



## BUILDING INTEGRATED LANDSCAPE SYSTEMS

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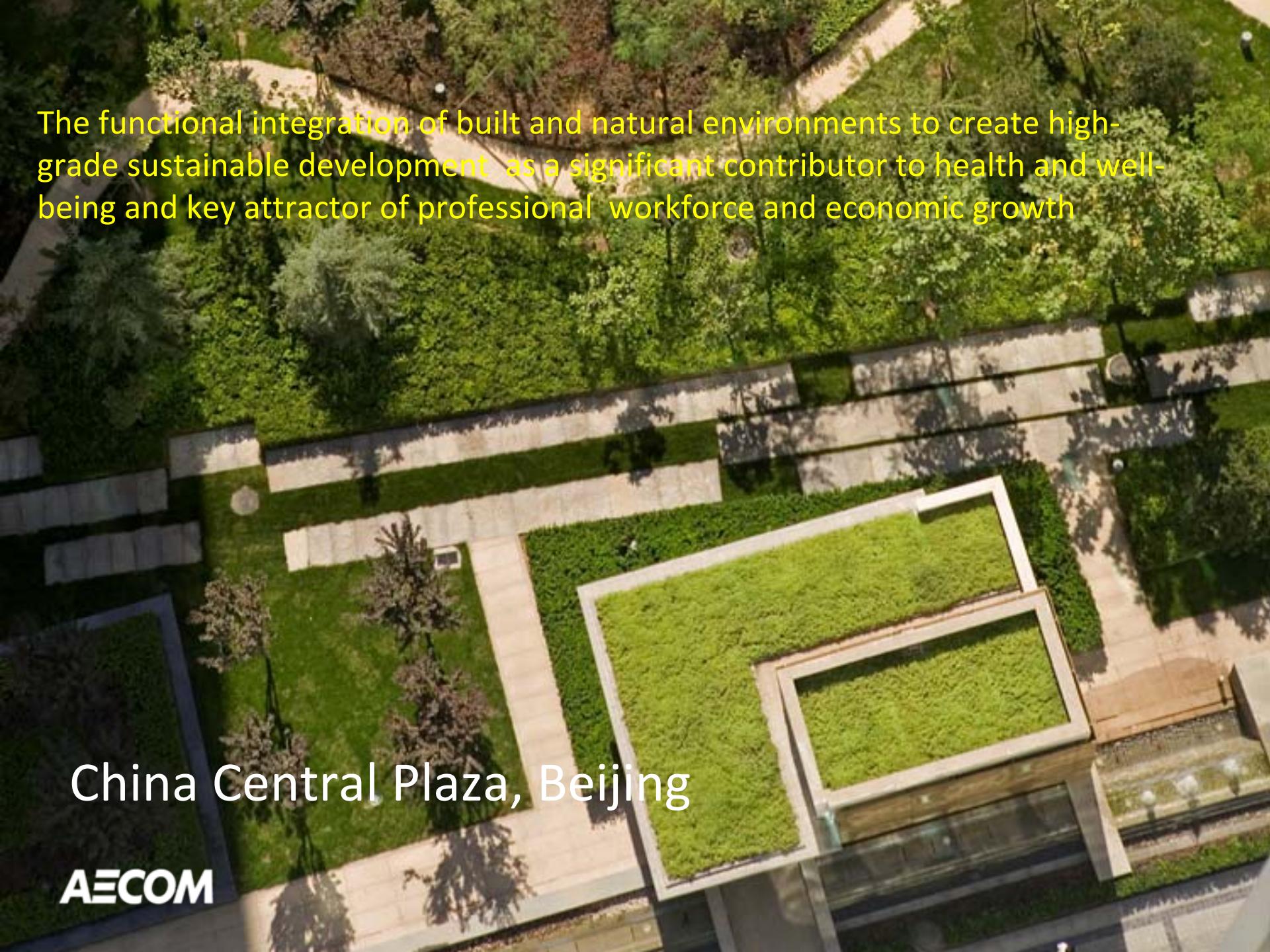
“The most important issue that faces all landscape architects, environmental planners and designers in the 21<sup>st</sup> century will be precisely the integration, perhaps by shotgun, of current economic and political thinking with ecological reality”, Garrett Eckbo, EDAW 1960



“ The only way we can make a difference in our impact on the global environment and climate is through a holistic approach to policy, planning, engineering and design, wherein we all work collaboratively towards the common goal”, Joe Brown, AECOM Design & Planning 2010.



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An aerial photograph of a modern building complex in Beijing. The building features a prominent green roof with a wooden deck area. The surrounding landscape is meticulously landscaped with various trees, including some with pink blossoms, and a network of light-colored stone or concrete walkways. The overall scene illustrates a high-quality, sustainable urban environment.

The functional integration of built and natural environments to create high-grade sustainable development as a significant contributor to health and well-being and key attractor of professional workforce and economic growth

China Central Plaza, Beijing

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## 纽约市炮台公园城

- 1)为成立新的世界金融中心所开发
- 2)计划始于七十年代后期，于八十年代末完成
- 3)由开发双子星大厦的挖方填海造陆而成
- 4)寸土寸金中的大片开放系统
- 5)如后院般的滨河公园
- 6)开放系统与建筑内庭之间的结合



## Battery Park City

- 1)Developed for the new World Trade Center
- 2)Started from mid '70s, finished in late '80s
- 3)Created by reclamation using excavated material from the 'Twin Towers' development
- 4)A large open space system in a densely developed urban context
- 5)Riverfront park as backyard
- 6)Integration between building courtyards and open space

## 伦敦金丝雀码头金融区

- 1) 伦敦市的新金融中心
- 2) 计划始于八十年代中期，于九十年代后期完成
- 3) 后工业用地开发。原为码头用地和鱼贩集散地
- 4) 开放空间与大伦敦城市肌理的充分揉合
- 5) 基础建设与开放空间的结合

## Canary Wharf, London

- 1) The new financial district of London
- 2) Started from mid '80s and completed in late '90s.
- 3) Post industrial brown field development – originally a pier and fish market.
- 4) Integration of open space with the larger urban fabric
- 5) Integration of open space as a key component of the internal infrastructure systems



# Mission Bay, San Francisco

## 三藩市教会湾再开发

- 1)后工业用地开发。原为铁路集散场。
- 2)始于九十年代初期，目前仍在建设中
- 3)有轨电车是主要的公共交通工具，并成为街道景观的一部份
- 4)充分运用公园系统进行雨水管理
- 5)中央公园道是连接开放系统与周边邻里的平台

- 1)Post industrial brown field development – originally a railroad yard.
- 2)Started in the early '90s, the development is still ongoing.
- 3)The tram is the major public transportation tool and becomes part of the streetscape
- 4)Utilises parks and green zones to manage stormwater runoff
- 5)Central Commons is the platform to connect the open space system and the adjacent neighborhood



## 东京中城

- 1)开发如同坐落于一个大公园中
- 2)充分保留既有的古老树木
- 3)着重街道生活与步行体验

## Tokyo Midtown

- 1)Developments sited within the open space network, creation of a new city park generating and totally integrated with prime economic activity of the city
- 2) Holistic integration of elements creates spaces that are welcoming and attractive, stimulating the cultural, social and economic interaction that gives the place life
- 3)Preservation of the old trees – heritage connection, conservation and identity – sense of place
- 4)Emphasis on street life and walking experience





Germany	Federal requirement, interpreted at city level. Subsidies available. Emphasis on reduction drainage charges. Green roof technical standards published in the 1970s.
Switzerland	Federal requirement, interpreted at Canton level. Emphasis on biodiversity
Linz (Austria)	Since 1985. First subsidies, now compulsory
Portland (Oregon)	Emphasis on water quality, developers get extra floor space for roof greening
Chicago	Urban heat island and energy consumption concerns
London	Guidance only. UHI and biodiversity concerns
Toronto	Urban heat island and energy savings
Tokyo	Encouragement: urban heat island and accessible greenspace issues
Singapore	'Skyrise greenery' initiative helps to extend the garden city concept



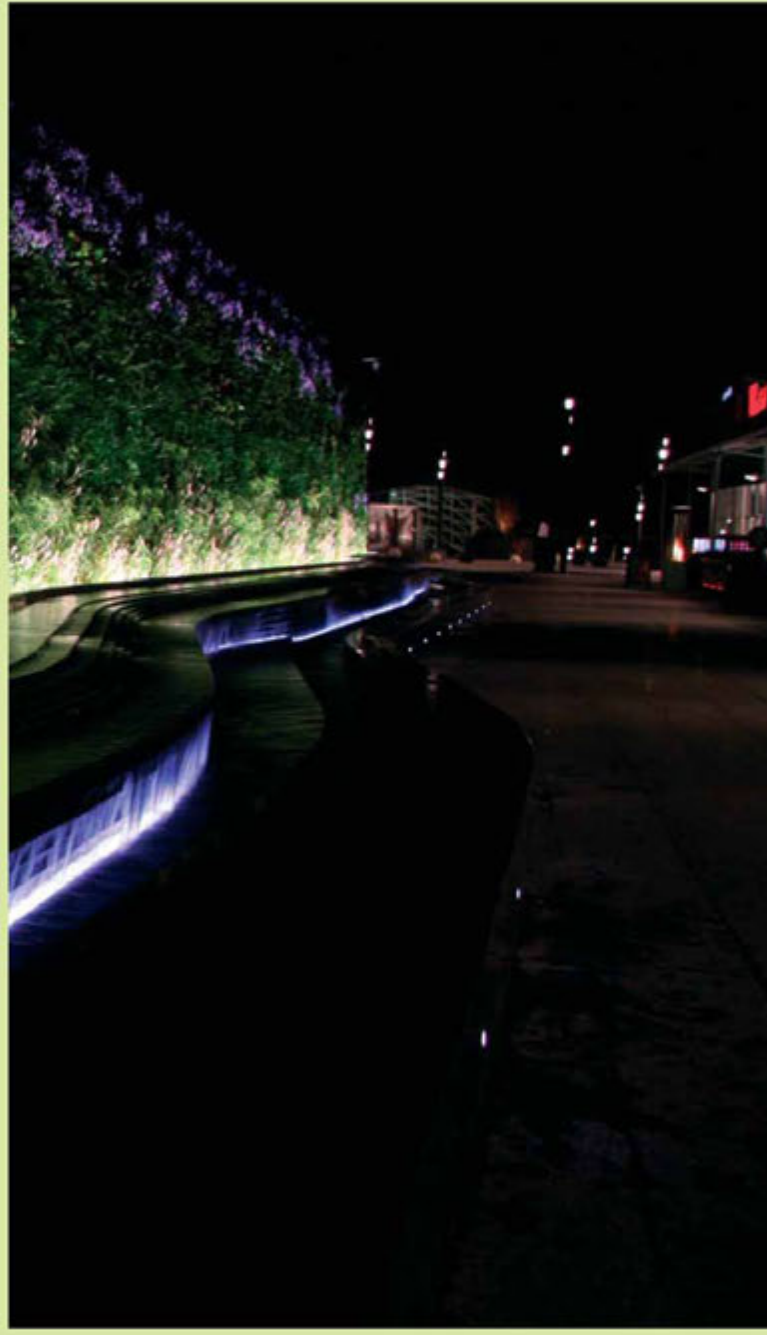
Result of roof greening in Linz, Austria since 1985



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BLACK COUNTRY

# ENVIRONMENTAL INFRASTRUCTURE DESIGN GUIDELINES





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BLACK COUNTRY ENVIRONMENTAL INFRASTRUCTURE DESIGN GUIDELINES

# GREEN ROOFS



## Introduction to the Intervention

Green roofs (sometimes known as living roofs) are deliberately vegetated roofs. Intensive green roofs are roof gardens, found on residential and substantial commercial buildings which are usually irrigated. Extensive green roofs are relatively lightweight and low maintenance with self-sustaining vegetation.



Green roofs are truly multi-functional. Typical extensive green roofs absorb 50% of the rainfall that falls on them, helping to reduce the pressure on drainage systems and the risk of flooding. Green roofs are recognised by the Environment Agency and CIRIA as a valuable component of sustainable drainage systems (SUDS). Water that evaporates from green roofs cools down buildings and neighbourhoods, helping people to cope with heat waves and the urban heat island. Green roofs save energy and reduce carbon dioxide emissions by increasing insulation and reducing air conditioning loads. Green roofs can bring valuable wildlife habitat into areas where the conservation of biodiversity is often neglected. Roof gardens provide amenity and places to relax and grow food in even the most urban locations.

## Multiple Benefits



• **Supporting Investment:** Installing green roofs helps to support the growth of green industry in the Black Country



• **Fostering High Quality Neighbourhoods:** Roof gardens and extensive green roofs will help to green districts that might otherwise be perceived as harsh environments



• **Creating Sustainable Links:** Green roofs can act as stepping stones in ecological networks



• **Protecting and Enhancing Biodiversity:** Extensive green roofs can be designed to benefit birds and rare invertebrates, including bees, which are responsible for pollinating much of our food crops.



• **Celebrating a Sense of Place:** Green roofs can bring a new attractive look to otherwise generic 'anyplace' buildings.



• **Supporting Healthy Living:** Green roofs can bring psychological benefits for those who overlook or use them. Roof gardens can be used to produce local food



• **Managing Resources Efficiently:** Green roofs conserve energy and prolong the life of the waterproofing on a roof. They also help to maintain water and air quality.



• **Building Resilience to Climate Change:** Green roofs help to reduce the urban heat island effect and are part of sustainable drainage systems.

## Introduction to the Intervention

There are serious surface water flood risks in the Black Country. There are also serious water pollution issues in the canals and waterways. Therefore measures which help to capture, store and treat runoff after it rains will help to protect property and waterways from both flooding and pollution.

Urban wetlands are a type of Sustainable Urban Drainage System (SUDS) that act to store and treat water while also providing valuable habitat and amenity. Urban wetlands are constructed, and can be sized and designed to suit their contextual surroundings. The wetlands can be lined and have a hard edge to suit commercial or industrial surroundings, though the soil and vegetation layers are specifically designed to provide water filtration.

The Black Country has a lot of commercial and industrial areas where softscape water management features may not be suitable. Urban wetlands can be accommodated in 'lost spaces' in these areas, and may be linear or irregular in shape, capturing runoff from

several surrounding properties (directly from roofs and paved surfaces).

SUDS will be required on all new development sites under the Flood and Water Management Act 2010, but there is a very apparent need to also retrofit SUDS into existing areas, particularly areas with a high portion of paved surfaces where runoff volumes are considerable.



## Priority Areas

Surface water flooding is an issue across the Black Country due to the high proportion of impermeable surfaces which create runoff when it rains. Streets and roads generate a high quantity of runoff, polluted with sediments, oils and heavy metals, which then drains to local waterways and canals. The introduction of Sustainable Urban Drainage Systems (SUDS) will help to alleviate flood risk and lessen water pollution, and should be implemented across the sub-region. Street raingardens are a type of SUDS that should be focussed on in the Black Country. The following criteria should be used to identify streets and roads that should be given higher priority:

- Streets or roads where changes to the streetscape are proposed for other reasons, including introduction of traffic calming measures or public realm where raingardens or treepit raingardens could also be introduced as water management features.

- With preference given to residential areas, where street greening would benefit house values and amenity,
- Where communities would like to get involved in the implementation and management of raingardens on their street,
- Rain gardens should be prioritised in areas where there are known issues with surface water flooding,
- Which act as a walking or cycling link, where additional greening would support greater use
- Streets or roads that coincide with key ecological corridors, where raingardens and street trees could be integrated with a wider habitat network.



## STREET RAINGARDENS

### Key Design Principles

**Design** – Street raingardens should be sized to provide adequate capture of water after a rainfall event, but also to allow for a high level of natural water treatment to take place. As a rule of thumb, urban wetlands should be between 2-5% of the impermeable area it drains (the area of roofs and paved space it will capture water from). Raingardens or other SUDS features should be sized by an engineer.

**Streetscape Integration** – Raingardens should be integrated into appropriate spaces within a streetscape. Verges can be used on either side of a street, or for more efficient construction, one central garden can be used in a central reservation. Traffic islands and roundabouts can also be converted to raingardens to create an attractive yet functional landscape. The underground filtration layers and piping beneath a raingarden mean that they need to be carefully placed in relation to other underground utilities.

**Inclusion of Street Trees** – Street trees can be incorporated into a raingarden and runoff can therefore be used to passively irrigate the tree. A tree pit can also be designed as a small raingarden, gathering runoff and passing it through vertical filter layers.

**Water Treatment** – The wetland should be vegetated with plants that can cope with both wet and dry conditions, which assist in water treatment, which are native, and which contribute to amenity. The soil layers beneath the rain garden should be specifically designed to allow rapid draining (with a highly permeable layer on top), but also to aid treatment (with sand filtration layers). A gravel storage area with a perforated pipe should be included as the bottom layer to capture water and direct it to either a reuse need or to the wider drainage network.

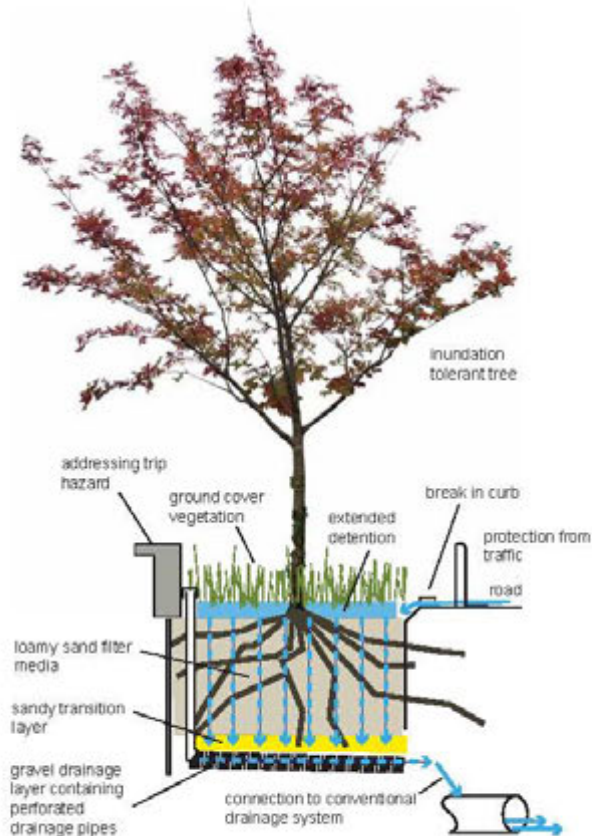


Fig 9.1 Raingarden Tree Pit - Typical Section

**Soil Contamination** – Where land may be contaminated, raingardens should be lined with a geomembrane to ensure water does not contact contaminated soil and subsequently infiltrate groundwater supplies.

**Adoption and Maintenance** – Under the Flood and Water Management Act 2010, unitary authorities will be responsible for adopting SUDS features. Private owners can also take responsibility for adoption and maintenance.



An aerial photograph of a city, likely Shanghai, showing a dense urban grid and a prominent river winding through the center. The image is in a sepia or brownish tone, giving it a historical or archival feel. The river is the central focus, with buildings and infrastructure on either side.

## 机遇的把握 Opportunities

发展时机：城市的重大转型期

城市本底：后工业用地

景观价值：滨水空间

地域便利：交通枢纽

发展愿景：世界金融区

Timing : Major Transformation of the city

Base : Post-industrial land

Value : Waterfront

Convenience : Transportation hub

Vision : World Financial Center

Green infrastructure systems at the heart of new city redevelopment and the key to meeting its enhanced social, environmental and economic objectives

# 于家堡金融区启动区总平面图 Master Plan of Mobilization Area

塘沽南站再开发  
Tanggu South Station  
Revitalization

交通公园  
Transit Park

中央大道  
Central Boulevard

先期启动区  
Primary Area



# 金融区先期启动区总平面图 Master Plan of Primary Area

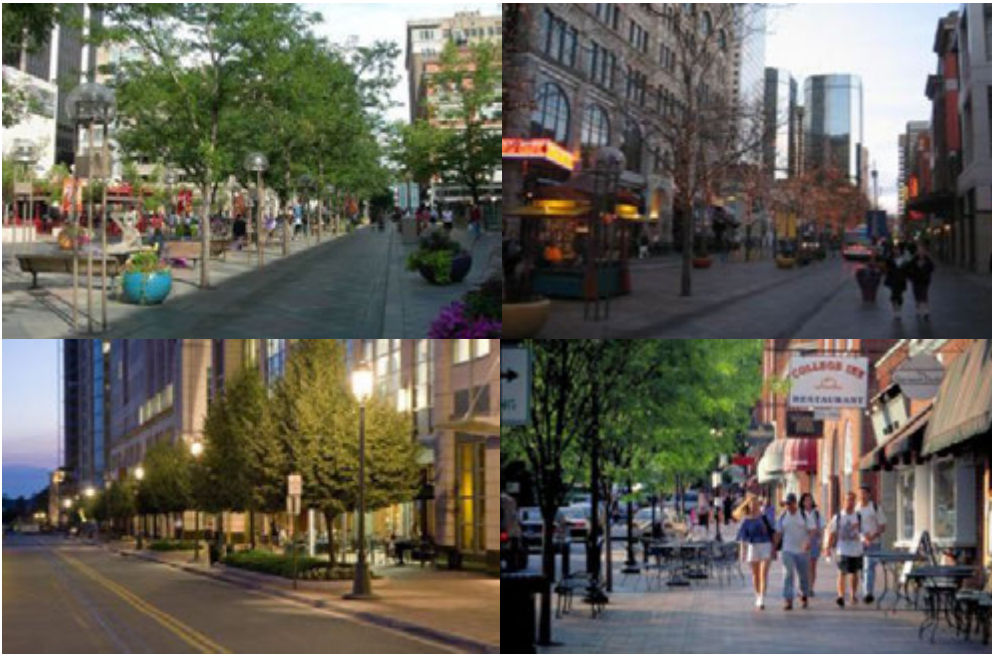
- 北部公园  
North Park
- 滨河公园  
Riverfront Park
- 步行街  
Pedestrian Streets
- 南部公园  
South Park



# 街道生活

## Street Life

- 街道不仅是路过的地方，更是能驻足而让生活有个喘息的去处
- 道路的特色是建立在人们对这些街道的使用



- 1)The streets are not only places for movement and circulation; moreover, they are places for relaxation and enjoyment
- 2)The characters of streets are built upon pedestrian usage and the activities they generate



## 建筑与开放空间的互动

# Interaction between Buildings and Open Space Systems

利用每个地块建筑均提供了内庭的条件，建筑内庭与街道景观间的联系应适度地强化，使行人乐于使用建筑内庭，开发更多的行走路线，更进一步丰富了街道生活。

Taking advantage of the condition that all buildings within CBD will provide courtyards, the connection between building courtyards and the streetscape shall be emphasized to encourage pedestrians to use the courtyards, to explore more routes to their destinations, interact with their surroundings and enrich street life.

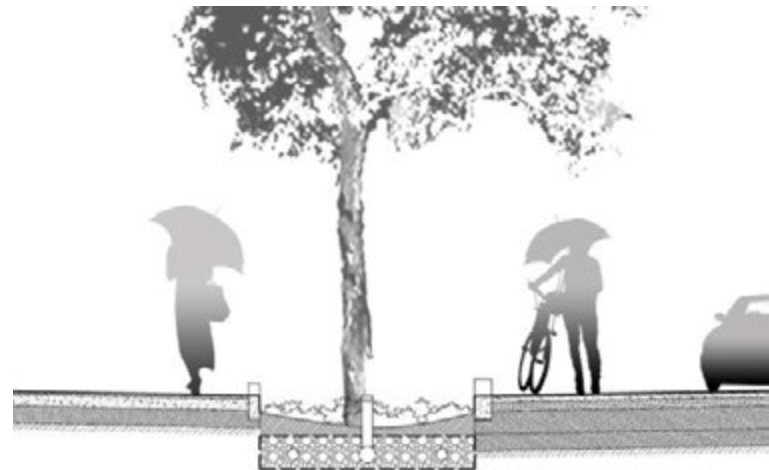


## 街道为雨水收集系统的一环

# Streets for Runoff Collection and Re-use

运用路旁的绿化带，雨水径流透过边沟收集于此，透过绿化带的土壤层将表面径流净化，再汇流到城市的雨水排放系统，减轻被排放处的污染负担。

Use the planting zone of the sidewalk to collect the runoff from streets and paving. Through the soil the water can be cleaned and re-used for irrigation before it is discharged to the municipal stormwater piping system. This process relieves the burden on the municipal systems for stormwater drainage and discharge, water supply and treatment.



# 公园为雨水收集系统的一环

## Parks for Runoff Collection and Re-use

除了街道系统之外，于家堡的公园，绿带等城市开放空间系统，都可以运用为整体雨水管理规划的一部分。公园的下方可置储水槽，将净化过的雨水回收做灌溉使用。

Besides the street system, the parks and the green zones can also be part of the stormwater management. Cisterns and storage tanks can be installed below grade inside the parks to recycle cleansed runoff for irrigation.



→ 汇水方向 RUNOFF DIRECTION  
● 雨水花园 RAIN GARDEN

连续不断的开放空间  
**Uninterrupted open space**





提升步行体验

Enhance walking experience



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运用景观元素体现可持续发展  
**Sustainability within Landscape Elements**



# Greening Master Plan

# 綠化總綱圖



# Stages of GMP



## Short-term measures

- conforming to existing layout of the districts
- make full use of the **existing space** for greening
- can be implemented within **1 to 2 years**



## Medium-term measures

- to be implemented in **association with other developments**, requiring **private participation** or involving complex **design/management** issues like roof greening



## Long-term measures

- greening **vision** setting aside existing constraints
- ambitious and **innovative** approaches  
e.g. green corridors



Before



After

# Central Murray Road

# Maximize Greening Opportunities

## Vertical Greening



- Climbers were planted against vertical walls
- Tall palms and shrubs were planted to screen vertical walls





Vertical Greening in it's Simplest Expression



*green wall*

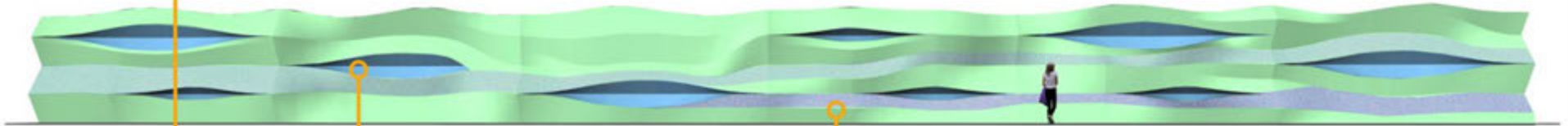
140x4m - double sided in places



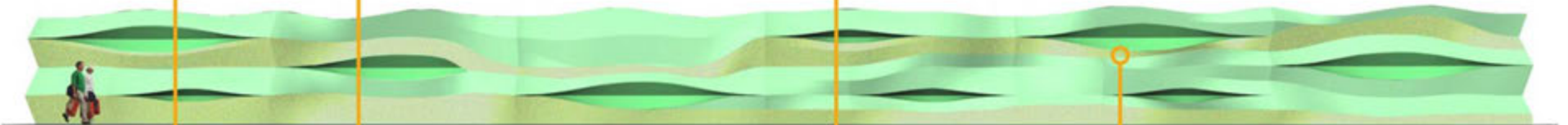




winter



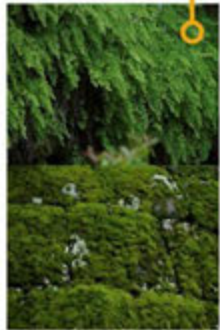
spring



summer



autumn



ferns and moss



wood anemones



violets



epimedium



periwinkle



psedofumaria



cyclamen



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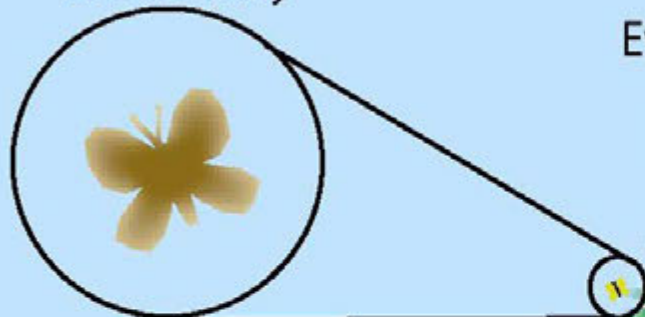


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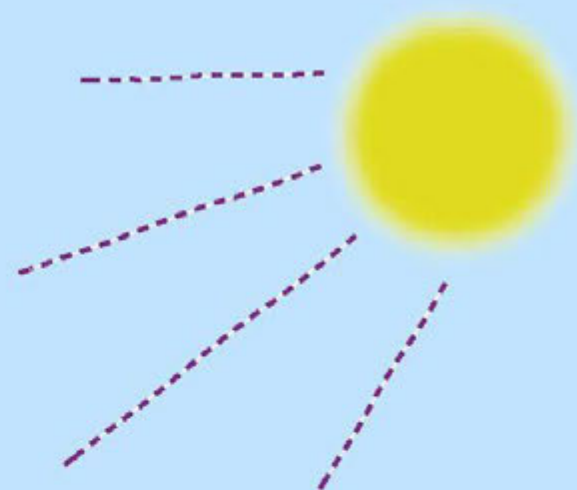
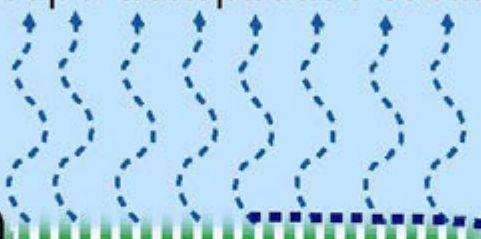




Biodiversity

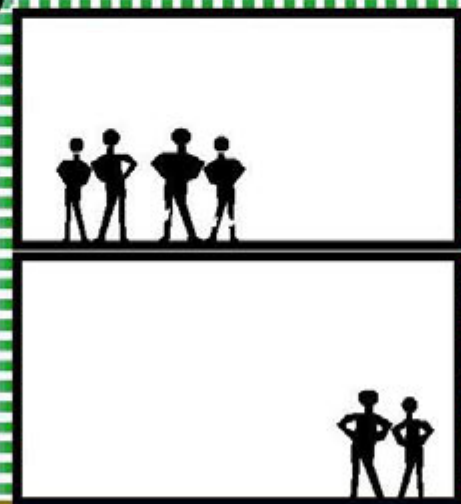


Evapo-transpirative cooling



Protection from UV radiation

Thermal insulation



Tranquil view



Attenuation of rainwater runoff

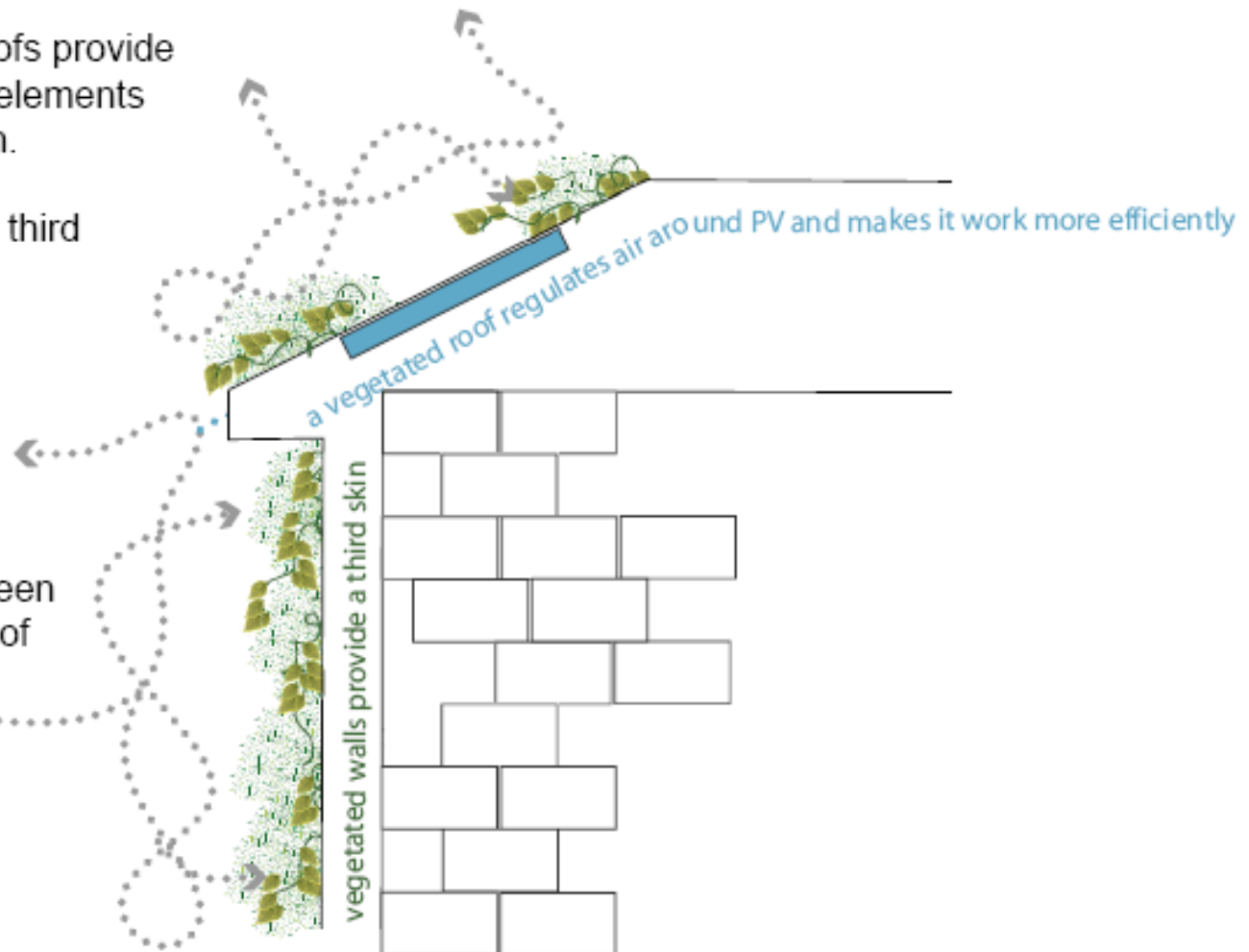


# Building-integrated vegetation benefits

# Thinking about the Exterior: Green Roofs + Vegetated Walls



- ★ Green Walls and roofs provide protection from the elements and reduce pollution.
- ★ They also provide a third insulation skin.
- ★ PVs work well with green roofs
- ★ Photovoltaic panels can be used in combination with green roofs. The green roof regulates the temperature and makes the PV more efficient.





# Singapore Sports Hub – Singapore

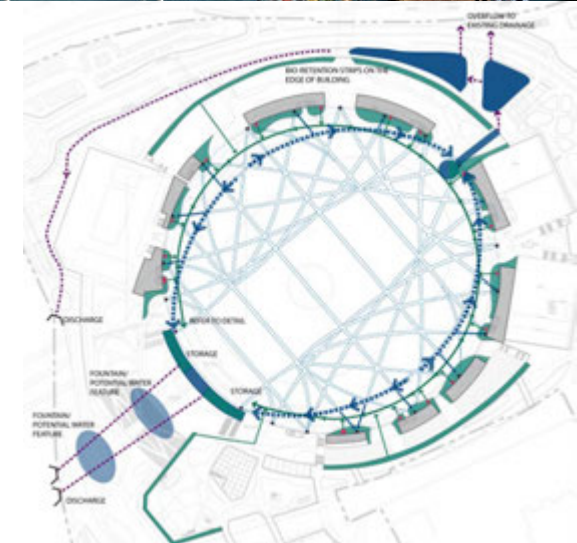
## Client: Dragages Singapore Pte Ltd

AECOM has been involved in the schematic design of a non-conventional storm drainage system integrated with productive landscape and rainwater harvesting

The system aims at reducing potable water consumption, minimizing system maintenance and operating cost through the use of green infrastructure that functions as a natural treatment system

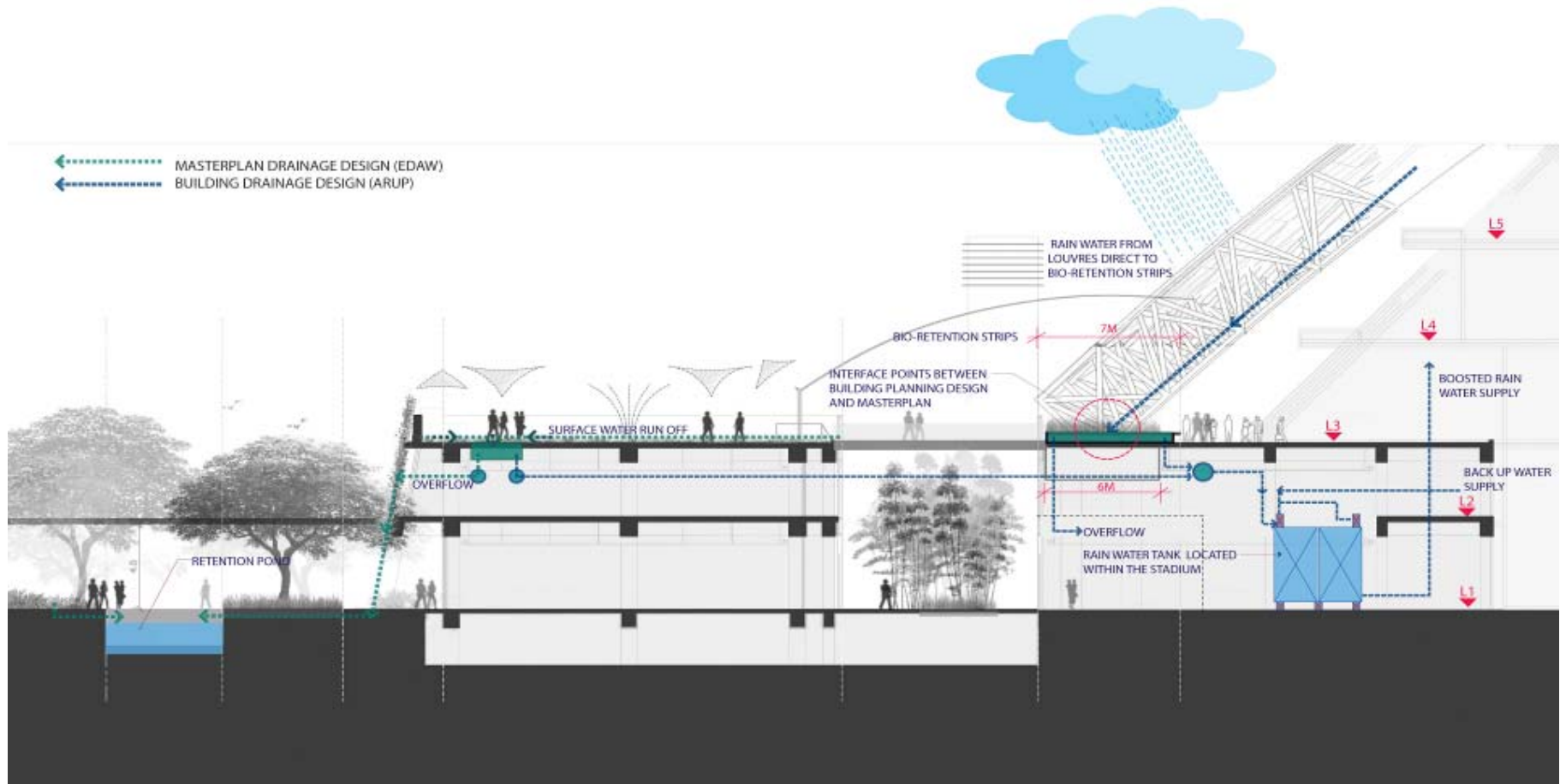
The design demonstrates commitment to sustainable design alternatives and helps achieve high Greenmark recognition

Estimated total saving related to reusing harvested water is on the order of S\$ 200k per year

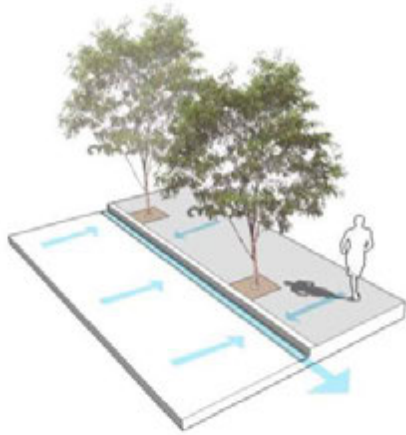


# Singapore Sports Hub – Singapore

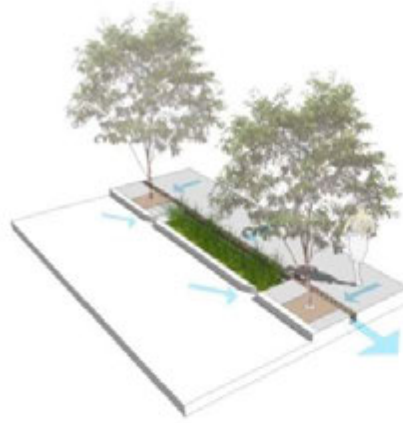
Client: Dragages Singapore Pte Ltd



# Stormwater runoff management



Gutter Flow



Streetscape  
bioretention planter



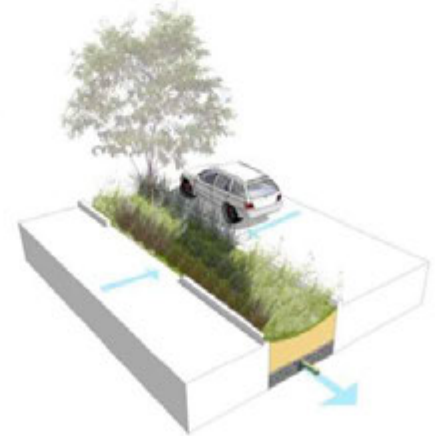
Bioretention basin



Plaza bioretention planter



Constructed wetland



Median bioswale

# constructed wetlands



# constructed wetlands



# Building Integrated Landscape - Tianjin

