

Nature-based solutions for cities

Professor Tony Wong, CEO

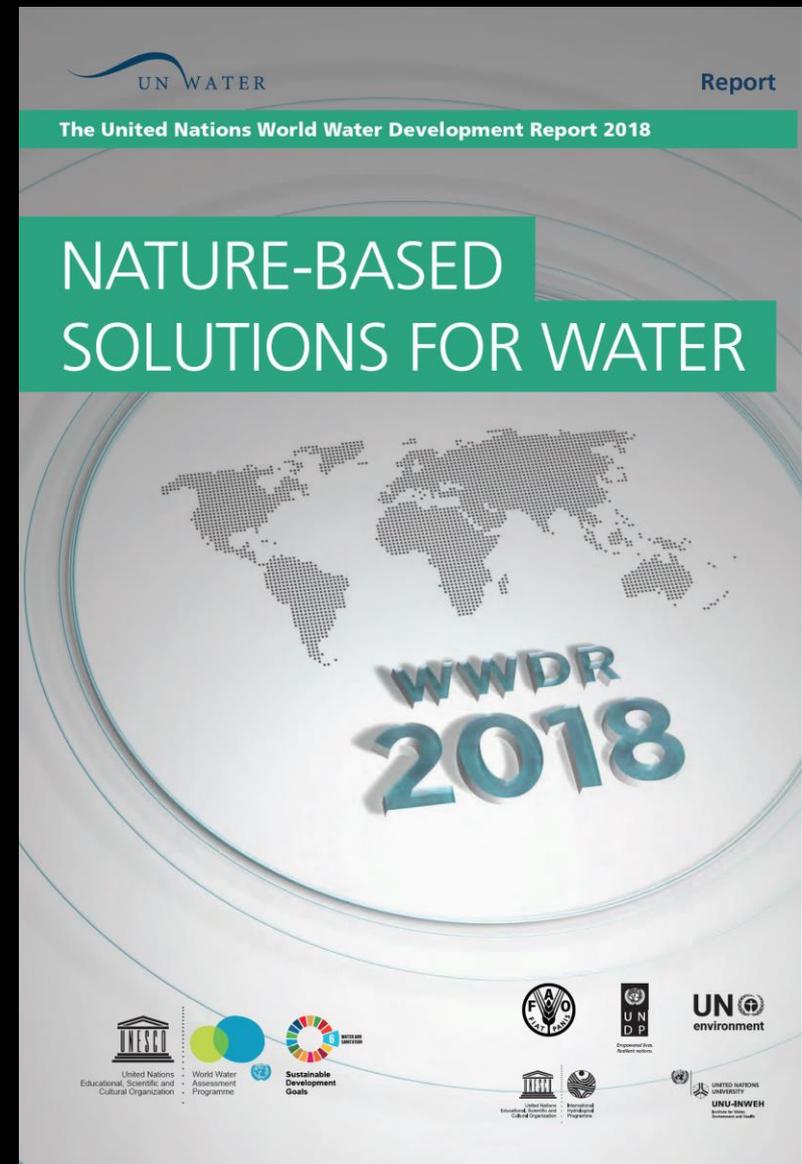
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Nature-based Solutions for Water

“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.”

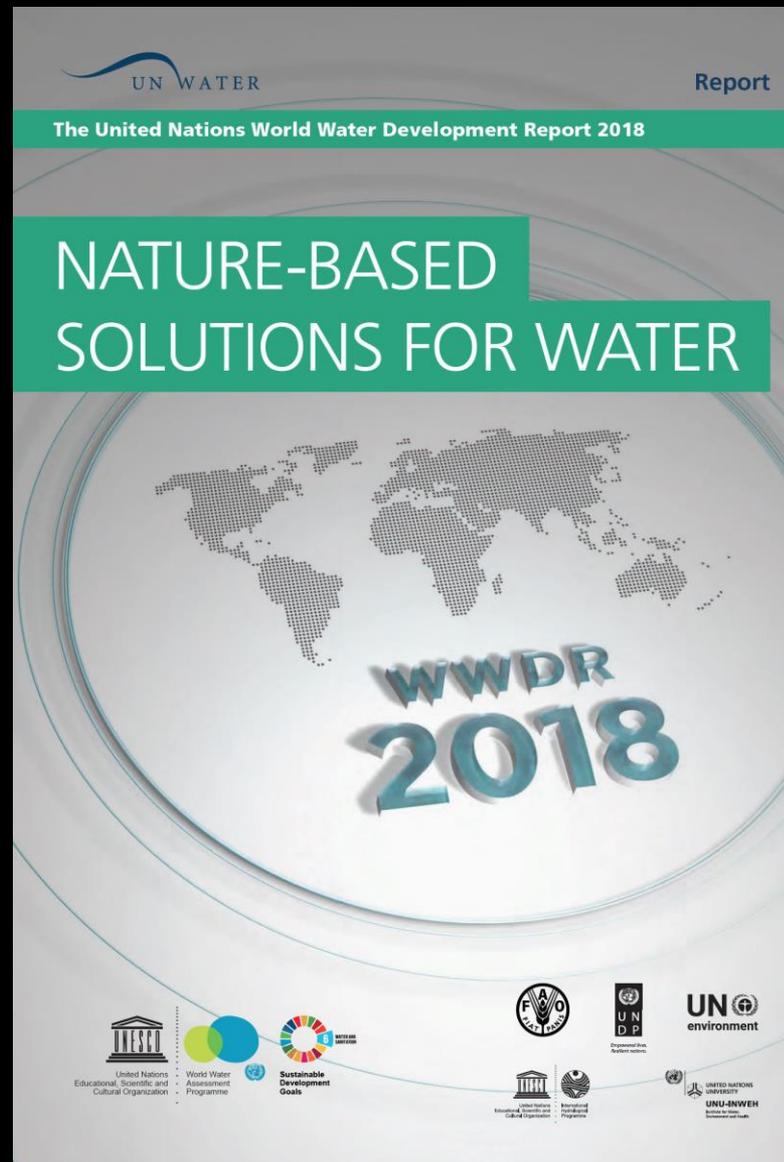
Gilbert Hougbo, Chair of UN-Water



Nature-based Solutions for Water

*“The current situation, with ageing, inappropriate or insufficient grey infrastructure worldwide, creates opportunities for NBS as innovative solutions that embed **perspectives of ecosystem services**, enhanced resilience and livelihood considerations in water planning and management”*

extract from Executive Summary



WHAT ARE NATURE-BASED SOLUTIONS FOR WATER?



SOIL MOISTURE RETENTION,
GROUNDWATER RECHARGE



NATURAL AND
CONSTRUCTED WETLANDS



REFORESTATION



RIPARIAN BUFFER STRIPS

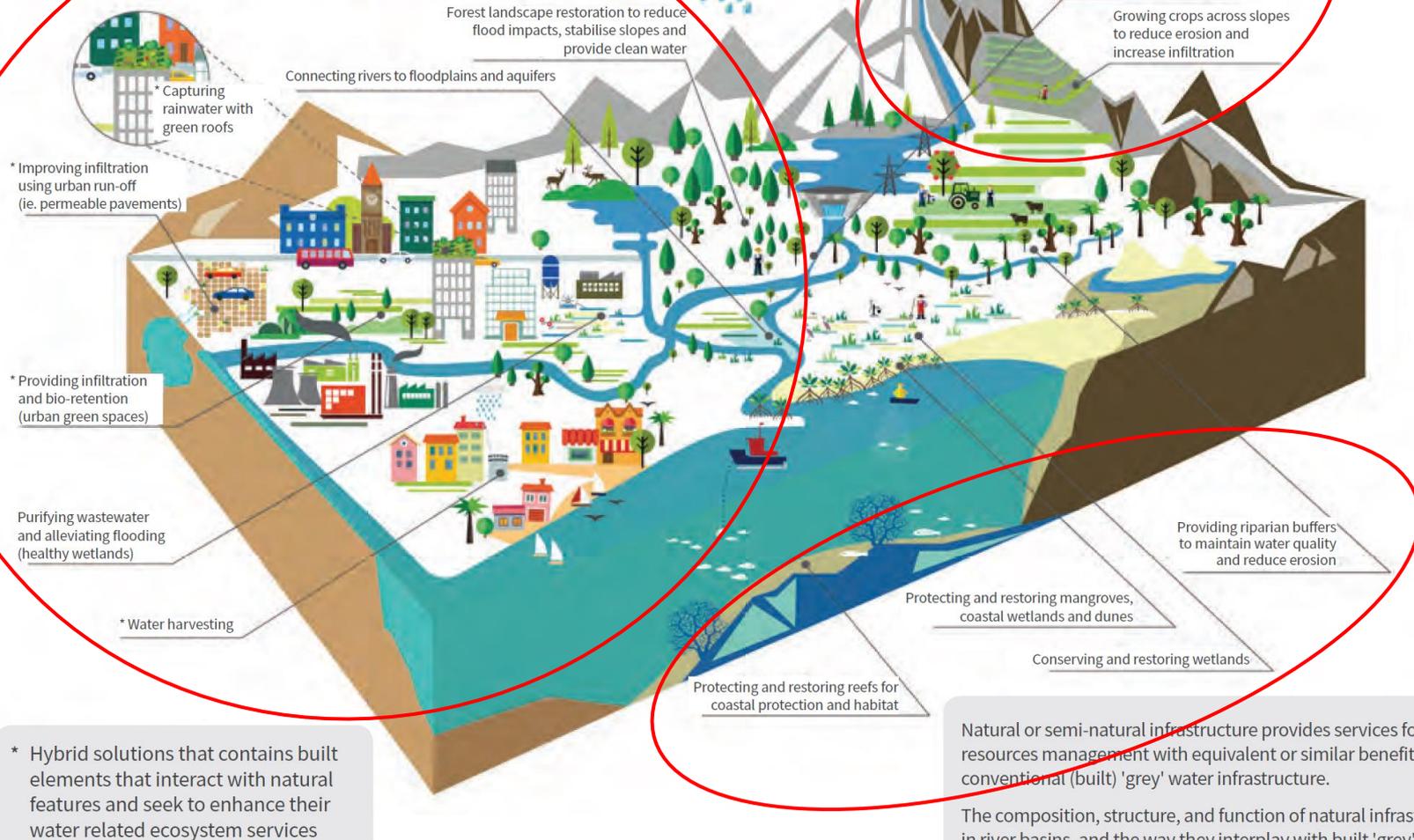


URBAN GREEN SPACES AND
GREEN BUILDINGS

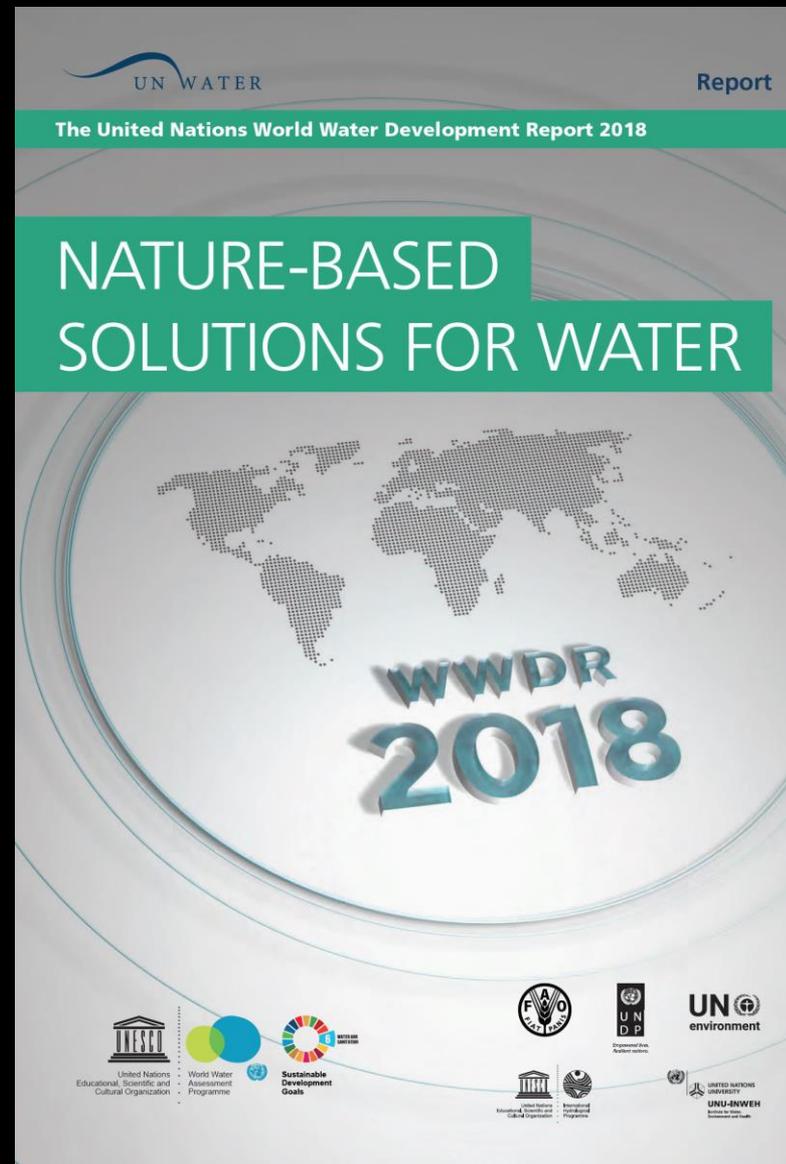
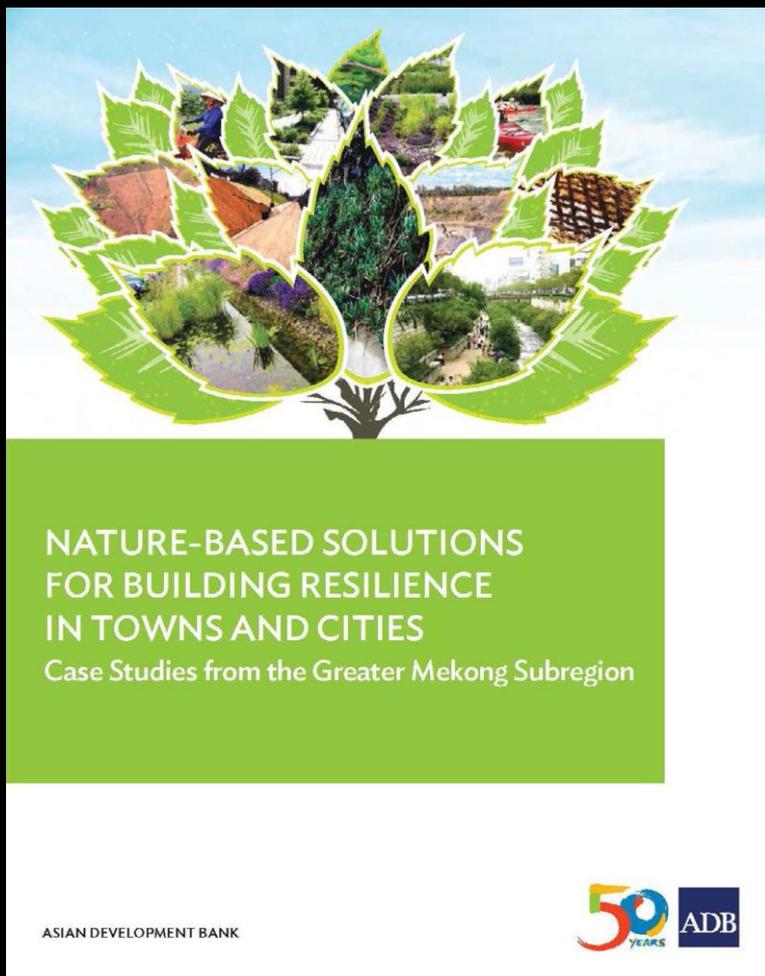


DRY TOILET

Nature Conservation, Restoration, Rehabilitation and Biomimicry



Nature-based Solutions for Water

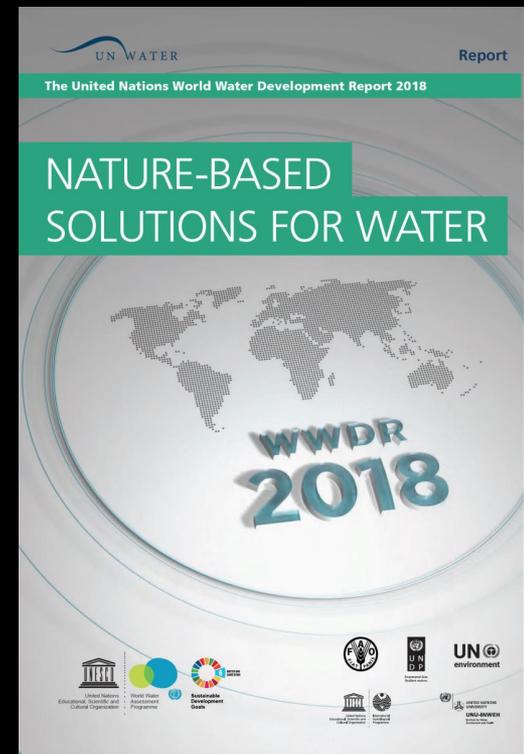


Biomimicry

Embedding ecosystem services into cities and towns

*NBS for addressing water availability in urban settlements are also of great importance, given that the majority of the world's population is now living in cities. **Urban green infrastructure, including green buildings**, is an emerging phenomenon that is establishing new benchmarks and technical standards that embrace many NBS.*

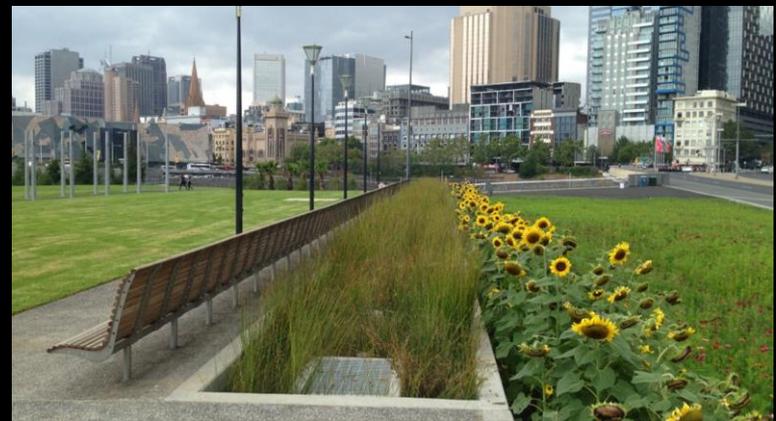
extract from Executive Summary



Cities Providing Ecosystem

Services: meaning the built environment functions to supplement and support the function of the natural environment;

- ❑ water quality improvement
- ❑ management of stormwater, greywater/blackwater as resources
- ❑ buffering aquatic ecosystems from the effects of catchment urbanisation and climate change



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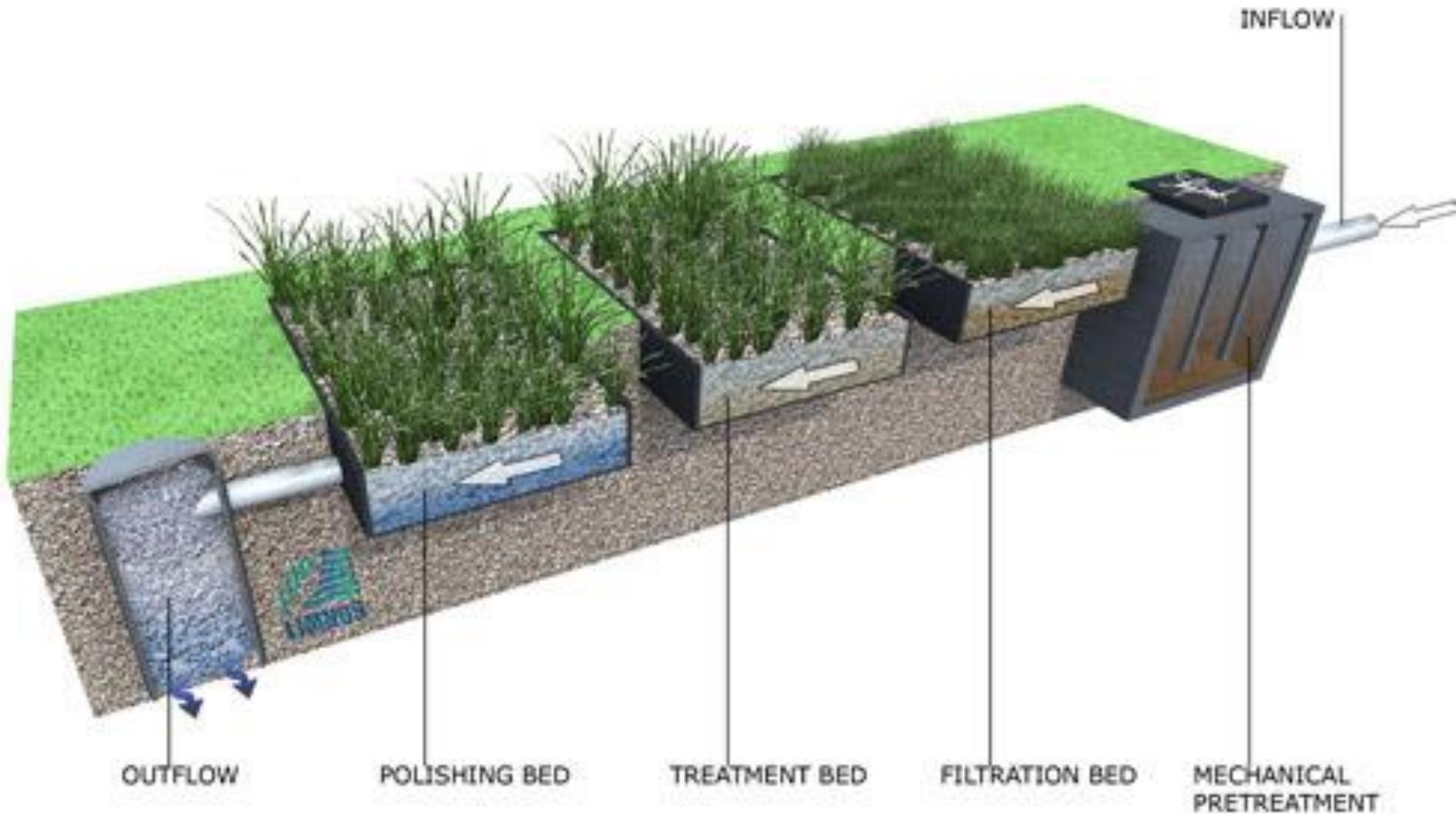


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- ❑ flood mitigation – Infiltration; Detention; Harvesting & safe passage of flood water
- ❑ influencing urban micro-climates
- ❑ enhancing urban ecology and biodiversity



Spaces in the public domain are essential features of public amenities. However, these urban landscapes must be functional beyond providing spatial amenities.

*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.*



Constructed Wetlands



CRC for
Water Sensitive Cities



Constructed Wetlands



CRC for
Water Sensitive Cities



Toilet



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Water Sensitive Cities



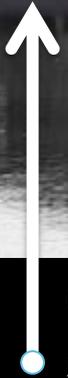
**Reticulated
collection of
sewage**



Toilet



CRC for
Water Sensitive Cities



**Communal
septic tank &
Smart Box**



**Reticulated
collection of
sewage**



Toilet





**Communal
septic tank &
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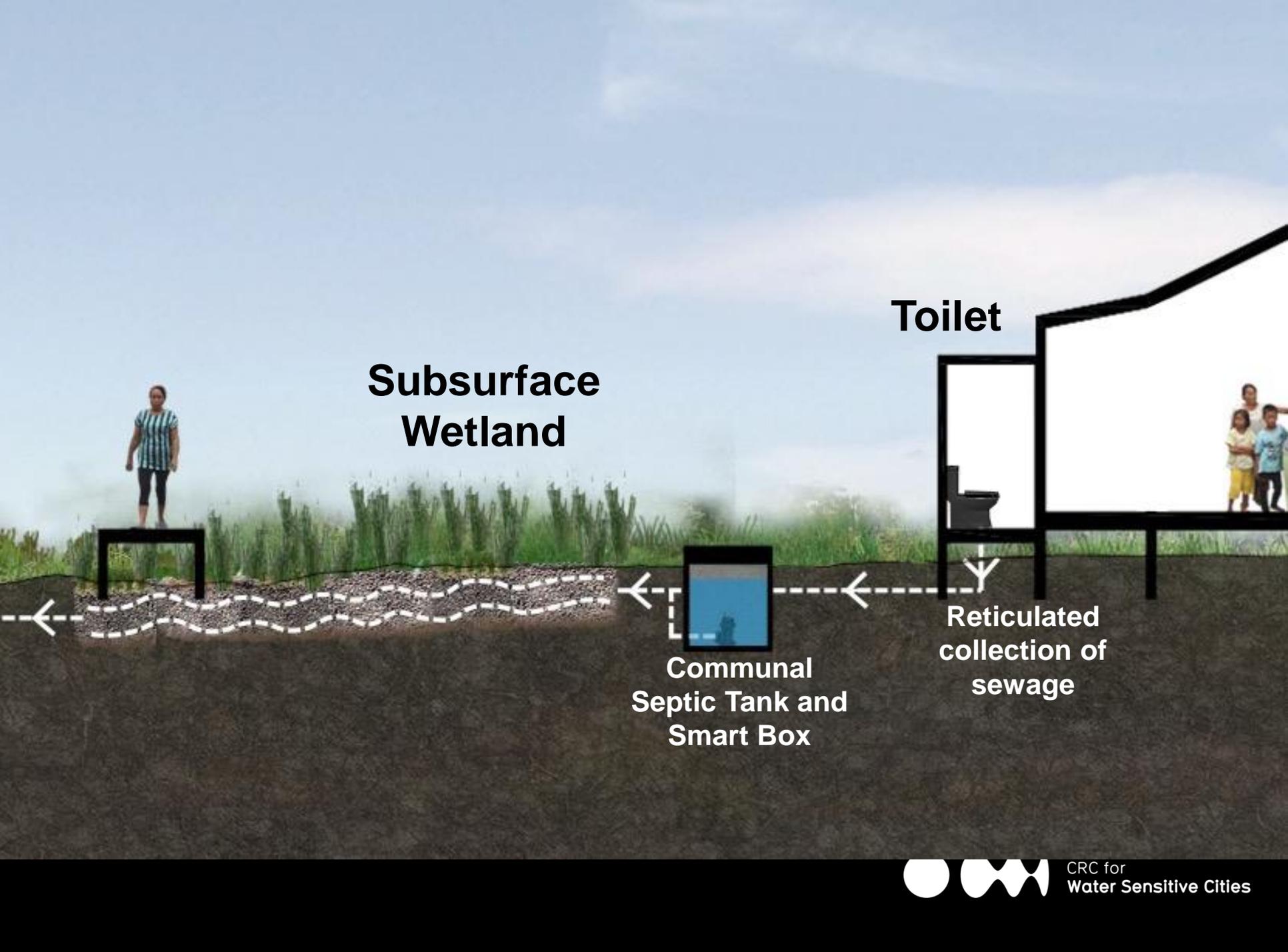
**Reticulated
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Toilet



**Subsurface
wetland &
flood detention**



**Subsurface
Wetland**

Toilet

**Reticulated
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**Communal
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Constructed Wetlands

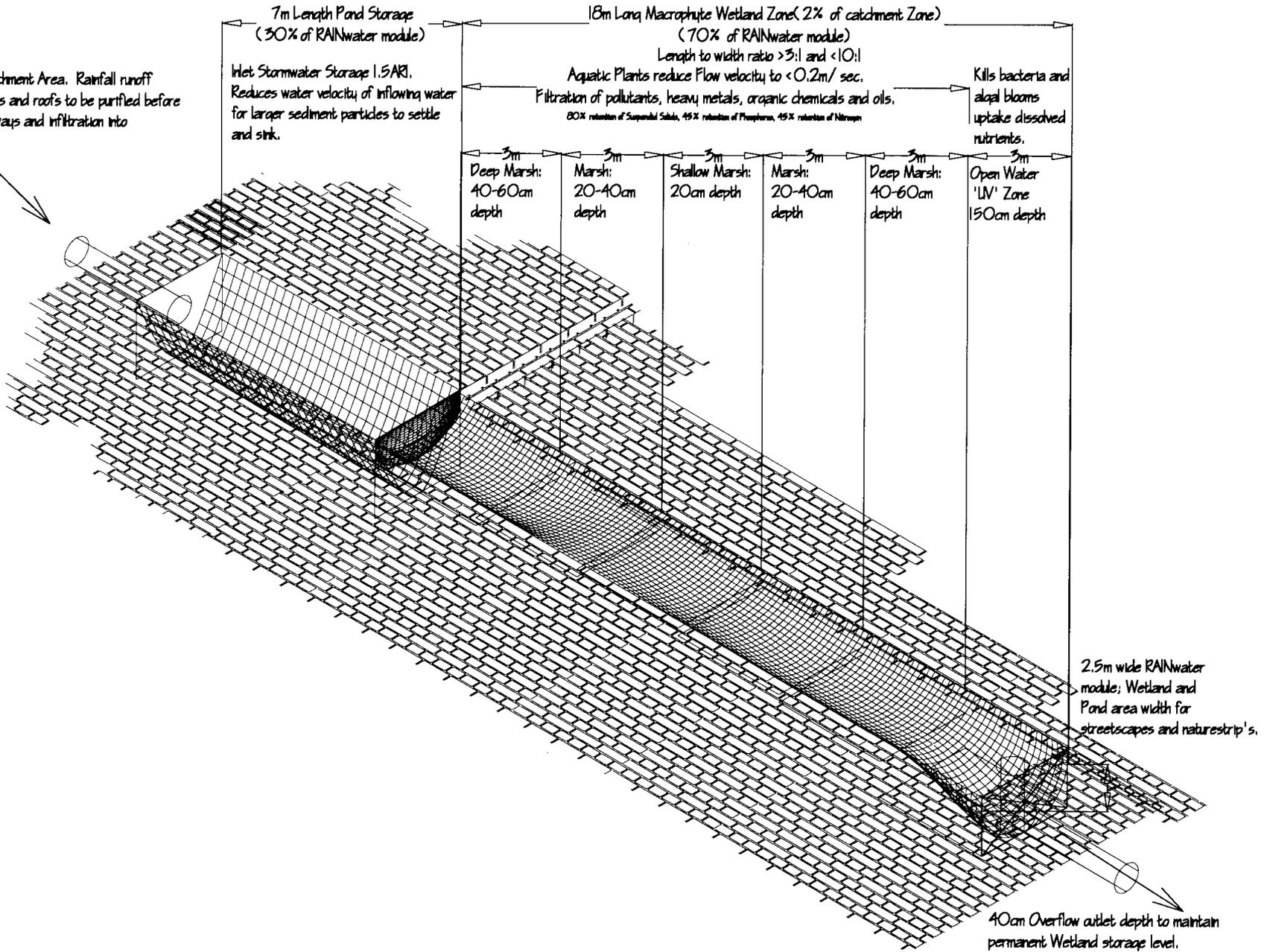


Constructed Wetlands

Hallam Wetland Experiments



2.25 hectare Catchment Area. Rainfall runoff collected from roads and roofs to be purified before release into waterways and infiltration into watertable.









What is stormwater biofiltration?

Compared with undeveloped or natural catchments, stormwater runoff from urban areas tends to have substantially larger peak flows, volumes and pollutant loads. The poor water quality and altered hydrology are both highly detrimental to the health of receiving waters (e.g. streams, estuaries, bays).

Water biofiltration is the process of improving water quality by filtering water through biologically influenced media (Figure 1). Stormwater biofiltration systems (also known as biofilters, bioretention systems and raingardens) are just one facet of a range of accepted Water Sensitive Urban Design (WSUD) elements. They are a low energy treatment technology with the potential to provide both water quality and quantity benefits.

A typical biofilter consists of a vegetated swale or basin overlaying layers of porous media. Stormwater is diverted from a kerb or pipe into the biofilter, where it flows through dense vegetation and temporarily ponds on the surface, before slowly filtering down through the filter media (Figure 1). Depending on design, treated flows are either infiltrated to underlying soils, or collected in the underdrain system for conveyance to downstream waterways or storages for subsequent re-use.

The technology can be applied to various catchment sizes and landscape settings (Figure 2), from street trees and private backyards to street-scale applications and car parks, up to larger regional stormwater treatment systems, including those in public parks and forested reserves. Further, biofilter design can be tailored to optimise performance for local conditions and specific treatment objectives.

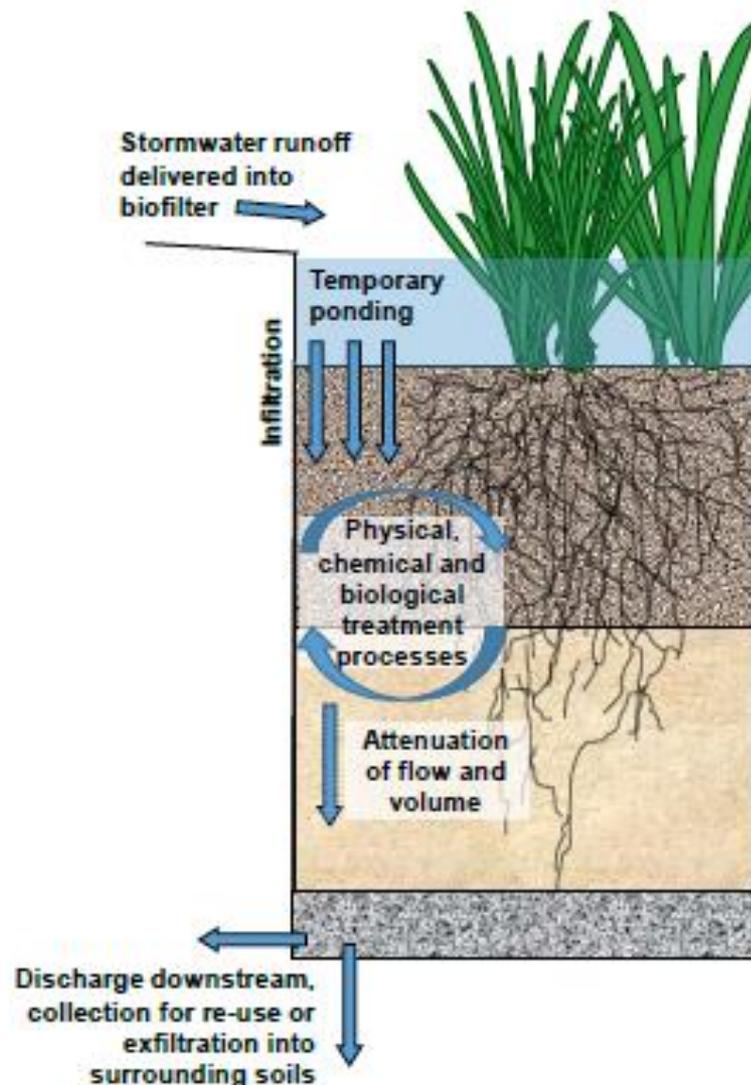


Figure 1. Key principles of stormwater biofiltration









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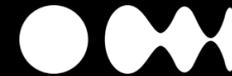




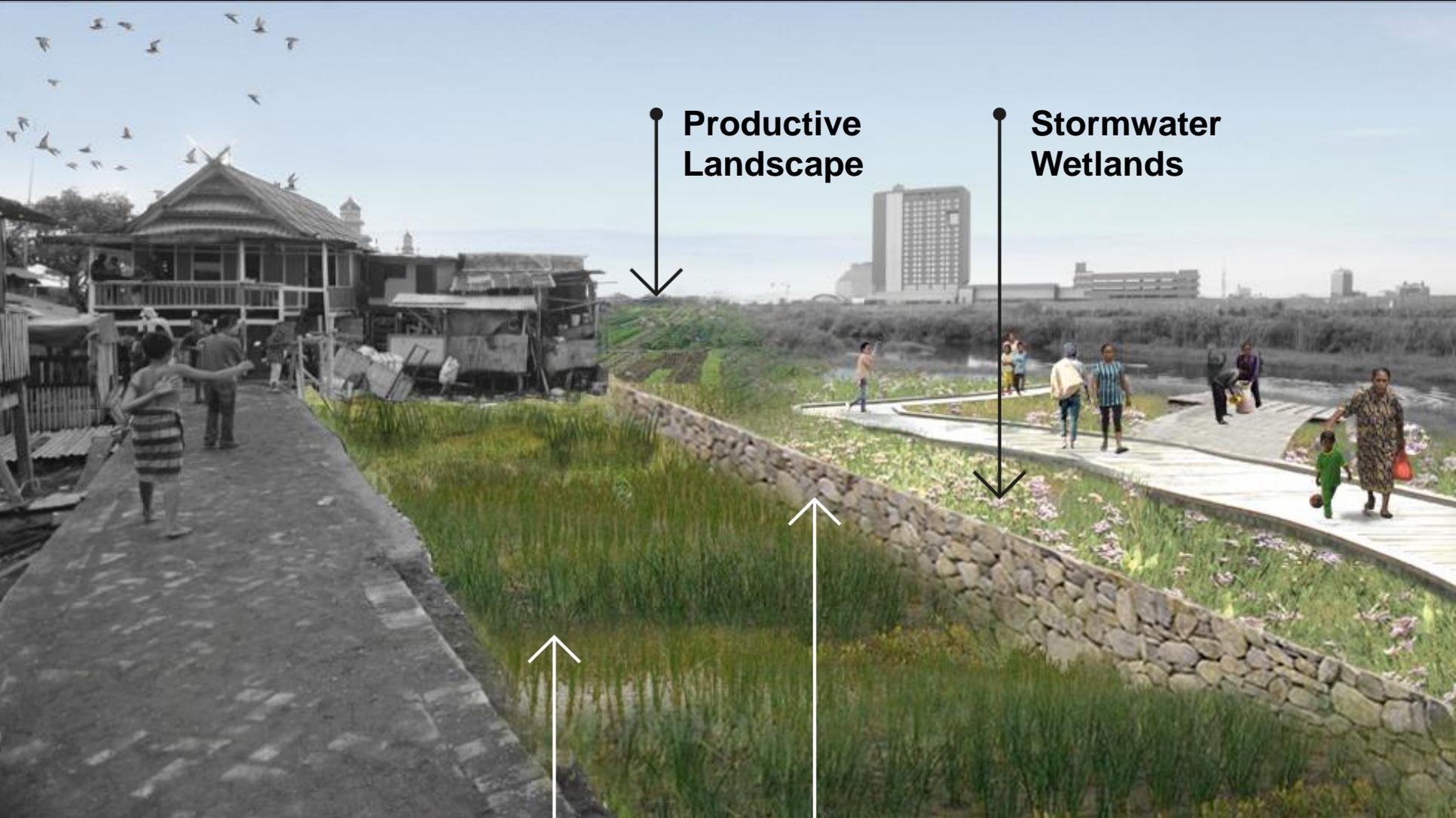
**Stormwater
Biofilters**



**Flood
Protection
Wall**



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**Productive
Landscape**

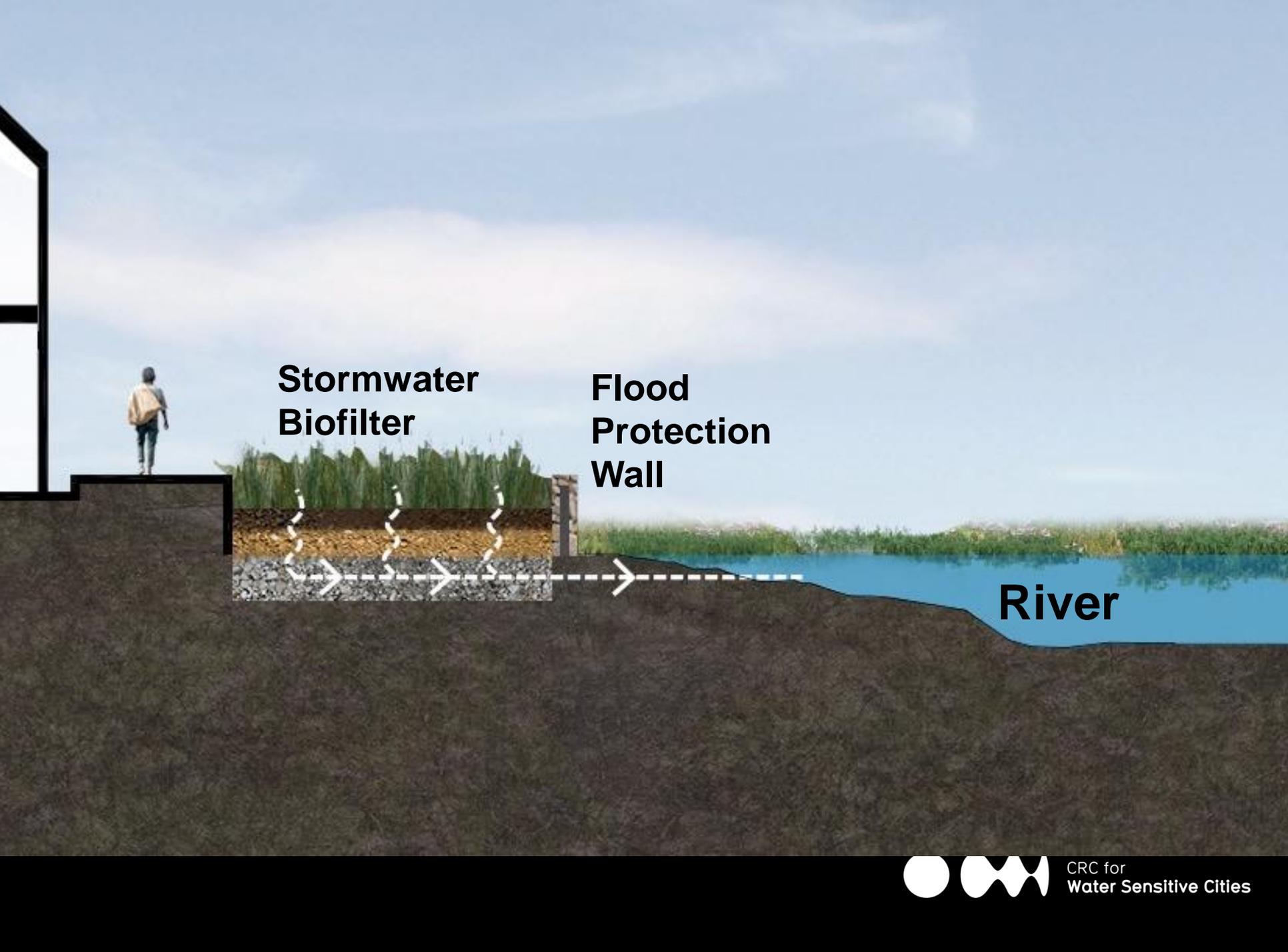
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**Stormwater
Biofilter**

**Flood
Protection
Wall**

River



2012



**Linking ecological
landscapes:** for safe
detention and passage of
flood waters





Street tree bioretention system

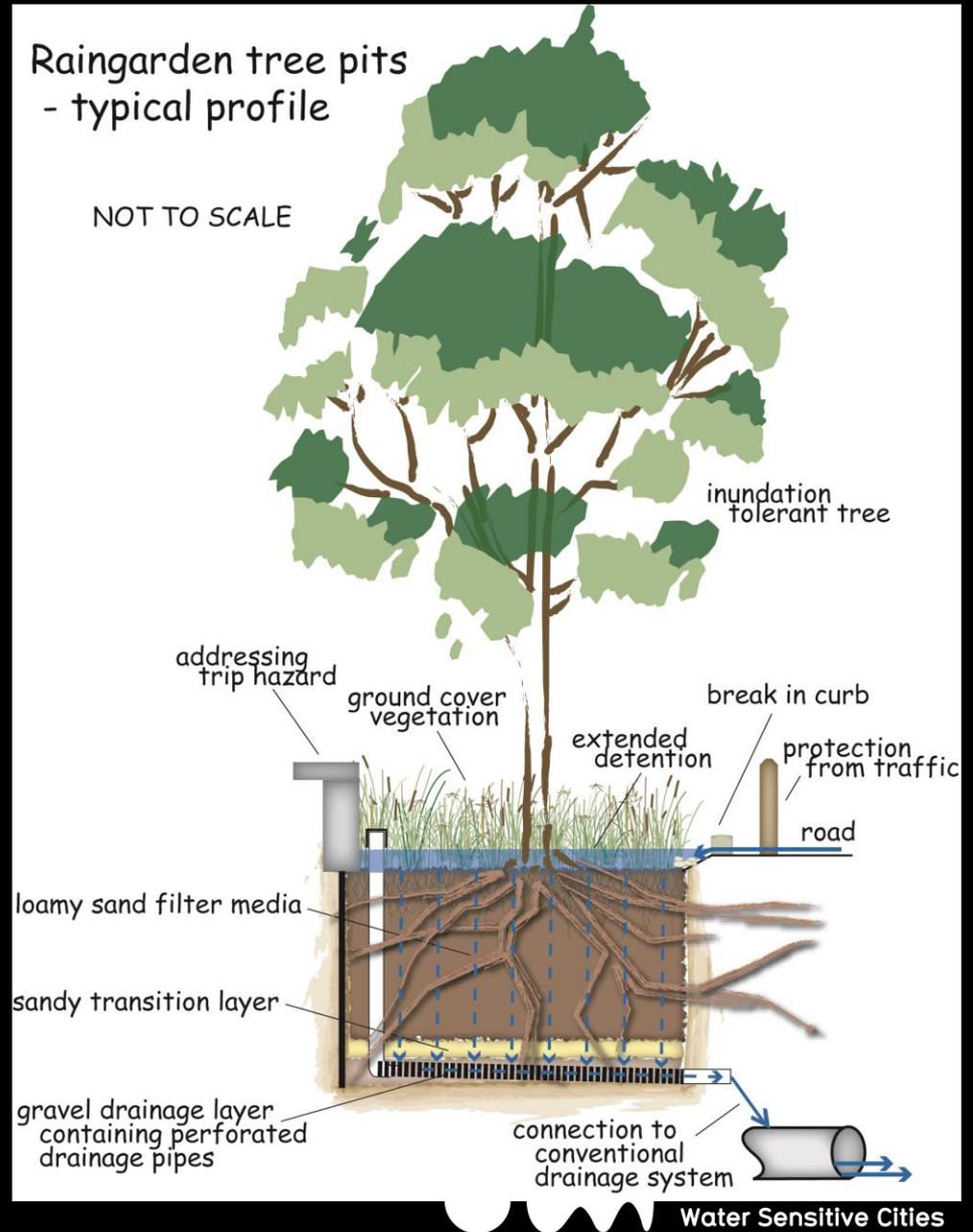


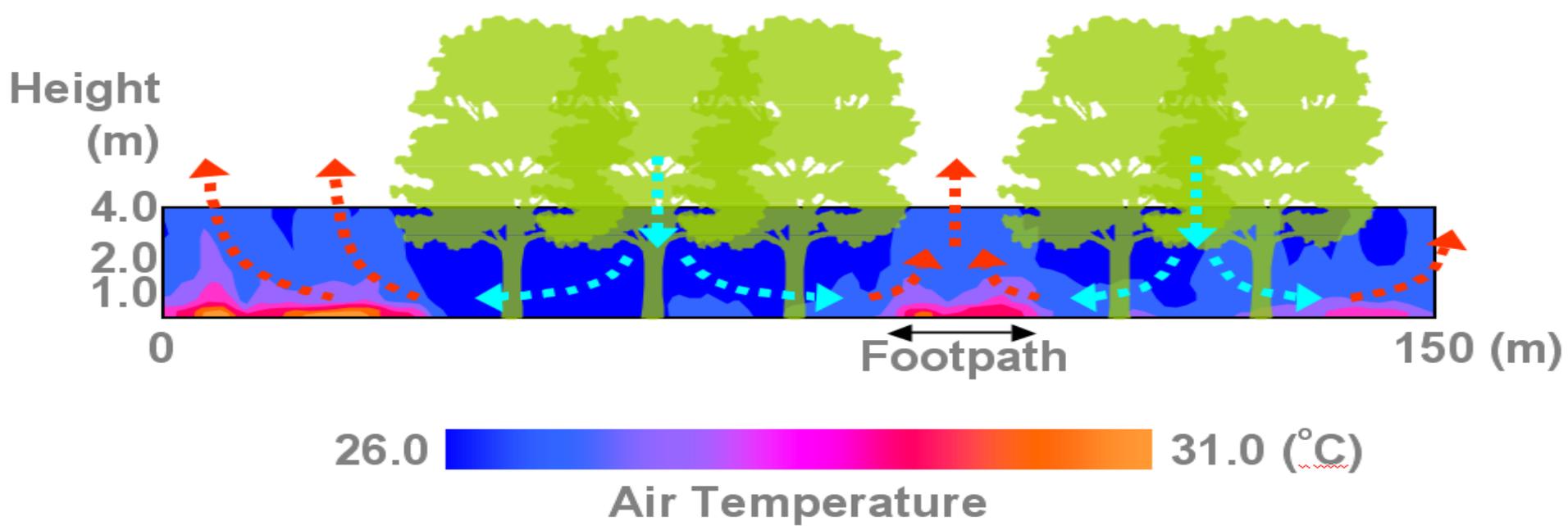
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Raingarden tree pits - typical profile

NOT TO SCALE

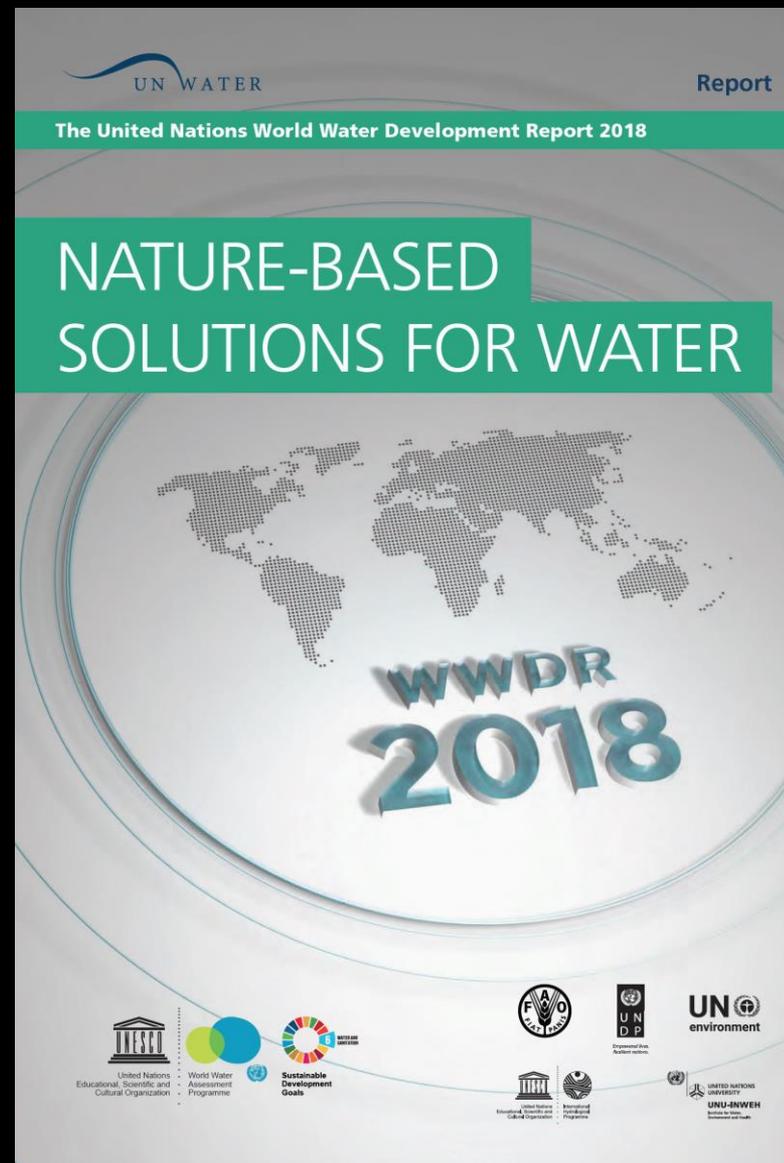




Nature-based Solutions for Water

*“A key feature of NBS is that they tend to **deliver groups of ecosystem services together** – even if only one is being targeted by the intervention. Hence, NBS usually offer multiple water-related benefits and often help address water quantity, quality and risks simultaneously. Another key advantage of NBS is the way in which they contribute to building overall system resilience”*

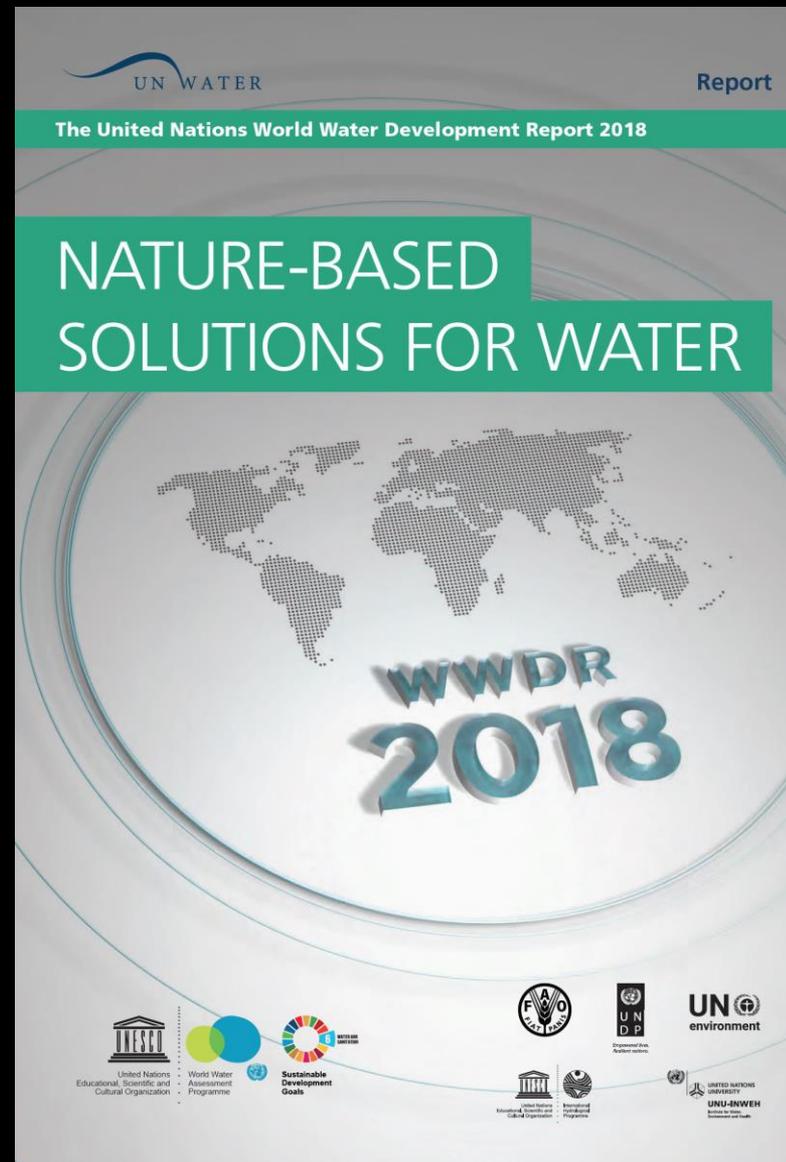
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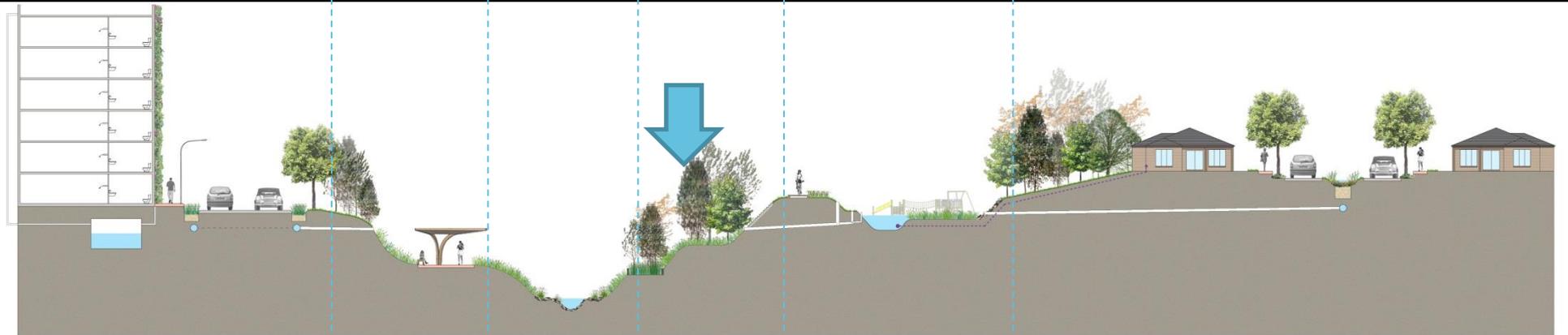
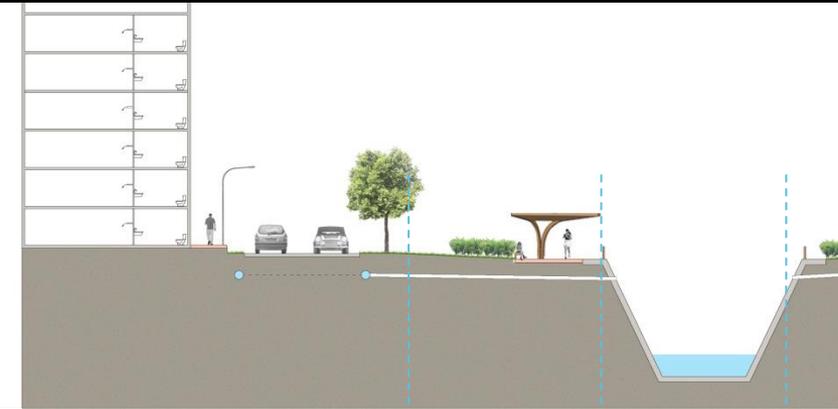


Multi-functional waterway corridors

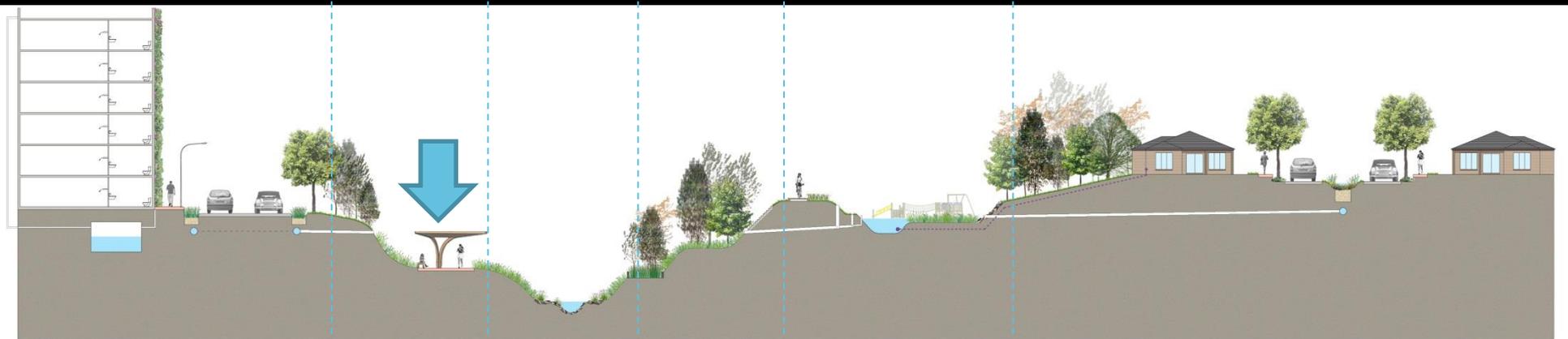
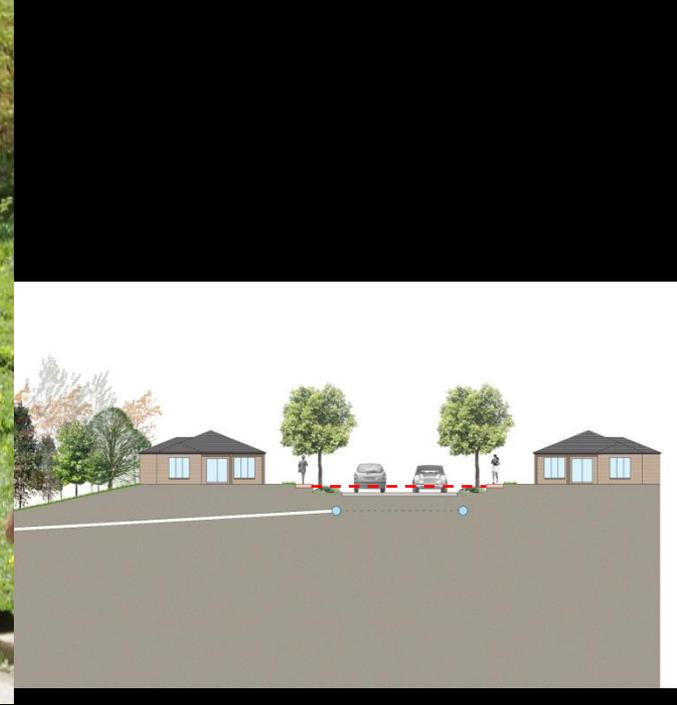


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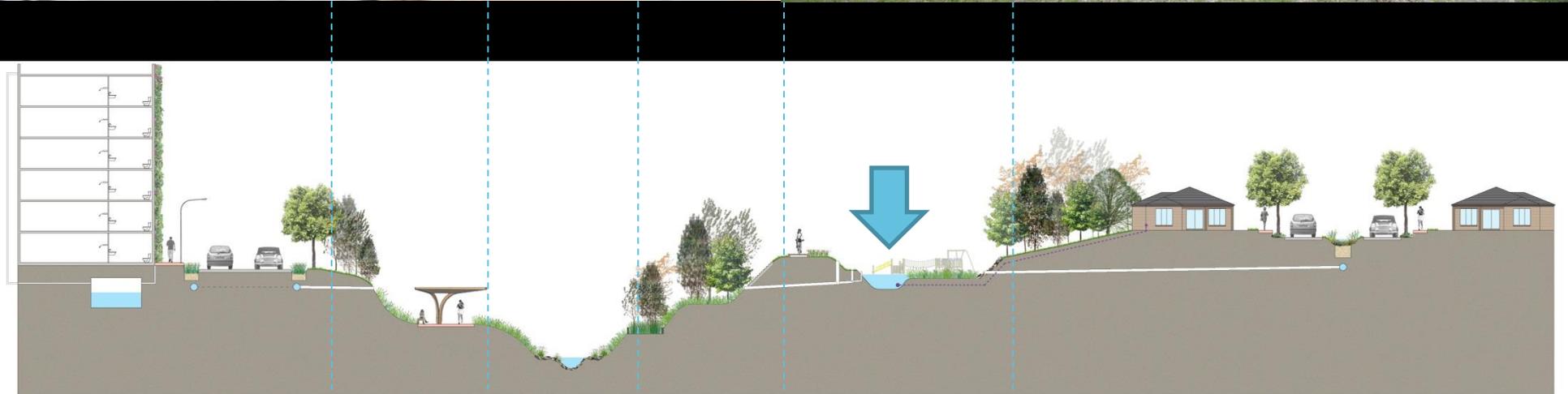
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Green Corridors as Source Control

