



RAINDROP TO RECHARGE: URBAN STORMWATER SOLUTIONS THAT “WORK WITH WATER”

The Use of Modular, Geo-Cellular Product - LID Flexibility and Scalability

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Rain Drop to Recharge: Urban Stormwater Solutions that “Work with Water”





URBAN SURFACE & SUBSURFACE STORM WATER "FLUID DESIGN"

GREEN INFRASTRUCTURE _ RETROFITS TO CONCRETE & PIPE

UTILIZE ASPECTS OF HYDROGEOLOGY TO REDUCE STORM WATER FLOW

PERMEABLE (POROUS) CIVIL & STRUCTURAL SOLUTIONS

"LEGO" STYLE GEO-CELLULAR PRODUCT VERSATILITY IN STORM WATER CHANNELING, ABSORPTION AND HARVESTING

BIO ENHANCED (QUALITY) FILTERS - NATURE'S WATER TREATMENT

CLIMATE CHANGE RESILIENCY THAT ADDS 'PORE SPACE'- UPSTREAM

Sponge City Design

Respects natural water courses, past & present.

In new development or urban retrofit, incorporate the multiple paths water can take, using tabling panels and channeling 95% void crates.



Restores natural hydrogeological channels, by scaling the amount of void absorption needed to offset impermeable roofs, road and grade flow.

Creates healthy cities that value water and its benefits as a resource for sustainable urban living.



Realities for Retrofit

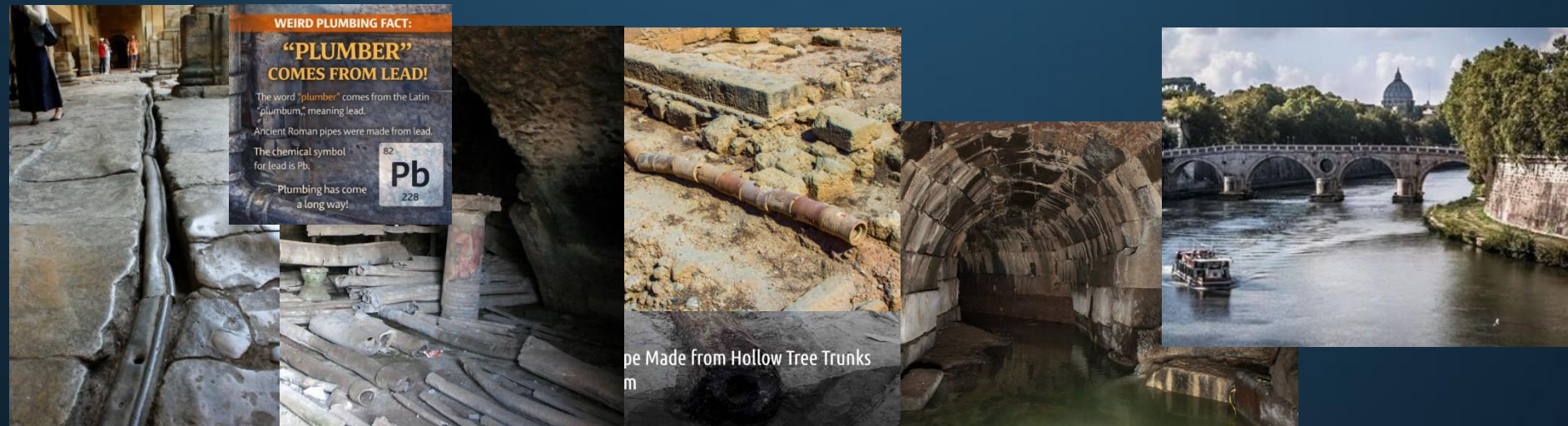
- Retrofit Goals: to deliver multiple benefits, increase resiliency, add value to our investment, support sustainability, water capture, water quality & green ecology.
- Realities – specific site challenges:
 - Interface with existing infrastructure (at capacity)
 - Contaminated soils
 - High ground water or depleted ground water
 - Topography - sloping sites or very flat sites
 - Unstable rock bed or soil mix
 - Flood plains / urban creep
 - Road runoff
 - Cold weather vs drought patterns
 - Zone tolerant plant selections
 - Maintenance
 - Budget

Roman Pipe Design = Civil (Hydraulics), Supply and Drainage

What a Sponge City is not - Pipe Controlled Water Channels - historically driven design: using hollowed tree, pottery pipe (Bronze Age), Lead, ("PlumBum"), Cast Iron, concrete or plastic pipe that move water.

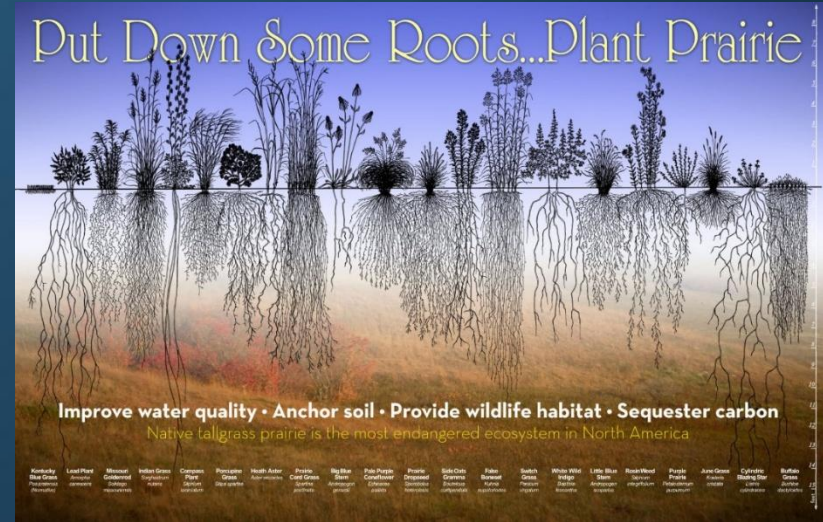
Aims to not use "material" that contaminates, through leaching or corrosion. Some say "the ultimate fall of Rome" based on the levels of lead found in humans (tooth enamel & bones) - and storm water fall outs.

Rome – "La Citta eternal!" challenged by multiple floods, burnings and geological land slide threat on the Tiber and coast. Old infrastructure of concrete channels, and controlled upstream dams.



Nature's Uptake & Recharge 'Pipes'

Eliminates soil saturation with restored porosity.



Vertical and horizontal deep roots of trees with canopy, bushes and grasses for phytoremediation, paths to underground water pathways and less erosion. Keeps the soil healthy, with structure, nutrients, microbes & cooled temperature.

WATER SENSITIVE SOLUTIONS – “MUSIC” MODEL

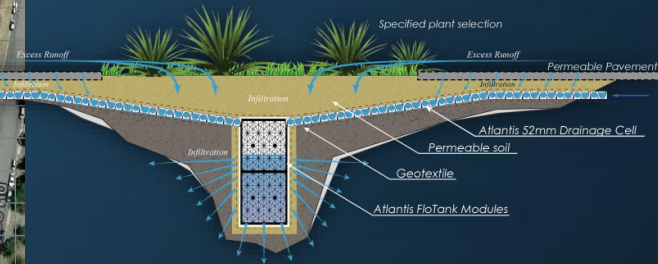
- Bio-Absorption – Surface (Plant Uptake of Water)
- Bio-Filtration Systems – Rhizo & Microorganism Habitat
- Bio-Retention Systems + Subsurface Void, Passive Irrigation
- Onsite Detention / Recharge / Rainwater Harvesting Tank



(Retrofit - add permeable channels & underground void – heighten porosity)

Case – Green Roofs and BioSwales

Cassola Place, Penrith
NSW 2750



Water Quality + Biodiversity

WATER SENSITIVE SOLUTIONS

- Bio-Filtration w/ all direction panel / flow through
- Green Roofs w/ high compressive drainage panels
- Vertical Gardens w/ soil for roots
- Permeable Surfaces w/ underdrain
- Rainwater Harvesting & Grey Water Reuse (circular value) - to reduce pressure on fresh water supply.

- ✓ Total suspended solids loads by 85%
- ✓ Total phosphorus loads by 65%
- ✓ Total nitrogen loads by 45%

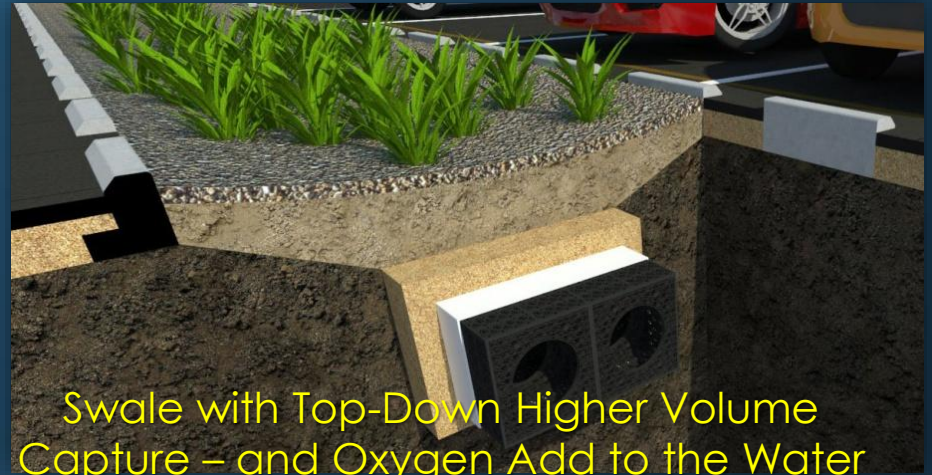


Add zone-accurate vegetation for increased uptake & filtering

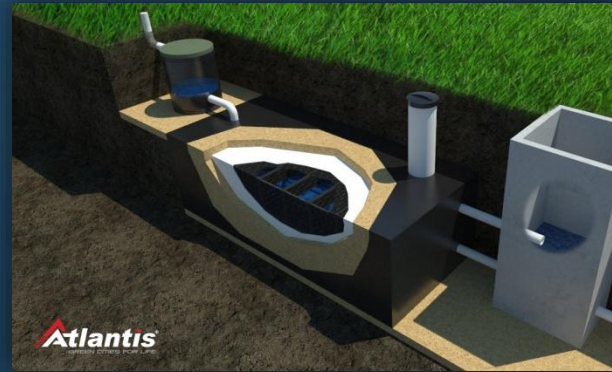
STORMWATER MANAGEMENT with '95% Void' Crate Benefits:



Parking Lot - High Volume Capture & Release, with a Smaller Footprint



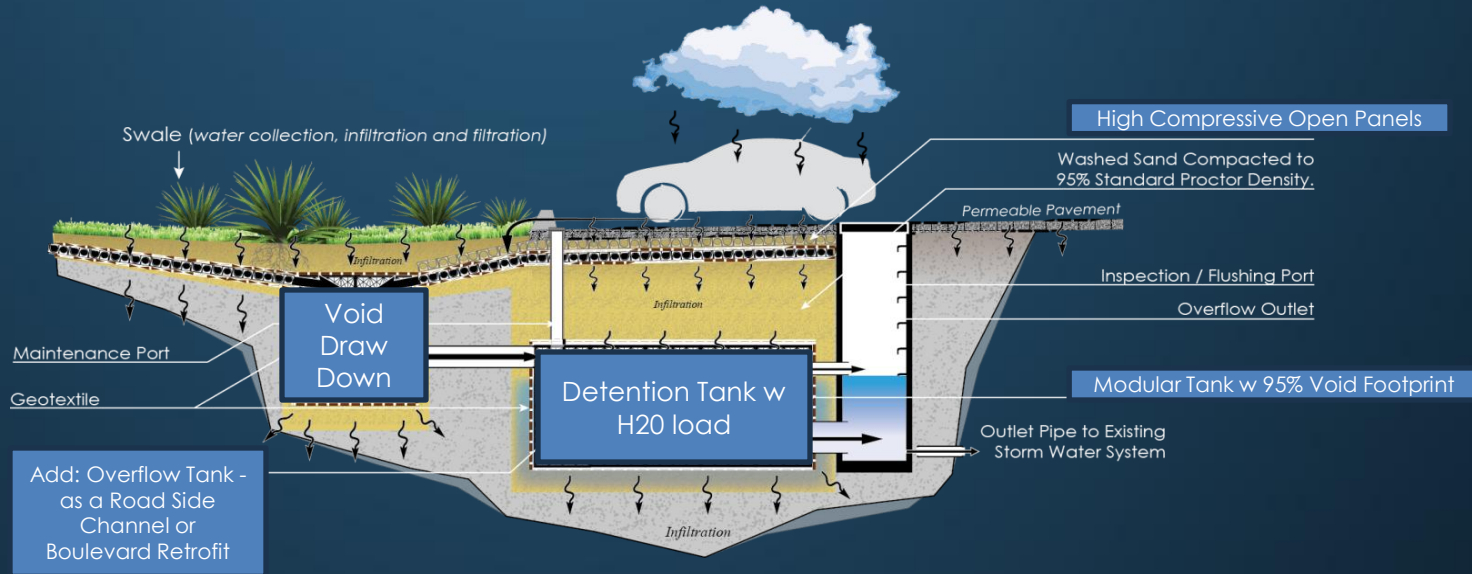
Swale with Top-Down Higher Volume Capture – and Oxygen Add to the Water



Harvested Water for Fire Suppression & Passive Irrigation (Built in Sand Filter Option)

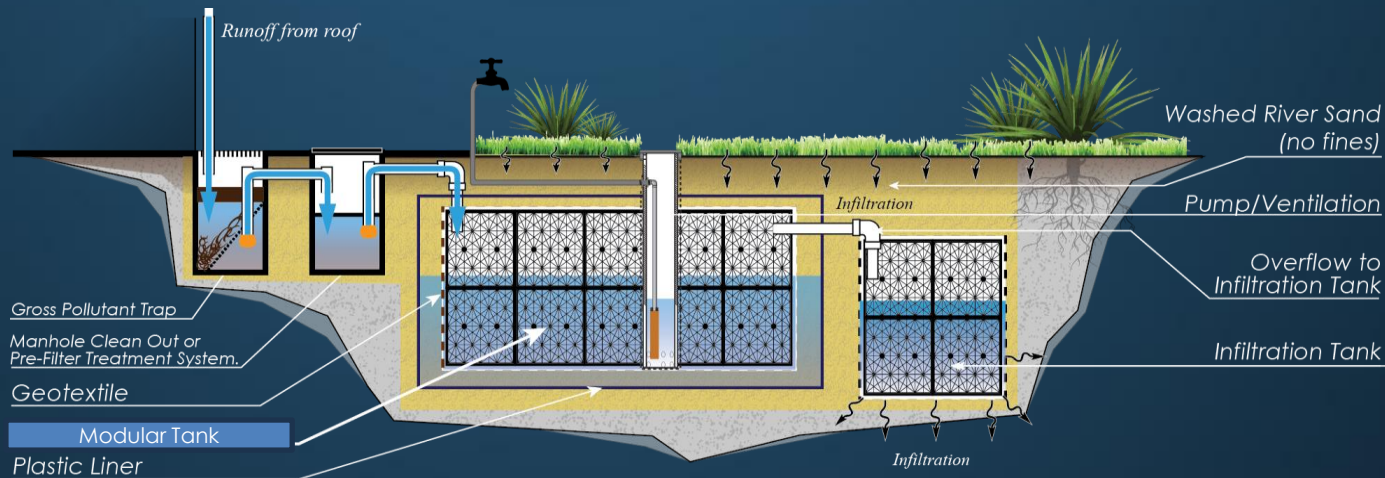
MODULAR CRATE Retrofits to Alleviate Flooding

Increased Water Draw Down by Installing “95% Void” Crates, Wrapped in hydrophilic non-woven geotextile.



Modular Crates for Combined Property Goals

Rain Harvest for Fire Suppression w/ Rain Garden Infiltration
Mixed Purpose – using passive irrigation for plant uptake

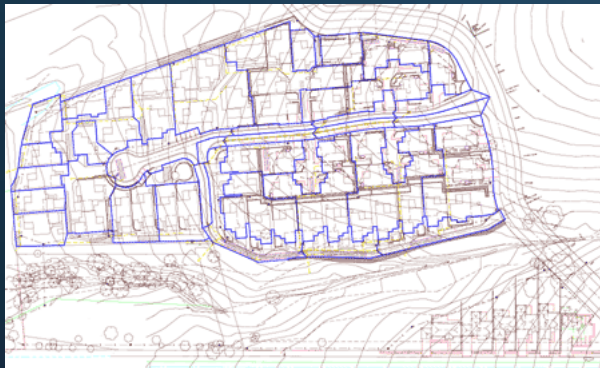


Modular systems are wrapped in geotextile, liners or both to meet property SW goals.

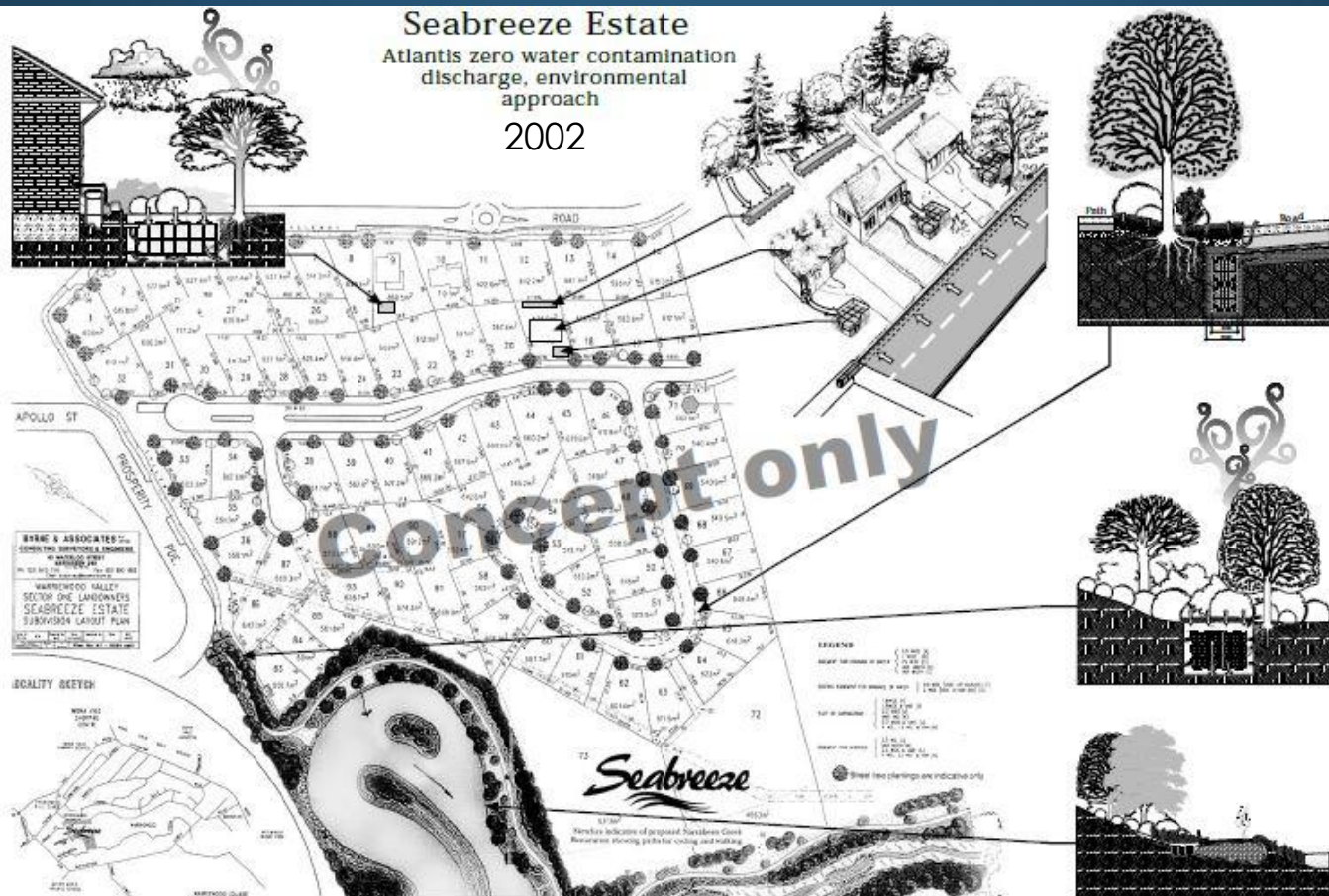
Residential Developments

Heritage Mews – A Flagship Water Sensitive Urban Design

Zero discharge with ALL storm water dealt with on site using infiltration and harvesting (possible with sandy soils).



2002



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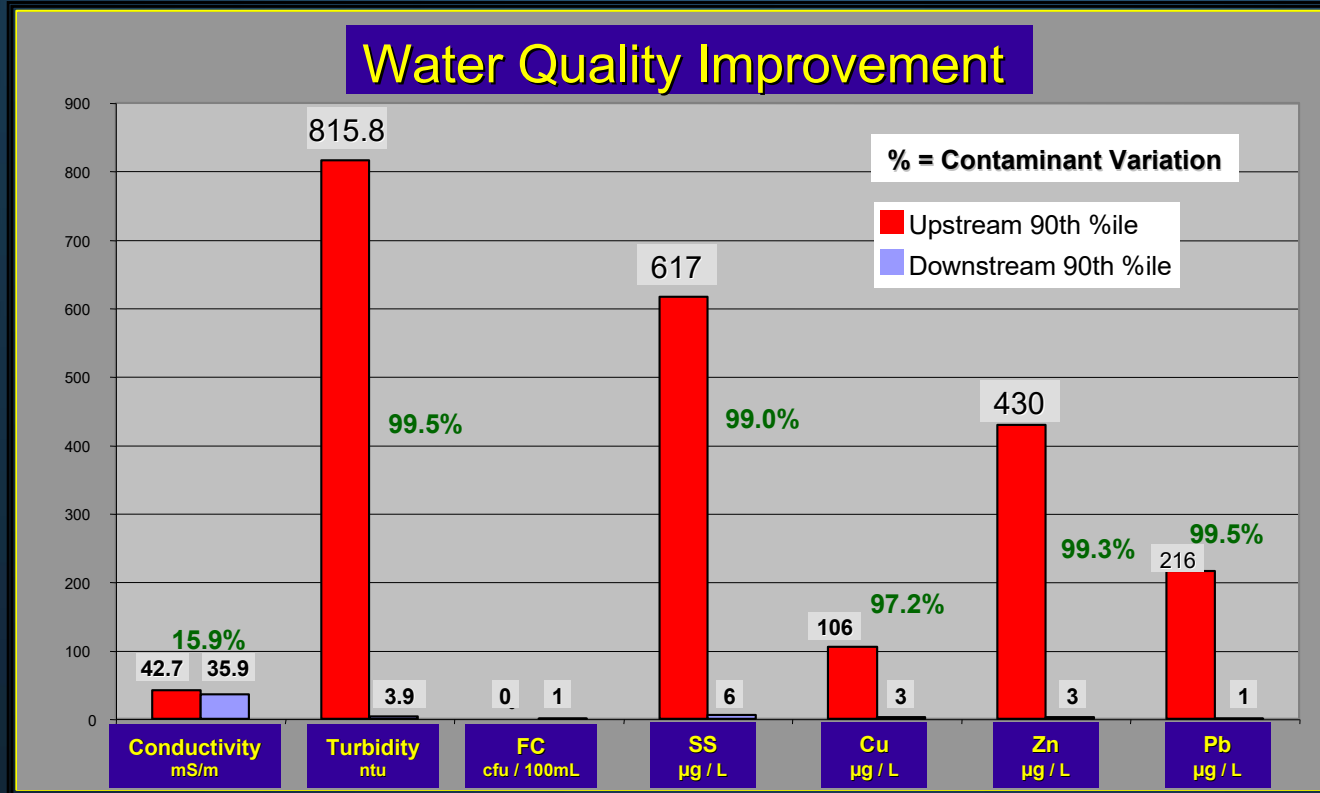
Retrofit - Manly Beach STAR Project 1998

Stormwater clean up of flow into Sydney Harbour.

- This Pilot Retrofit Project conveyed stormwater into an infiltration basin set up with gross litter removal and built in “Advanced BioFiltration Material” upstream.
- This removed various soluble containments including heavy metals and hydrocarbons.
- The infiltrated water was then collected into a channel of geo-cellar crates that directed flow back to the Whites Creek Channel.
- The system was fully gravitational, with built in oxygen-add to the water through cellular crates

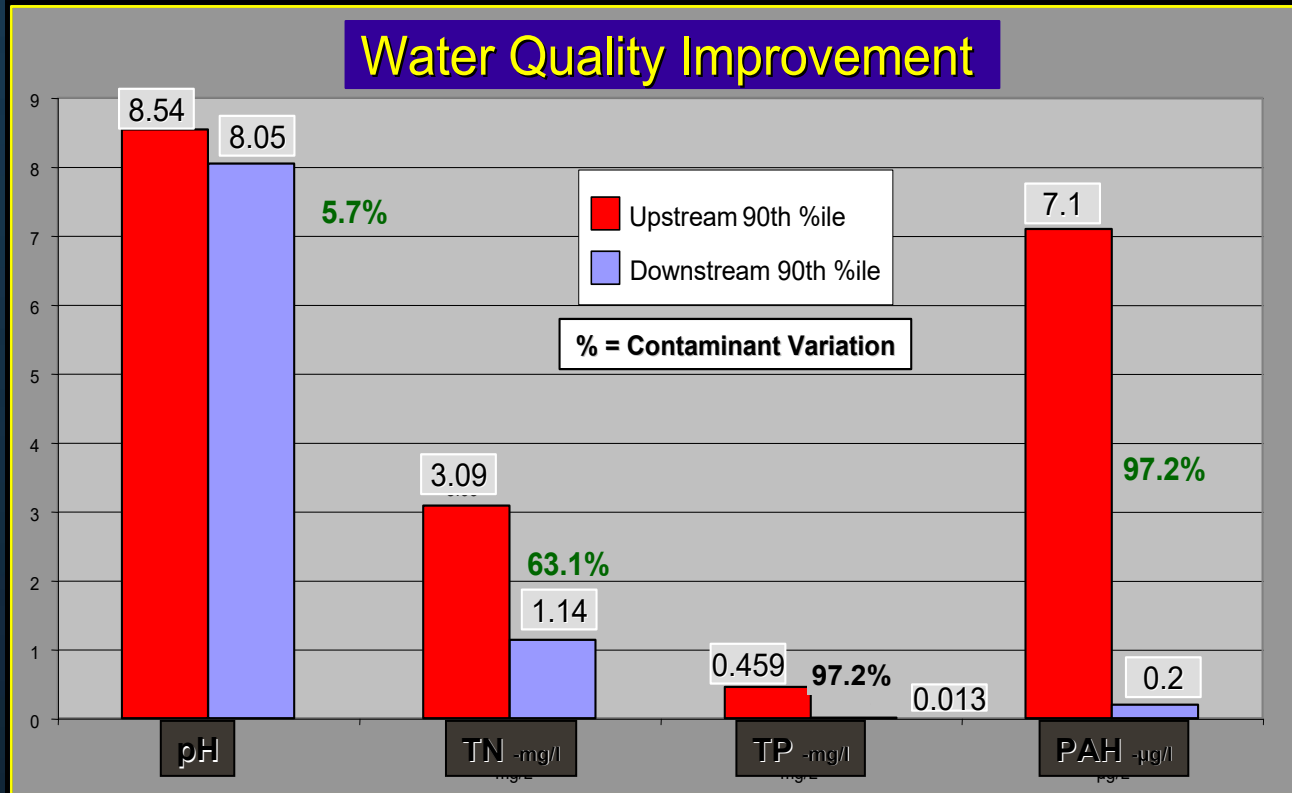


Manly Beach STAR Project 1998



Reduced:
Zinc, Copper, Lead
Turbidity
Suspended Solids

Manly Beach STAR Project 1998



Active Benefits – QUALITY :

- Ion Exchange w filtering soils
- Oxygen add in flow, through plates
- Breaking up hydro-carbons
- Reduced laminar flow (that destroys the water molecule)
- 'Recharged' Water Molecules

CASE STUDY

Virginia, USA _Infiltration Crates

340,000 ft³ shopping center expansion;
4 Olympic swimming pool size.

Developers regain land reserved for a detention basin and transform it into usable parking lot and additional development space under their existing permit.



Storm water ponds – cheaper, but with no nutrient removal. Un-useable land. Prone to stagnant water, that sets the stage for virus and bacteria growth; gathering pathogens from run off (mosquito-borne disease). Subject to algal blooms and contaminated sediment collection.

(continued) Water Neutral Parking Lot (VA)

No-fines concrete – permeable concrete solution.

No catch basins to 'back up'.

Passive irrigation to plants above

Maintenance – vacuum trucks



Deep Trench Applications for Flood Mitigation

Full depth ecological channels were installed to control & re-direct flood water on site with **limited space available**

Earthquake Zone:
Modular Crate
seismic capability



Option 1: Connecting to controlled selected catchment area to pump it for re-use..

Option 2: Connecting to the permanent Storm Water Network System. Or both..



Santiago, Chile

ORANGE MEMORIAL PARK

STORMWATER CAPTURE PROJECT South San Francisco, CA

Stormwater Diversion

- 6 Jurisdictions
- Collaborative / Interagency
- Land Owners / Canal
- Water Providers
- Caltrans (Roads)
- Seismic Tested Tanks

Goals:

- Water Quality
- Conservation – Water Re-Use
- Aquifer Recharge – Drought
- Flood Protection
- Seismic Site Class D

“Community Flagship”

6 Water Treatment Building

5 Wet Well

2 Flow Splitter

1 Upstream Diversion & Pretreatment

3 Cistern

4 Infiltration Gallery

Water Reuse Signs (throughout park)

Quad Modular Tank
Selected for variable Flex
With underground movement.



New Jersey Route 1 Widening - with Retrofit

- Creative design required to take advantage of site capacity for storage
- Transition from quad to mini's crates to adapt to existing utilities.
- Showed modular crate versatility



Reserve at Park Ten, Houston, TX

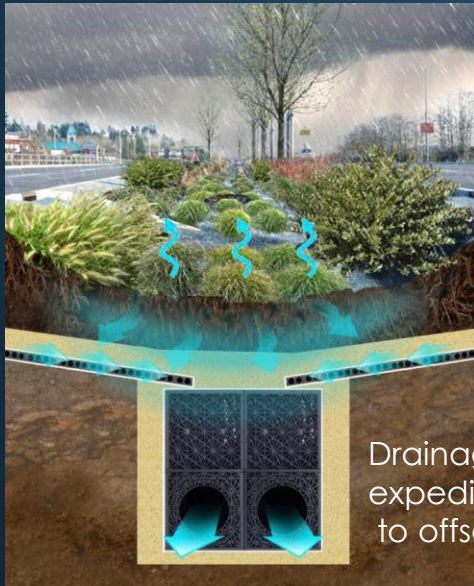
Why Modularity for Limited Footprint in Civil Work Matters

The excavation revealed concrete-encased 480 volt electrical line running diagonally through the allocated space.



Road Swales & Rain Garden Catchment Systems

- Permeable surfaces enhance purification and cooling of water
- Open void below (with no flow through) increases residence time, if needed, for higher nutrient removal and sand filter functionality.



Drainage panels can expedite draw-down to offset saturated soils and ice formation



Boulevard Detention – Retrofit for Flood Prevention (CA)

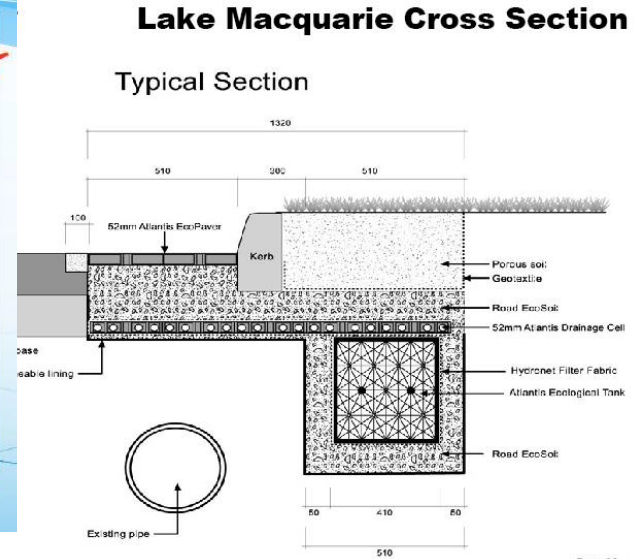
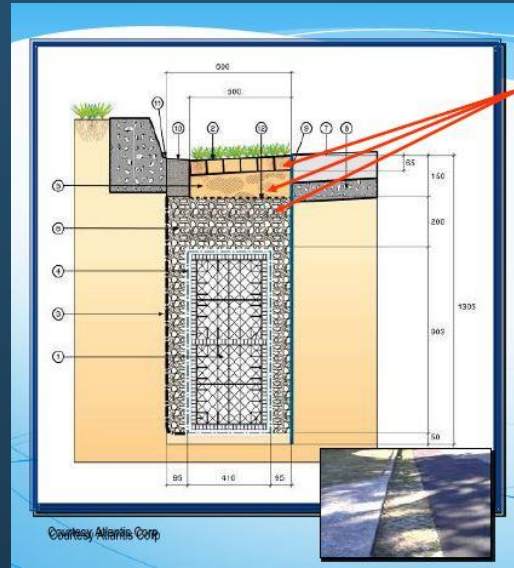


Tree Boulevards



Add permeable curbside sections with trench grill or gravel paver for infiltration to below channeling panels & added crates in the boulevard.

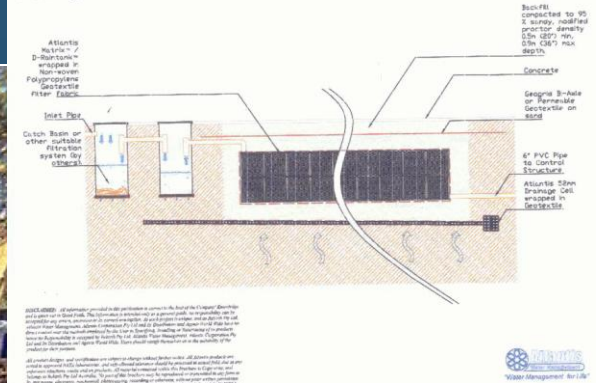
Cut out curbs for water infiltration, (with filters) for tree root uptake.



Villa Riva Condominiums Jacksonville, FL

High Water Table: Used a Liner to Seal the System, and an Underdrain to Reduce Buoyancy.

Atlantis Matrix™ / D-Raintank™
Parking Lot Stormwater Catchment with Underdrain



Shedd Aquarium, Chicago, IL

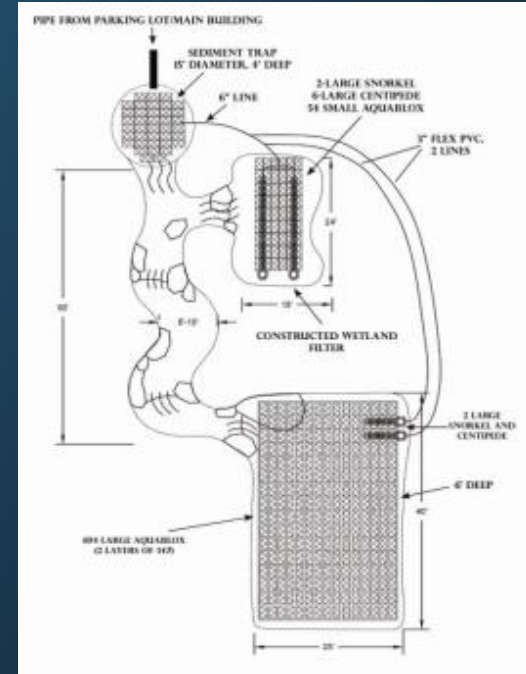
- Turning stormwater into waterfall amenities to be enjoyed.
- Installed 80 ft waterfall and self-sustaining stream feature that was replenished by rainwater
- Filtered and aerated.



Boerner Botanical Garden



- 20' X 60' Private Reservoir
- 23,000 gallons crate system with pumps
- Constructed wetland filter



Budget for Stone Storage - with a Modular Crate

Completely flexible and scalable



The Modular crate bonus over chamber & concrete systems is:

- 95% gravel contact for enhanced water filtering
- High surface area that accommodates healthy bio-film treatment
- Storm water infiltration from the top

RAIN HARVESTING SYSTEM COMPARISON



50,000 Gallon Tank Comparison

Buried Fiberglass Tank

- \$125,000 tank materials
- Special shipping and installation equipment
- Requires 16 foot deep excavation
- Special anchoring requirements
- Requires 25% more excavation & fill

Modular Crate System

- \$45,000 tank materials
- Assemble on site with hourly labor and standard site equipment
- Excavation depth options 6-11 ft. No anchoring required
- 95% efficient space utilization

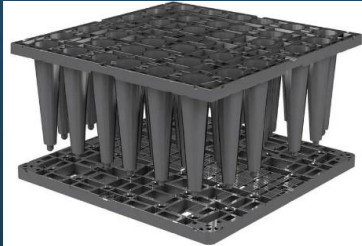
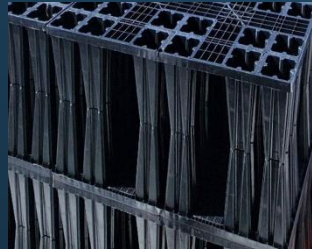
95% Void 'Crates' – Characteristics

Not all geo-cellular, modular crates are the same:

- Varying structures – plate, post, tall pillar, stout pillar, narrow
- Varying install history in America _ 2003 to recent EU entry
- Similar compressive PSI with distinct lateral load differences
- Different depth capabilities
- Similar flush-out options (Maintenance)
- Different cost
- Different color



5 PLATE CONFIGURATION

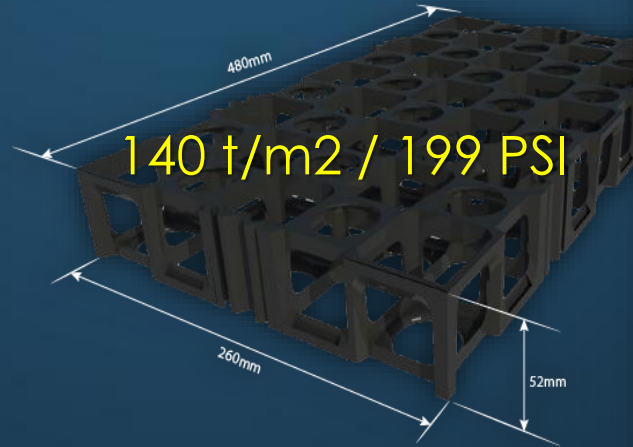
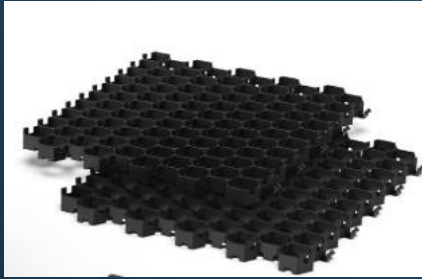
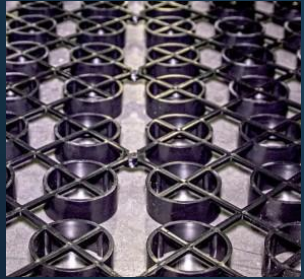


Modular Crate Backdrop

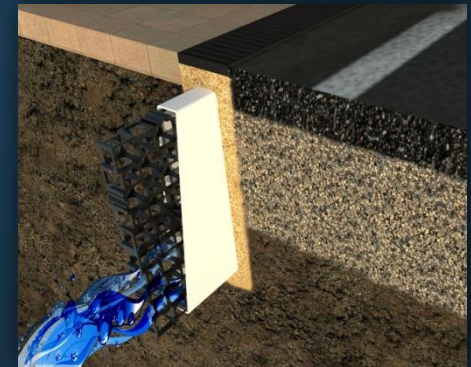
- First stormwater crate installations North America 2003
- 2007 Ciria – Crate Compressive test (UK) www.ciria.org
- North America - Assembled on site – with no comparable ASTM standard to manufactured tanks delivered to site until 2026.
- New ASTM F3754 PP Crate Stormwater Storage System
- Loads (H20 / H25) calculated in accordance to AASHTO Load Resistance Factor of dynamic load, live load, long term creep
- Standard - 50 year life span
- Standard technical check list
- Use “Installed Cost” as your base for comparison

APPLICATION DRAINAGE PANELS – High Impact

- Wrapped high compressive panels, with 95% void intake (H25 Standard)
- High flow capture, with no collapse – look for all direction channel
- Slope base – capture and channeling
- Highway and Rail Underdrain (H25) – remove freeze/thaw
- Unique, heavy duty, LID conveyance solution



- Water is naturally aerated in the flow
- Open channel

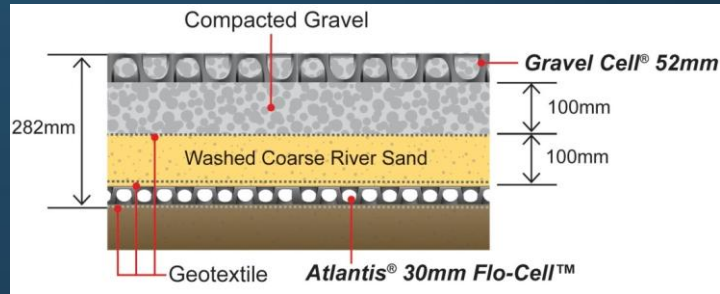
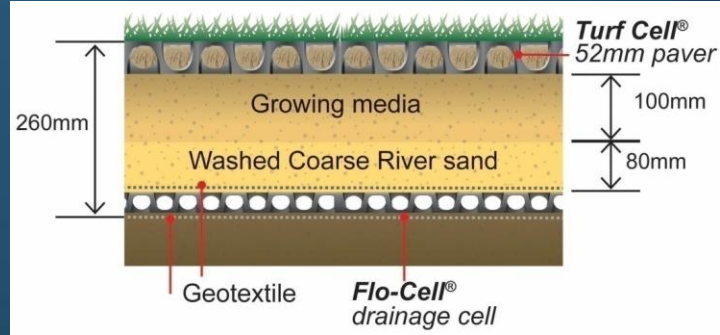


Turf / Gravel Cell Permeable Pavers



Typical Applications

- Roads
- Footpaths
- Parking Bays



- Driveways
- Slope Reinforcement
- Vertical Gardens
- Drainage under Paving

Sub Grade Paver or Permeable Pavement Support Gravel Stabilization with Void

Insert an open underdrain for long-term faster absorption

- Less freeze thaw upheaval
- Less sediment blockage
- Open channel
- Vacuum maintenance



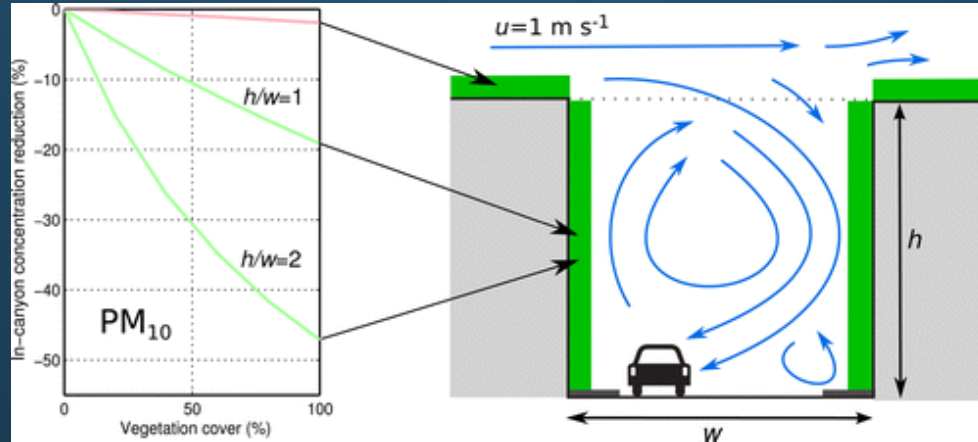
SURFACE – Add Water Paths

Retrofit – Install Permeable Pavers with Underdrain Panels

- Retrofit Roofs - Large Scale Lightweight Green Roof Installs
- Urban Agriculture Add – Roof top / old railway corridors
- Roof Garden Podiums with Drainage Panels (passive irrigation)
- Add Planter Boxes and Vertical Gardens – Soil Based for healthy root support (Green thumb fix).



Effectiveness of Green Infrastructure for Water Capture, Improvement of Air Quality, Noise Reduction & Temp. Reduction in Urban Street 'Canyons':



According to scientists at the Universities of Birmingham and Lancaster 'greening' streets with trees, bushes and living walls could cut nitrogen dioxide (NO_2) by 40% and particulate matter (PM) pollution by as much as 60%. This is more than 10 times greater than was previously thought.

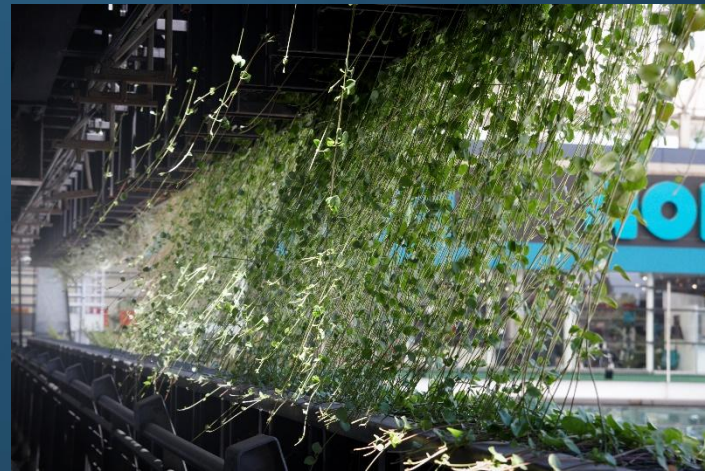
Shopping Centre Parkade - Project: Santiago, Chile



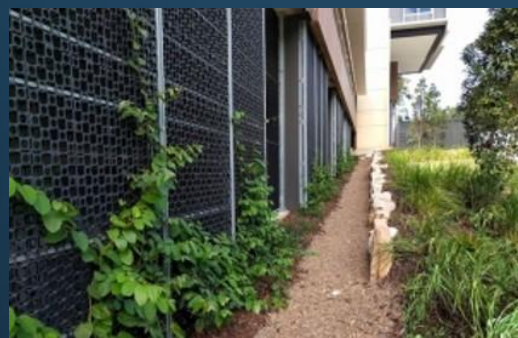
Living Wall _ Turkey (Corporate Marketing)

- Benefits of storm capture, external heat reduction & building insulation.



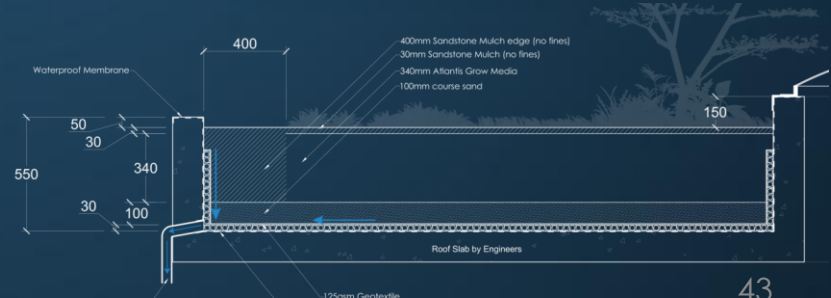
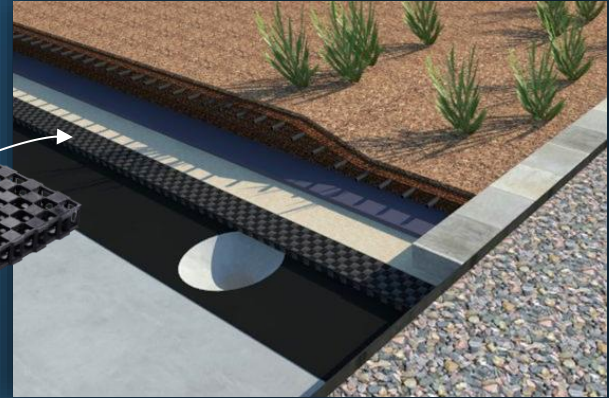


Urban Roofs and Walls – Add Porosity w Agriculture

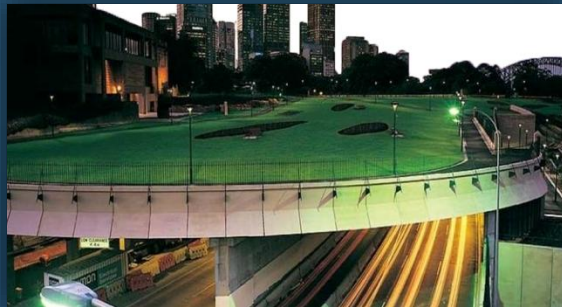


Lightweight Void Panel - Roof Retrofit for Delayed Runoff

- High Compressive Drainage Cell for Useable Space
- Open Channel – All Directions
- Balcony / Planter Box Drainage
- Waterproofing Support (No Back Up)



GREEN ROOFS



Ecological Advertising – “Corporate Challenge”



Energy Efficiency

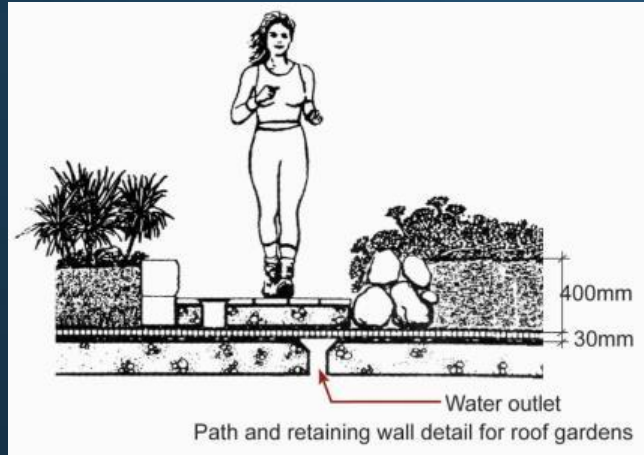
- **Insulation:** Green roofs and walls provide natural insulation, reducing the need for heating and cooling. This leads to lower energy consumption and decreased greenhouse gas emissions.
- **Temperature Regulation:** Vegetation on rooftops and walls absorbs sunlight, reducing the urban heat island effect and lowering the ambient temperature around buildings.



Water Management

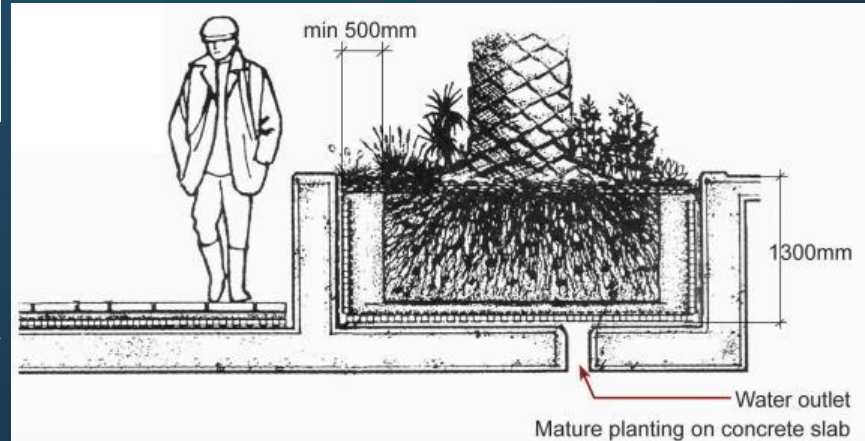
- **Stormwater Absorption:** Green roofs can absorb and filter rainwater, reducing runoff and alleviating the burden on stormwater systems. This helps prevent flooding and reduces the risk of water pollution.
- **Water Reuse:** Vertical gardens can be integrated with greywater recycling systems, utilizing reclaimed water for irrigation and reducing overall water **consumption**.

Roof Top Garden Solutions



***Path and retaining wall
detail for roof gardens***

***Drainage Cell
under paving***



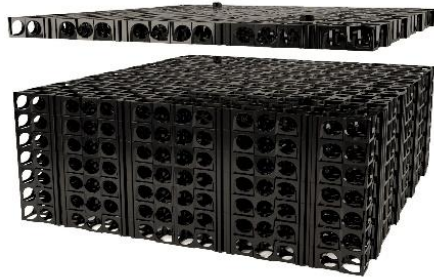


Atlantis Product Line

Flo-Vault® Tank



Titan® Tank



Geo Vault Tree Soil Structure



Flo-Pipe



Flo-Cell® Drainage Panels



Permeable Paver / Gravel Stabilizer



Gro-Wall® 4.5



® Slim PRO



Vertical Gardens

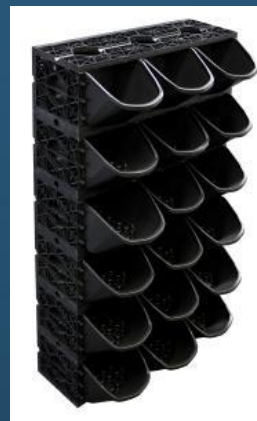
Atlantis Green Cities Today!



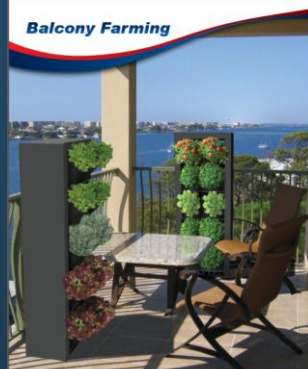
Gro-Wall®
VERTICAL GARDEN SYSTEM



Green Walls Made Easy!



Balcony Farming



Ideal for small spaces

Atlantis
VERTICAL GARDEN SYSTEM

Gro-Wall® VERTICAL GARDEN SYSTEM

Gro-Wall® PRO

Versatile Living Wall

Gro-Wall® PRO is a versatile living wall system designed to construct robust living walls such as double sided landscaped walls, cascading living walls and living walls requiring intensive soil depth requirements.

Gro-Wall® PRO Features

Gro-Wall® PRO features channel conduits for steel reinforcement and the housing of irrigation systems. The channels can be used for multiple drip line or drip head irrigation systems for intensive watering applications. Gro-Wall® PRO also features a rigid wall mount clip for fixing to wall surfaces.



Create cascading living walls



Create double sided living walls

Available under management
Phone: +612 9611 0044
Fax: +612 9611 0011
Email: info@atlantiscorp.com.au
Web: www.atlantiscorp.com.au

VERTICAL GARDEN SYSTEM Gro-Wall®

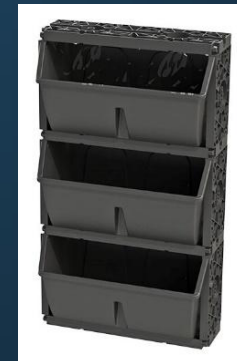
Gro-Wall® Façade

Create beautiful dense vegetated façades.

The Gro-Wall® Façade system facilitates easy installation and integration with existing buildings and new architectural designs. The strong design and ease of installation makes Gro-Wall® Façade an ideal choice for architects, landscape designers and landscape contractors.




Vertical and Horizontal Expandable



Q & A

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