous threes with high leaf surface area
- existing - *Carpinus Betulus, Catalpa bignonioides*, Acer sp., *Juglans nigra*, *Platanus* sp
- new - Liqiudambar sp.

Wind corridor for the urban adiabatic cooling - summer day

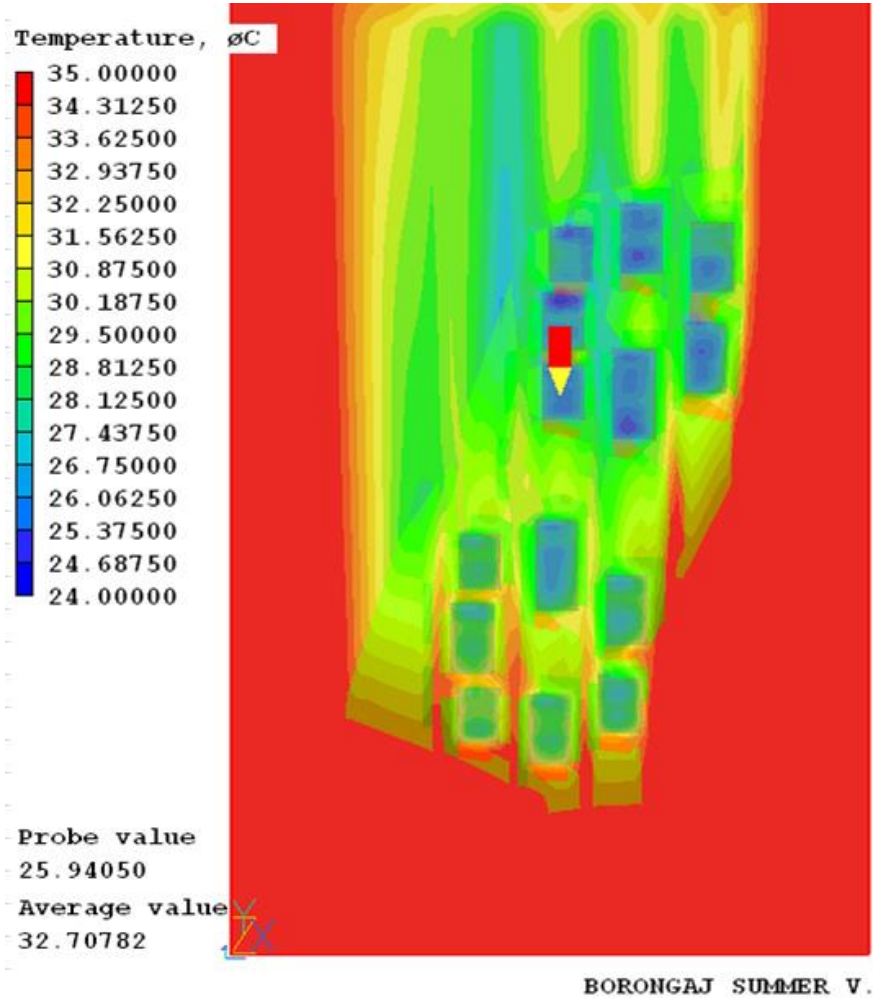
THE RESULT: lower cooling load, higher thermal comfort, HVAC capital cost reduced, glazing cost reduced, energy savings

RESULTS SUMMER

CAMPUS SUMMER OUTDOOR TEMPERATURE WITHOUT THE FORREST



CAMPUS SUMMER OUTDOOR TEMPERATURE WITH THE FORREST



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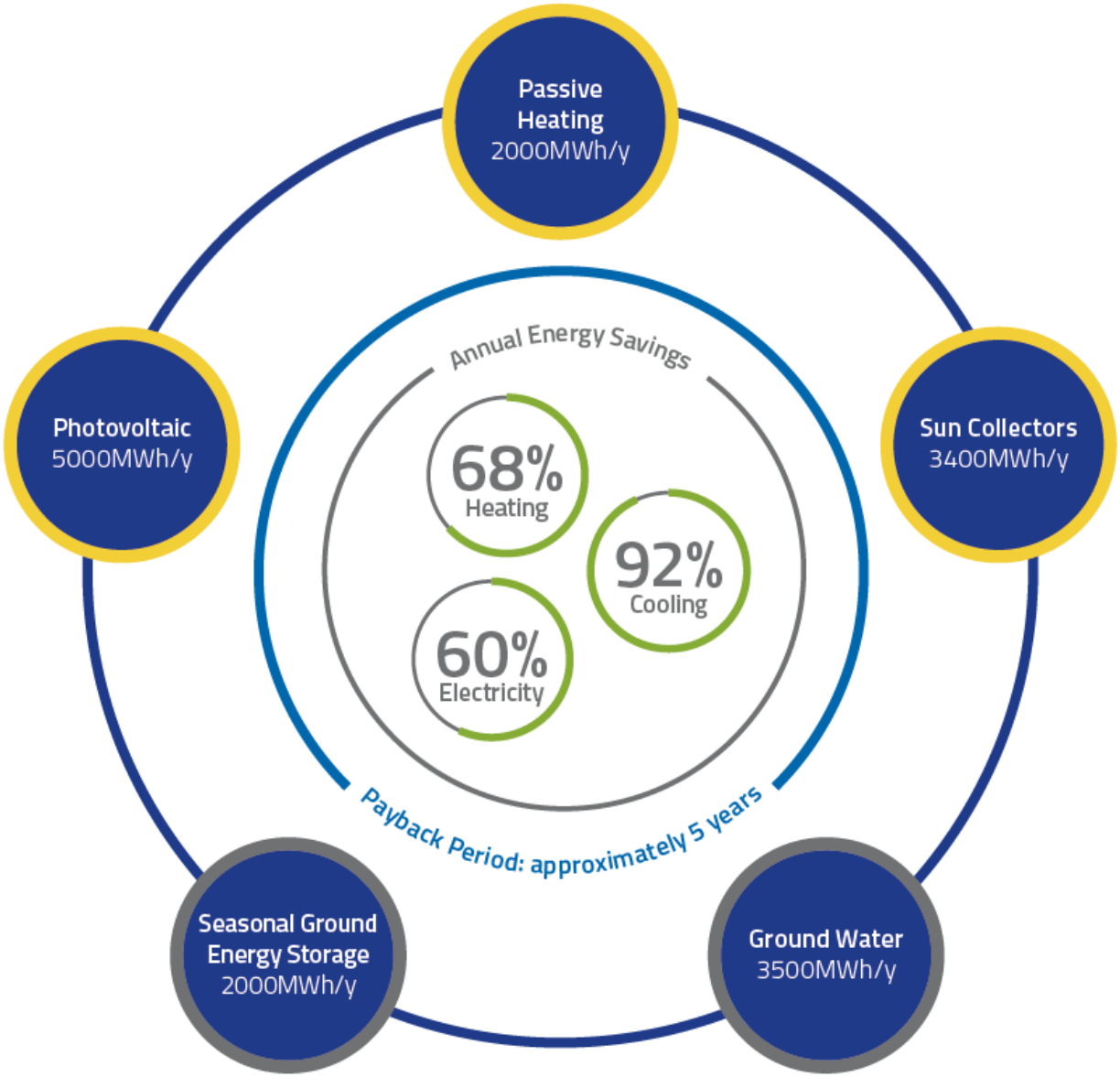
University Campus Borongaj – resulting operational costs savings



Two other attempt od BGS planning methodology applications in Zegreb

1. Strategic development ZAGREB PLAN

2. Multi-functional Sava diversion canal in Zagreb area

A.2 ENERGY CONSUMPTION OPTIMIZATION BY ARCHITECTURE

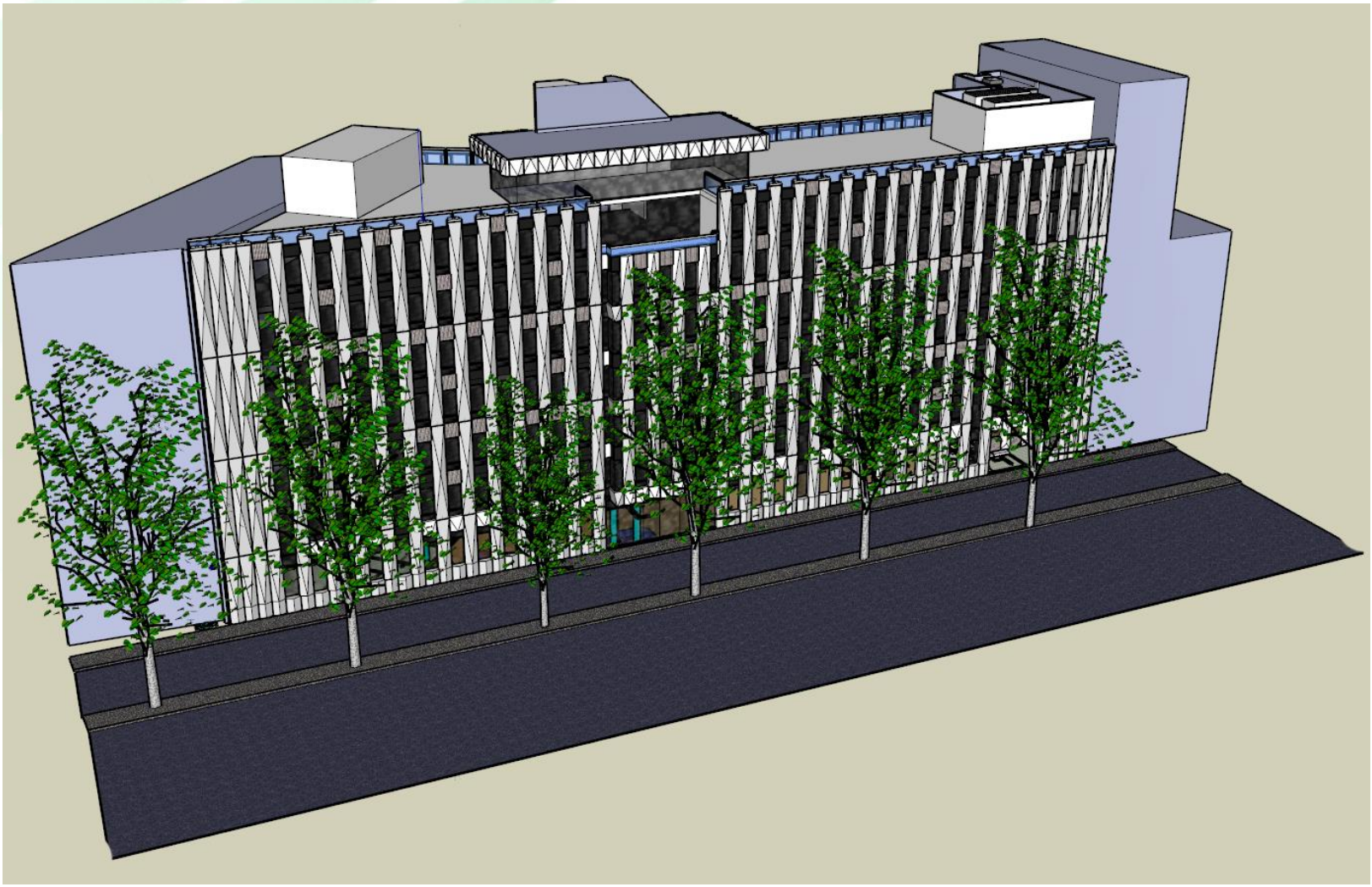
REDUCE COOLING&HEATING CAPACITY

An initial example
Energoprojekt HQT. - INTEGRATED DESIGN SOLUTION:
COOLING LOAD REDUCTION STRATEGY
(Reduction from 3.5 MW 1.7 MW for cooling)

AUGUST 14.00 PM / 39 ºC – COOLING ON – ROOF OPEN

Example 2: World Bank Paris

MAY 2009



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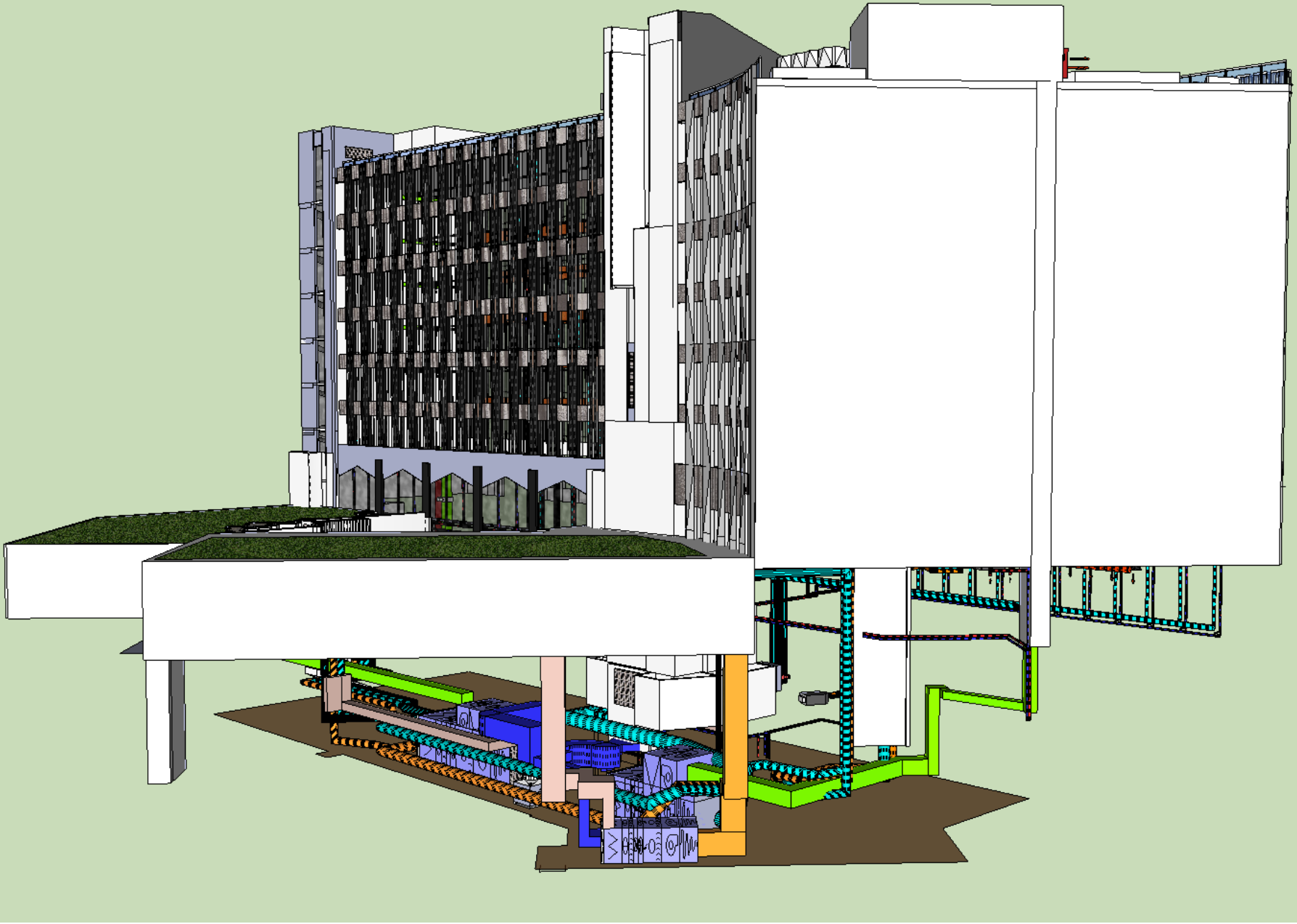
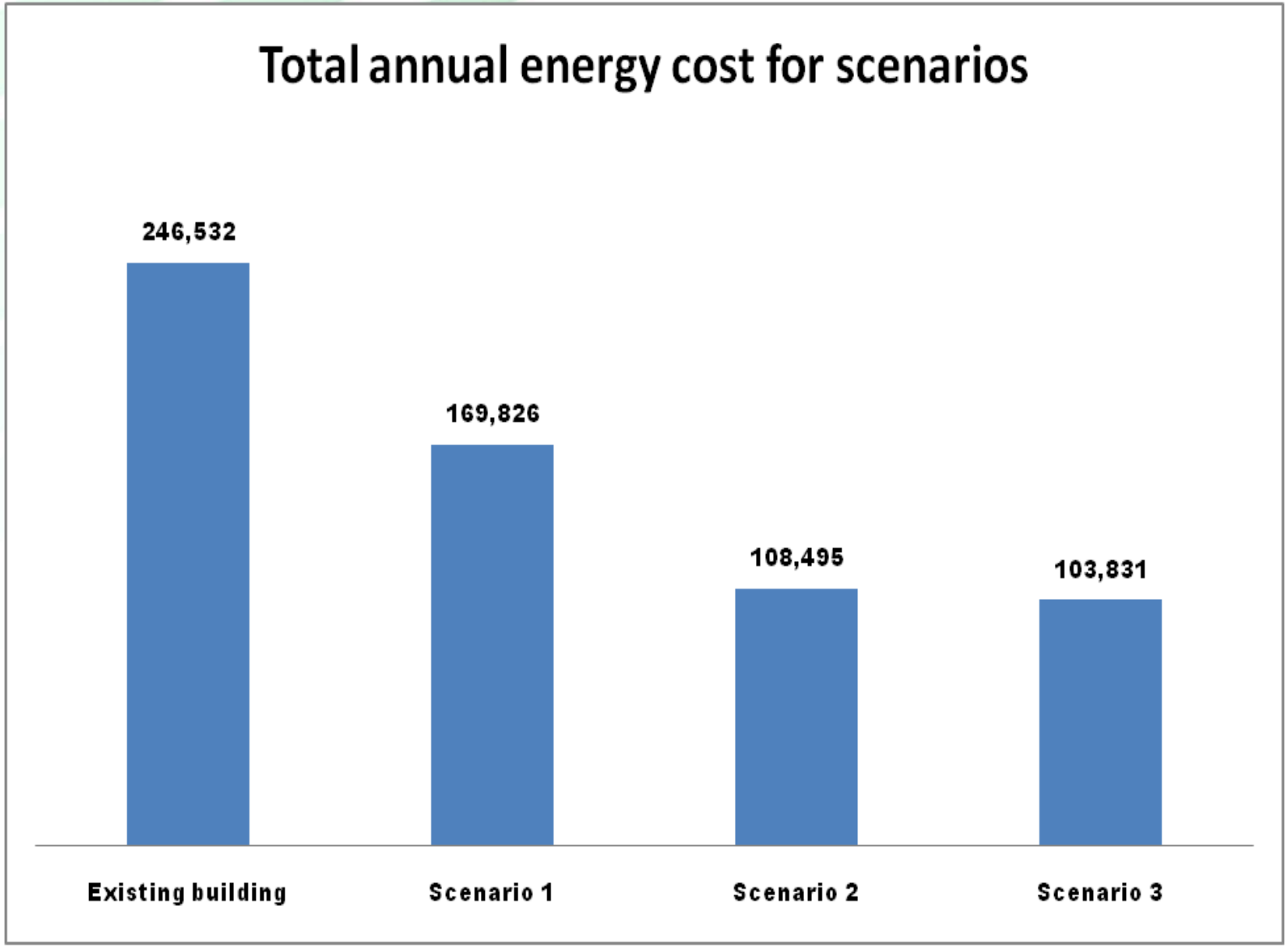
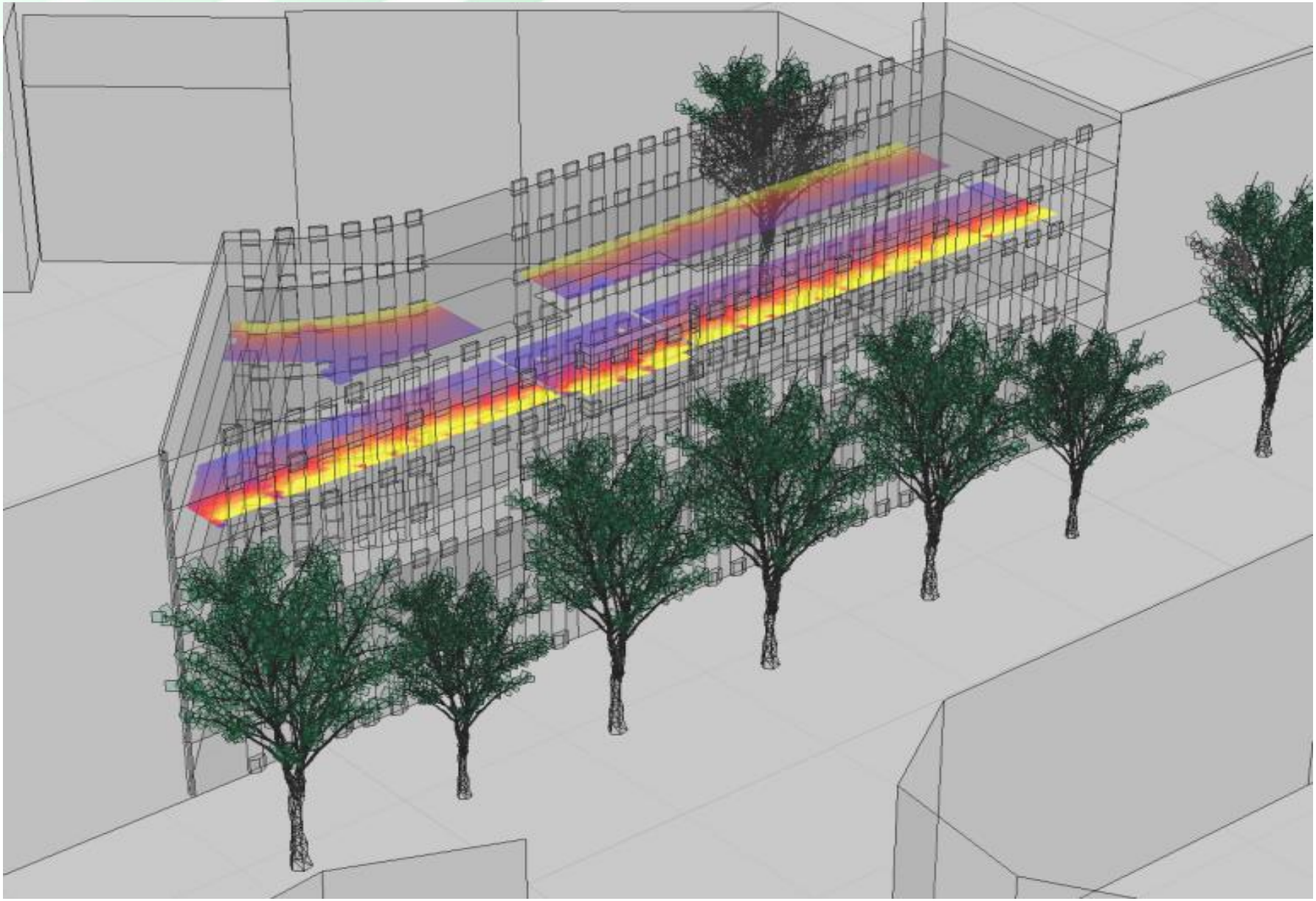
In harmony with nature



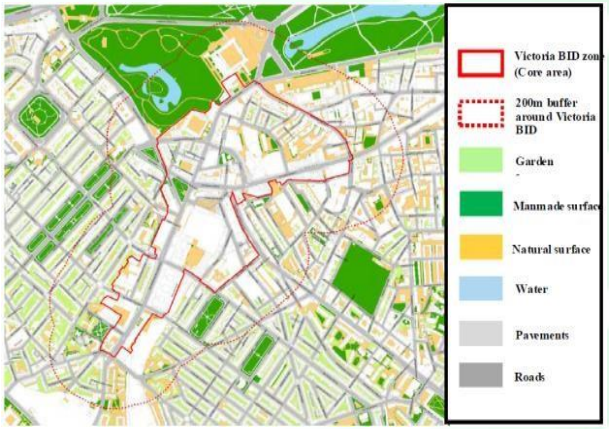

Total annual energy cost for scenarios
246,532
169,826
108,495
103,831
Existing building
Scenario 1
Scenario 2
Scenario 3

EURO



Porto Montenegro-Tivat

City of London - Cheapside



Victoria BID London

Siemens – Production site

K66 Ljubljana – building front adiabatic cooling proposal

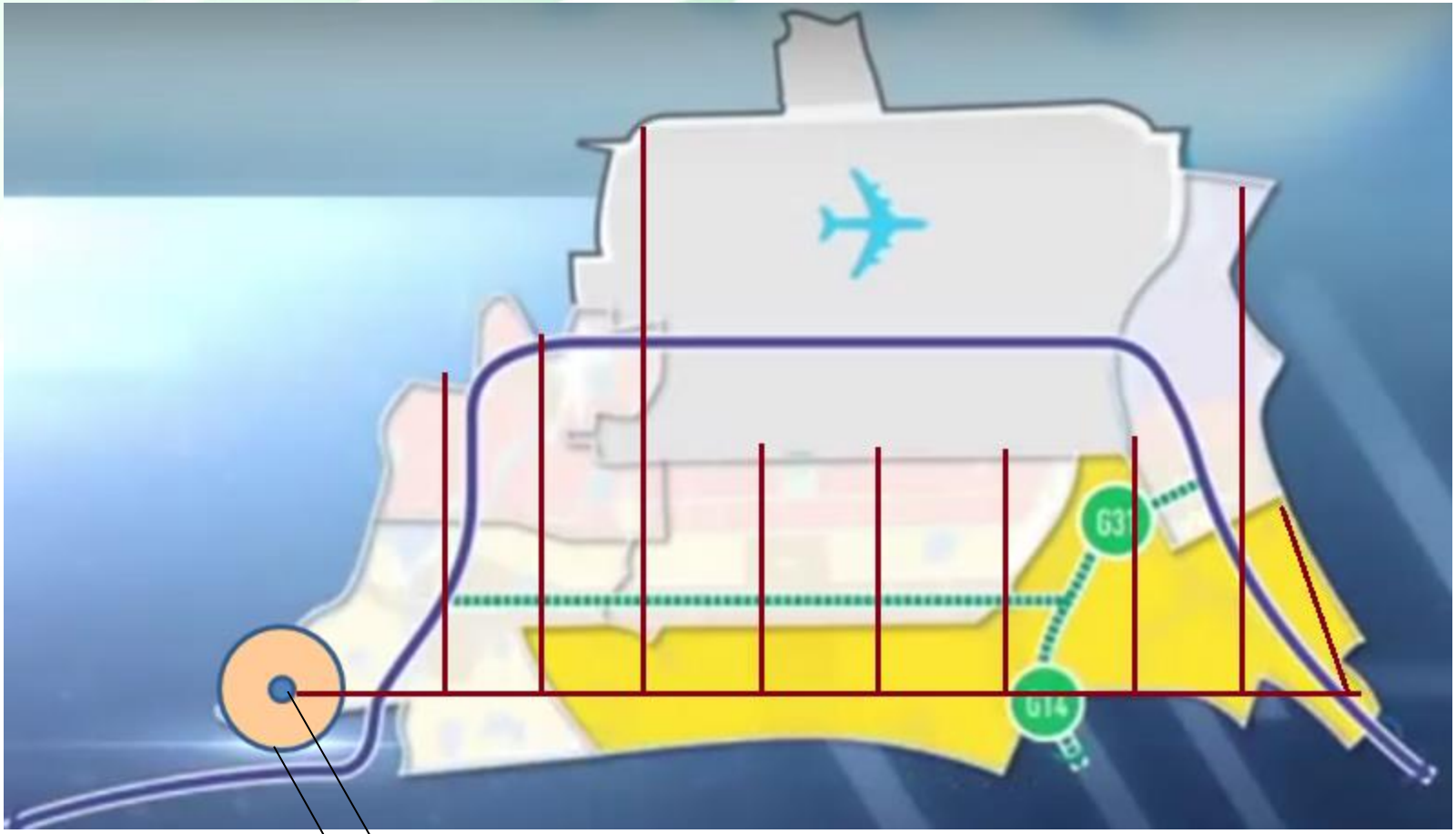
Example 3
Decentralised WWTP
Taoyuan – Taiwan

BGS team note:
The available Master Plan animation demonstrates advanced strategy and high quality urban solutions.
From the BGS angle some of presented urban fabric does not seem to comply with the BGS concepts.

The BGS Peer Design Review would most probably identify areas for improvements and/or added value related to:

- Interactions between NBS and City Efficiency,
- Integrated Heat Island Effects mitigation (OEQ and IEQ improvements),
- Benefits from interactions between BGS and WWTP,
- And number of other potentially interactive Urban Solutions

TAOYUAN – CLASSIC WWTP

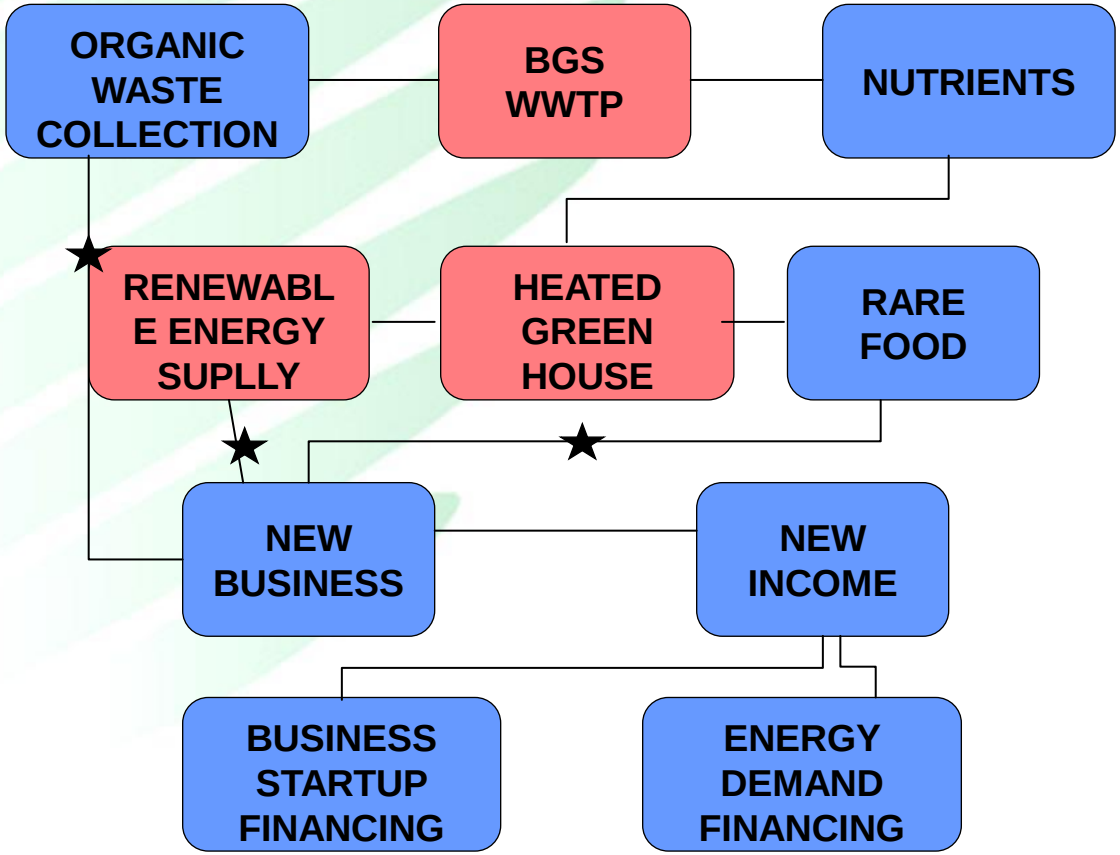


CLASIC WWTP

CLASIC WWTP PROTECTION AREA

THE RESULT: Master Plan now can utilize interactions between WWTP & Urban components > more options > MP changes !

BGS (FRACTIONAL) INTERACTIVE PLAN EXAMPLE OPPENING NEW OPPORTUNITIES:



★ New employment opportunities

ENERGY MIX concept for Klekovaca Ski resort

Sun (PV) + Grid + Geothermal + Biomass + Wind





a. Waste Energy

1. Lake water energy

2. Reuse of water in Water treatment Garden

3. Central laundry waste energy

4. Snow making waste energy

b. Waste for combined production of Heat & Electricty & Composting

1. Organic food waste

2. Sludge from waste water treatment garden

3. Agriculture waste

En Plus

En Plus

AERO PLANTS grain crops

DRAFT

Aeroponic production allows a rapid production of grain crops, like **barley, wheat, oats, clover, alfalfa** etc.

Barley for example can be ready to harvest in 7 days. With aeroponics, approximately **7 kg of grass** can be produced from every **1 kg of barley seed**.

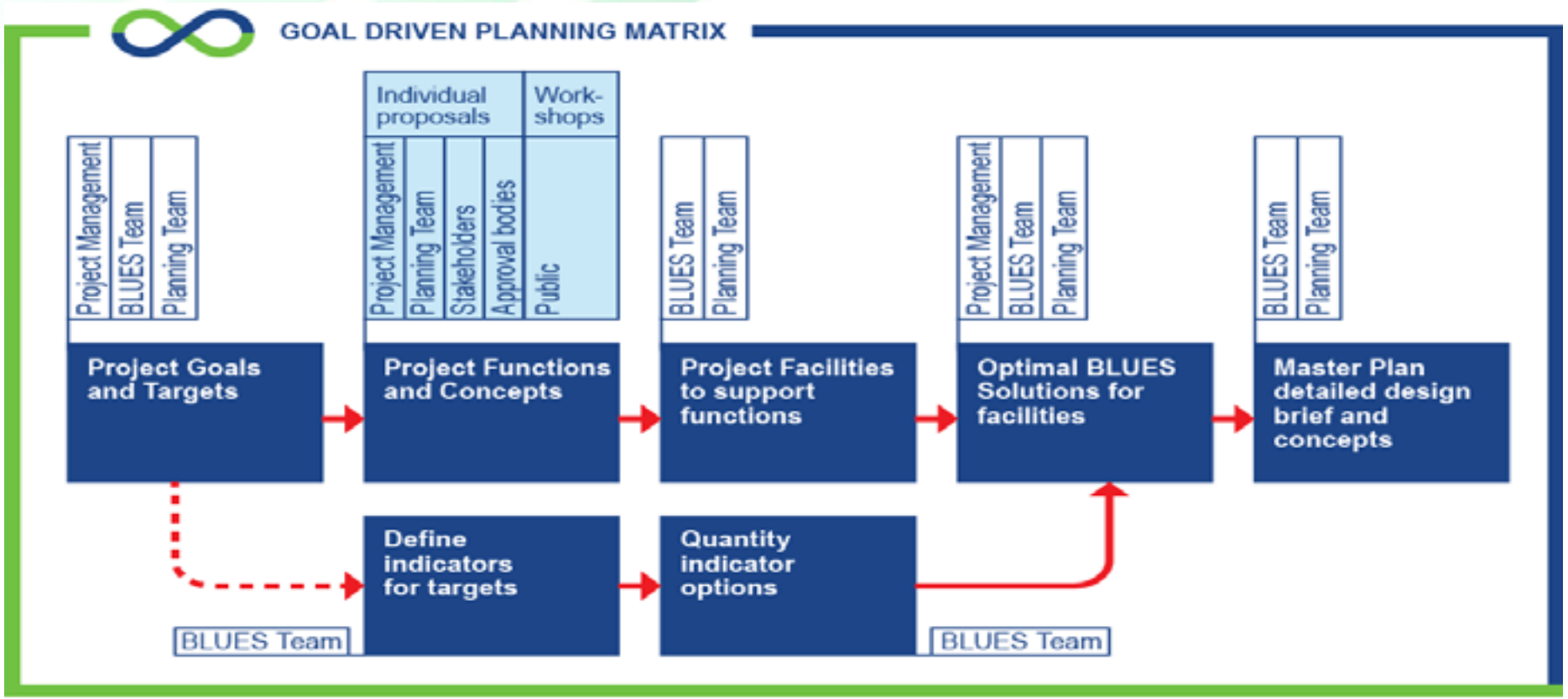
BARLEY GRASS FOOD

Green food concentrates such as barley grass and other cereal grasses are a great supplement for a healthy diet.
Barley grass is best consumed by juicing the grass sprouts to produce a powerful fresh **green juice**. It is also consumed in **powder form** and is very easily digested by the body.

BARLEY GRASS FEED

Green fodder is nutritious and rich in energy comparable to traditional fodder.
The "sprout mat" is completely edible and highly nutritious as it is a living food. The animals will eat the entire mat, roots and green growth, so there is no waste. Useful for dairy farms as green barley grass fodder increases milk yields, improves animal fertility and resistance to sickness.

En Plus


GOAL DRIVEN PLANNING MATRIX
Individual proposals
Work-shops
Project Management
BLUES Team
Planning Team
Project Management
Planning Team
Stakeholders
Approval bodies
Public
BLUES Team
Planning Team
Project Management
BLUES Team
Planning Team
BLUES Team
Planning Team
Project Goals and Targets
Project Functions and Concepts
Project Facilities to support functions
Optimal BLUES Solutions for facilities
Master Plan detailed design brief and concepts
Define indicators for targets
Quantity indicator options
BLUES Team
BLUES Team

Blue Green Dream - Examples: Activities and Services

Quantifying and modelling BG Solution Benefits

Measuring/Modelling

Green roof plant performance

University of Reading

Royal Horticultural Society

Sharing the best in Gardening

- 4 plant species studied:
- *Salvia*; *Stachys*; *Heucheral Sedum*



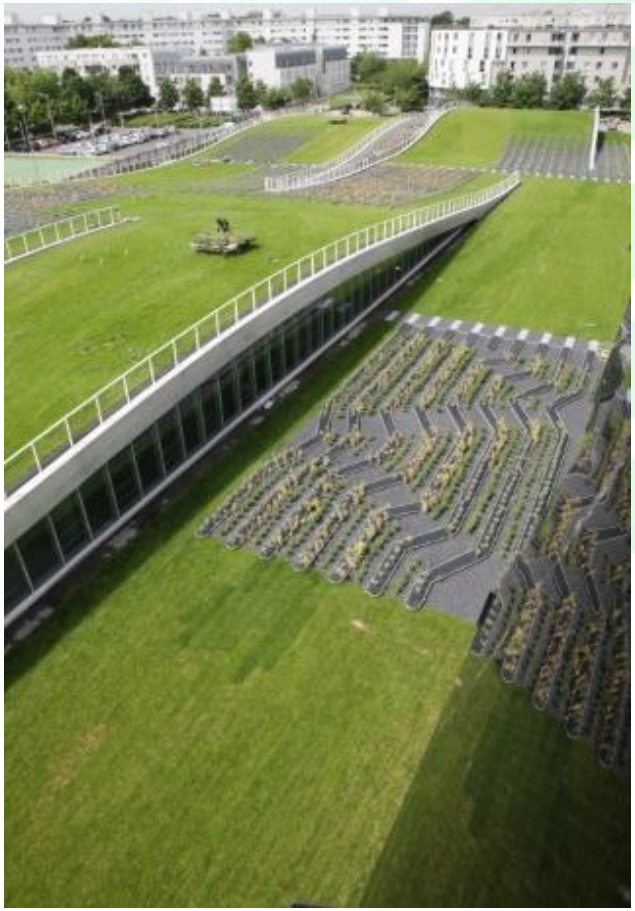

En Plus

Measuring/Quantifying Examples

Blue Green Wave roof at ENPC, Paris France

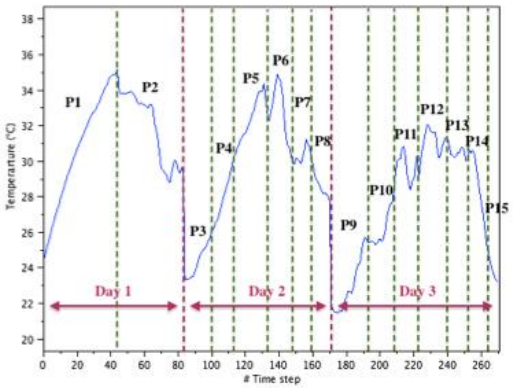
- Experimental site to understand the hydrological behavior of a large blue green structure

École des Ponts ParisTech



Water content

Temperature



Humidity

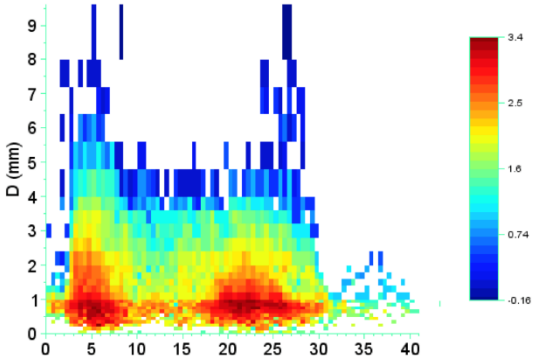


Figure 40: Temporal evolution of N(D)

Precipitation

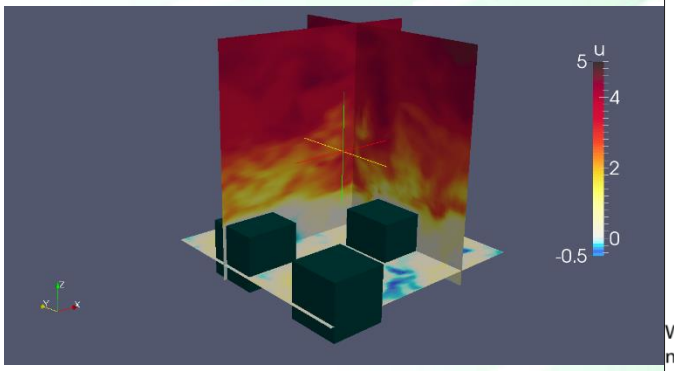
En Plus

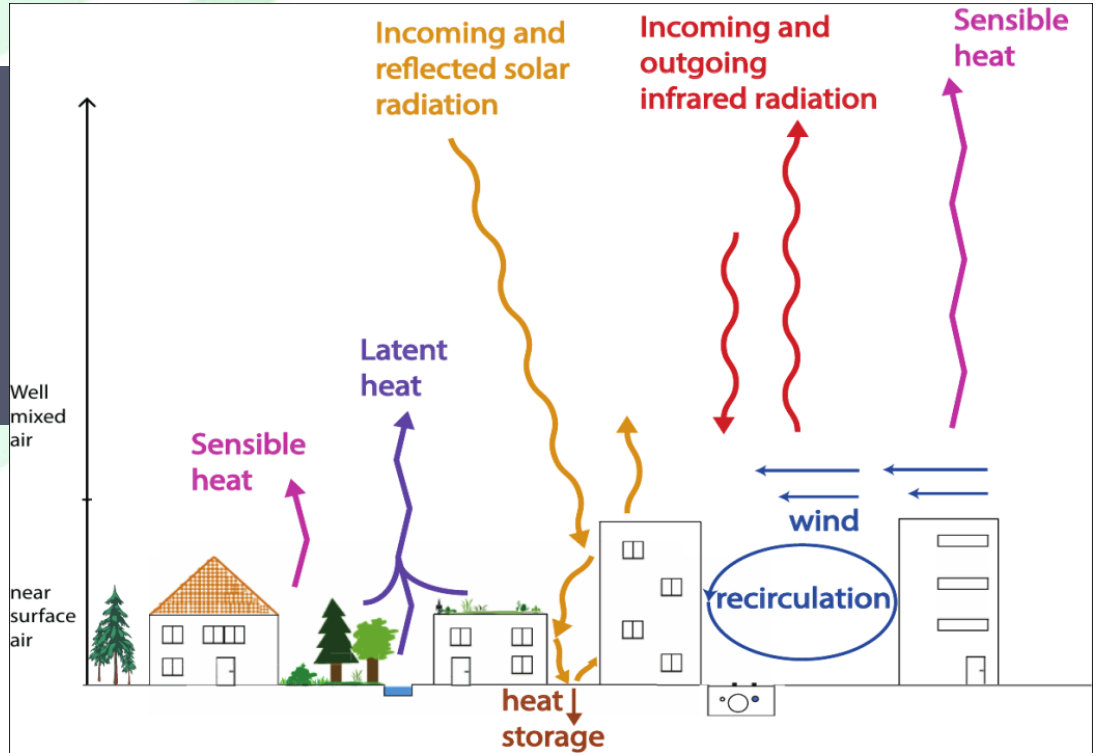
Measuring/Modelling

Microclimate modelling

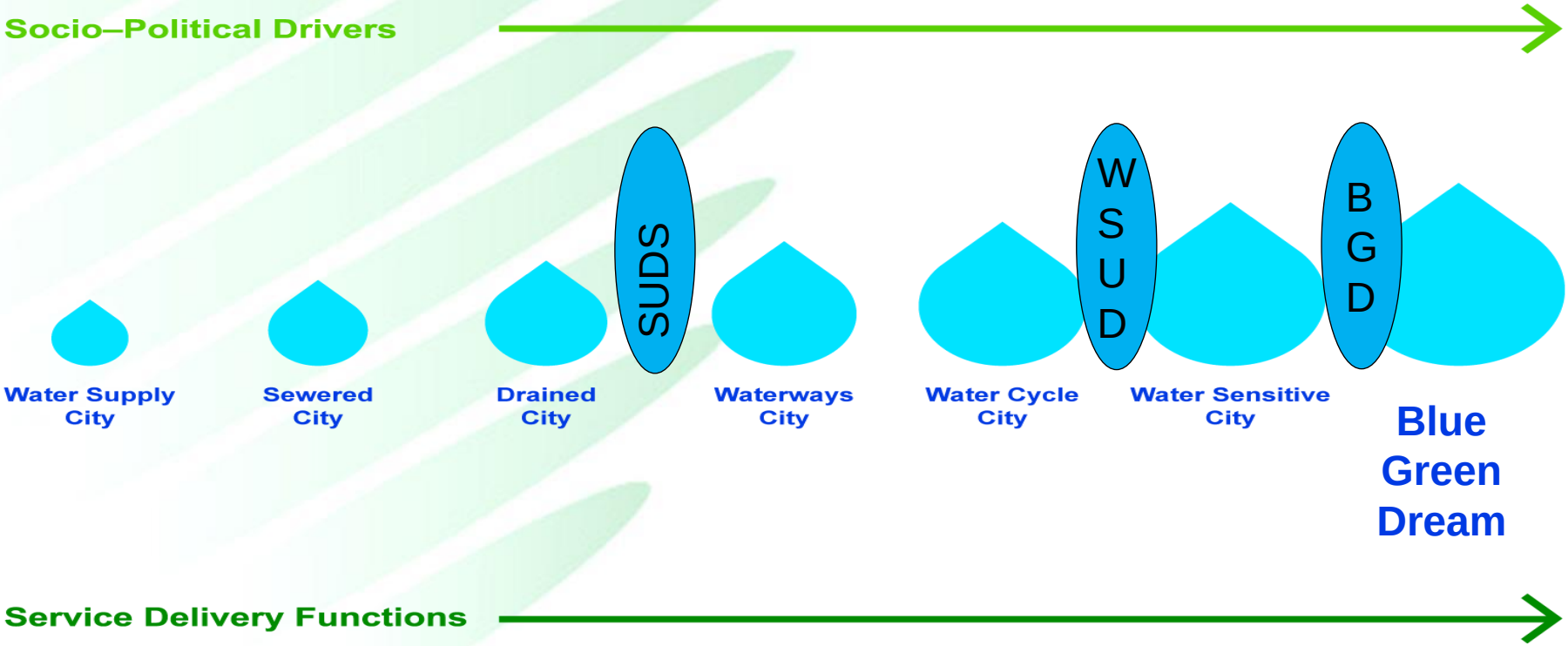
Imperial College London

- Mesoscale atmospheric model to assess influence of BG Solutions on metropolitan microclimate
- Model will represent urban areas and their climate at a low computational cost.





Urban water systems development



Key BGD principle:

Delivery of multi-benefit solutions through use of natural processes and maximisation of synergistic interactions with urban Ecosystem Services

BGS - FLOODING ANALYSIS

STANDARD APPROACH:

a. Flood protection by structural measures,
b. Emergency management

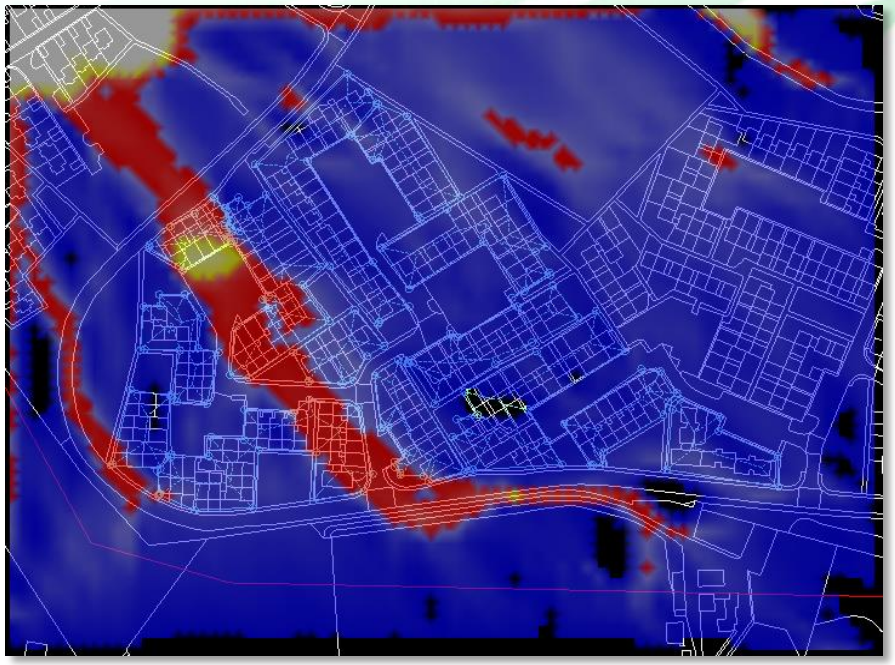
BG APPROACH:

1. Analyse of all previous modeling results
2. Flood hazard reduction by BG Multifunctional Interactive Solutions in structural (natural) and non-structural measures in the upstream catchment and built environment
3. Urban Stream rehabilitation
4. Fine scale rainfall and pluvial prediction, residual flood operational management (under one management body).

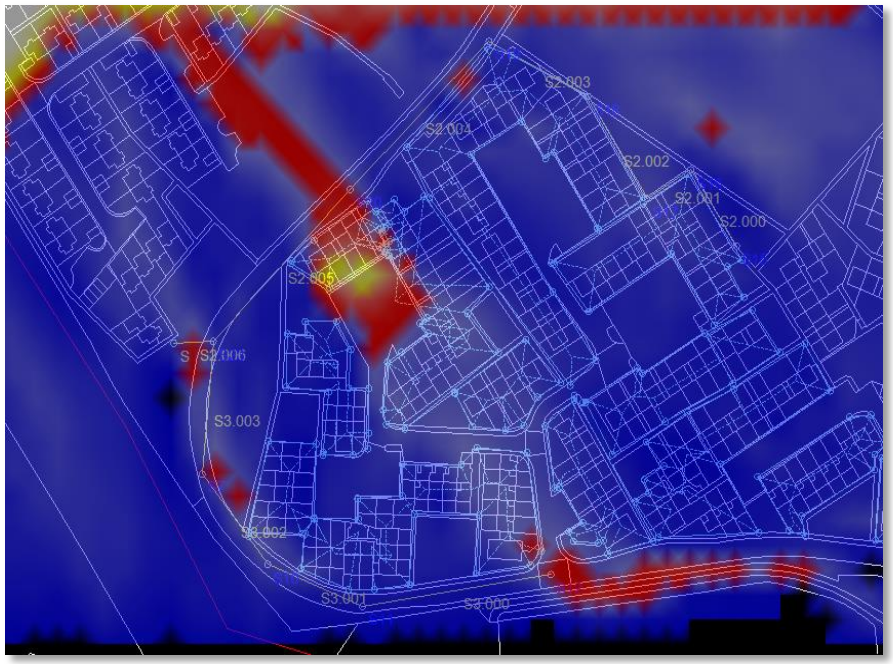
EFFECTS OF BGC IMPLEMENTATION FLOOD RISK REDUCTION – NO FLOOD DEFENCE

(DEFENCE IS ONLY ONE MESURE FOR RISK REDUCTION)

BGC

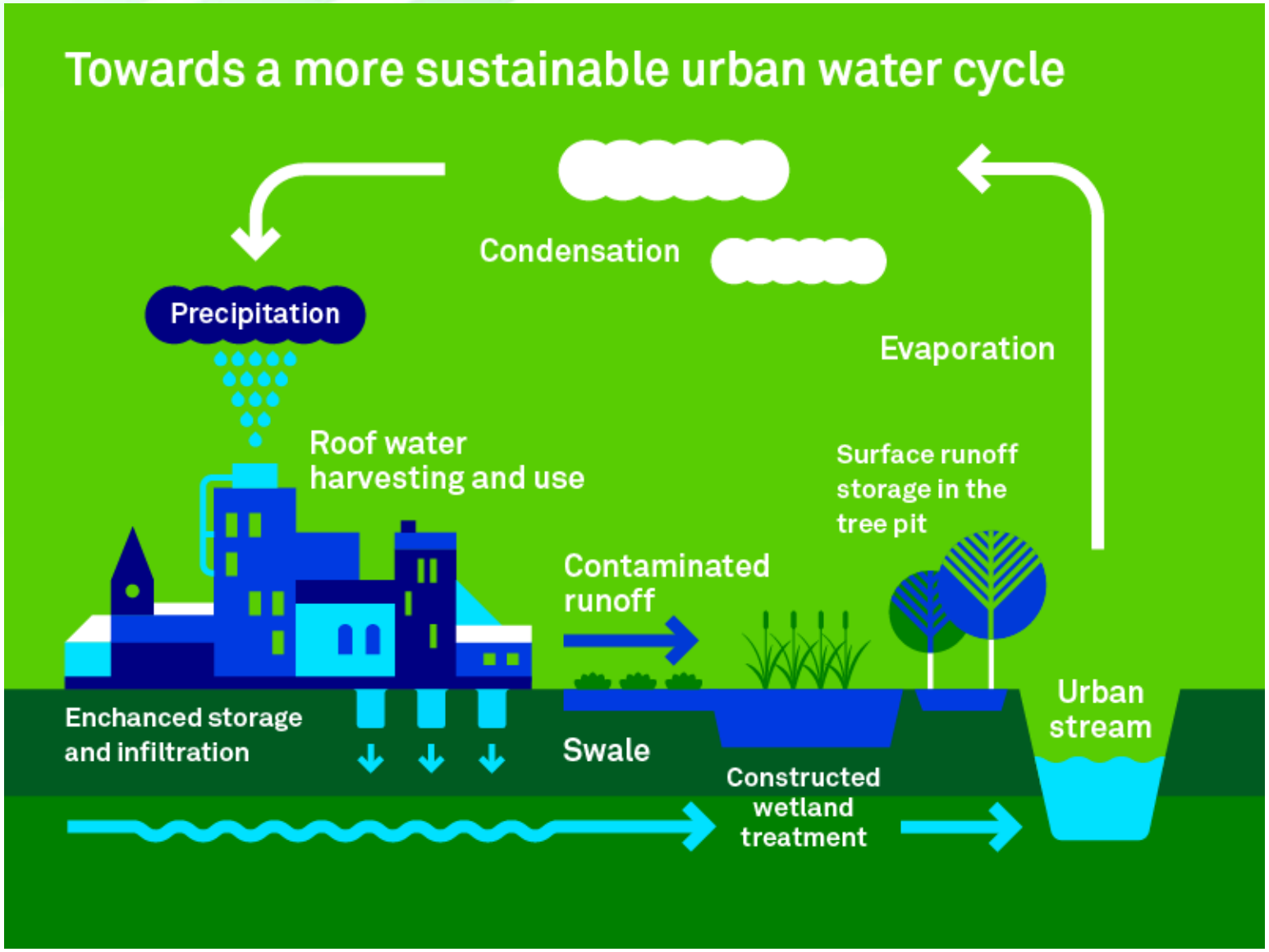


PLUVIAL FLOODING BEFORE BGC



PLUVIAL FLOODING REDUCTION AFTER BGC

(Mapp C. 2011)

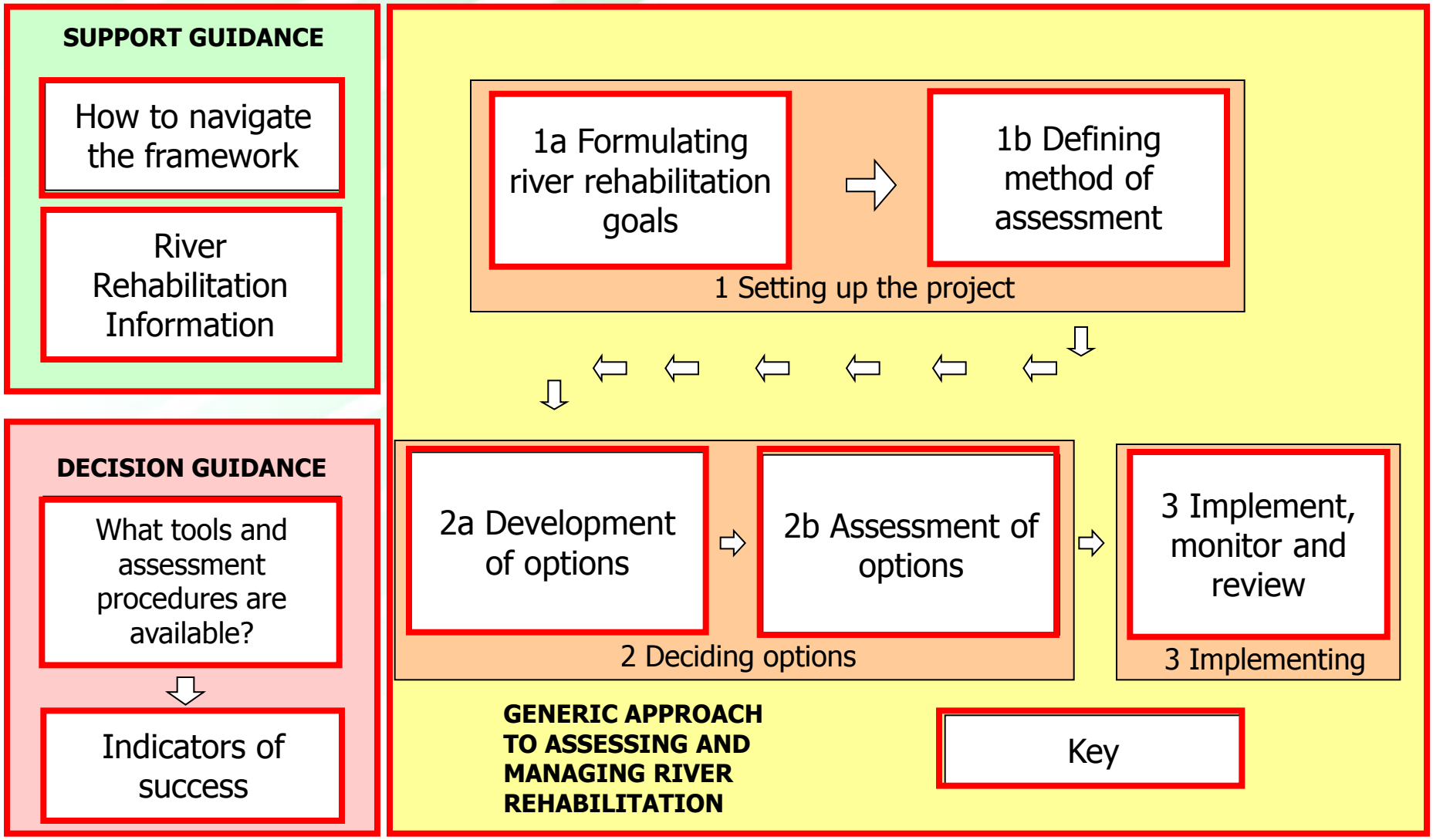

Towards a more sustainable urban water cycle
Condensation
Precipitation
Evaporation
Roof water harvesting and use
Surface runoff storage in the tree pit
Contaminated runoff
Urban stream
Enchanced storage and infiltration
Swale
Constructed wetland treatment

BGS project 2: Holland Plain, Singapore

EVK4-CT-2002-00082

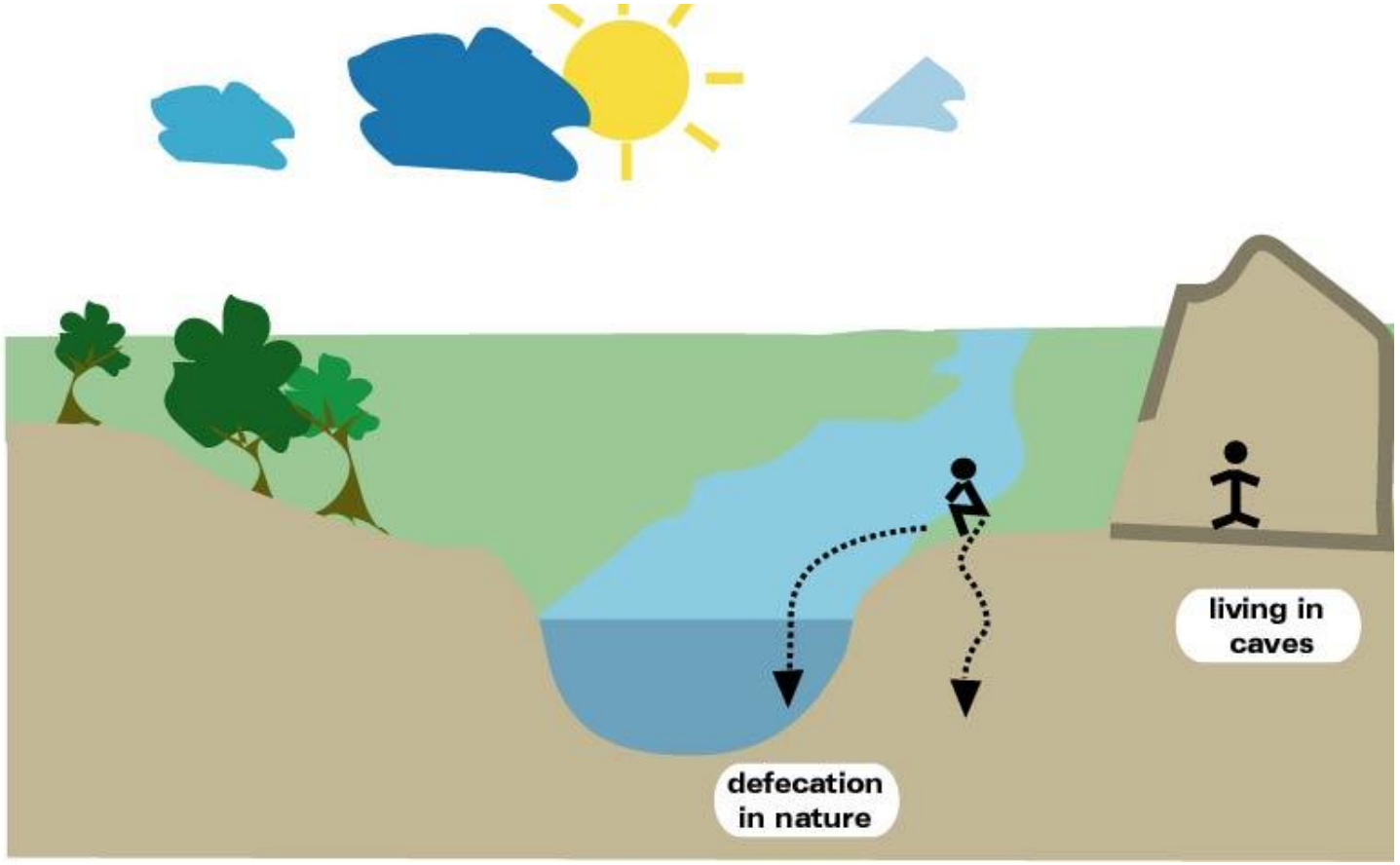
Urban River Basin Enhancement Methods (URBEM)

Activity Chart

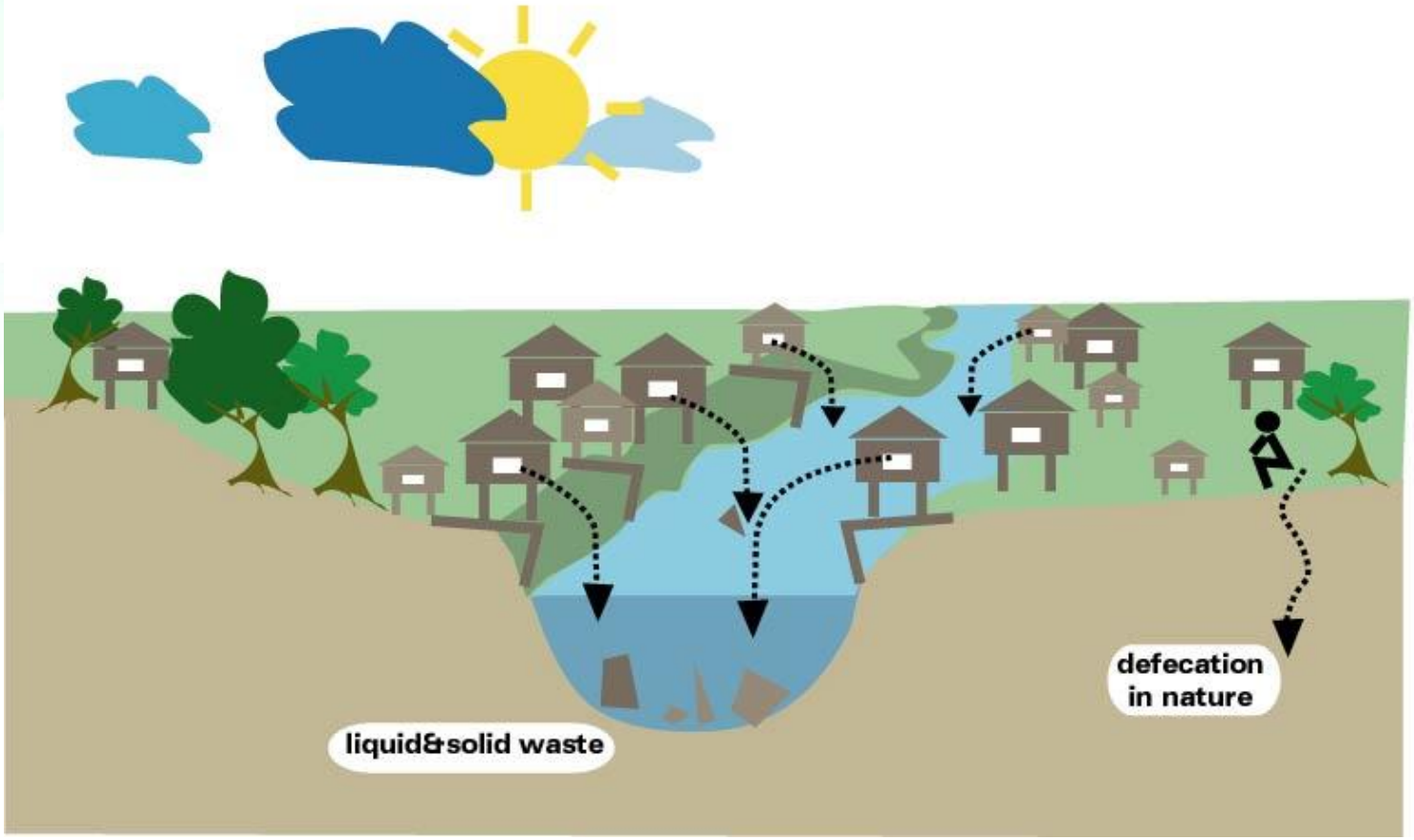


Phases in Unsustainable Urban Development

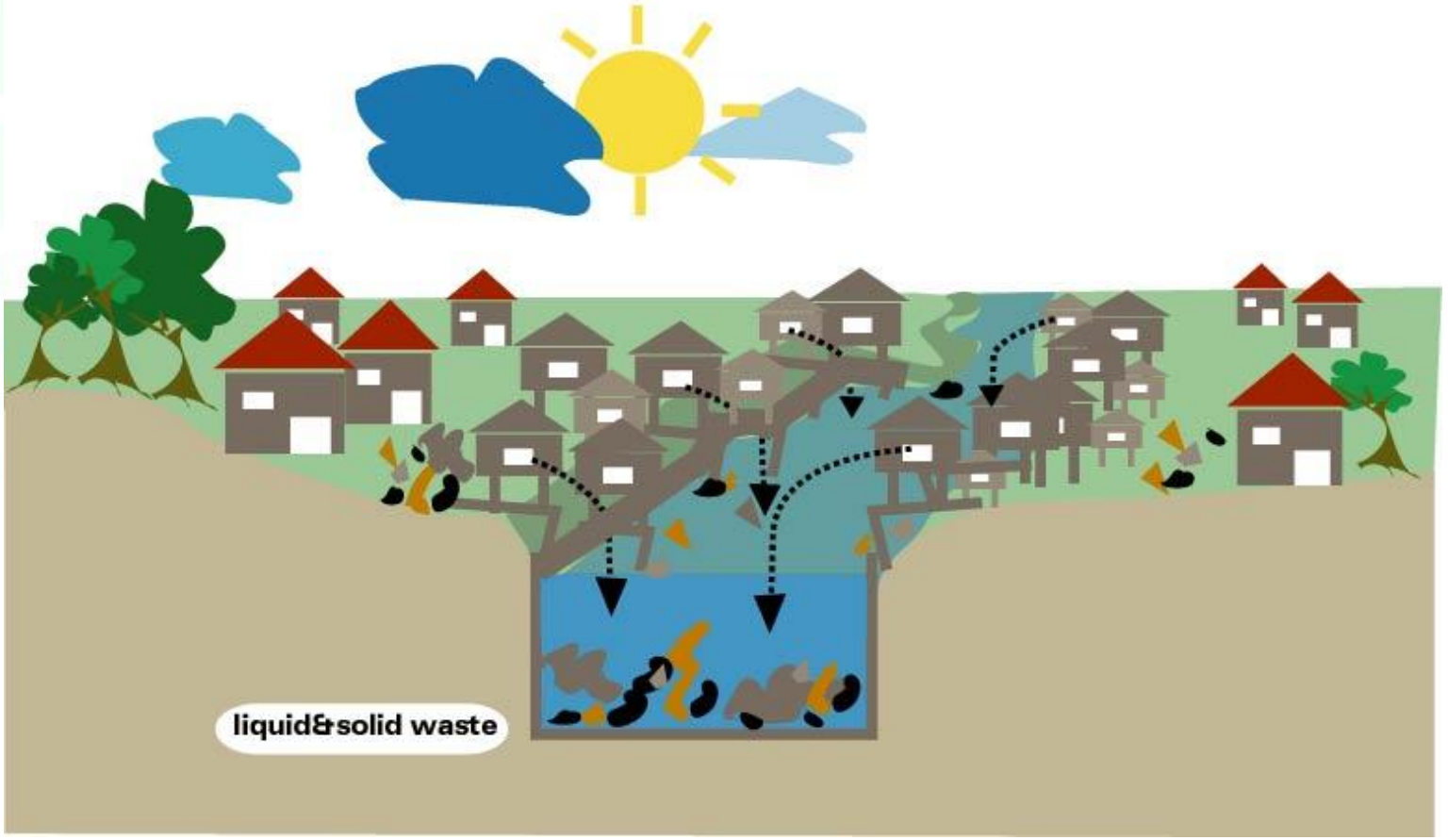
1. Early Civilisation - Living in Nature - Low Level of Pollution



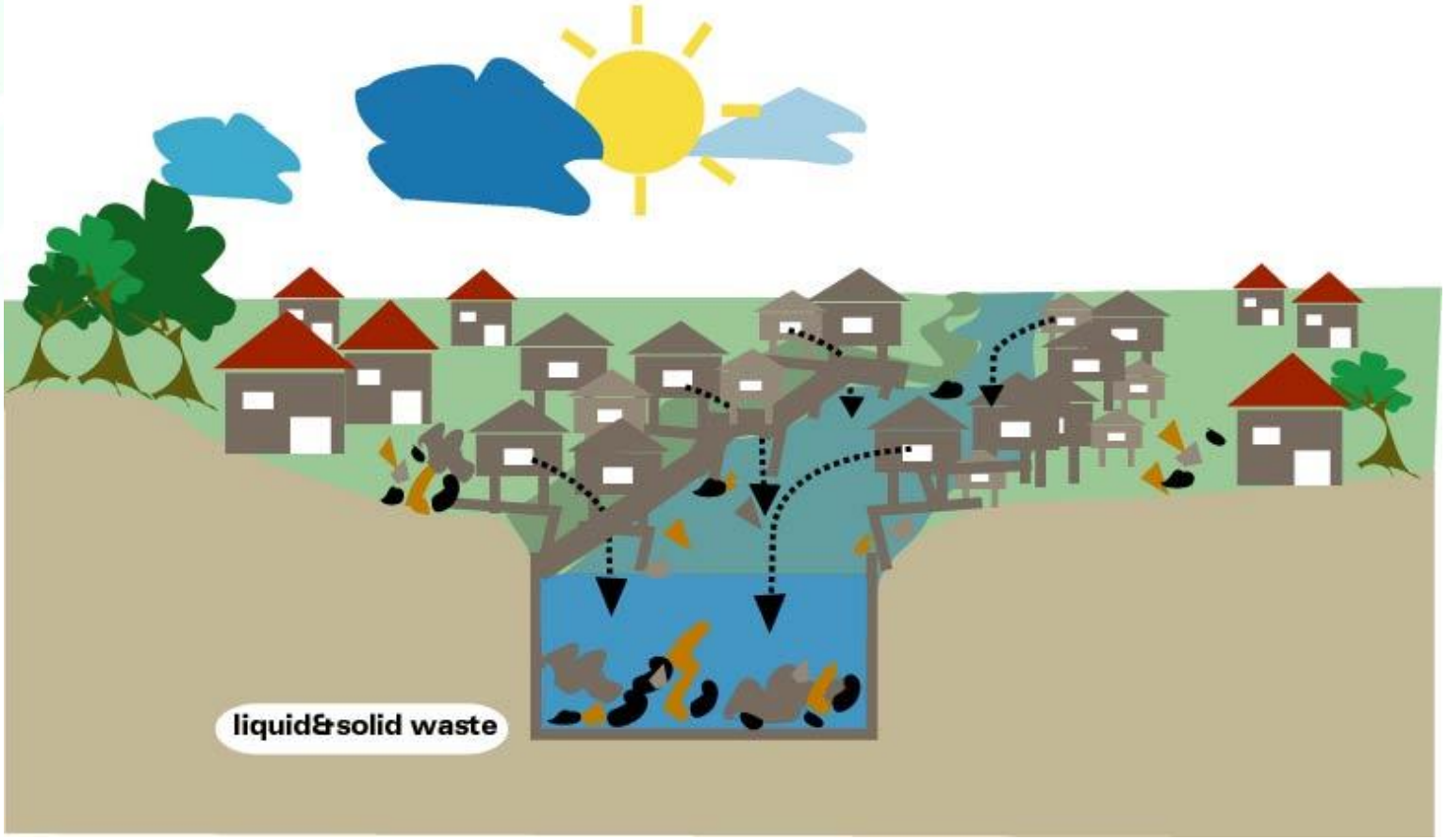
3. Uncontrolled Urbanisation (Occupation) of Flood Plains Streams as Recipients of Solid & Liquids Wastes Problems with Flooding



4. Channelisation of Urban Streams Recipients of Solid & Liquid Wastes - & Stormwater Problems with Flooding & Clogging

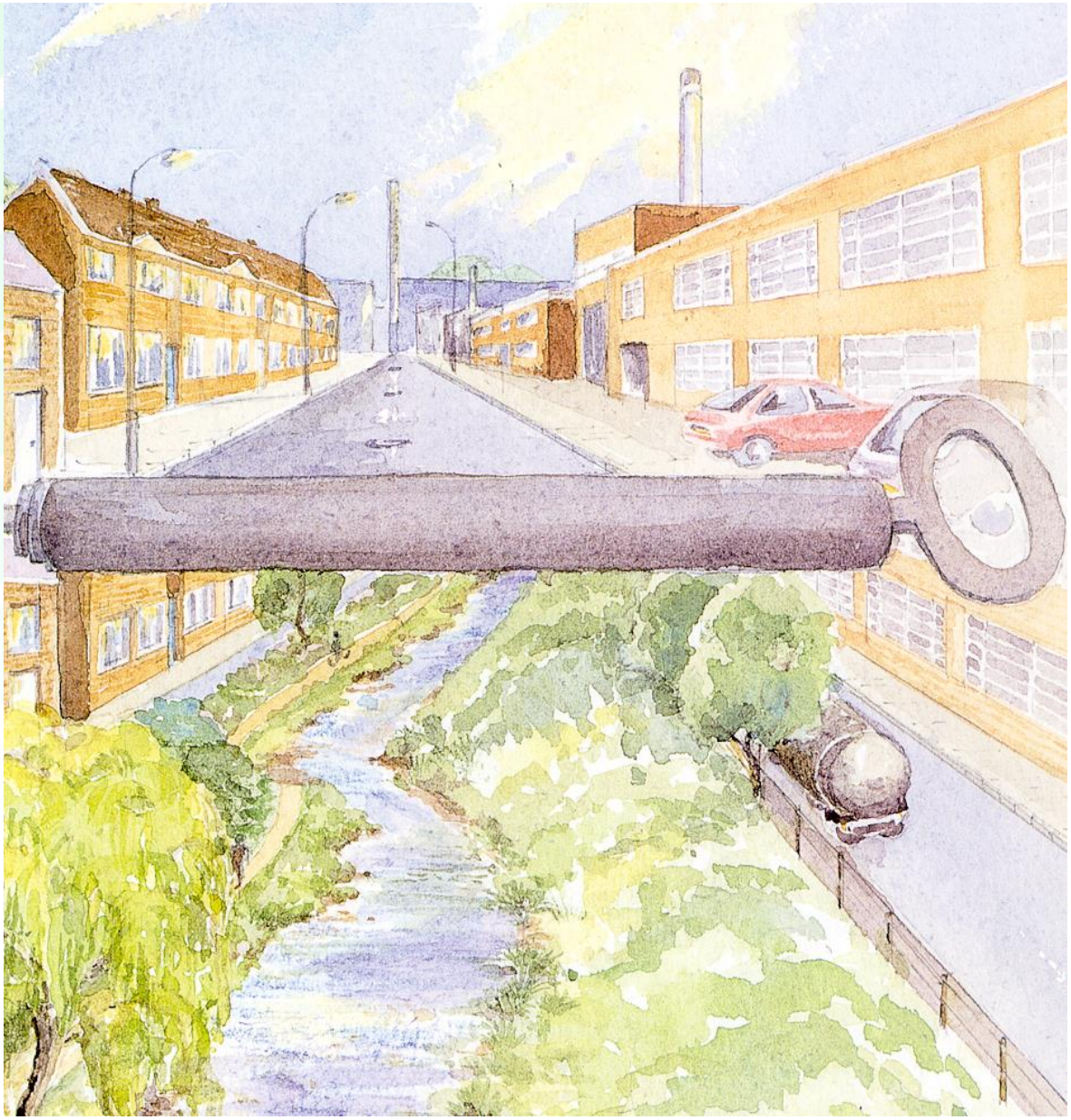


4. Channelisation of Urban Streams Recipients of Solid & Liquid Wastes - Wastes & Stormwater Problems with Flooding & Clogging

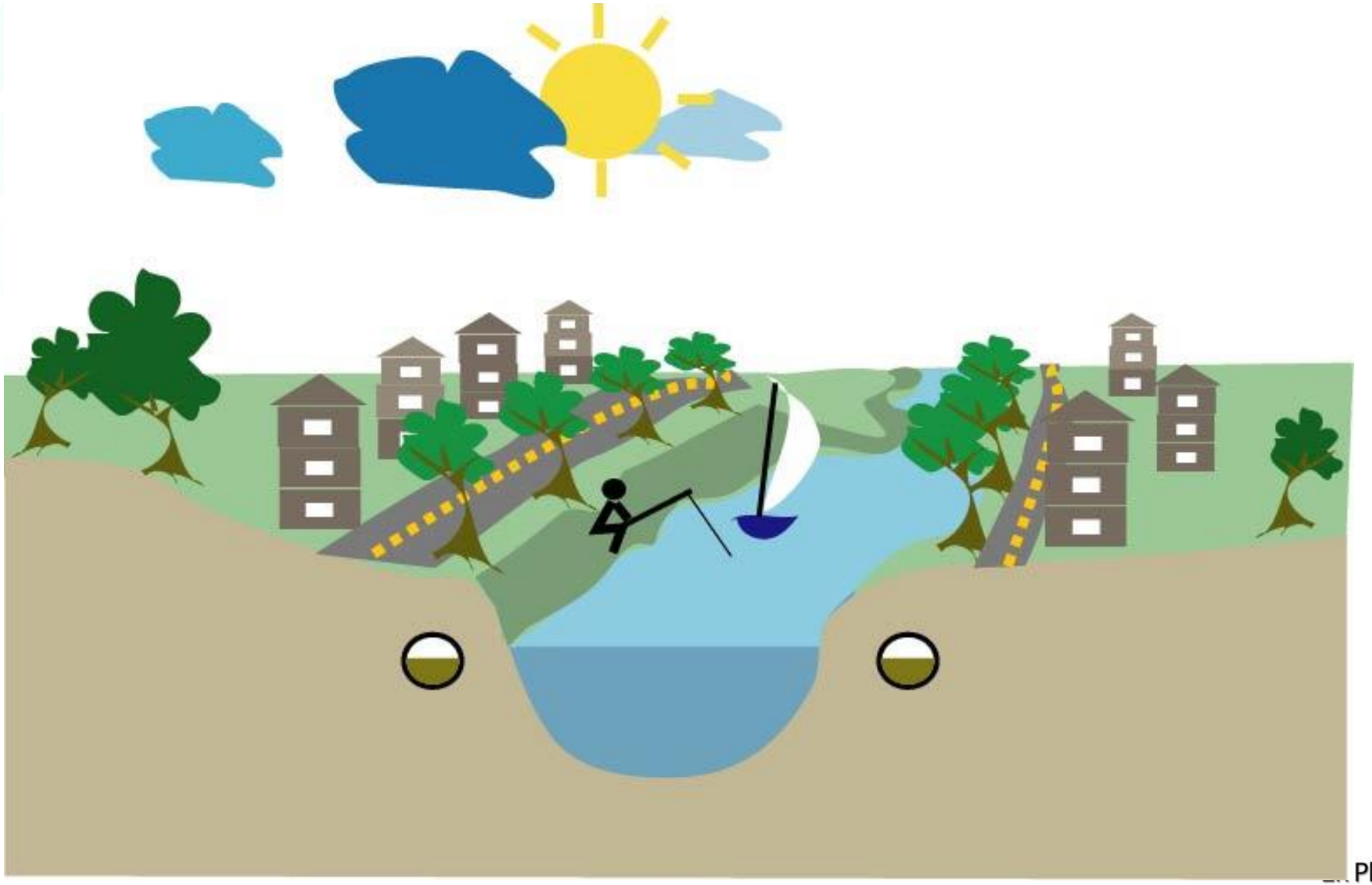


6. Uncontrolled Urbanisation in the Upper Parts of a Stream Building of Separate Sewers - Problem of Inlet Clogging

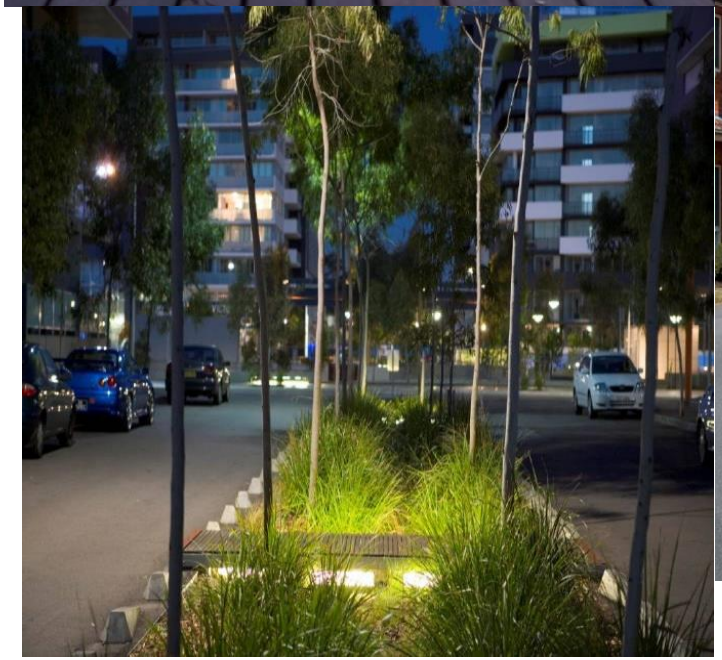
7. Re-naturalisation (Day-lighting) of Urban Streams



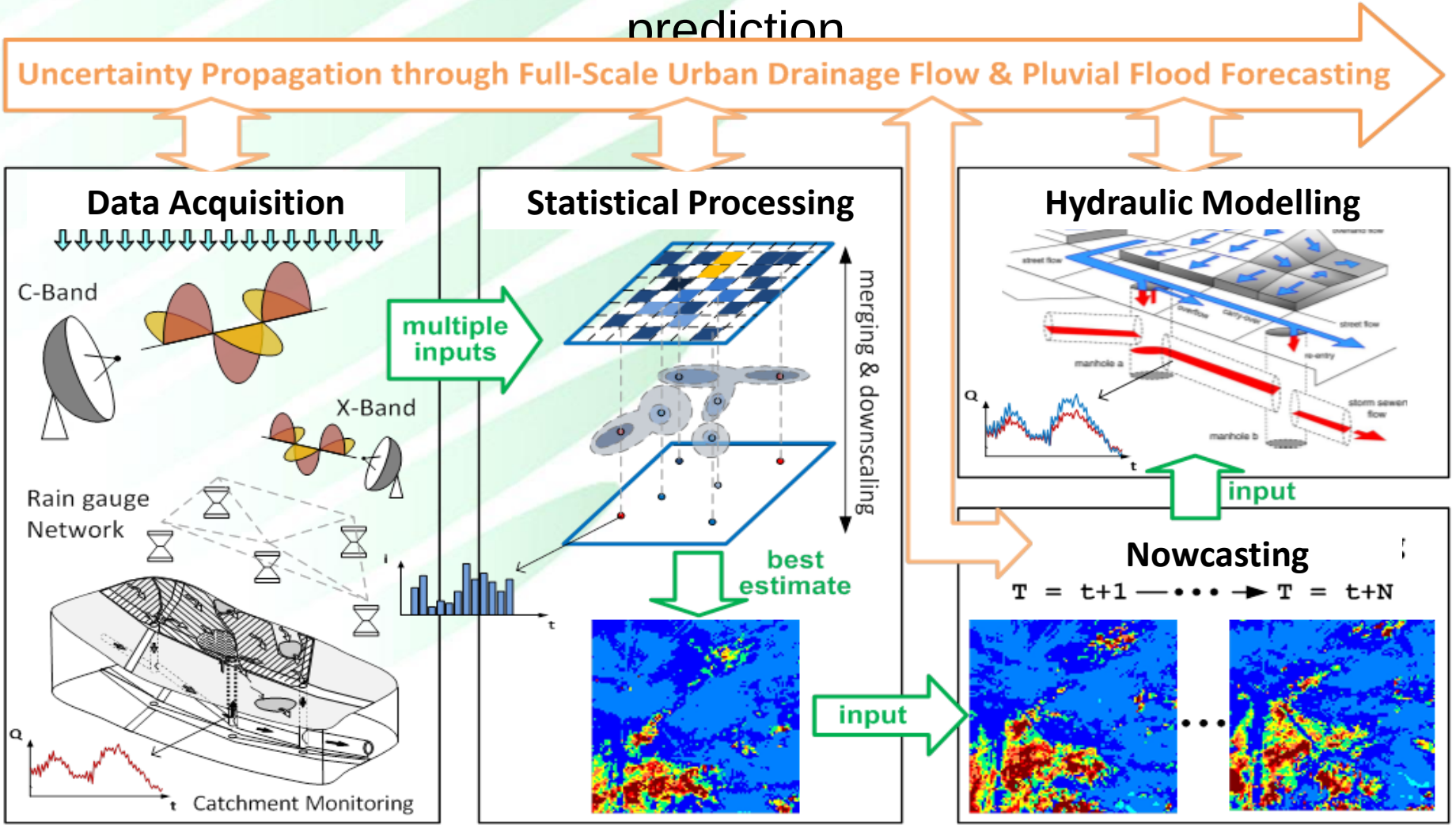
8. Renaturalised Urban Streams - Back to Nature



Elements of Water Sensitive Urban Design – Bio filtration with other benefits

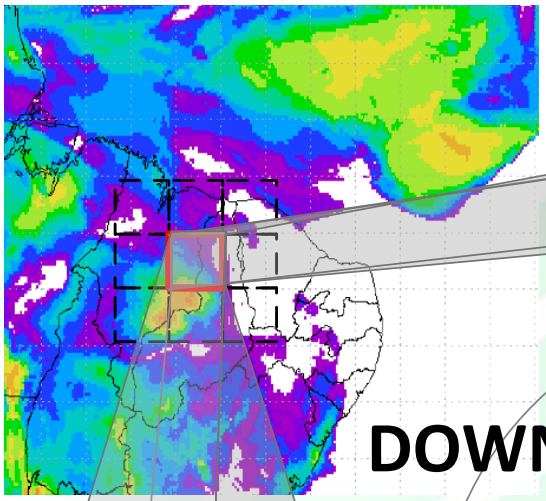


3. Full-scale testing: improved rainfall estimates/forecasts to urban pluvial flood models to enhance short term pluvial flood prediction



NOWCASTING

Numerical Weather Prediction: UM/MM5



10 km

1 km

1 km

100 m

C-Band

X-Band

DOWNSCALING

Techniques

1 km

Spatial

CALIBRATION

i

T = Current

i

t

Temporal

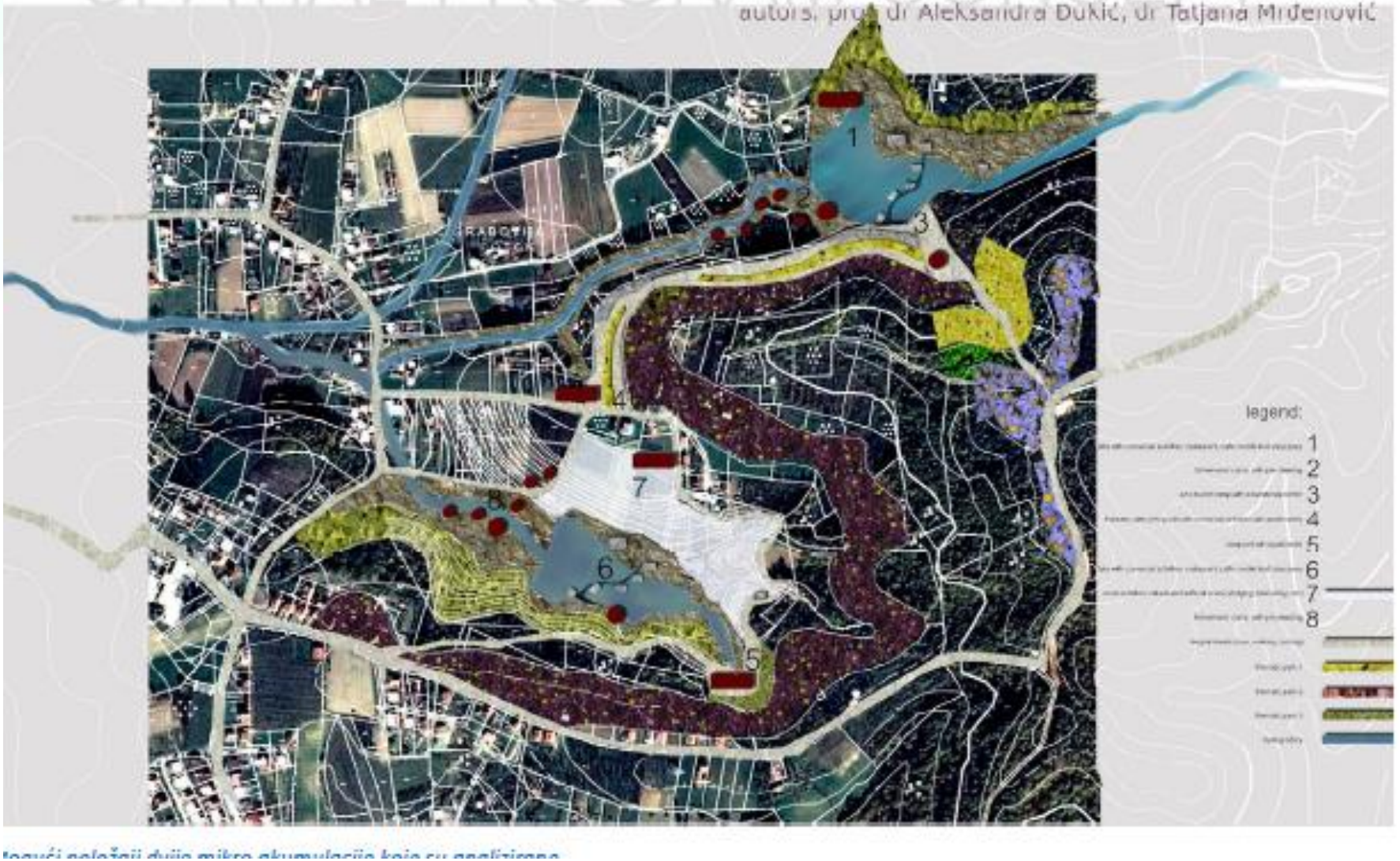
T = Future

t

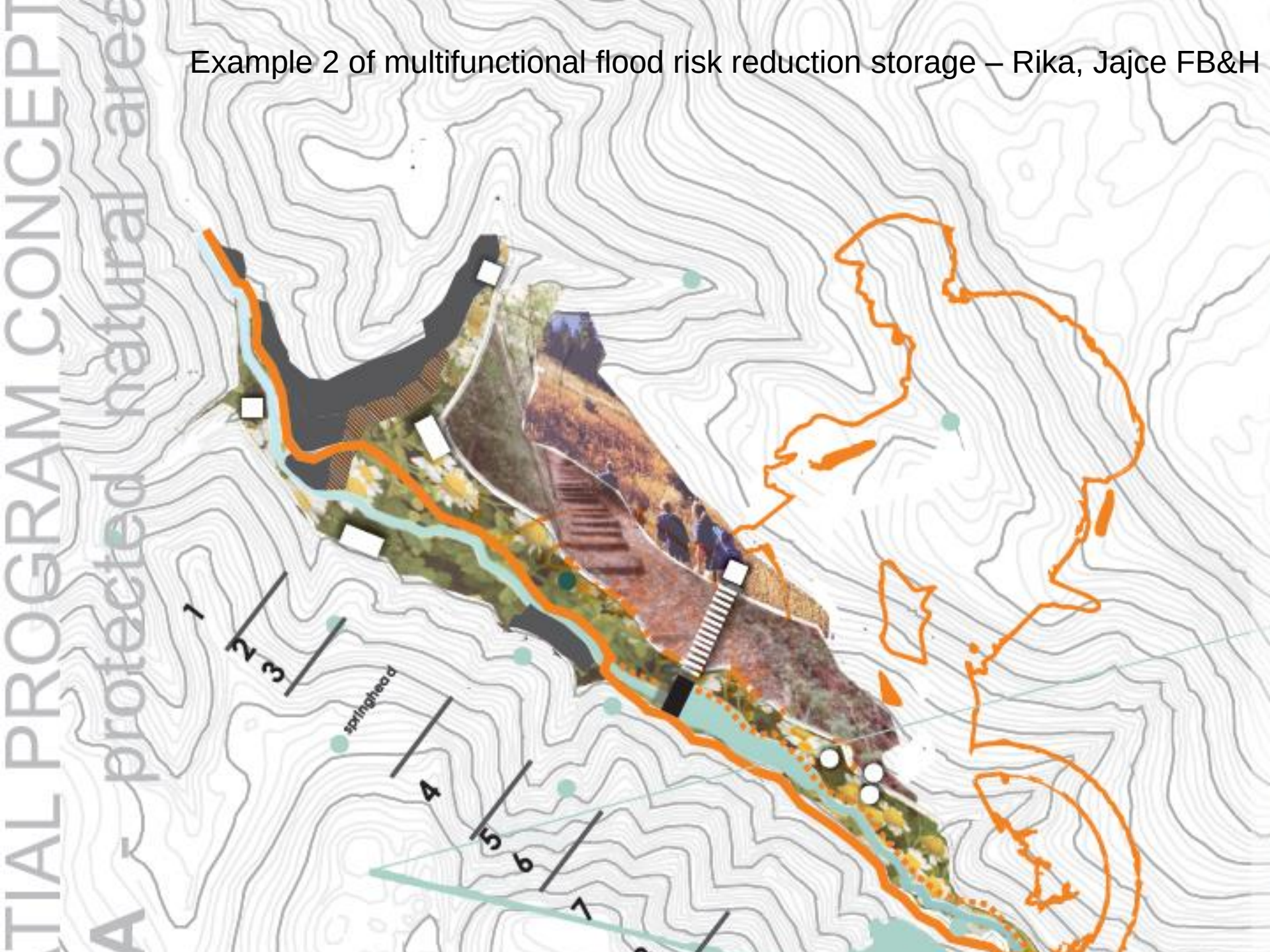
Ground Raingauge Network

En Plus

Example1 of multifunctional flood risk reduction storage – Srbac, RS B&H



Example 2 of multifunctional flood risk reduction storage – Rika, Jajce FB&H



U zoni Jezera su predviđeni sljedeći sadržaji: restoran, kafe, komercijalni sadržaji, kao i prostori za smeštaj i boravak turista u mobilnim strukturama (u sojenicama duž sjeverne strane jezera i u objektima - splavovima na samom jezeru međusobno povezanim drvenim talpama za pristup).

Slika 4. Jezero sa komercijalnim aktivnostima

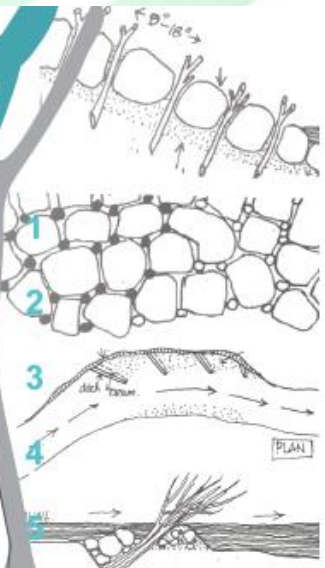
Zona urbane adaptacije BGD tehnologije

Područje uz obale donjeg toka Rike, do ušća u rijeku Vrbas je *Zona urbane adaptacije BGD tehnologije*

Lijeva obala Rike -
šetalište sa vodopropusnom podlogom

Desna obala Rike je primjer uređenja obala urbanih vodotoka prirodnim materijalima i podijeljena je na 5 segmenata. Ovdje su predstavljeni različiti načini uređenja obala u gradskim uslovima

Svi primjeri su preuzeti sa web stranice projekta URBEM (http://www.urbem.net/)
U okviru ovog projekta ekipa Prof. Maksimovića (Imprial College London) je uradila edukacioni materijal



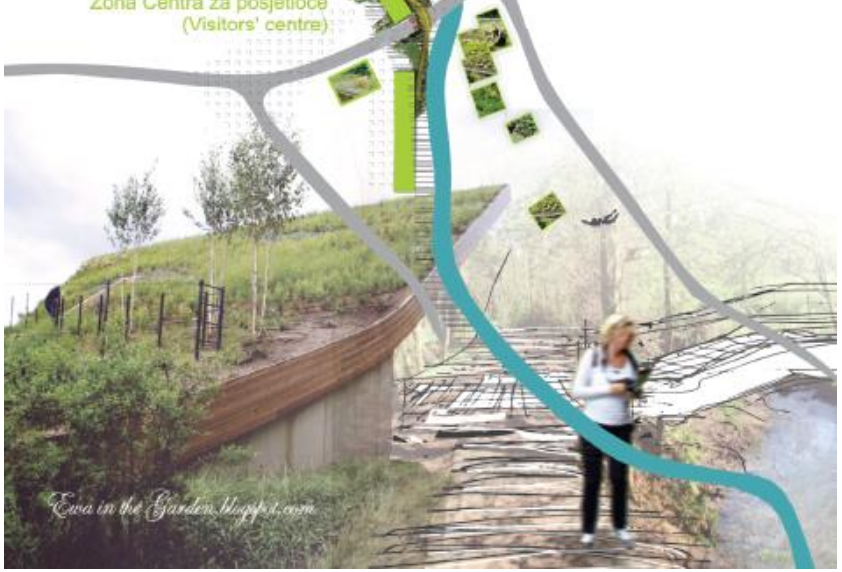
Sa obe strane puta koji pilazi mostu zamišljena je zona Centra za posjetioce (Visitors' centre), odnosno *EKO_NGO edukativni centar*

Višenamjenska krovna bašta, pilaz i dvorište uređeno je BGD sadržajima: porozni asfalt, parking sa drvoredom koji ima svoje mini rezervoare za vodu, infiltracioni rov. Sistem za korišćenje vode za toplotne pumpe radi grijanja objekata (zimi) i njihovog hlađenja (ljeti) istim sistemom uz korišćenje vode Rike

Uređena obala Rike - šetalište koje povezuje sve zone BGD naselja.
Postojeći objekti, uglavnom jednoporodičnog stanovanja koji se nalaze u ovoj zoni, adaptirani su u cilju ispunjavanja BGD kriterijima i sa sopstvenom proizvodnjom energije

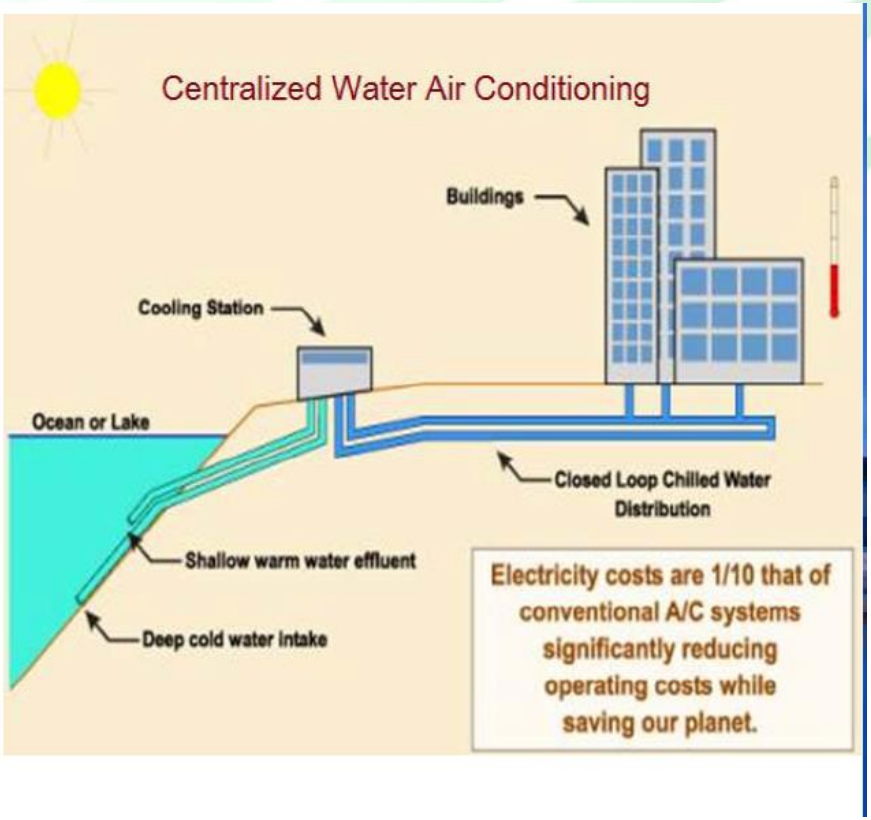
S obzirom na to da se zona nalazi sa obe strane magistralnog puta, dostupna gradu i od značaja za regiju, zamišljena je ne samo kao centar (BGD) naselja već kao ulaz u "Turistički raj" sliva rijeke Rike sa višenamjenskom akumulacijom

Zona Centra za posjetioce (Visitors' centre)



Measuring/Modelling

Creteil Urban Lake, Paris France



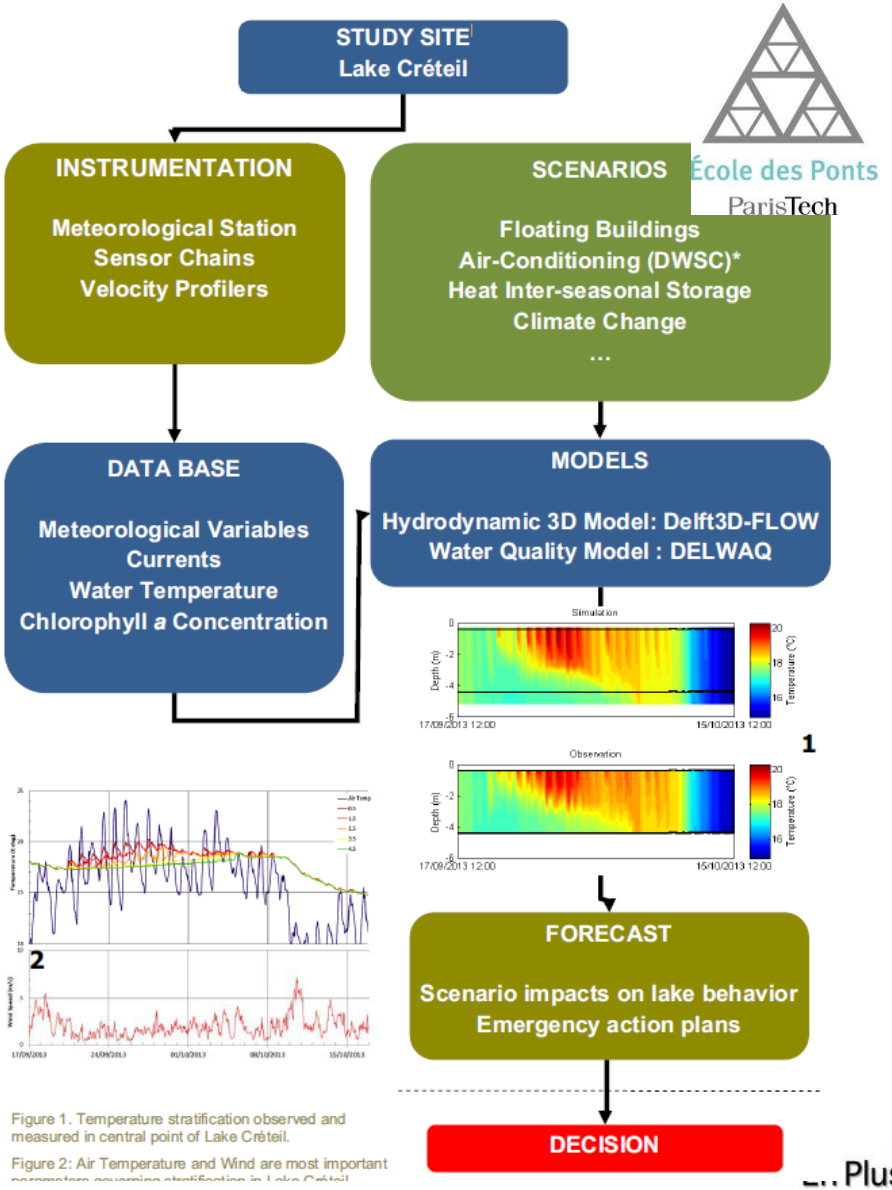


Figure 1. Temperature stratification observed and measured in central point of Lake Créteil.

Figure 2: Air Temperature and Wind are most important

Advance WWTP – Waste Water Treatment Plants
MNR/BGS – (BGS Consortium: Biopolus, BGG, Enpuls)

Biopolus Technologies

Water Treatment and Recycling

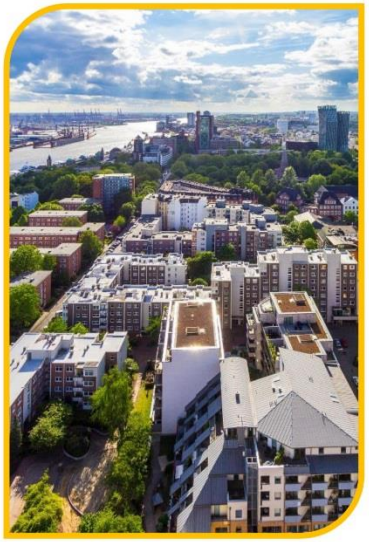
Evolution of Ecological Engineering

Machines ▸ **Living Machines** ▸ **Living Factories** ▸ **Living Cities**

Conventional Water Purification

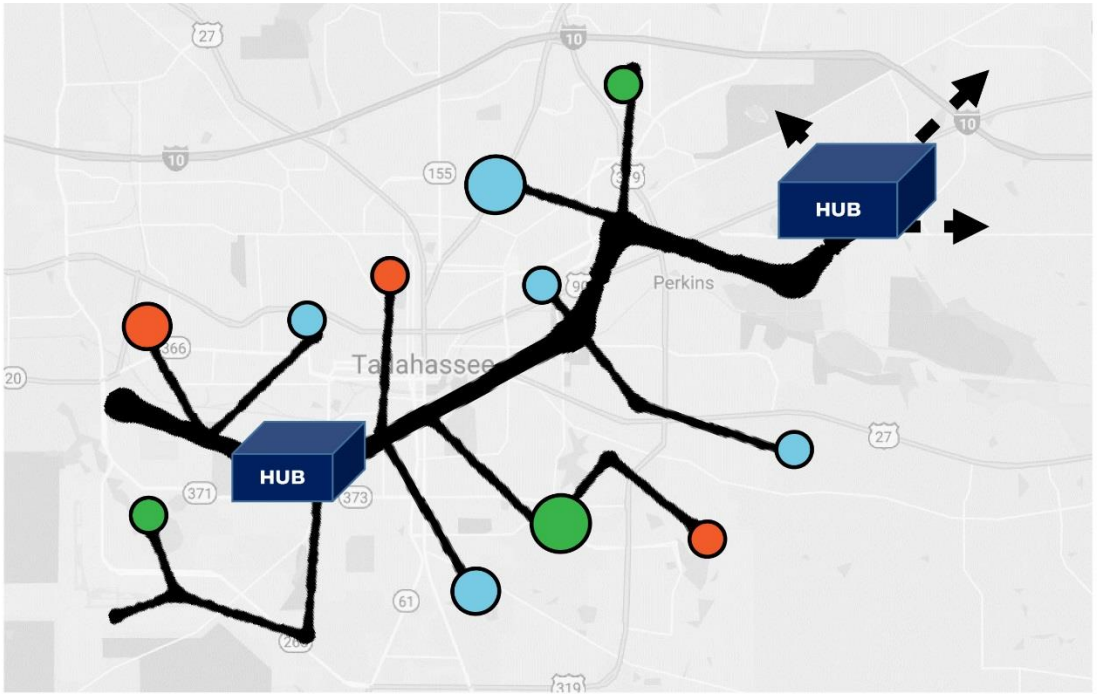
Engineered Ecosystem

Integrated Urban Metabolic Hubs



Metabolic mapping (citywide) for an **Interconnected / Integrated Network of Hubs**

Interconnected Network of High Tech Infrastructure Solutions

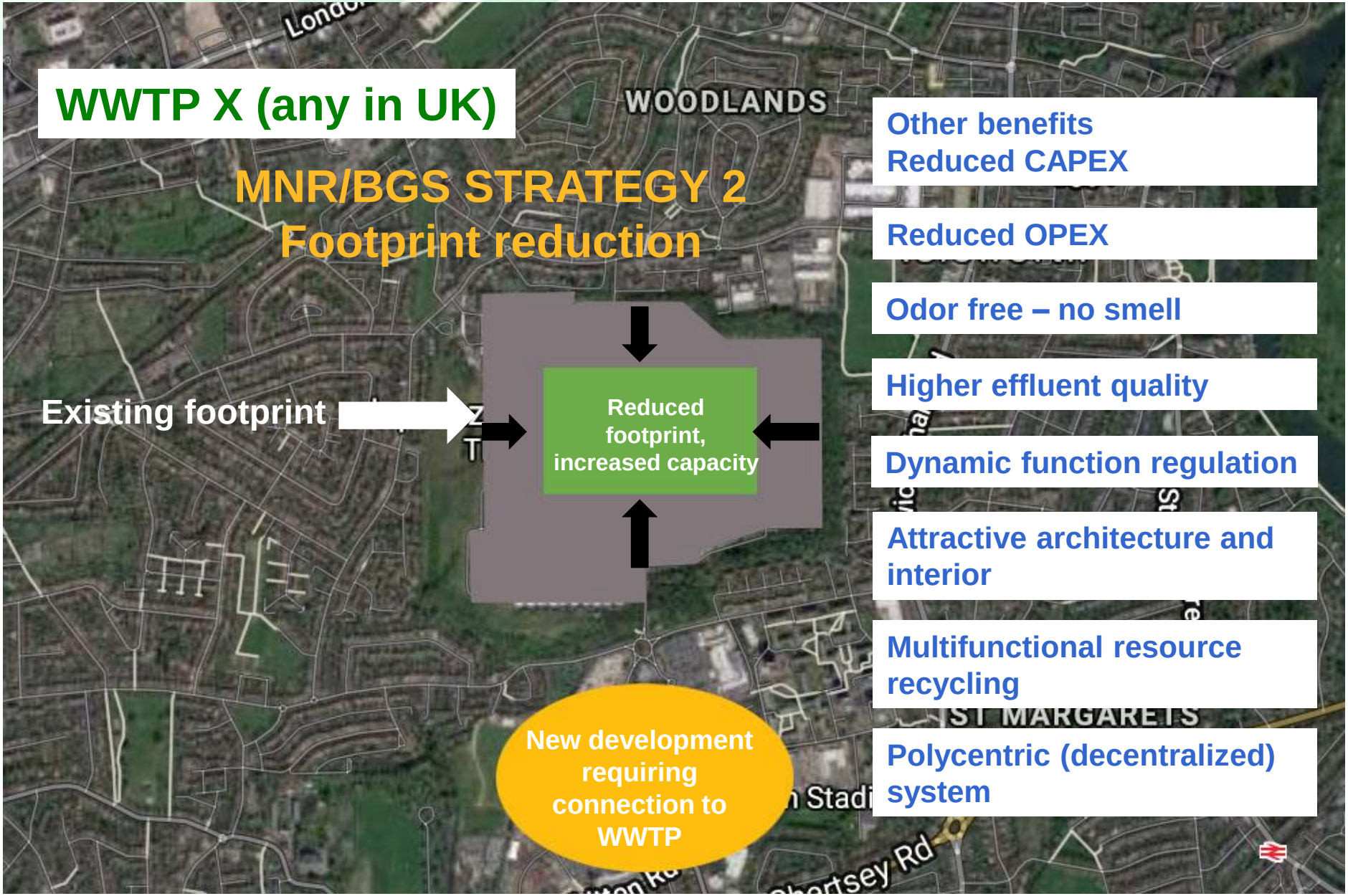


Strategy for WWTP upgrade / retrofitting: Conventional vs. MNR/BGS concept

Strategy for WWTP upgrade / retrofitting: Conventional vs. MNR/BGS concept

Strategy for WWTP upgrade retrofitting

Strategy for WWTP upgrade retrofitting

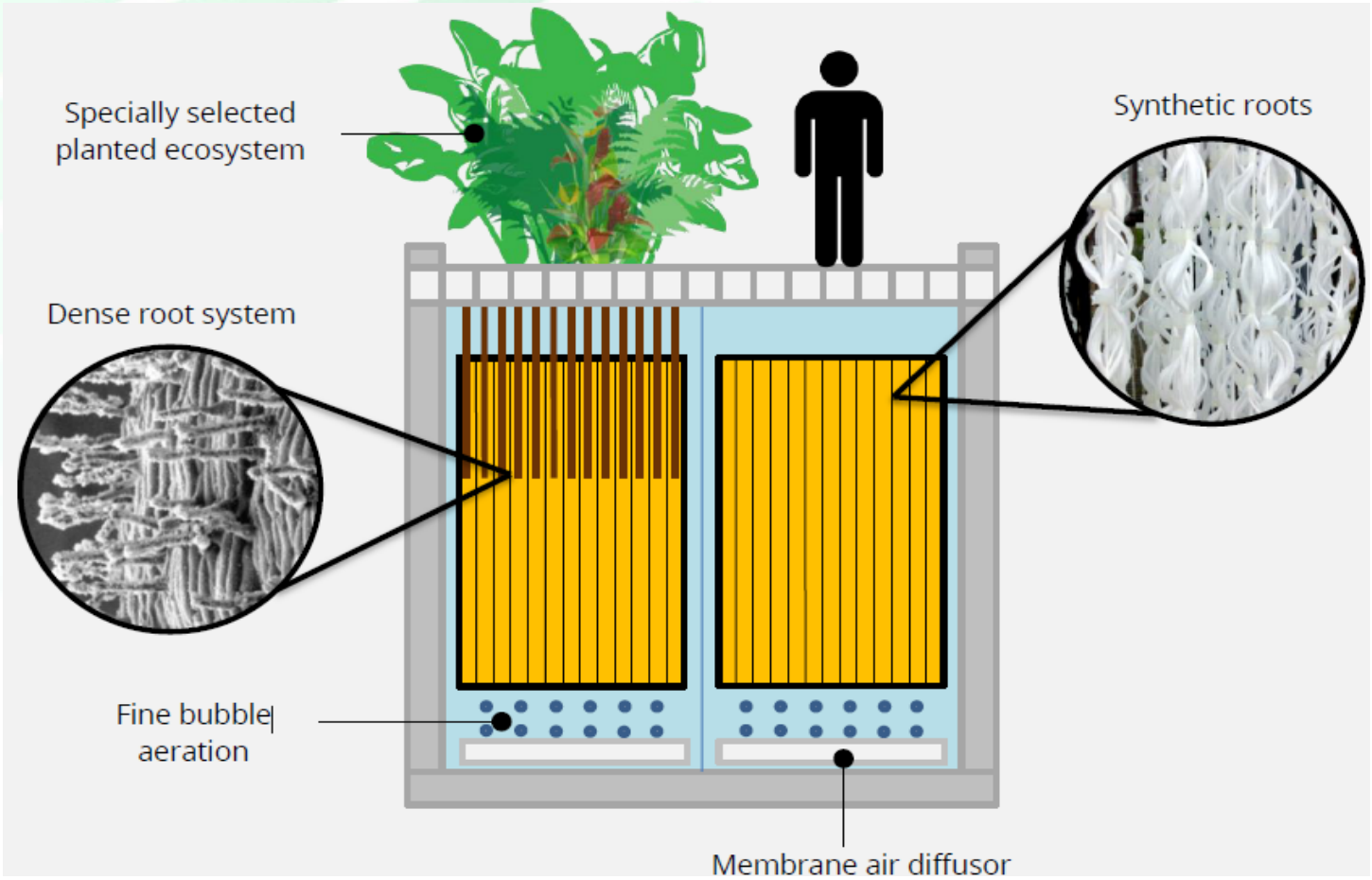


Next generation WWPT is a High-Tech Industry

Living Technologies

BIOTECHNOLOGY
MICROBIOLOGY
NANOTECHNOLOGY
INFORMATICS
ARTIFICIAL INTELLIG
ECOLOGICAL ENGIN

MECHANICAL ENGIN
ARCHITECTURE
ELECTRICAL ENGINEERING
CIVIL ENGINEERING


Specially selected planted ecosystem
Synthetic roots
Dense root system
Fine bubble aeration
Membrane air diffusor

Synthetic Roots – A Unique Biofilm Carrier

These carrier units can support a very large amount of attached biomass. Moreover, the formed biofilm has a loose, fibrous structure. This result in excellent mass transfer characteristics in all layers, which means that the whole of the attached biomass is healthy and active, and takes part in the breakdown of contaminants.

The carrier units are able to sustain such large amount of fixed biomass per unit of reactor volume that MNR reactors can operate in a pure fixed-film setup, without the need for substantial suspended biomass.

The surface of the carrier is designed to mimic plant roots

The carrier is able to support large quantities of biomass

The attached biofilm has a loose, fibrous structure

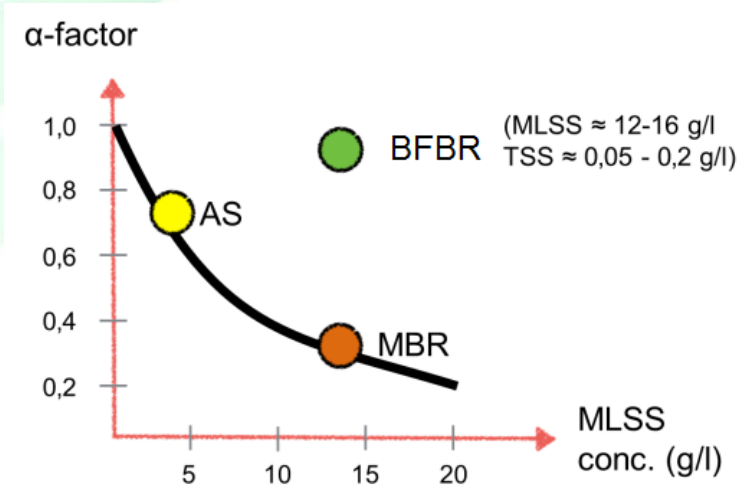
En Plus

Process Stability

The large number of species present in MNR reactors form a diverse ecosystem of living organisms that is more resilient to shock loading than conventional activated sludge systems. Because most of the biomass is in a fixed form, the high biomass concentration is maintained, even in peak flow situations and under very light loads (diluted influent). This allows the system to operate with stable effluent characteristics even after storm water surges.

Energy Efficiency

When MNR systems are operated in purely fixed-film mode with low TSS values the oxygen transfer rate (α-factor) of fine bubble aeration dramatically increases, resulting in substantial savings in energy consumption.

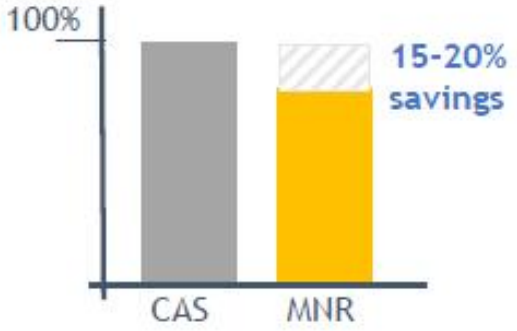


Metabolic Network Reactor (MNR) **Technology**

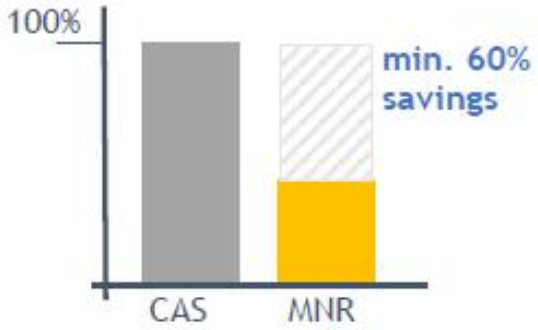
ADVANTAGES OVER TRADITIONAL WASTEWATER TREATMENT

OPEX

CAPEX



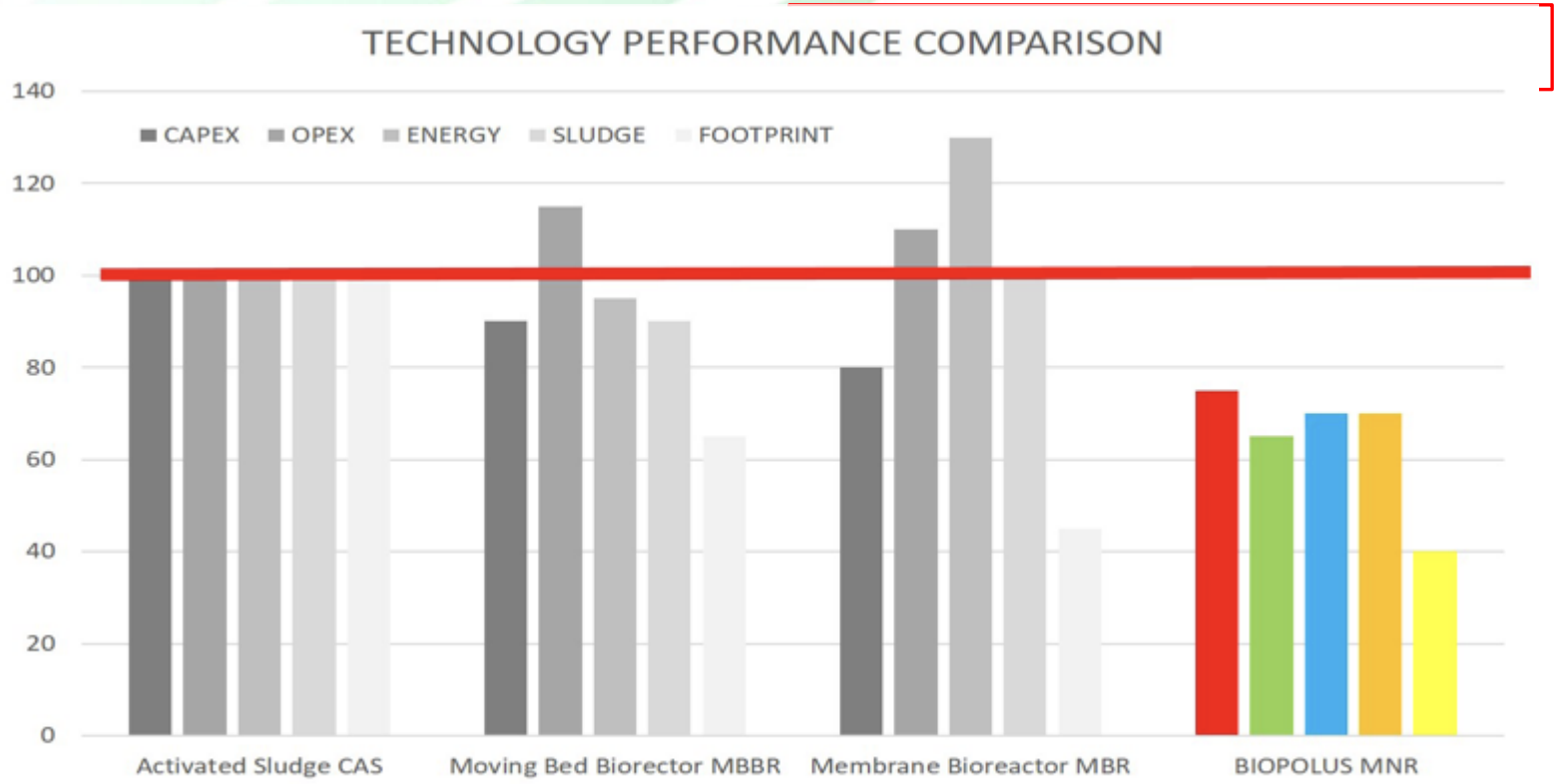
FOOTPRINT



AESTHETICS

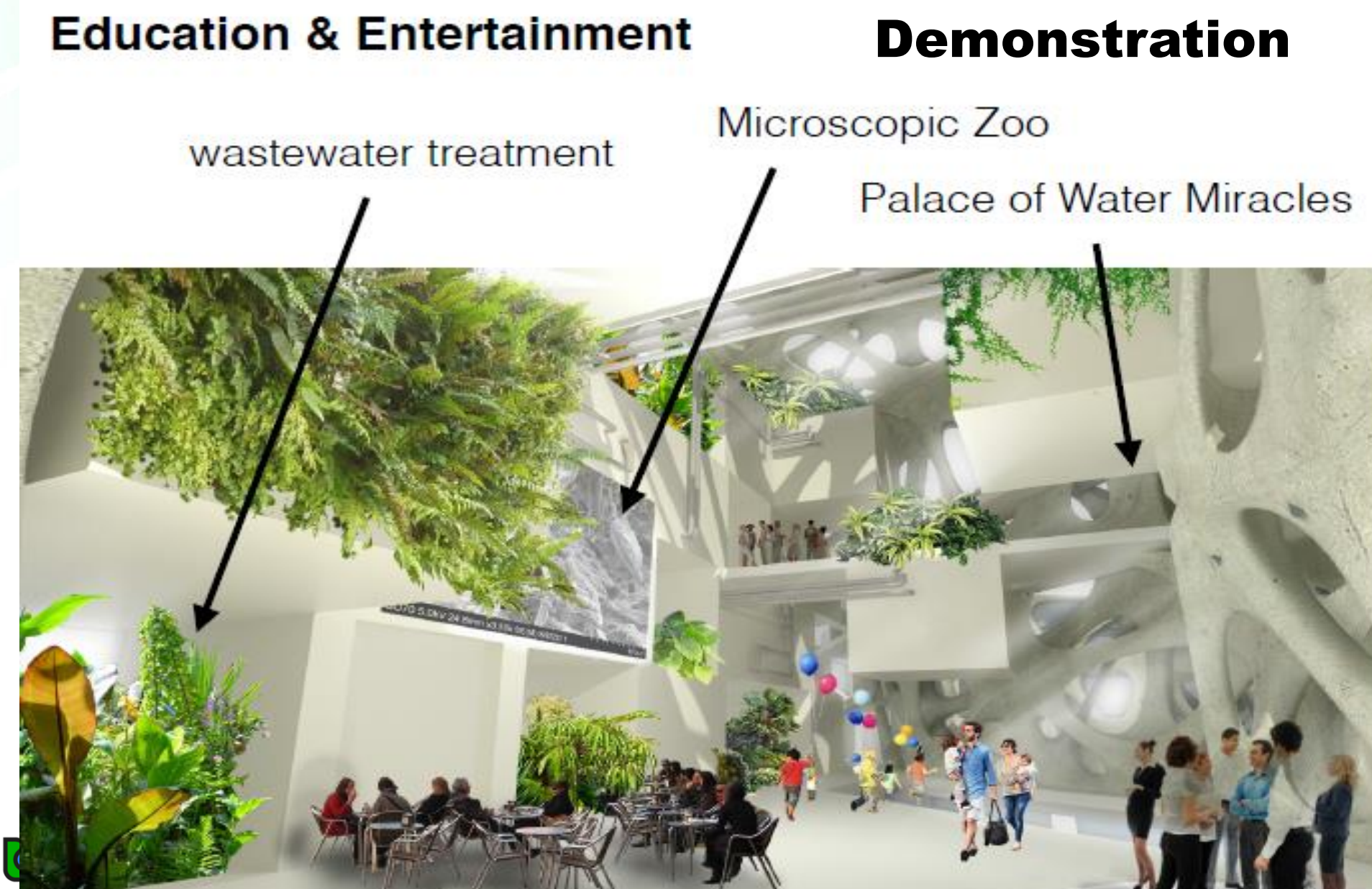
Note: CAS: Conventional Activated Sludge Technology; MNR: Metabolic Network Reactor

The Bottomline:
LESS EXPENSIVE & MORE EFFICIENT



En Plus

An example of an innovative WWPT integrated with other urban/art/ entertainment contents (Budapest city park)



The Kitakyushi Treatment Center Retrofit

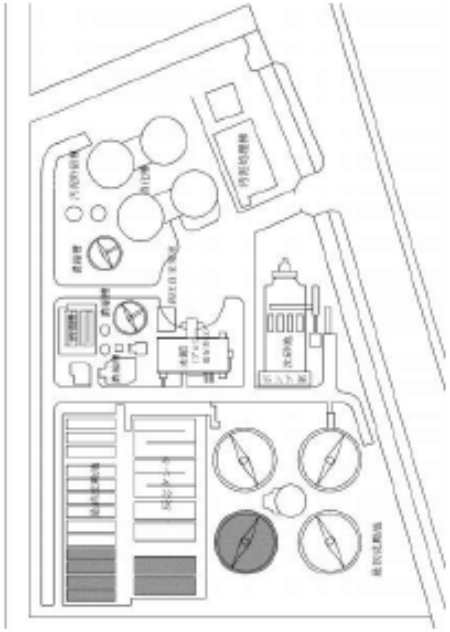
AN EXAMPLE IN FINDING DEVELOPMENT OPPORTUNITIES IN UNUSUAL PLACES

PRIVATE INVESTORS:

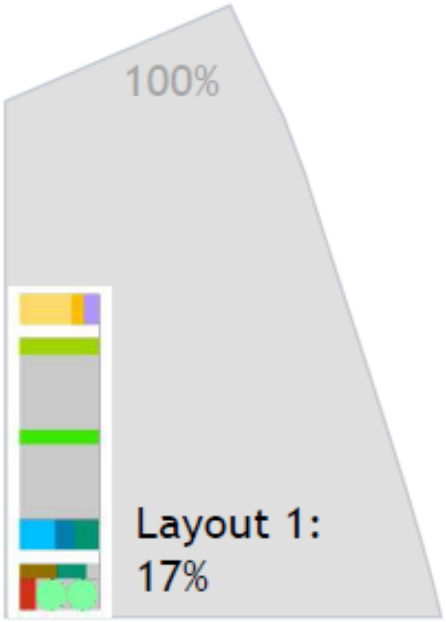
a. PURCHASE THE EXISTIN WWT PLANT
b. CHANGE TECHNOLOGY AND GAIN BEWEEN 83 AND 94 % OF LAND FOR OTHER COMMERICL USE (CONVENTION, FITNESS, HEALTH . ETC**.**

Architectural Concept

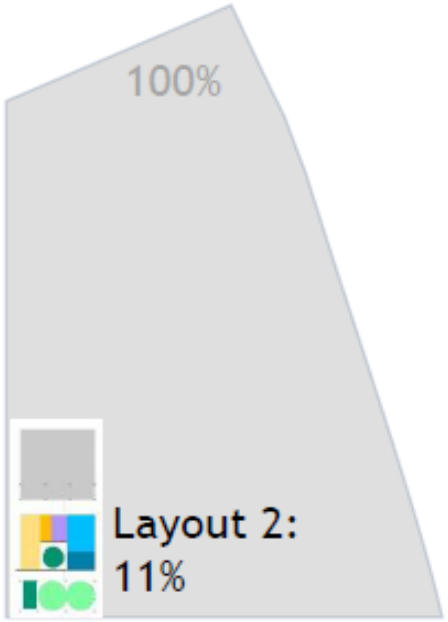
LAYOUT VARIATIONS



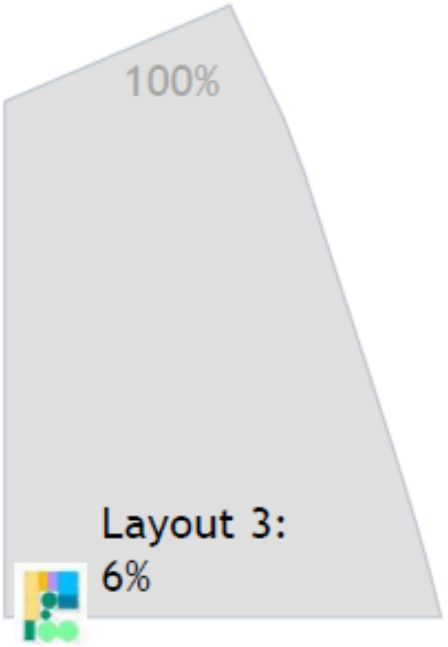
Current Facility
Footprint: 39,500 m2



Layout One
Footprint: 6,900 m2



Layout Two
Footprint: 4,300 m2



Layout Three
Footprint: 2,400 m2

Layouts 1,2 & 3 can potentially produce land value earnings of 10-12 million Euros.

En Plus

The new WWTP in the middle of business district

CHANGE IN MINDSET - ATTITUDE AND PERCEPTION

Fits into any Urban Environment

Imperial College London

Blue Green Dream

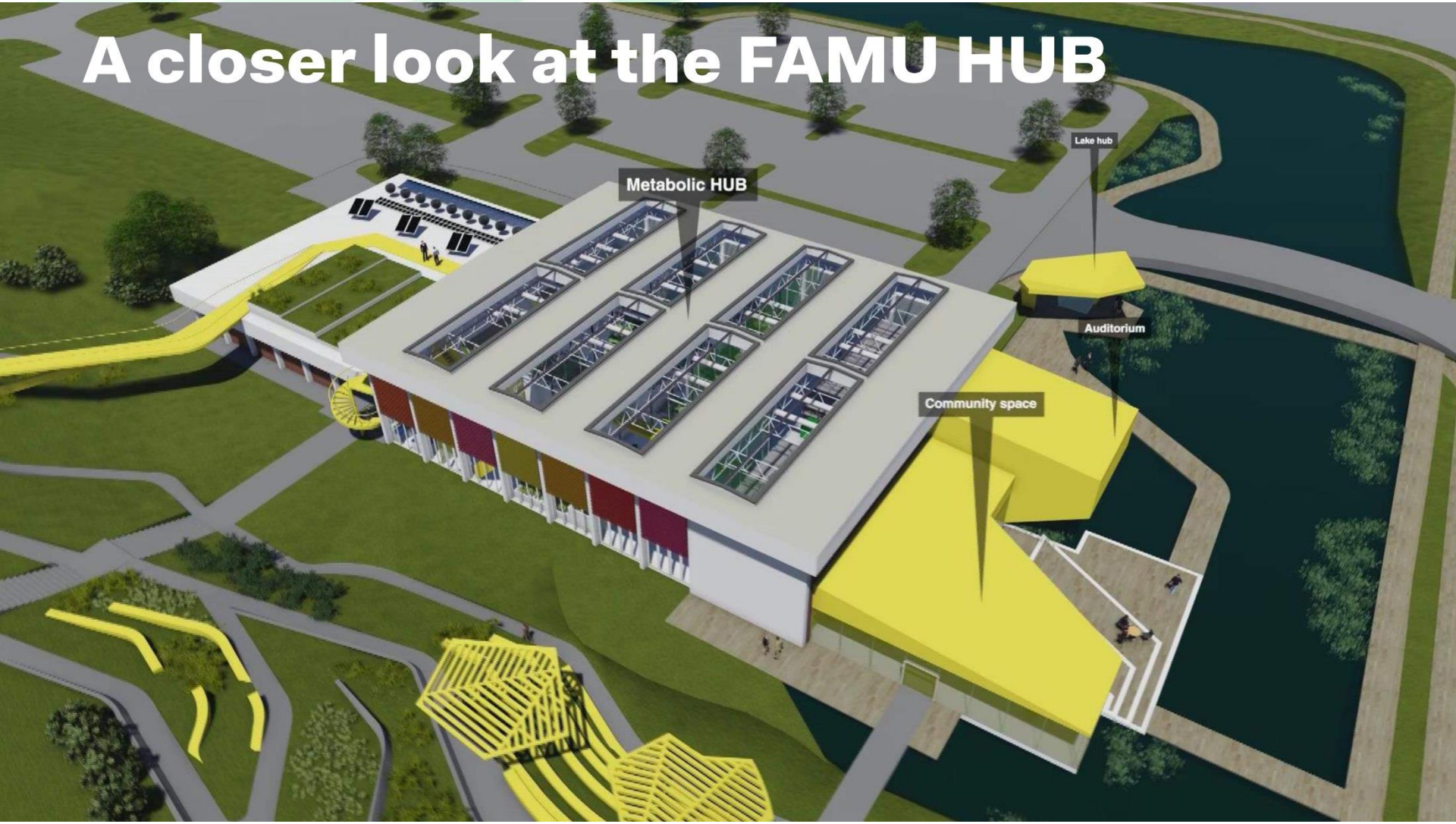
Open Innovation
Academic Partnerships

En Plus

Closing the Material flows at FAMU

A Circular System

A closer look at the FAMU HUB




Biotope Pond
Artificial Lake
(stormwater pond / buffer)
Lake Hub
(ecosystem maintenance)
Biotope Pond
Botanical Garden
Metabolic Hub
Outdoor Auditorium
Forum
Bridge to roof
Educational paths
Botanical garden on slope

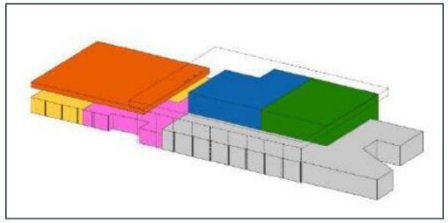
En Plus

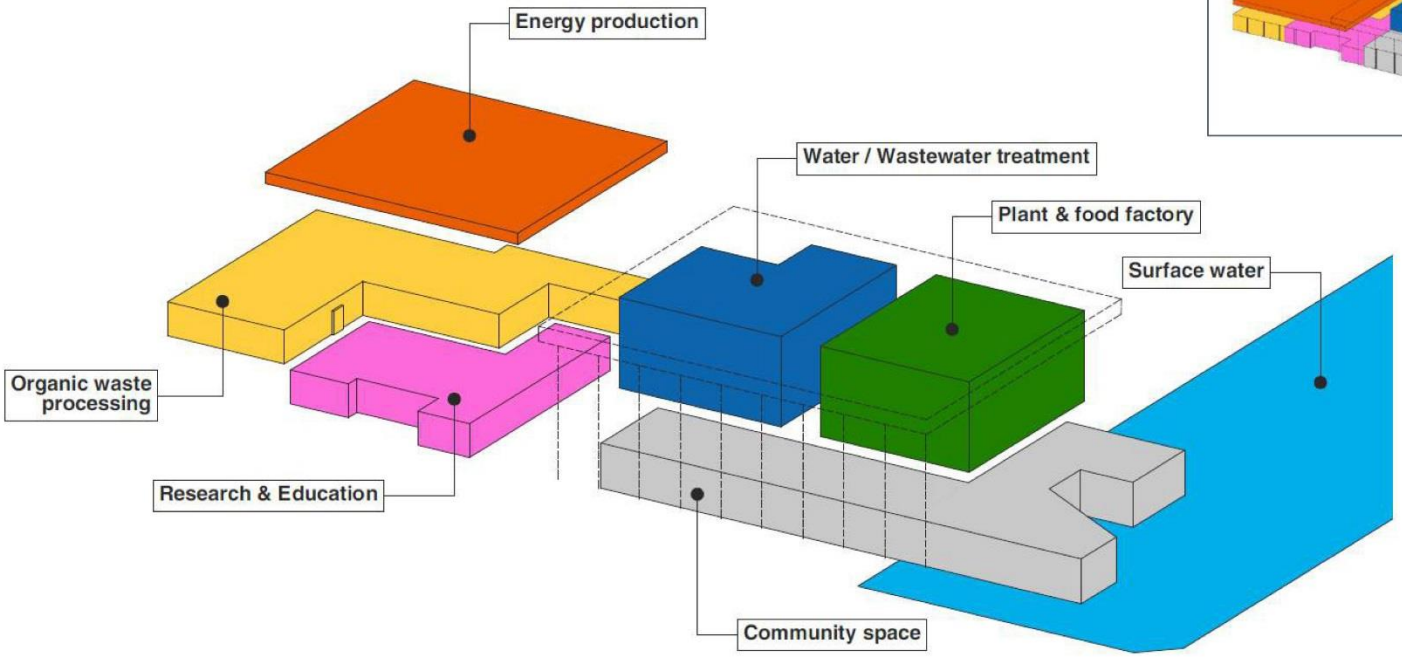
En Plus

En Plus

Realizing the EnergyWaterFoodNexus

The FAMU Metabolic Hub



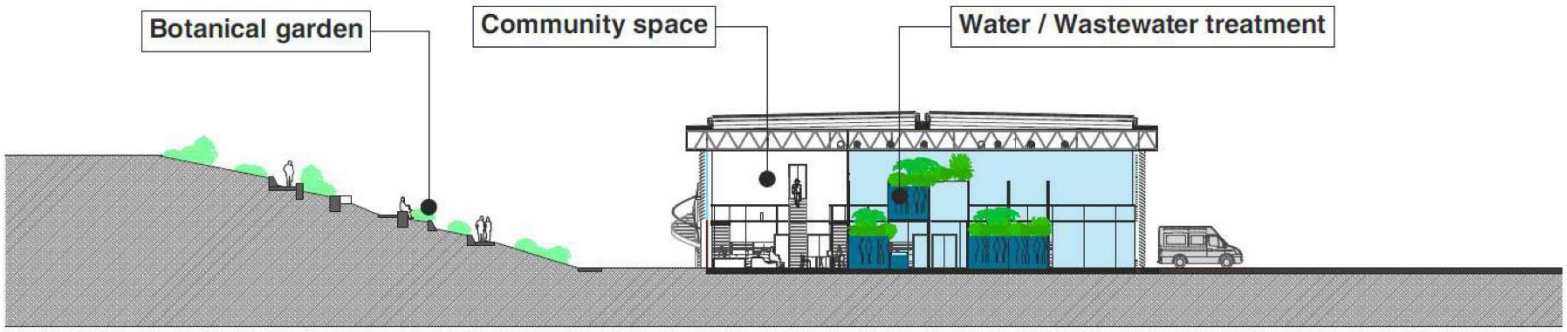


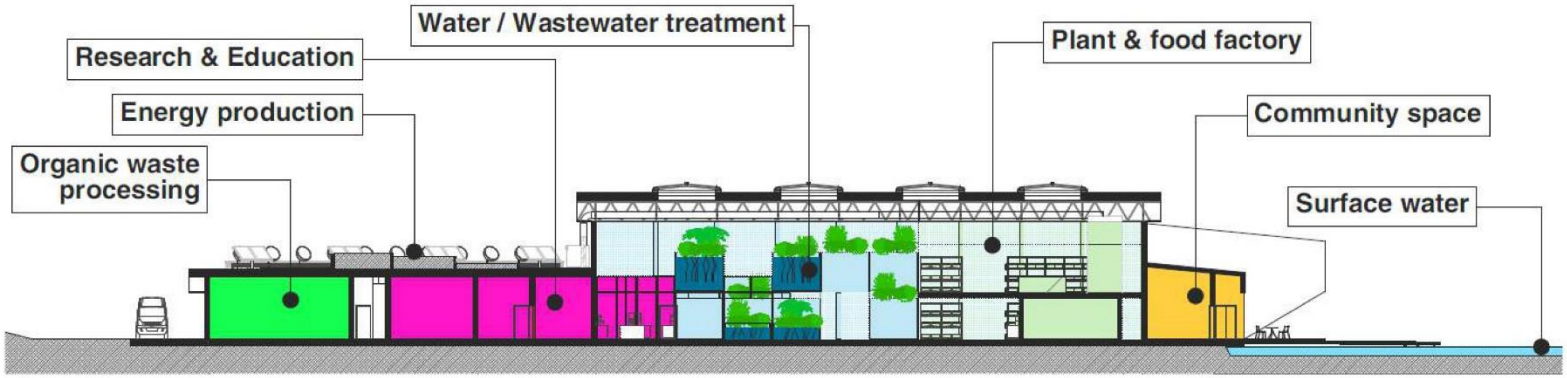
Famu - Water - Energy hub
Use scheme-3d

TectoBio

Architect:
Roland Dániel Németh MSc. Arch.
03.10.2017.

FAMU Metabolic Hub (cross sections)





Famu - Water - Energy hub
Sections

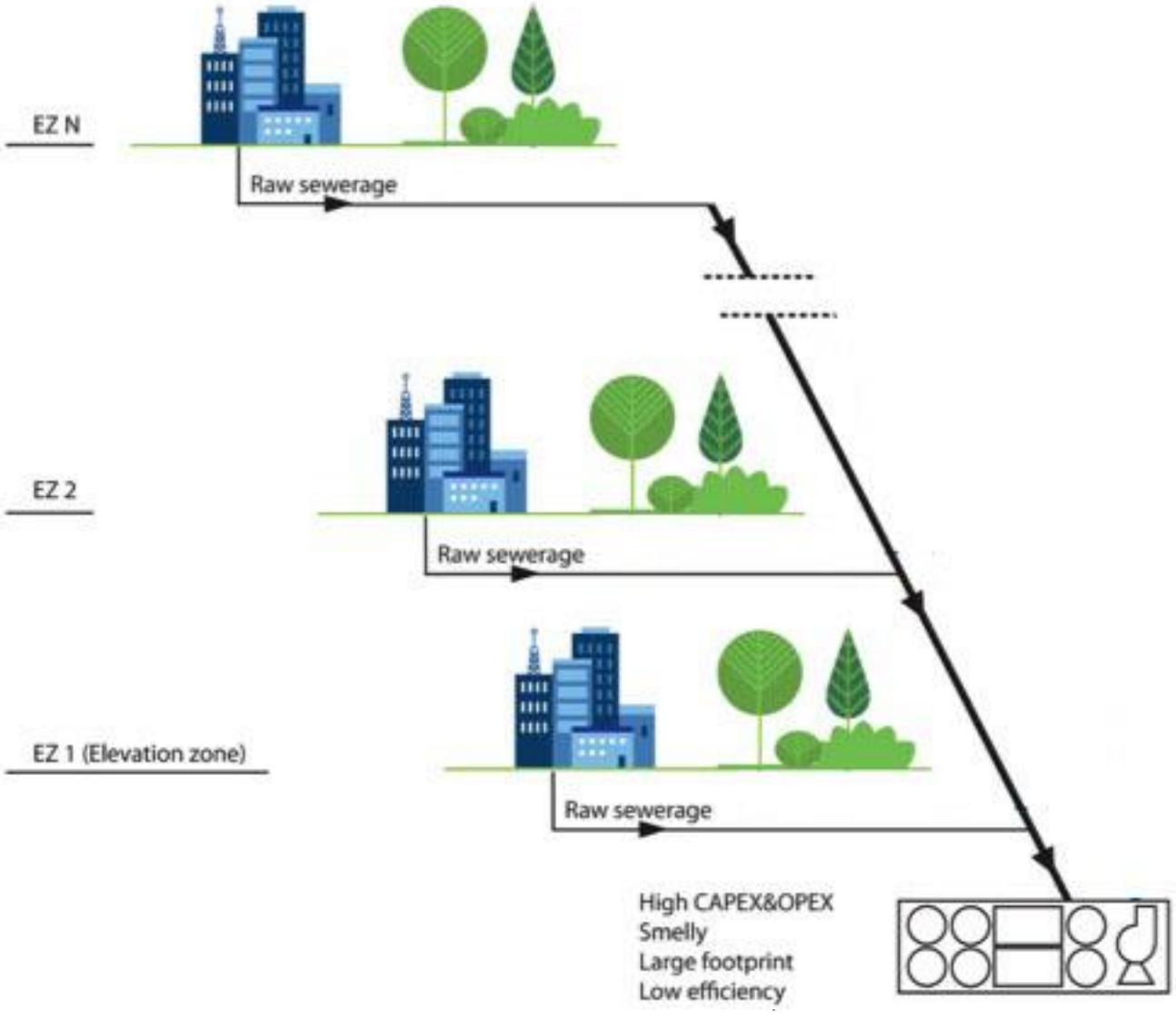
1:200

TectoBio

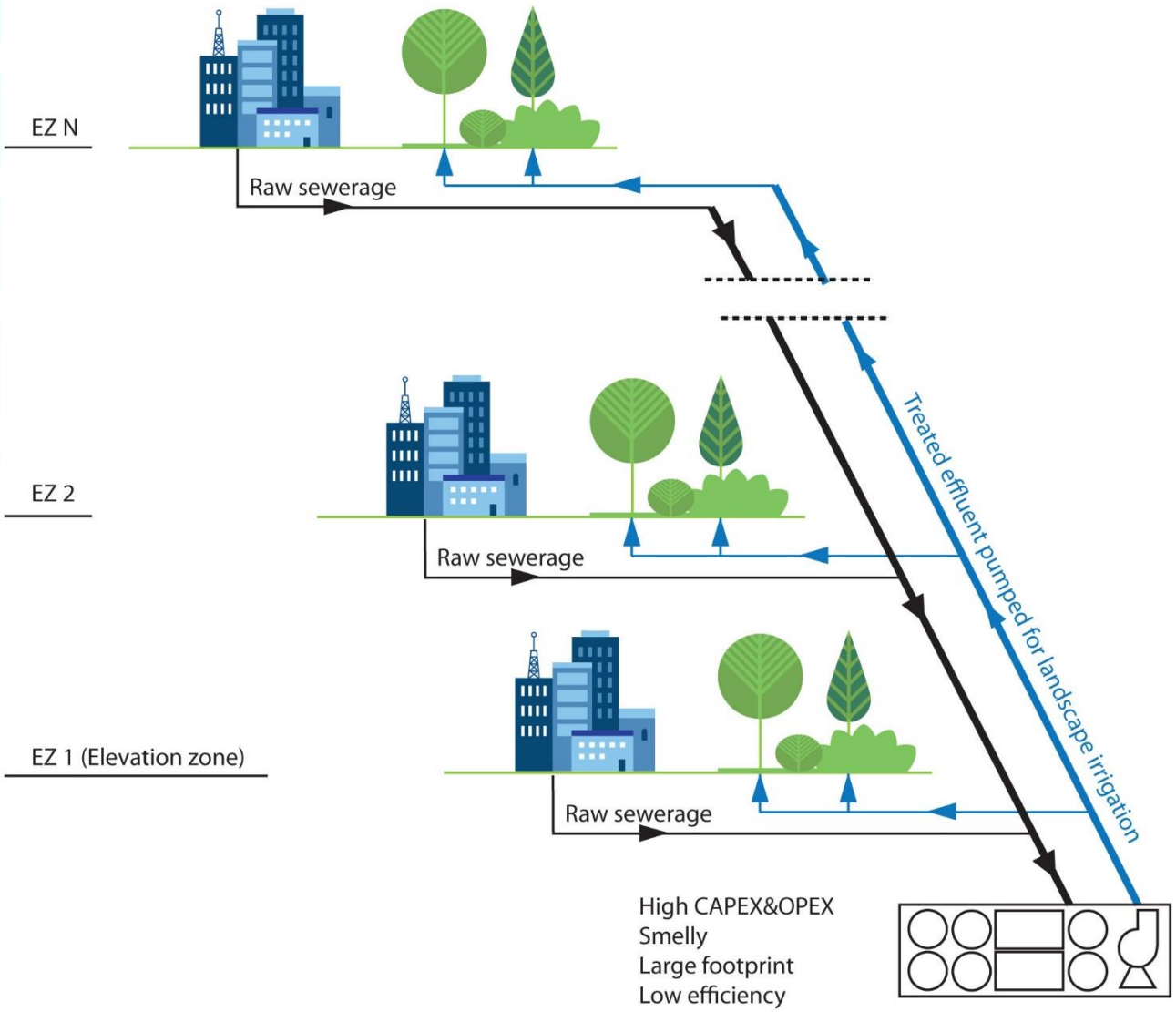
Architect:
Roland Dániel Németh MSc. Arch.
03.10.2017.


Lake Hub
ENERGY WATER
FOOD NEXUS
TectoBio

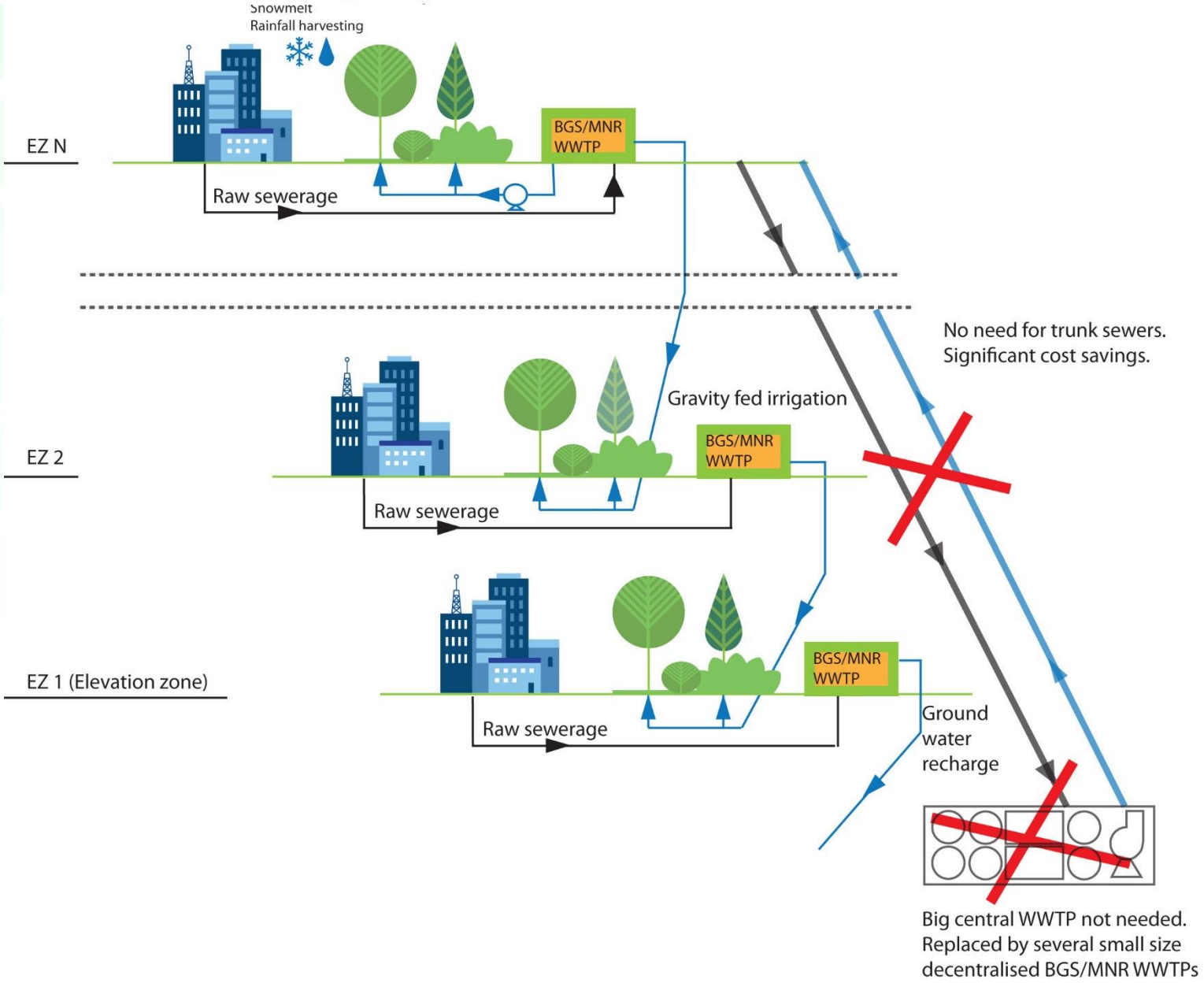
Conventional WWTP with all its problems



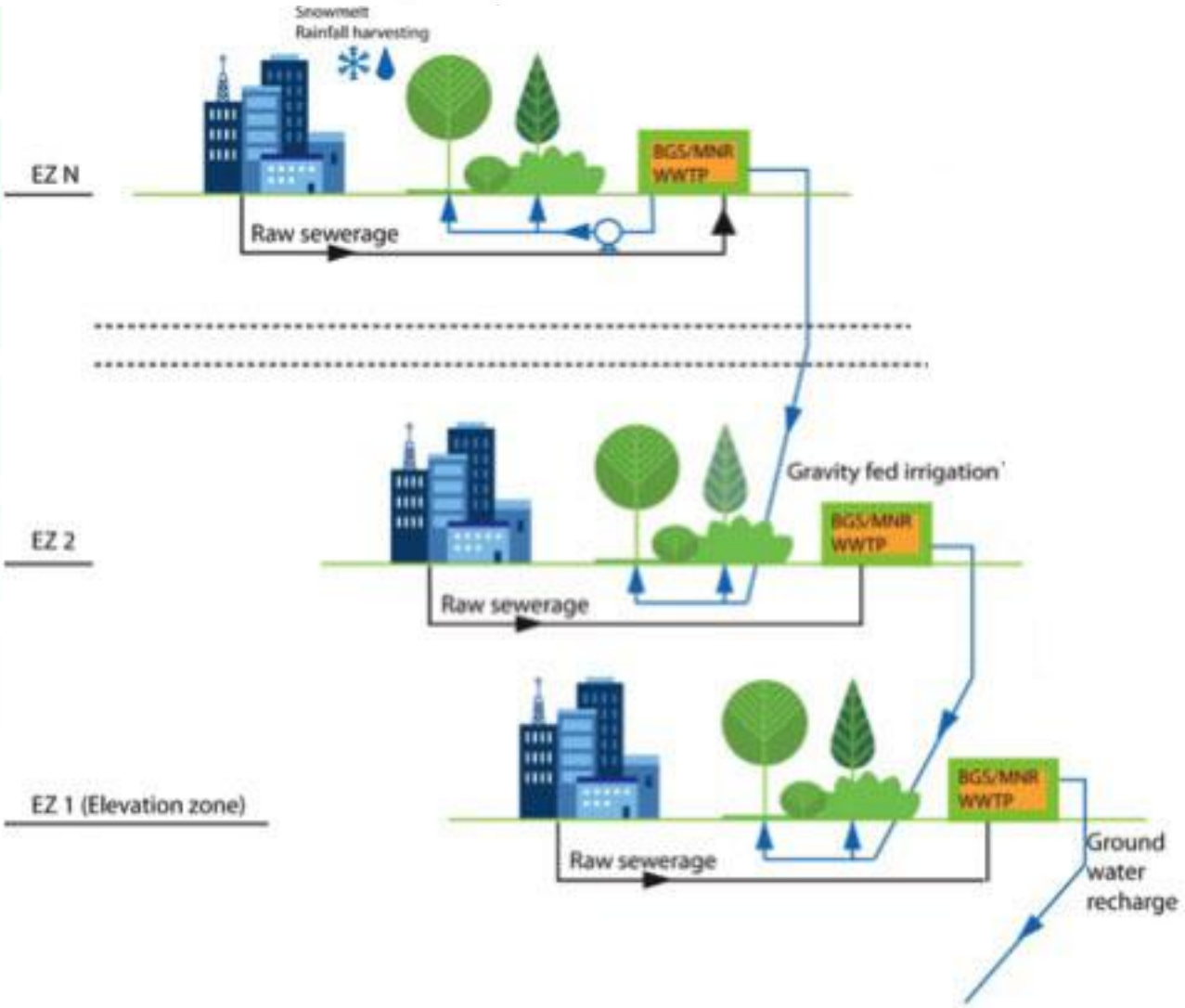
Conventional WWTP with all its problems



Decentralised BGS Metabolic Network Reactor (BGS-MNR)



Decentralised BGS Metabolic Network Reactor (BGS-MNR)




INTERIOR VIEW OF WATER TRE

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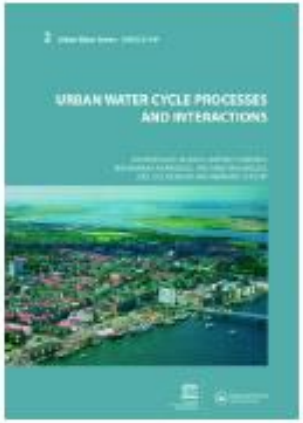
Urban Water Journal http://www.tandfonline.com

Urban Water Book Series http://www.routledge.com/books/series/UWS/

Blue Green Dream project http://www.bgd.org.uk

RainGain project http://www.raingain.eu/en



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