

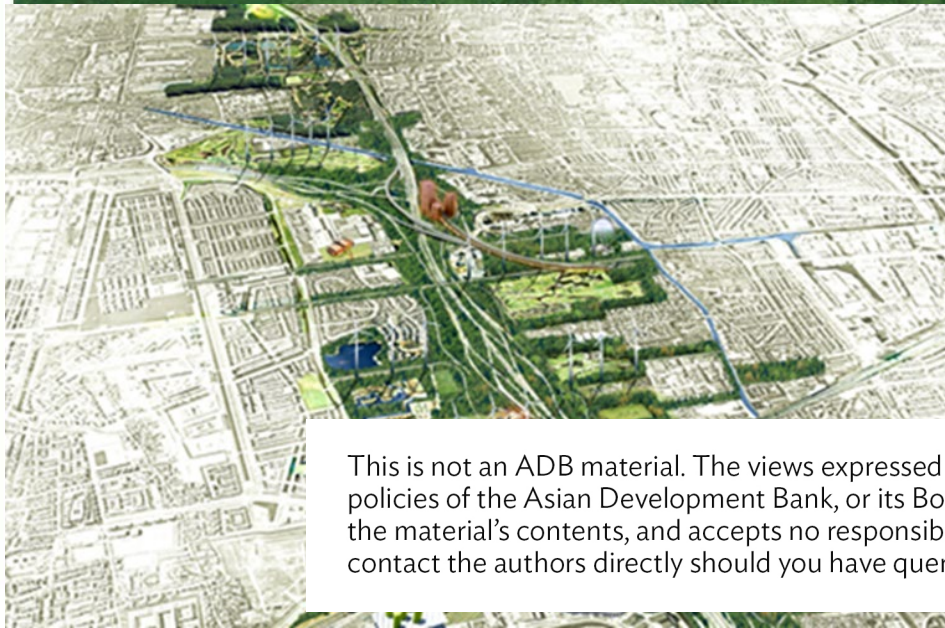
Green Road to Kunming

Promoting Quality/Sustainable Infrastructure in Asia and the Pacific

WORKSHOP SERIES 2022 28 April / 19 May / 23 June / 21 July

Embedding Nature-based Solutions in Transport Corridors

Professor Tony Wong FTSE

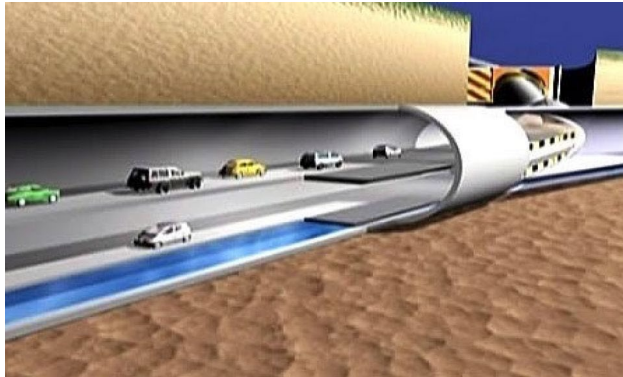


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The emergence of multi-functional & hybrid infrastructure in cities of the future

- **Multi-function infrastructure** serves multi-purposes beyond its primary function

Kuala Lumpur's Stormwater Management And Road Tunnel



How SMART operates



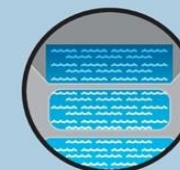
MODE 1
No flood water will be diverted into the SMART system.



MODE 2
SMART system is activated and flood water is diverted into the lower channel.



MODE 3
Tunnel is closed to traffic and on standby for stormwater diversion into the motorway.



MODE 4
Lower and upper decks in motorway is filled with stormwater and used as a passage for flood.



Multi-functional acoustic barriers



The multifunctional barrier consists of a novel traffic barrier with the capacity to reduce noise, NOx and PM caused by motorized vehicles. The outside of the barrier will provide the noise reduction capacity (and the partial reduction of NOx with photocatalytic coating) while its inside will contain a biofilter to capture NOx and PM by extracting and filtering the polluted air.

The emergence of multi-functional & hybrid infrastructure in cities of the future

- *Hybrid infrastructure* including grey & green infrastructure, centralised and decentralised utilities etc.
- *Our knowledge of the traditional 'values' of open spaces and landscape features needs to be bolstered with an understanding of the 'ecological functioning' of the urban landscapes that capture the essences of sustainable water management, micro-climate influences, facilitation of carbon sinks and use for food production.*



The role of transport corridors in city shaping

- *Transport corridors provide essential access and connectivity and are fundamental building blocks in shaping cities*
- *Transport corridors provide the essential connective networks with which **nature-based solutions**, and resulting ecosystem services, can be implemented throughout urban communities.*



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- *Transport corridors present the essential connective networks with which **nature-based solutions**, and resulting ecosystem services, can be implemented throughout urban communities.*
- *Transport infrastructure, particularly roads, generate significant stormwater pollution that need to be mitigated*

| Pollutant Source | Sediments | Nutrients | Oxygen demanding materials | Heavy metals | Toxic organic wastes | Micro-organisms | Hydrocarbons |
|---------------------------|-----------|-----------|----------------------------|--------------|----------------------|-----------------|--------------|
| Road and pavement wear | ✓ | | | | | | |
| Vehicle wear | ✓ | | | ✓ | | | |
| Vehicle fuels and fluids | ✓ | | ✓ | ✓ | | ✓ | ✓ |
| Fuel combustion | | ✓ | | ✓ | | | ✓ |
| Soil erosion | ✓ | ✓ | ✓ | ✓ | | | |
| Human and animal waste | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| Pesticides and herbicides | | ✓ | | ✓ | ✓ | | |
| Fertilisers | | ✓ | | | ✓ | | |
| Paint and solvents | | | | ✓ | | | ✓ |
| Industrial activities | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| Household chemicals | ✓ | ✓ | | | ✓ | | ✓ |

| | Pb | Zn | Cu | Cr | Cd | Ni |
|-----------------------------|----|----|----|----|----|----|
| Vehicle tyre and brake pads | | ✓ | ✓ | | ✓ | |
| Corrosion of metal objects | | ✓ | | | | |
| Petrol additives | ✓ | | | | | |
| Lubrication oil | | | | | ✓ | |
| Metal industry | | | ✓ | ✓ | ✓ | ✓ |
| Domestic Products | | | ✓ | ✓ | ✓ | ✓ |
| Pesticides and fertilisers | | | | ✓ | ✓ | |
| Dye and paint | | | | ✓ | | |
| Engine parts | | | | ✓ | | ✓ |
| Paper | | | | ✓ | | |

Nature-based Solutions for Water

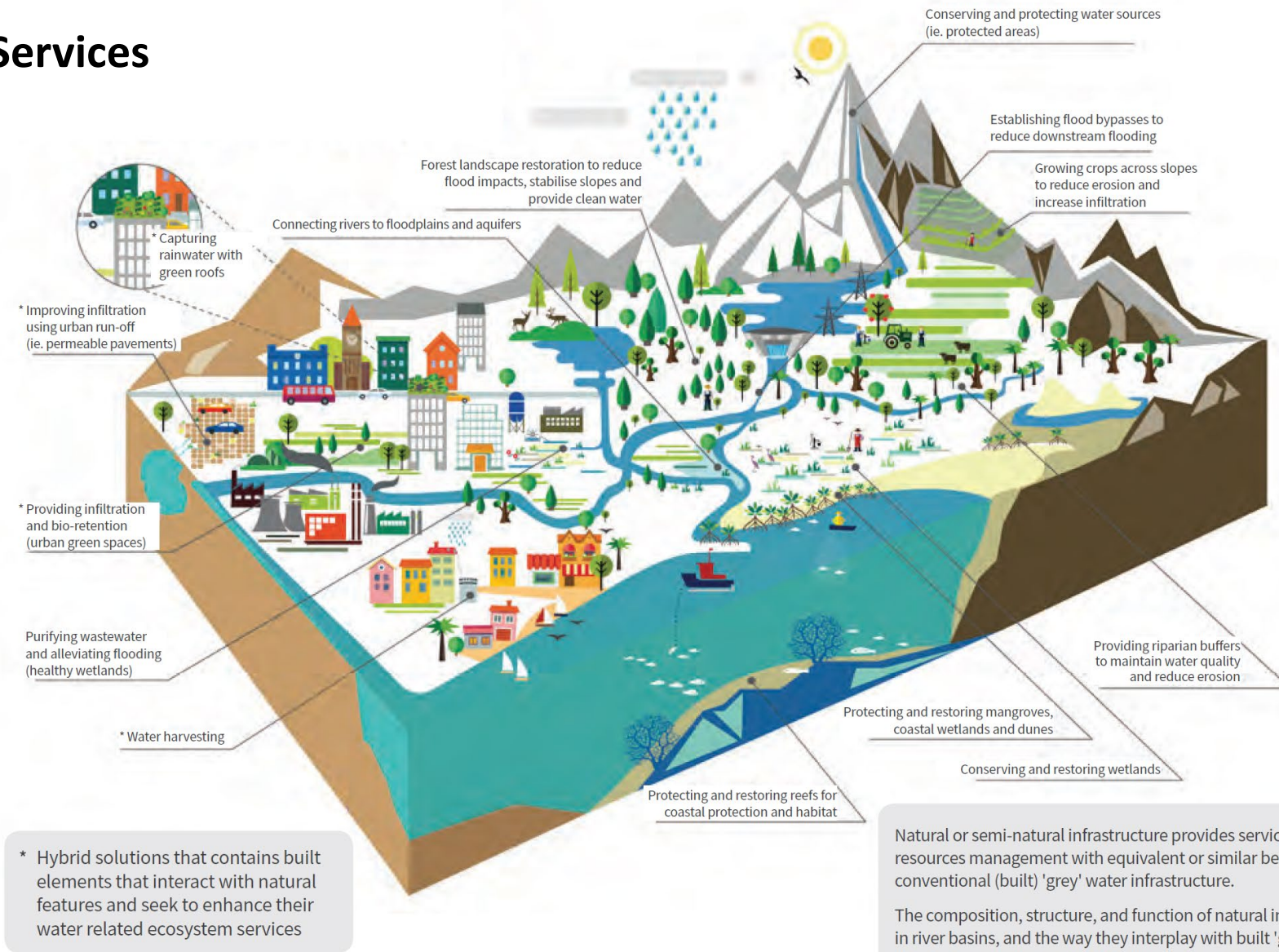
“For too long, the world has turned first to human-built, or “grey”, infrastructure to improve water management.....

*Three years into the 2030 Agenda for Sustainable Development, **it is time for us to re-examine nature-based solutions (NBS) to help achieve water management objectives”***

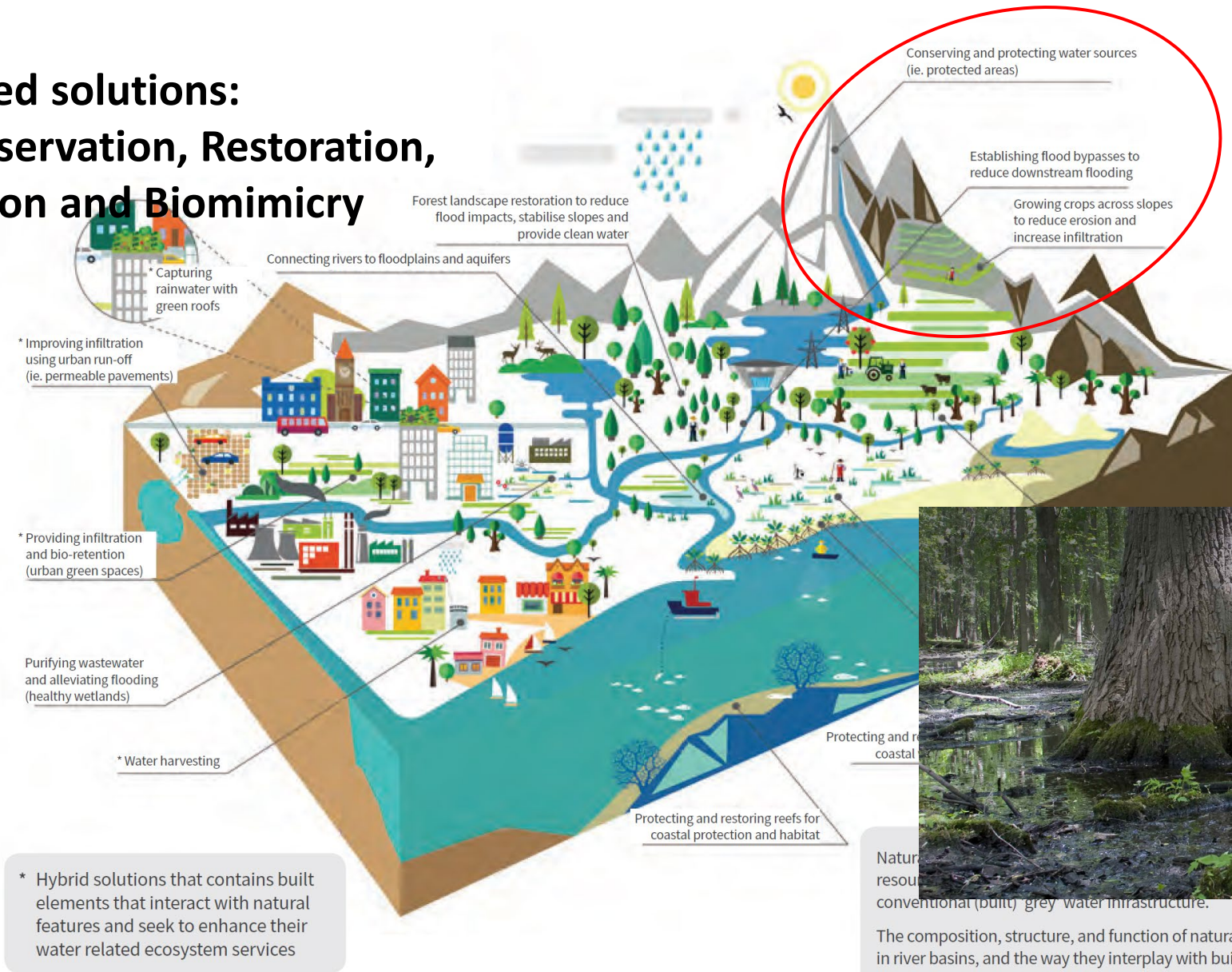
Gilbert Hounbo, Chair of UN-Water



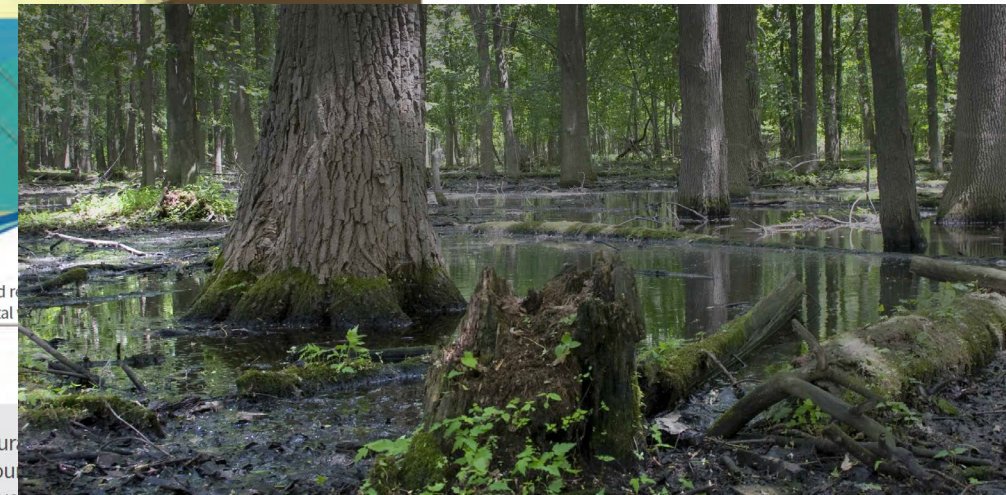
Ecosystem Services



Nature-based solutions: Nature Conservation, Restoration, Rehabilitation and Biomimicry



Conservation & Restoration

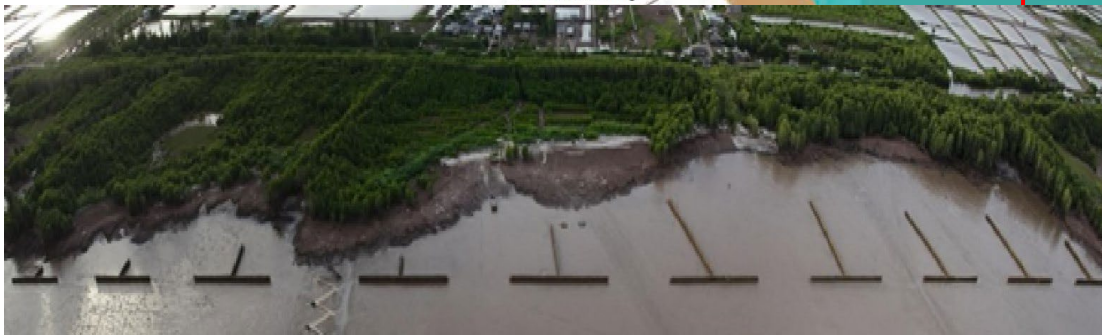
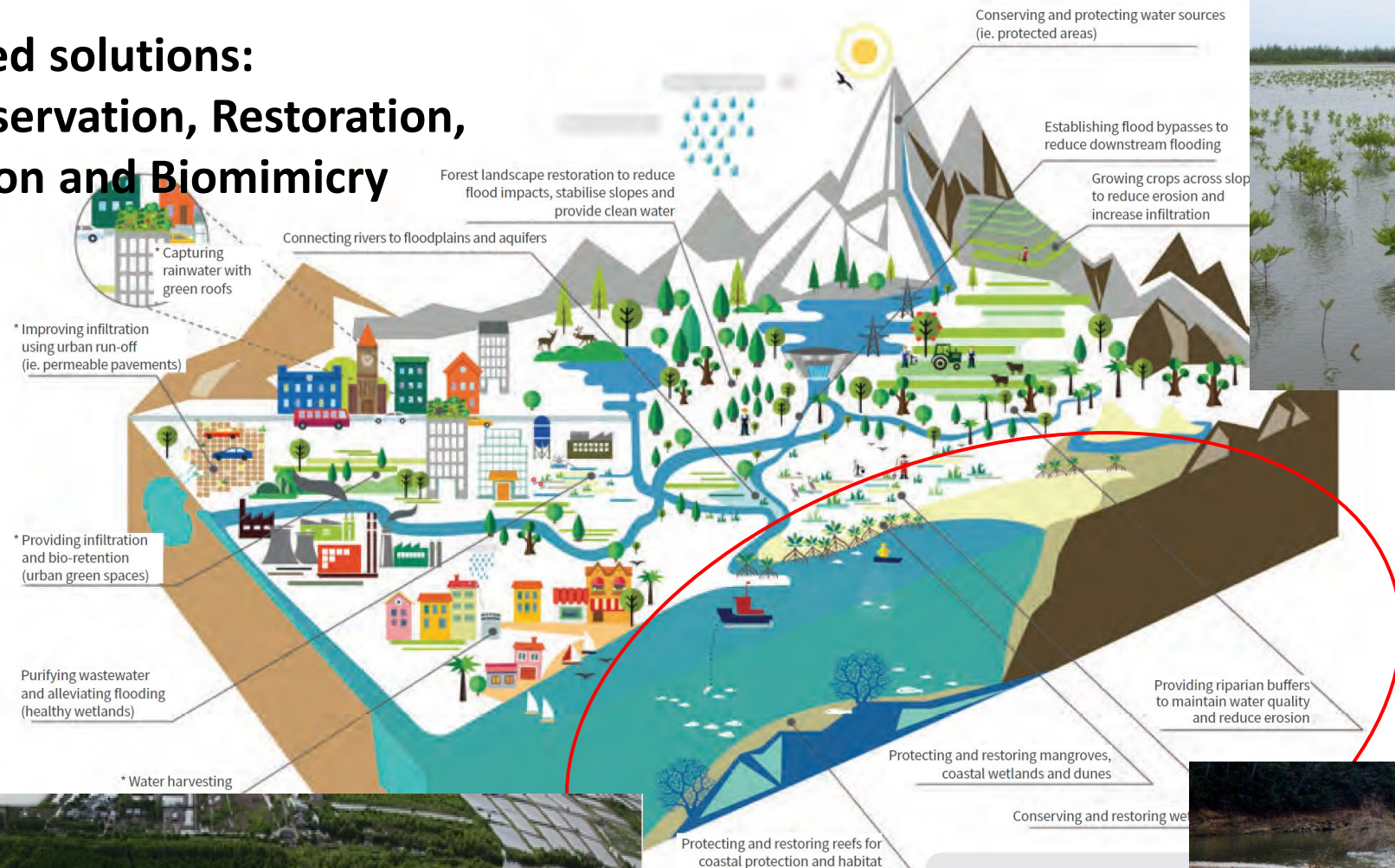


Natural
resources
conventional (built) grey water infrastructure.

The composition, structure, and function of natural infrastructure assets in river basins, and the way they interplay with built 'grey' infrastructure will determine the primary services and co-benefits produced.

Further information can be found in UNEP-DHI/IUCN/TNC (2014).

Nature-based solutions: Nature Conservation, Restoration, Rehabilitation and Biomimicry



Restoration & Rehabilitation

Natural or semi-natural infrastructure resources management with equal or better performance than conventional (built) 'grey' water infrastructure.

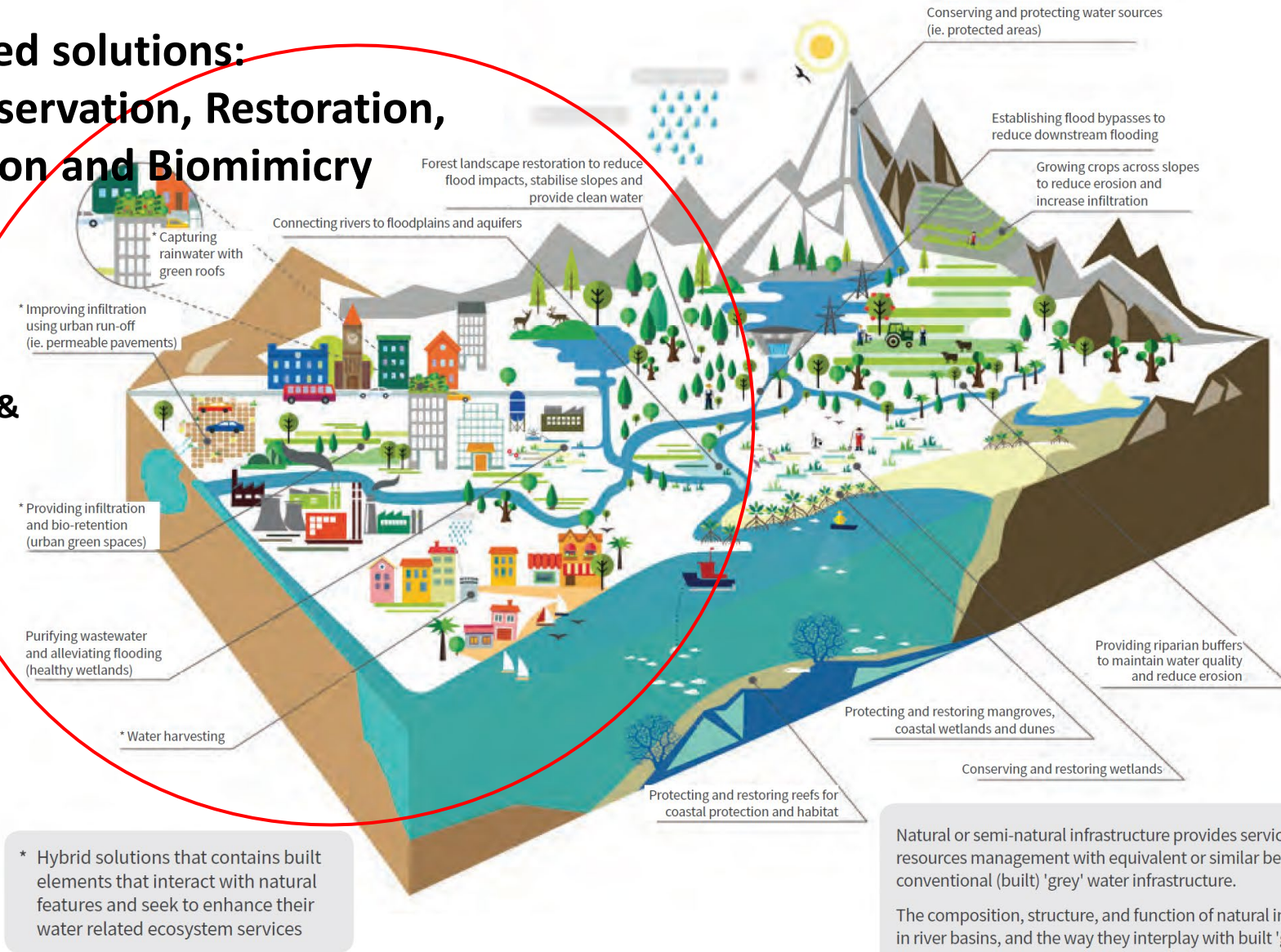
The composition, structure, and function of natural or semi-natural infrastructure in river basins, and the way they interact with the built infrastructure, will determine the primary services provided.

Further information can be found at <https://www.iucn.org/infrastructure>



Nature-based solutions: Nature Conservation, Restoration, Rehabilitation and Biomimicry

Rehabilitation & Biomimicry



Natural or semi-natural infrastructure provides services for water resources management with equivalent or similar benefits to conventional (built) 'grey' water infrastructure.

The composition, structure, and function of natural infrastructure assets in river basins, and the way they interplay with built 'grey' infrastructure will determine the primary services and co-benefits produced.

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Cities Providing Ecosystem Services

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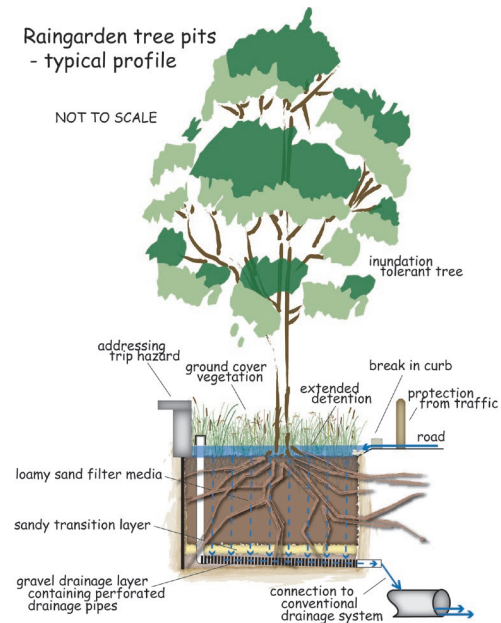
- ❑ water quality improvement



Cities Providing Ecosystem Services

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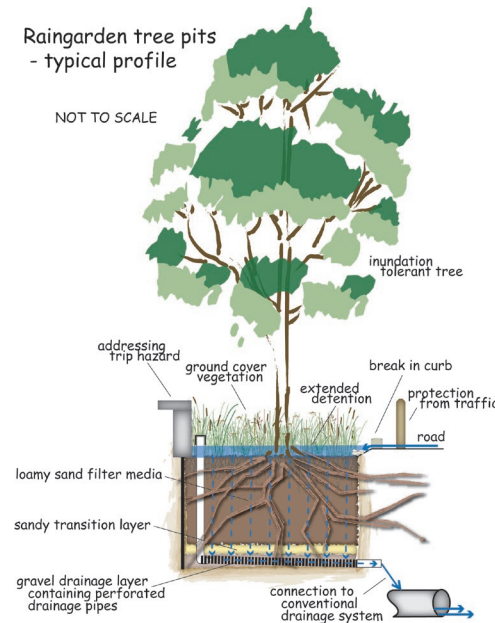


Cities Providing Ecosystem Services

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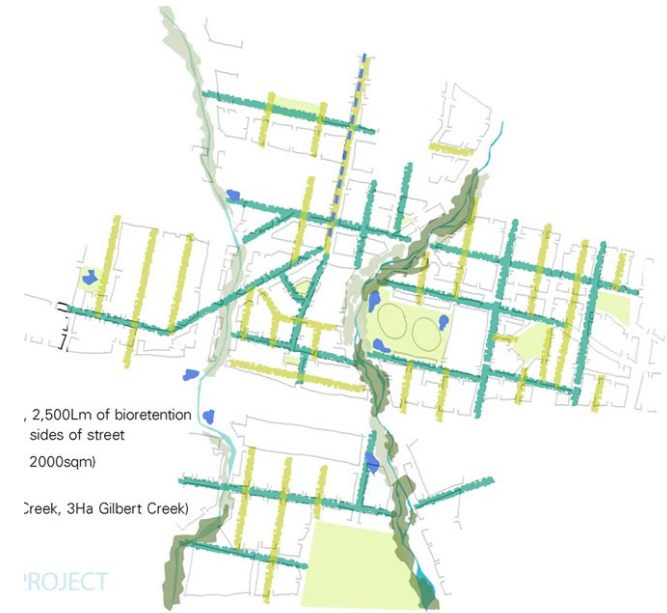
❑ management of stormwater as a resource



Cities Providing Ecosystem Services

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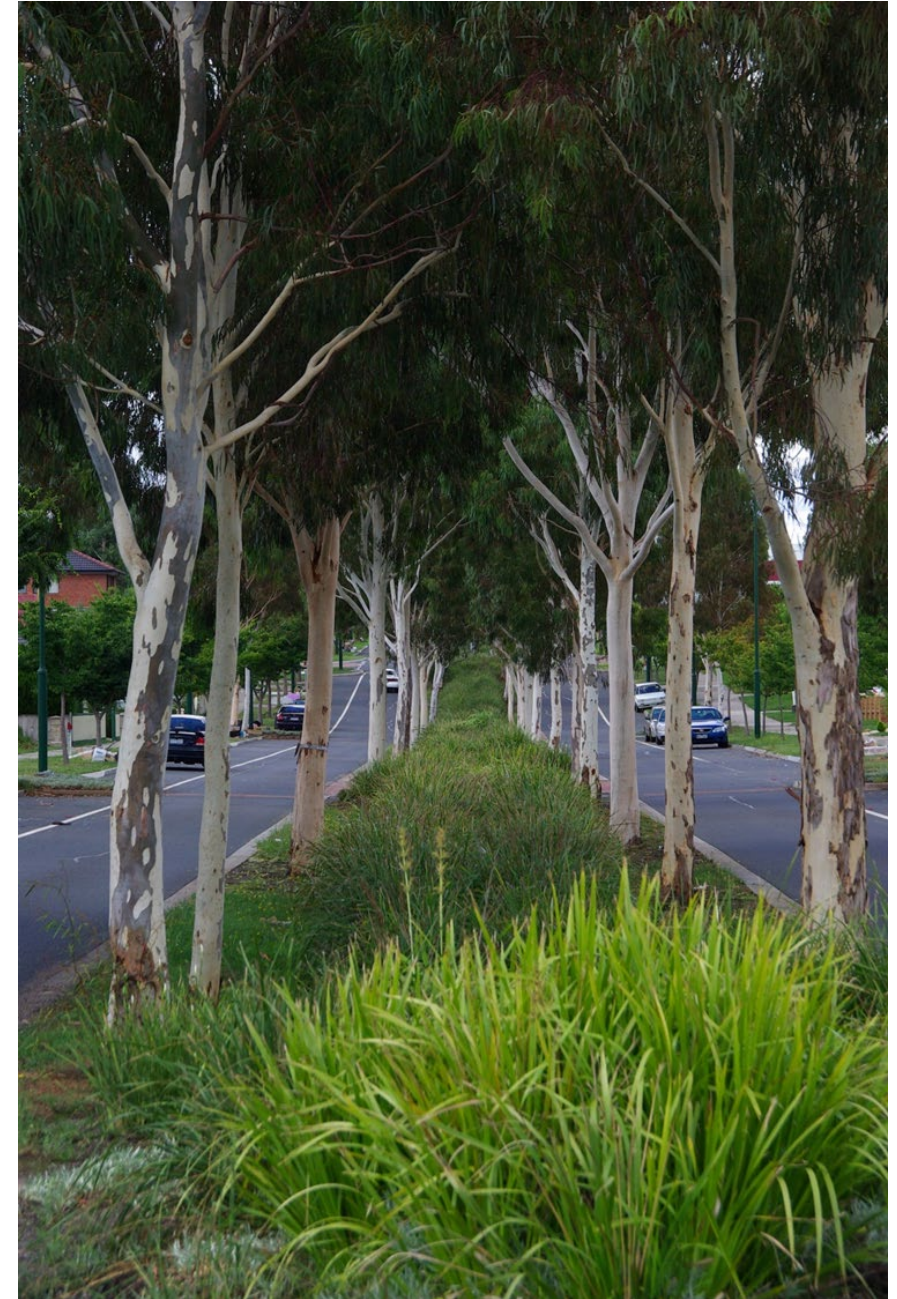
- ❑ water quality improvement
- ❑ management of stormwater as a resource
- ❑ buffering aquatic ecosystems from the effects of catchment urbanisation and climate change
- ❑ flood mitigation – Infiltration; Detention; & safe passage of flood water



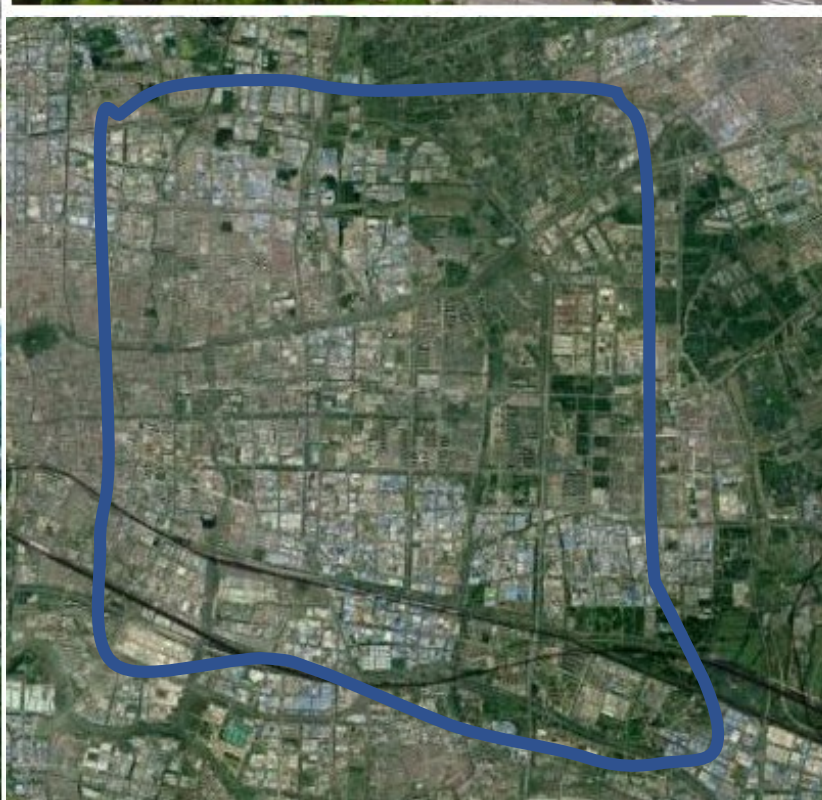
Cities Providing Ecosystem Services

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- ☐ water quality improvement
- ☐ management of stormwater as a resource
- ☐ buffering aquatic ecosystems from the effects of catchment urbanisation and climate change
- ☐ flood mitigation – Infiltration; Detention; & safe passage of flood water
- ☐ influencing urban micro-climates
- ☐ enhancing urban ecology and biodiversity



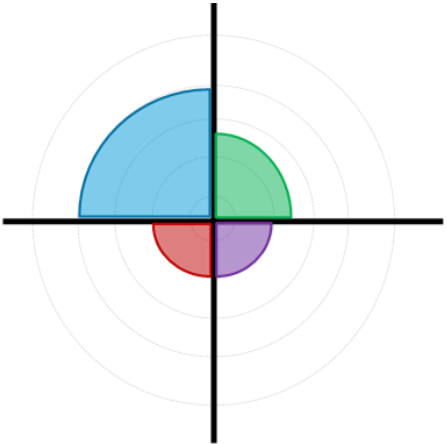
Urban Planning and Design Scale @ Kunshan Ring Road Strategy



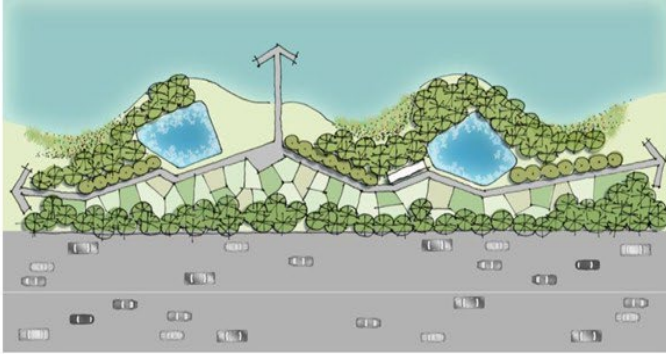


WATER
FOREST

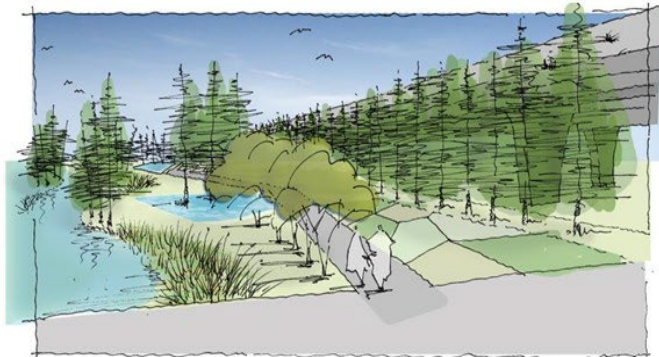
FOOD
CULTURE



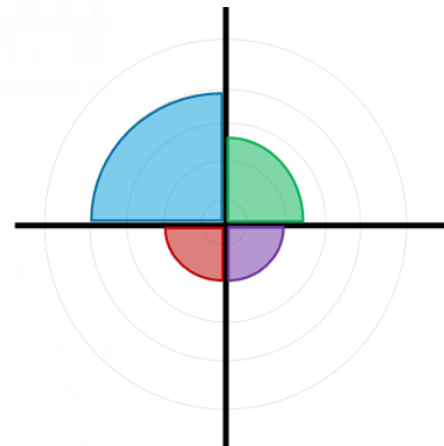
Current status



Conceptual design



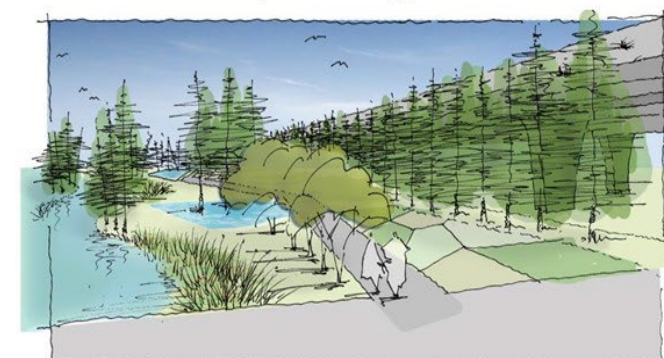
城市尺度的多功能廊道@昆山

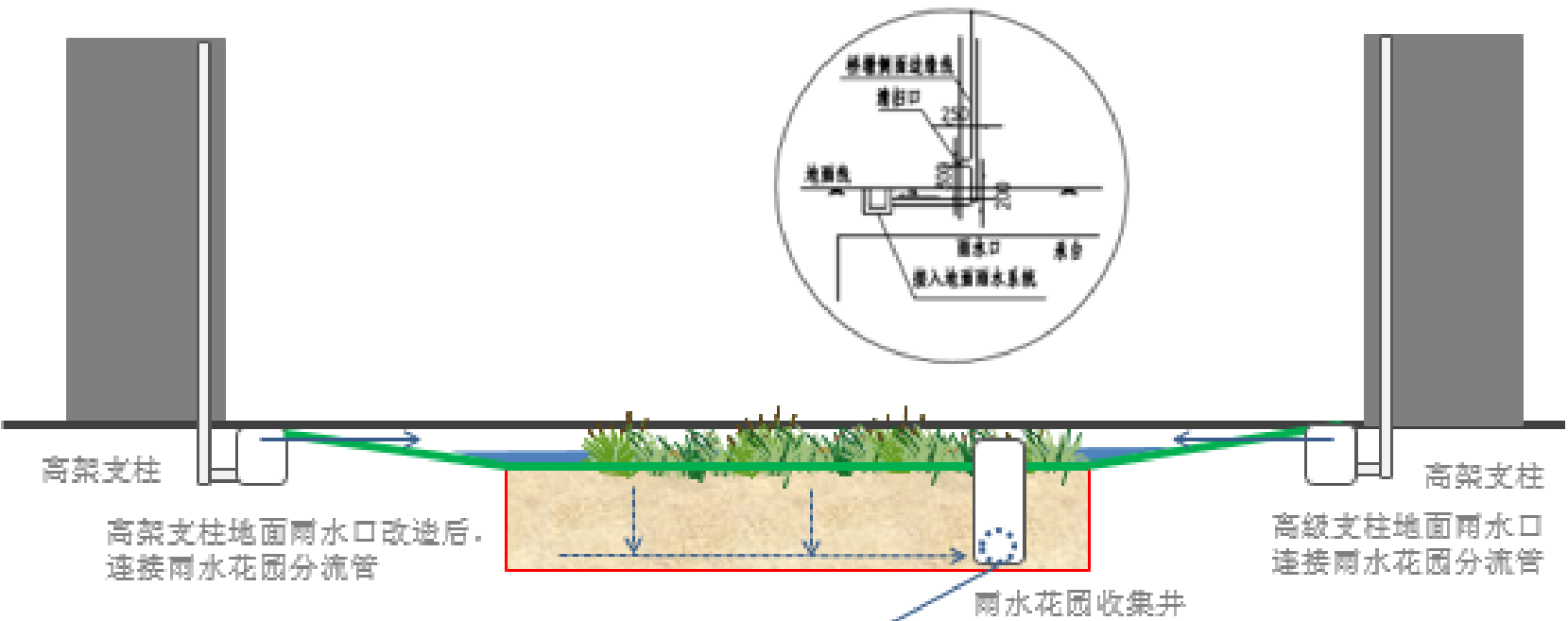


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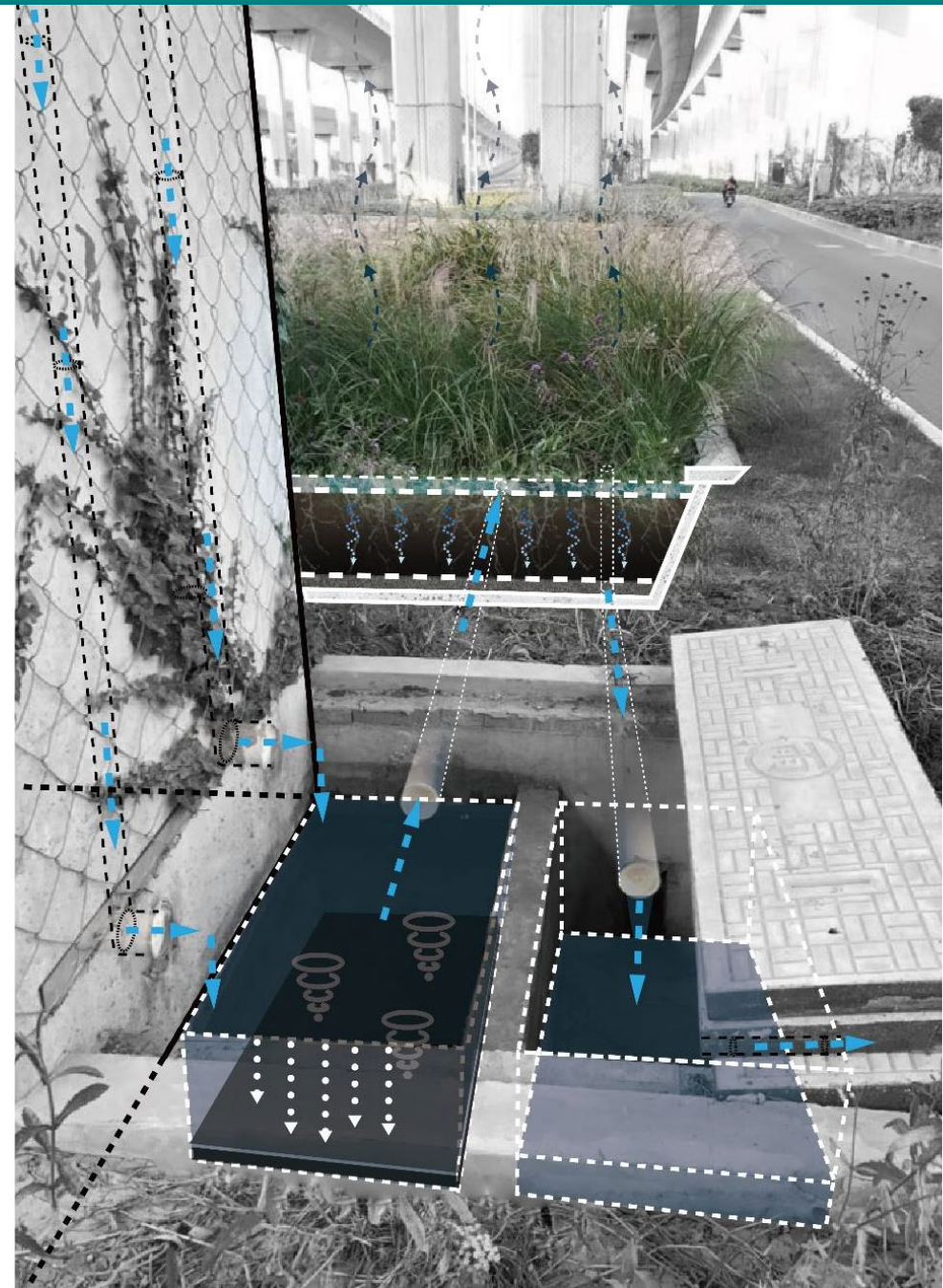




接入地面
道路雨水井



NBS for Climate Resilient Road @ Kunshan, China

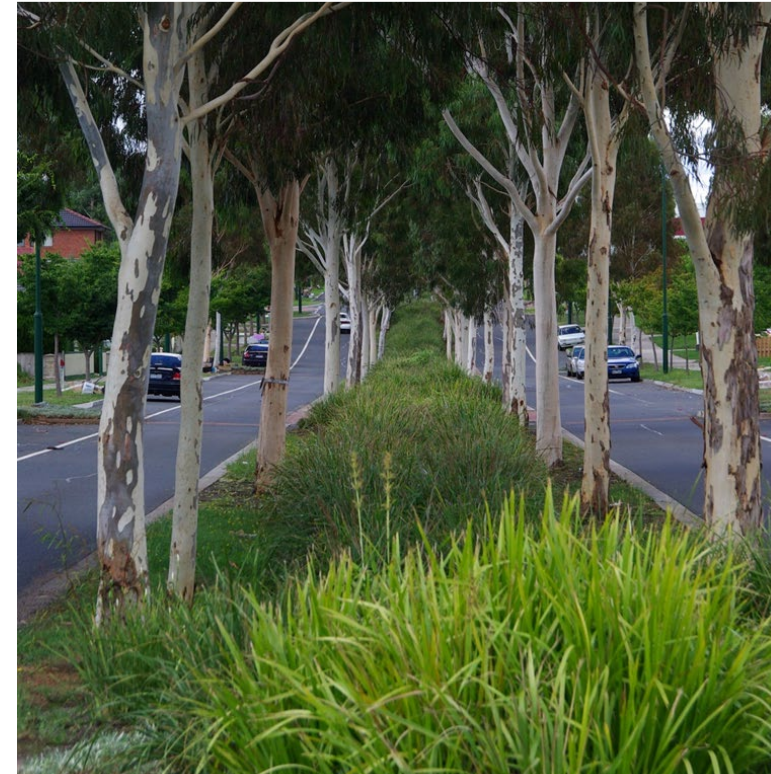


Hybrid infrastructure for ecological restoration —— 灰绿结合在生态修复领域的应用@昆山中环



Key Messages

1. Transport corridors present essential connective networks with which nature-based solutions, and resulting ecosystem services, can be implemented throughout urban communities
2. Nature-based solutions can be embedded into transport corridors to deliver ecosystem services such as water cleansing, pollution control and environmental protection; flood conveyance and detention; urban cooling; enhancing urban biodiversity through eco-connectivity
3. Nature-based solutions can be embedded into transport corridors in the urban landscape at a range of scale – from regional road and rail corridors and major interchanges to your local streets and pedestrian/cycling pathways.



An aerial photograph showing a two-lane asphalt road with yellow double lines and white edge lines, curving through a dense, lush green forest. The road is bordered by a metal guardrail.

THANK YOU!

ADB