EPIC™

The World's Most Versatile and Efficient Water Management Solution

EPIC GREEN REALM

pitrade

The Technology

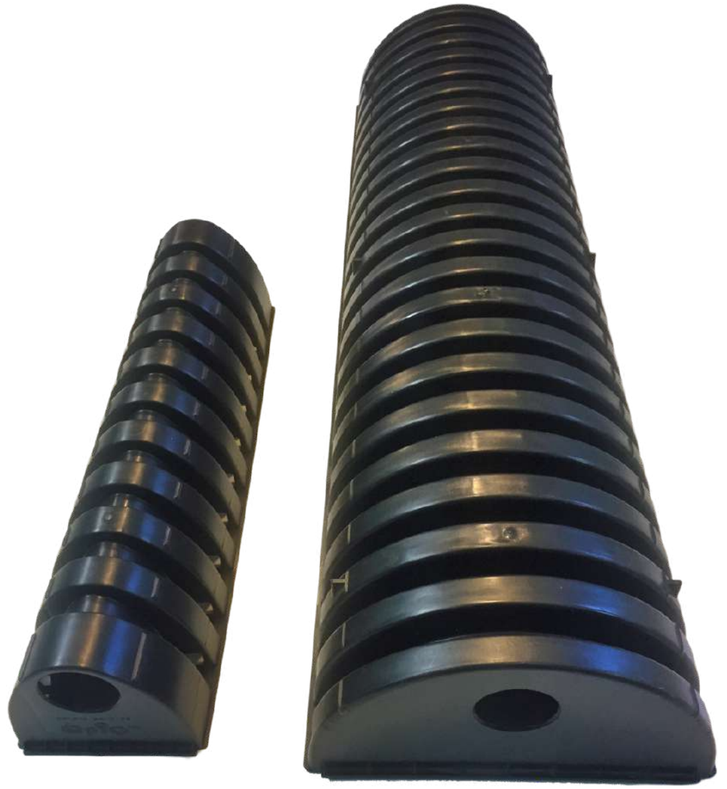
EPIC Total Water Solutions LLC, is a company specializing in highly efficient sub surface irrigation and drainage systems. The technology of EPIC TWS has been changing the face of water management for more than 25 years in the United States and is now being introduced to the Middle East.

EPIC TWS' patented core technology is based on **EPIC**- The Environmental Passive Integrated Conveyance (chamber).

EPIC is a highly engineered subsurface sand hydroponic apparatus and method, that enables the distribution of liquids and air throughout a sand engineered aggregate profile. It is a total water management system, which combines the world's most efficient irrigation and drainage system through non-pressurized, gravity driven, capillary physics of sand via direct interface of the EPIC subsurface pipe that never clogs.

EPIC controls the movement of Water and Air below the ground as as such can offer the ultimate sustainability - providing huge water and energy savings...

The World's most efficient Water Management & Environmental Solution

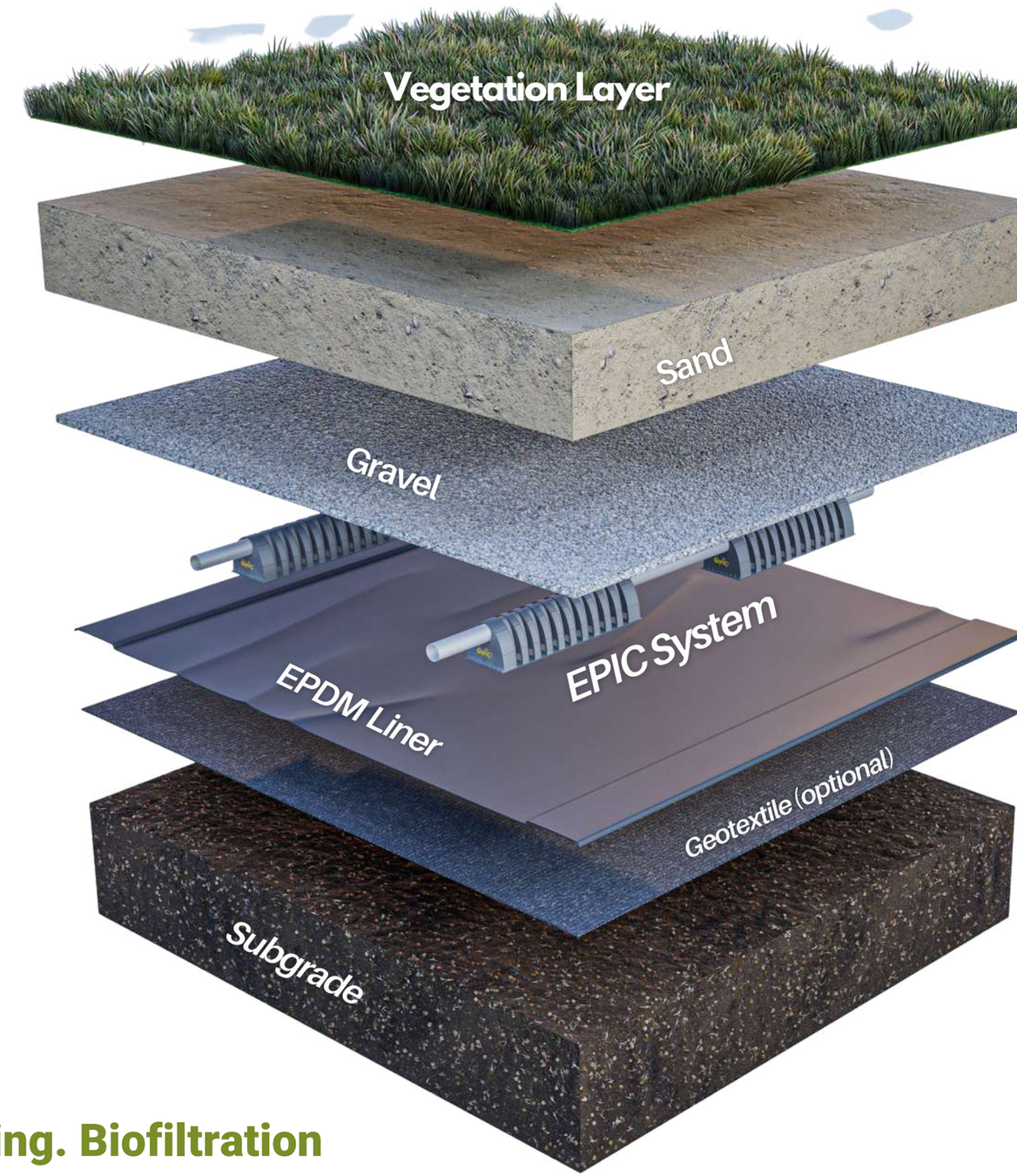


EPIC™

Environmental Passive Integrated Conveyance

Saves 80% TSE Water for Irrigation

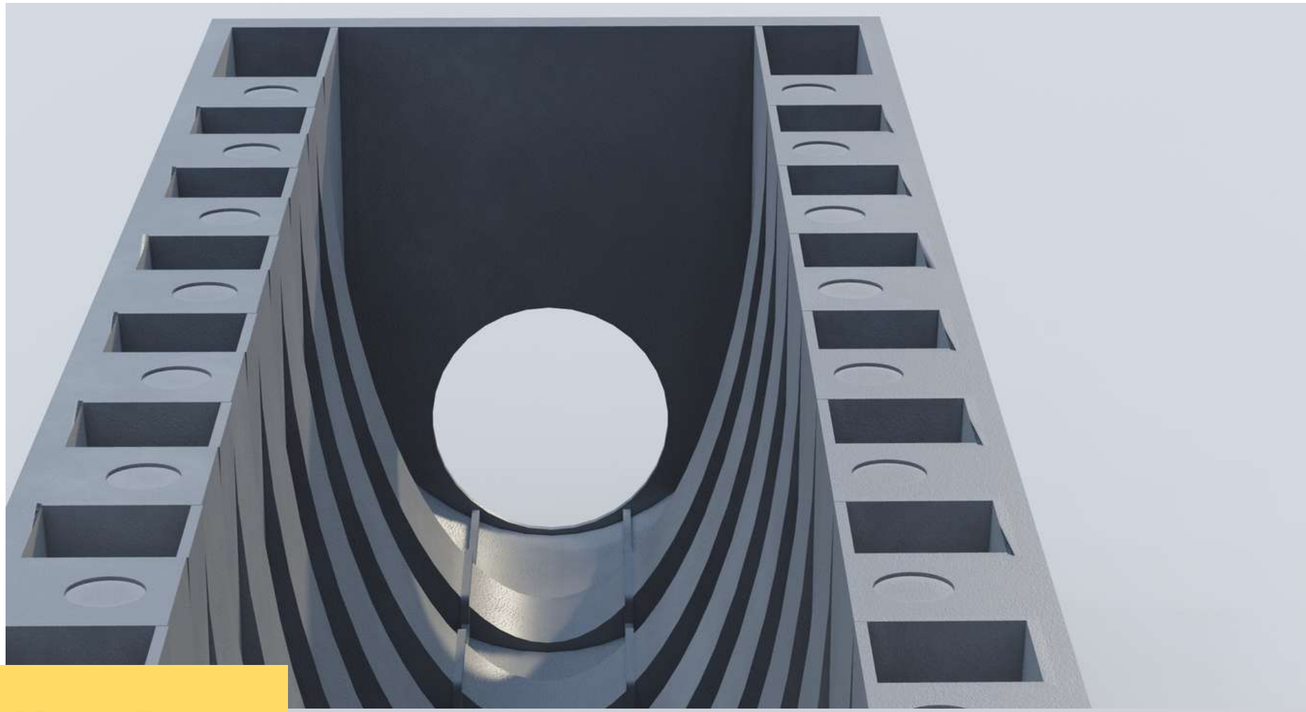
Achieves NET ZERO Water through sustainable design and implementation



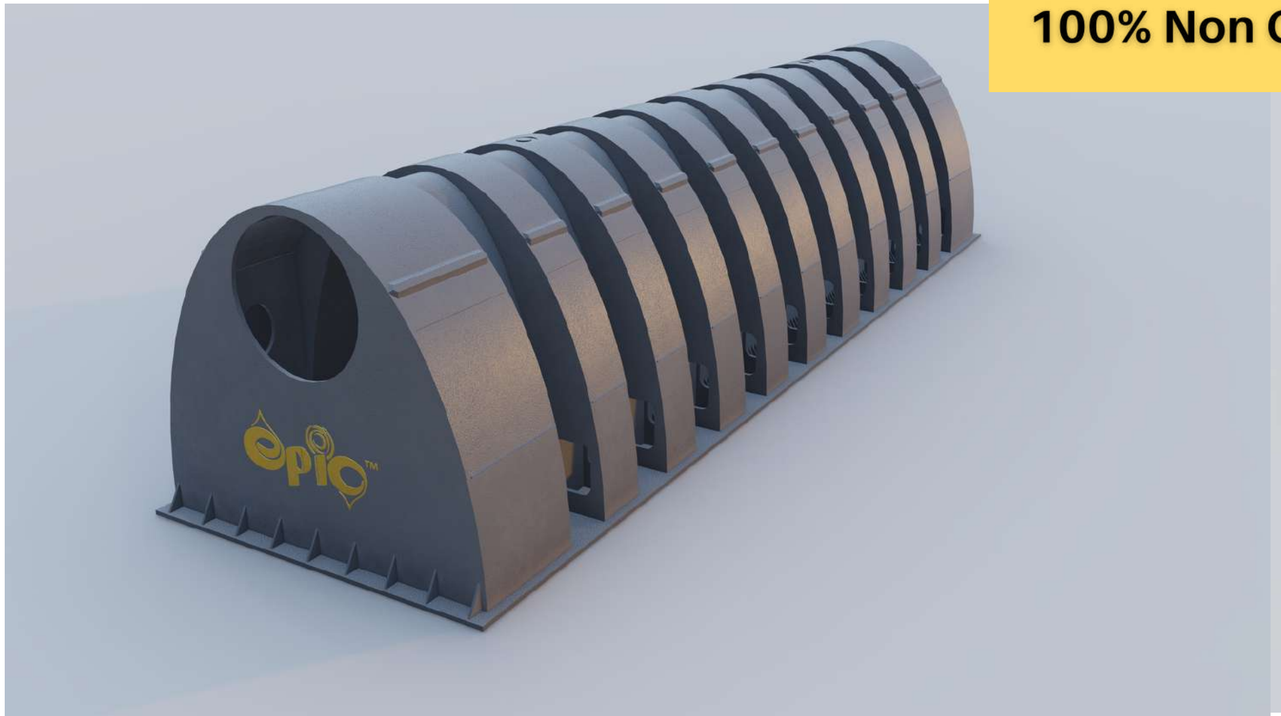
Irrigation. Drainage. Harvesting. Biofiltration

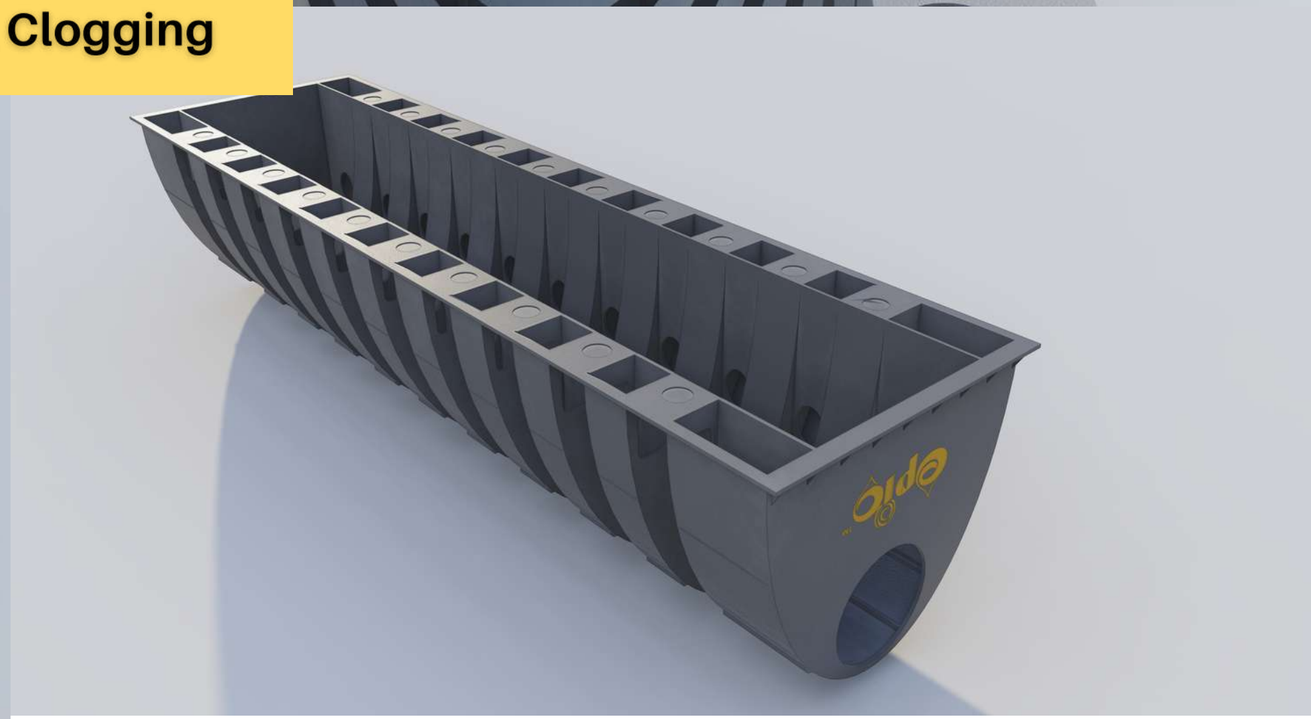
Patented Offset Holes

EPIC is a highly modified perforated pipe. The first of its kind to operate in “quicksand without clogging



100% Non Clogging






TOTAL WATER SOLUTIONS
A complete Water Management Solution
Providing Efficient Passive Drainage and
Subsurface Irrigation.
A TWO IN ONE SOLUTION
Incorporated
through
Sustainable Design
A Modular &
Scalable Solution
EPIC™
Environmental Passive Integrated Conveyance

TOTAL WATER SOLUTIONS

Saves up to 85% Water Use

Landscape and Agricultural Irrigation

33% Energy Savings

Passive Cooling of Buildings and Ground Surfaces

Achieves NET ZERO WATER

Using Grey, Black and Sea Water

New Water Generation

Air to Water Condensation and Solar Distilation

Efficient Water Reclamation

Rainwater Harvesting, Storage & Re-Use

EPIC™

Unique

Selling

Proposition

EPIC™ Benefits

- Patented, low technology with mastered method and technique.
- Low energy subsurface water delivery system.
- Never Clogs.
- Based on sand hydroponics.
- Provides huge water savings - unmatched by any other solution.
- Economic urban & rural Water drainage solution with storage.
- No need for plowing, tilling or worrying about field flooding.
- Guaranteed internal drainage.
- Offers sea water solar distillation for farming....a New Water Resource.
- Massively reduces surface water evaporation for irrigation.
- Uses Sub Fertilisation (fertigation)
- Plants use water when they need to, allowing nature to take its course.
- Gives far better yield and less crop loss.
- Has the ability to apply subsurface systemic pesticide application.
- Allows the growth of native plants in deserts without soil amendments.
- Can be be incorporated in any application through sustainable design!

EPIC™ Uses

EPIC can accomplish much more beyond irrigation. EPIC is a tool that can integrate with various other systems to perform common goals. Some of the fields where we can contribute / integrate with early planning include:

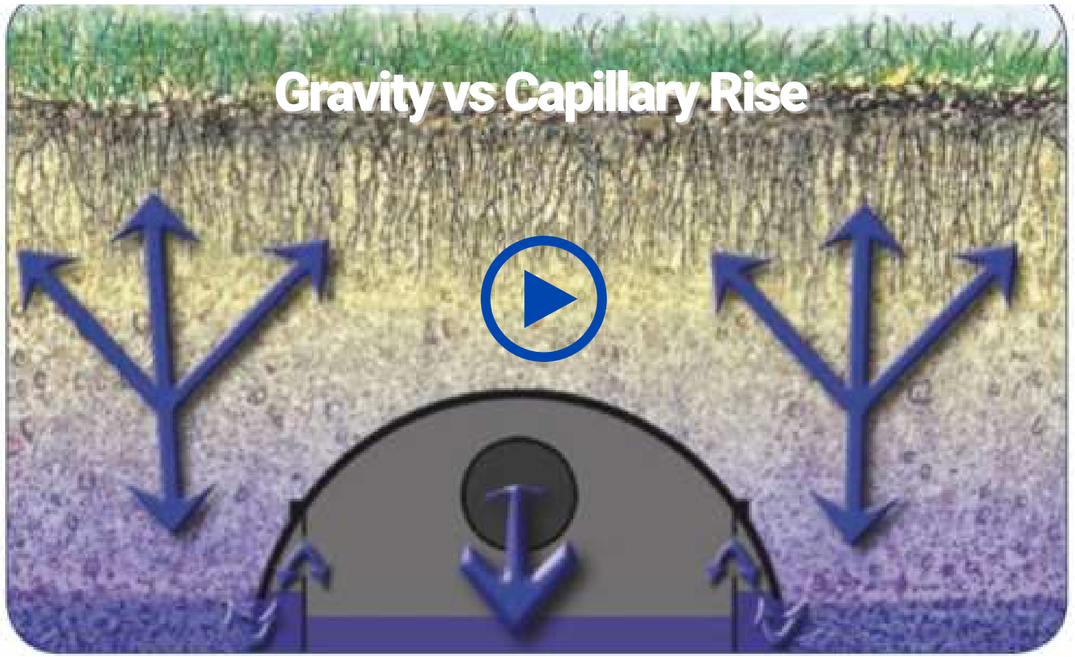
- **Passive subsurface Irrigation for Landscapes and Agriculture**
- **Storm Management**
- **Rain Harvesting**
- **Environmental Remediation**
- **Cooling Loads reduction integrated with the buildings**
- **Green roof**
- **Geothermal heat exchange**
- **Thermal Comfort zones under pavers**
- **Food & Beverage ice drains / water drains / AC condensation reuse**
- **Waste water management**
- **Black water & Grey water reuse**
- **Contribute to various LEED points**
- **Wet Utilities**
- **Sustainability**
- **Interior integration of toilets / showers**
- **Integration with structural engineering for green roofs and retaining walls**
- **Subsurface water / air delivery systems for energy reduction**
- **Salt water irrigation**

EPIC Applications

UNMATCHED CAPABILITIES

EPIC Chamber Cross Section

The EPIC chamber demonstrating the three dimensional closed loop flow of water through the system's non-clogging holes and to the roots. When rain events occur, the water is absorbed by the sand and trickles down to the Subzone. It is then collected by the chambers' gravity trap and conveyed to storage or a discharge point- depending on need or purpose.



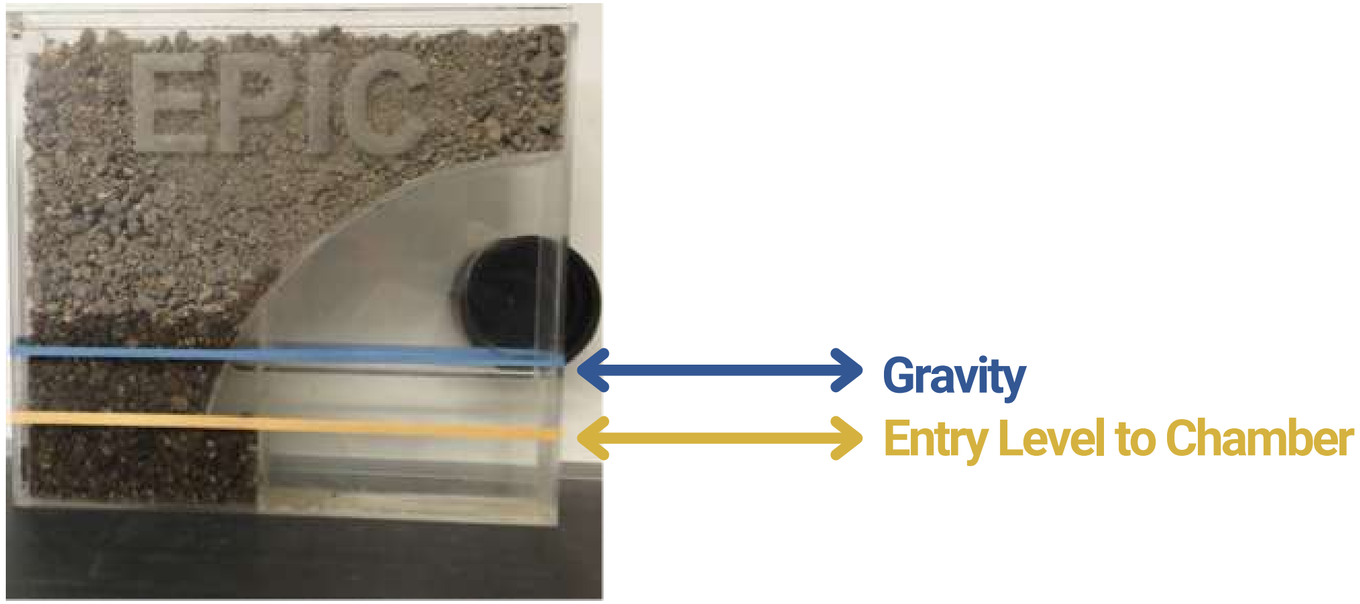
When irrigating subsurface, water gets slowly absorbed by the sand profile and capillary rise physics action takes place- giving plants the right amount of moisture and oxygen to thrive.

Nature's Pace

Washed sand media provide the perfect combination of stability without compaction and aerobic air-water ratios in the root zone without ever being over-watered. The plants themselves make the decision of when to drink and when to breathe.

Scientific Principles- Capillary Rise Physics

Water is introduced directly to the roots from the inlet. As water is transpired by the plant, new water is automatically replaced upward into the root zone by capillary action from the sub-surface reservoir. The water film from capillary rise and high oxygen levels among the sand voids provide an ideal growing environment for plant growth.



Beans grown in identical sand beds.. The roots on the left were irrigated by capillary rise in an EPIC planter. The roots on the right were conventionally top watered.

Multiple Sustainable Designs & Solutions

The epitome of sustainability

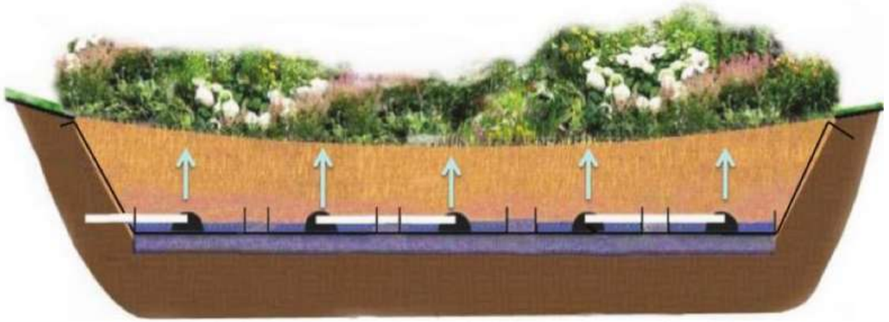
- Manages, captures and re-uses rainwater resulting in NET ZERO Water
- Manages and re-uses brackish, Seawater without harming underlying soils.
- For sea water the engineering sand profile desalinates while roots filter the salt water further
- Manages and re-uses blackwater and grey water without contaminating aquifers.
- Aeration in the sand and living vegetation treat contaminated water .
- Water harvesting of current impervious surfaces made possible.
- Provides highly economic unban and road drainage, green spaces and green belts
- Provides major green pockets capabilities throughout a city. Helps reduce urban heat islands.
- EPIC provides a much larger canvas for real sustainability than any other solution in the market.

How the EPIC System works...

The EPIC™ chamber is positioned below the surface (40, 50 or 60 centimeters, depending on Capillary characteristics of the sand soil). EPIC chambers are connected to each other in rows by 2inch plastic pipes. Each row of chambers is connected to a main water supply manifold which receives its water from a water tank that has a submersible pump. The row of Epic chambers are completely non-pressurized and as water fills the chambers, water then slowly discharges from the chambers and flows horizontally through 5-10cm gravel layer after which the water is filtered and rises through the sand (40-45cm profile) up to plant roots via capillary action. Lined with an EPIC Waterproof Liner at the subgrade, water is retained in the profile thus achieving zero loss to the ground. The only water loss that will be encountered is the Plants' transpiration. Any excess water which is not used in the system returns back to a drain manifold which is connected to the water tank.

At the end of the drain manifold, a swing joint is attached that can be elevated from 180 degree up to 90 degrees. This control mechanism determines various wetness levels across the sand profile thus achieving greater control and determining the right mix of oxygen to moisture content. Therefore with the EPIC System™ the top soil surface is always dry due to that control ability which then avoids disruptions to events such as sports and any general activity taking place on the ground. Furthermore, it also guarantees the absence of unwanted weeds, fungus and mold accumulation which is typically evident when traditional irrigations systems are used.

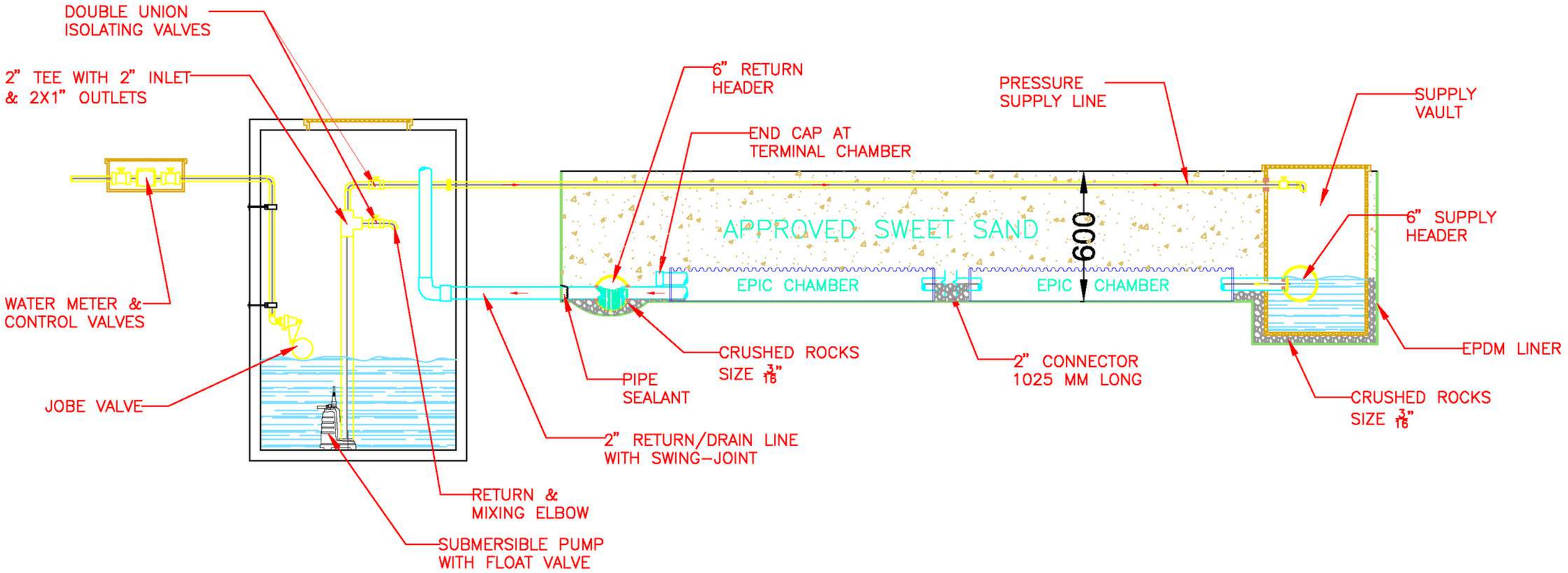
The Epic System will also require far less maintenance than any other system as it has very few moving parts. The only element that can malfunction is the submersible pump used to transmit to and recirculate water within the EPIC system. In event of this occurring, there will be enough standing water at the base of the system to be consumed over a week which allows time to replace it without jeopardizing the landscape.



The EPIC system can utilize 40%-80% less water for irrigation while removing nutrients. The EPIC profile stays moist as water wicks upward by capillary action from the chamber.

Illustration Courtesy: Firestone Specialty Products

The Epic System will insure all plants will have all necessary water requirements met 24 hours a day, 7 days a week.



EPIC Cell Detailed Section

Scale 1:50

EPIC System

Installation Sequence

1 **Excavation 600mm (Depending on Sand Soil) Flat Leveling**

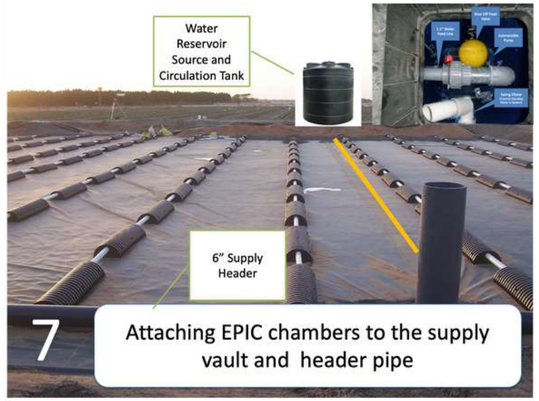
2 Laying the Epic Geomembrane Liner (EPDM or LDPE) Epic Recommends using Firestone EPDM Liner

3 Laying and securing the EPDM liner

4 Seaming the EPDM liner

5 Installing the EPIC Chambers

6 EPIC Chambers and Firestone EPDM Liner is in place



7 Attaching EPIC chambers to the supply vault and header pipe

8 Attaching EPIC chambers to the drain header pipe

9 Gravel Filling

10 Sand Filling

11 Plant Nutrient Starter Pack

The area is now ready for planting

(Liquid) Fertigation

Several Weeks After Planting

Parks & Fields

Multi-functional parks and fields create opportunities beyond traditional turf-grass recreation and beautiful landscaping. EPIC systems enable parks and fields to function as a storm-water treatment system, with irrigation needs reduced to 50-85% less water than traditional top-down systems. Collaboration with EPIC enables parks and fields to save costs in water use, eliminate single –serving land uses, decrease grey infrastructure and provide added value in all green spaces.

EPIC systems provide a non-pressurized, gravity driven irrigation and exceptional drainage system that has no moving parts, no surface emitters or drip lines to vandalize or damage.

4 Months after Installing the EPIC System

EPIC™

Environmental Passive Integrated Conveyance

13 Months after Installing the EPIC System

Average Water Consumption 2.68 Litres/M2/Day

4 x 50m2 Plots
Day 1 (after installing EPIC)

EPIC™

Environmental Passive Integrated Conveyance


TSE Water Plot

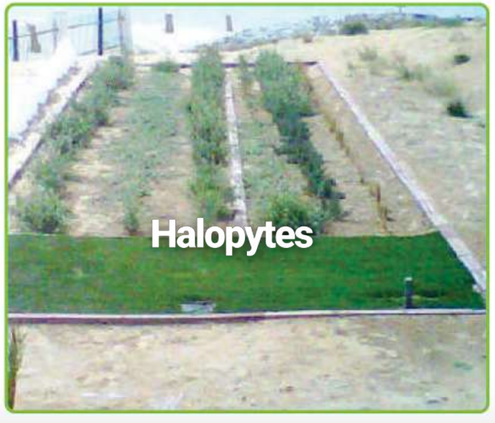

81% Water Savings


81% Water Savings

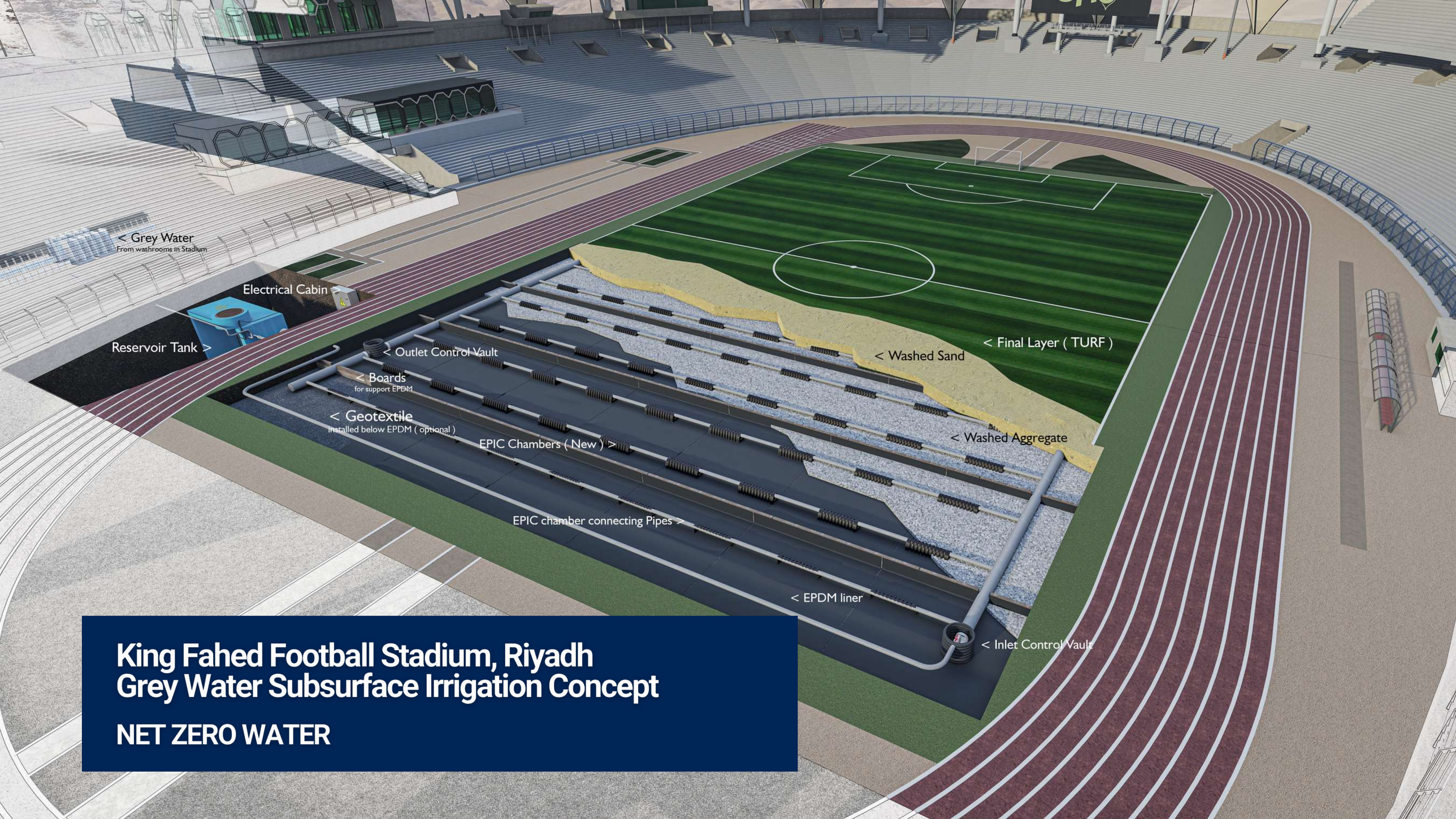

Grey Water Plot


NET ZERO WATER


Salt Water Plot

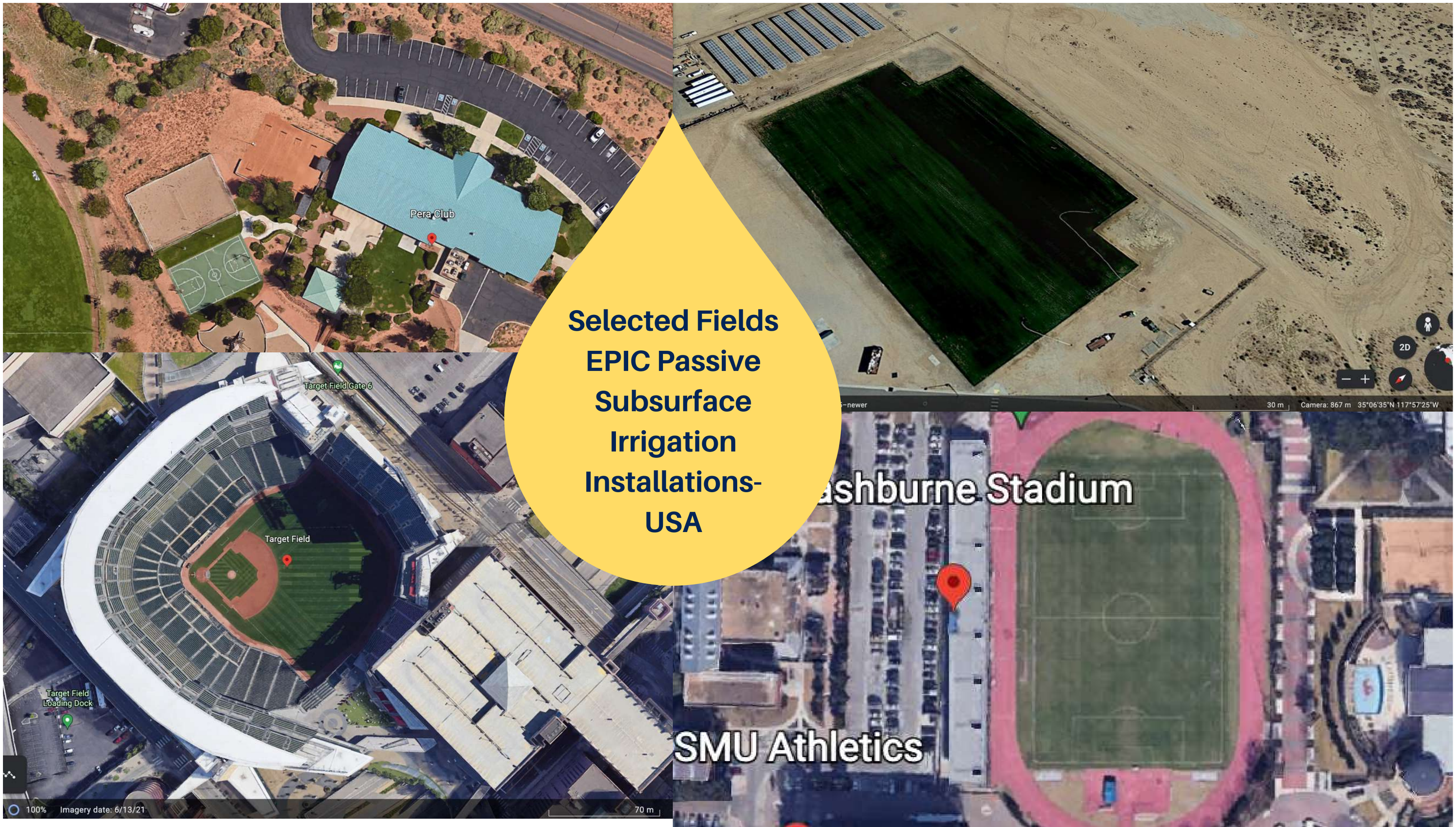

Halopytes


Seashore Paspalum



King Fahed Football Stadium, Riyadh
Grey Water Subsurface Irrigation Concept

NET ZERO WATER



Selected Fields
EPIC Passive
Subsurface
Irrigation
Installations-
USA

Agriculture Irrigation Solutions

The EPIC system is an advanced form of Sand Hydroponics. Publicly introduced in 1999, it is a scientific breakthrough in how plants are grown, watered and provided with nutrients. In large scale installations throughout the world, especially in desert climates, sustainable projects from landscaping, sports fields, and in agriculture the system showed reduced water usage by 50-85% when compared to drip or sprinkler systems, used less fertilizers yet produced a larger quantity and better plant quality. Watering frequency is also reduced to once per week watering in desert environments when temperatures exceed 90°F.

300% yield increase

Perfect Water & Oxygen Ratio

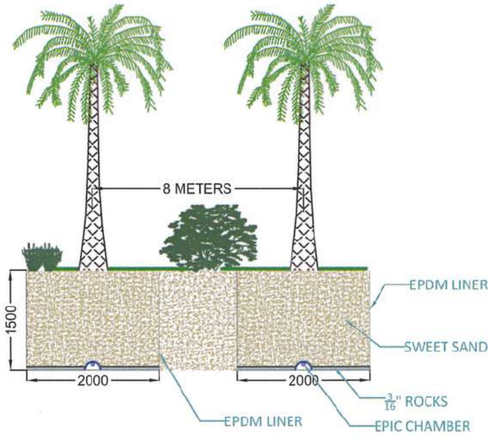
Saves up to 82% Water Use

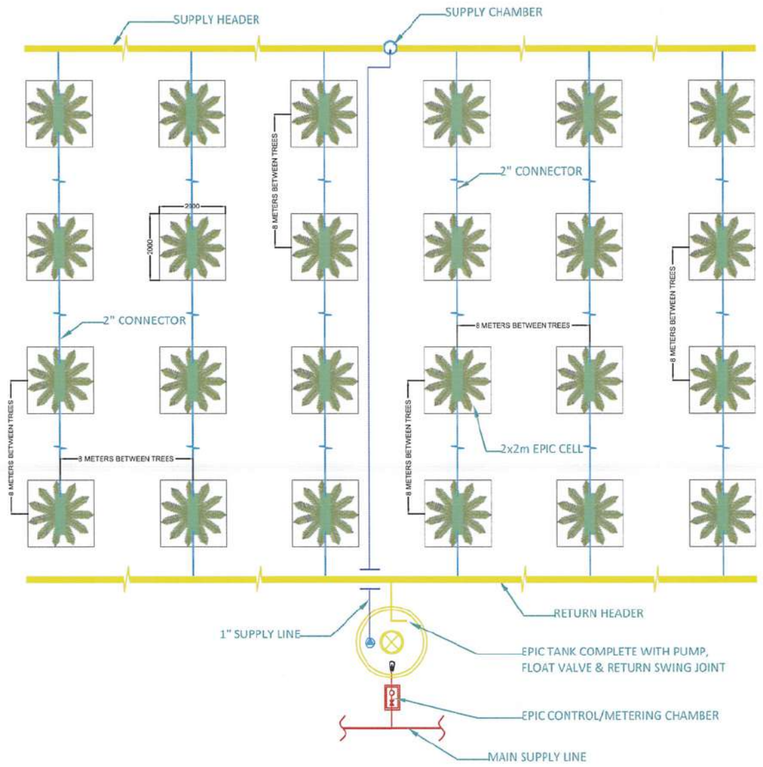
Vs Drip Irrigatoon

From California

To the Middle East

Passive Subsurface Irrigation

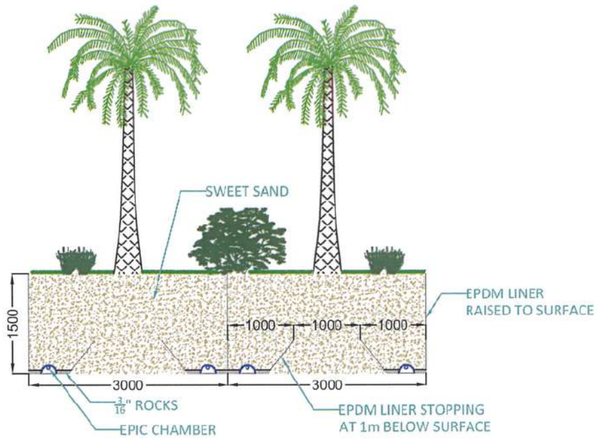


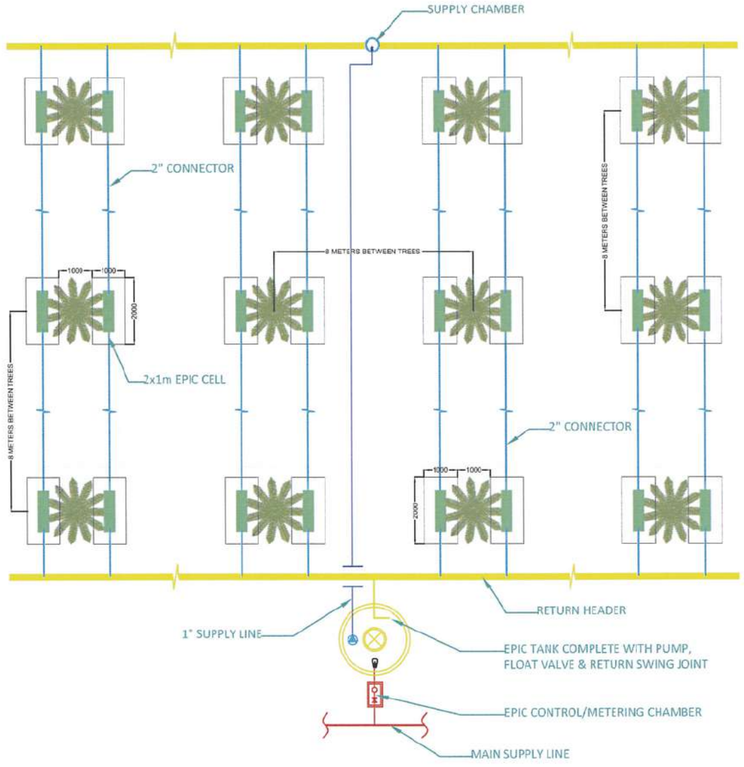


CASE-1
NEW INSTALLATION

The EPIC Method and Technique for Trees and Date Palms

Passive Subsurface Irrigation





CASE-2
EXISTING TREES

Installing EPIC Lines
Date Palm Orchard- UAE

Residences / Estates

Green landscaping around homes not only improves aesthetics and home values, but actually reduces the ambient temperature near the homes and buildings by better than 10 degrees. This reduces the cooling degree day calculations and reduces electrical energy of air conditioning units.

An AC unit works less by bringing in cooler air contributed from adjoining evapo-transpiration of plants and landscapes. While conventional trends dictate xeriscape landscaping for perceived water savings, EPIC systems can actually provide lush landscapes with even less potable water use.

All landscaping irrigation needs in EPIC systems for sub-divisions or individual lots can actually be accomplished through storm water capture and retention techniques and even supplemental reuse of shower water without public health issues or concerns.

Storm Water Management Solutions

Research shows that there is no other system that exists today like the EPIC System™. Apart from it principally functioning as an irrigation and drainage system; it can also act as a rain water harvesting tool whereby it can absorb natural run-off and effluents, storing it for later use in the system, any stormwater surge or runoff is retained and held in the system for re-use or slowly released in a controlled manner. Coupled with the natural system of gravel and sand, it acts as a highly effective and yet holistic bio-filter, thus making it a 4 in 1 system. With such attributes, it makes it an ideal system because it can, in the majority of cases eliminate the need for a costly drainage system- thus making the Epic System an economical choice™.

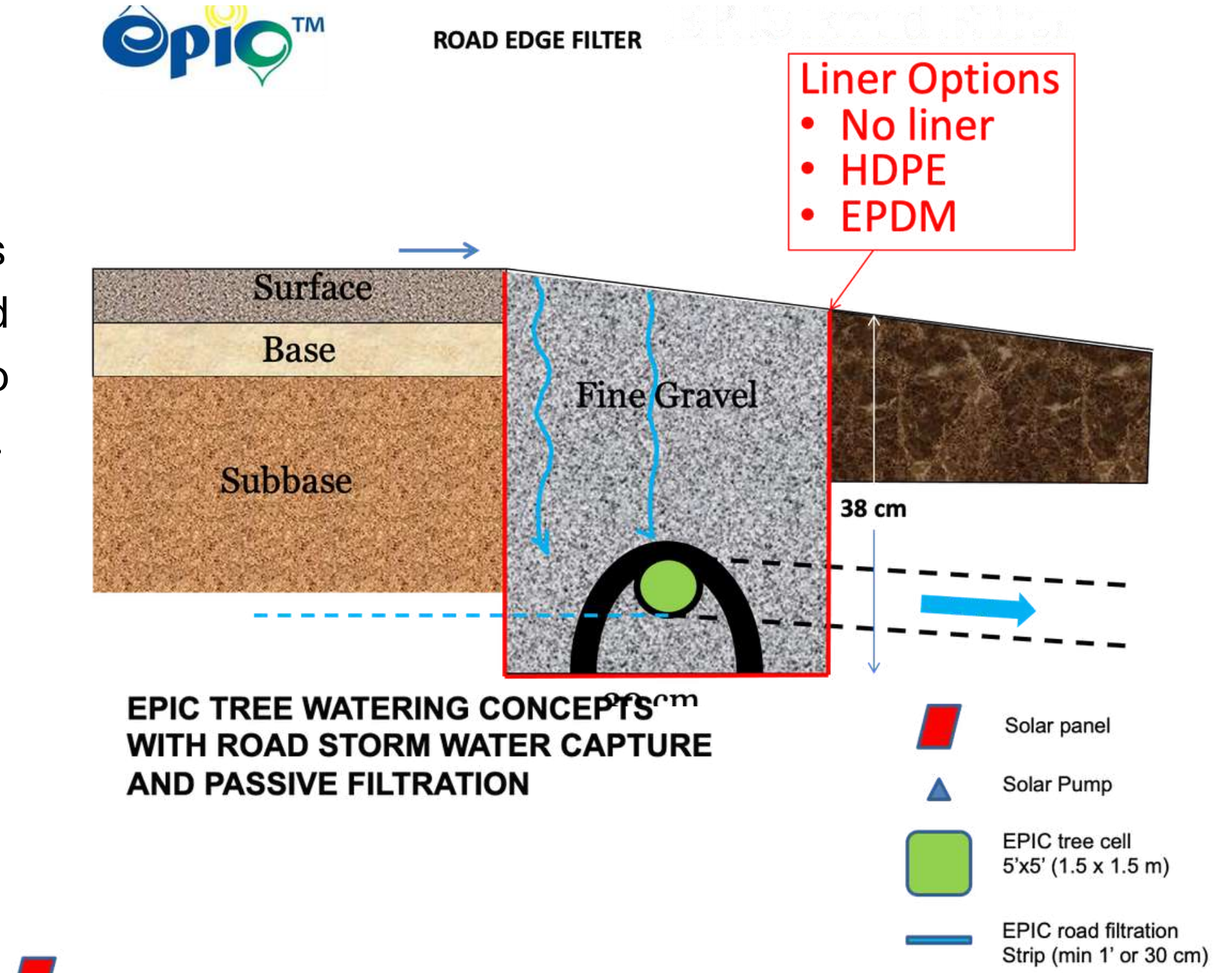
EPIC Benefits

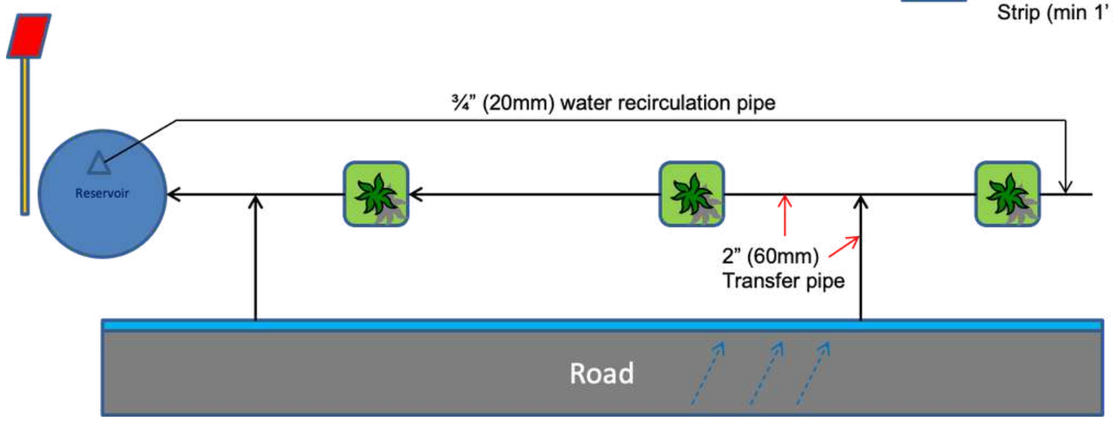
The EPIC System™ enables all runoff water to be filtered, collected, stored and reused.

All areas that have rainfall and hardscape can now have water collection systems that decrease aquifer drawdown and municipal water demands.

An inch of rain over a one square foot surface produces 0.62 gallons of essentially pure distilled water. Yet culturally and from a civil engineering perspective the traditional ingrained philosophy is that storm water is a waste product that must be removed and shed from the property as quickly as possible. The philosophy evolved to elaborate systems that move water away from developed property. EPIC systems opened the doors for efficient capture, passive treatment and reuse of storm water directly. The system acts as a pre-filter for run-off prior to storage and then flips as a 100% efficient irrigation system during dry periods. EPIC systems are true water management of a valuable resource.

With the EPIC Solution, Governments can implement national infrastructure programs to capture and harvest flash flood rainwater and events





City GreenBelts and Highways

1 mm of rainfall = 1 Litre of water per M2

Average highway lane 3.7m

10mm of rain, per km = 37,000 Litres

50km = 1,850,000L per lane, per 10mm, per year

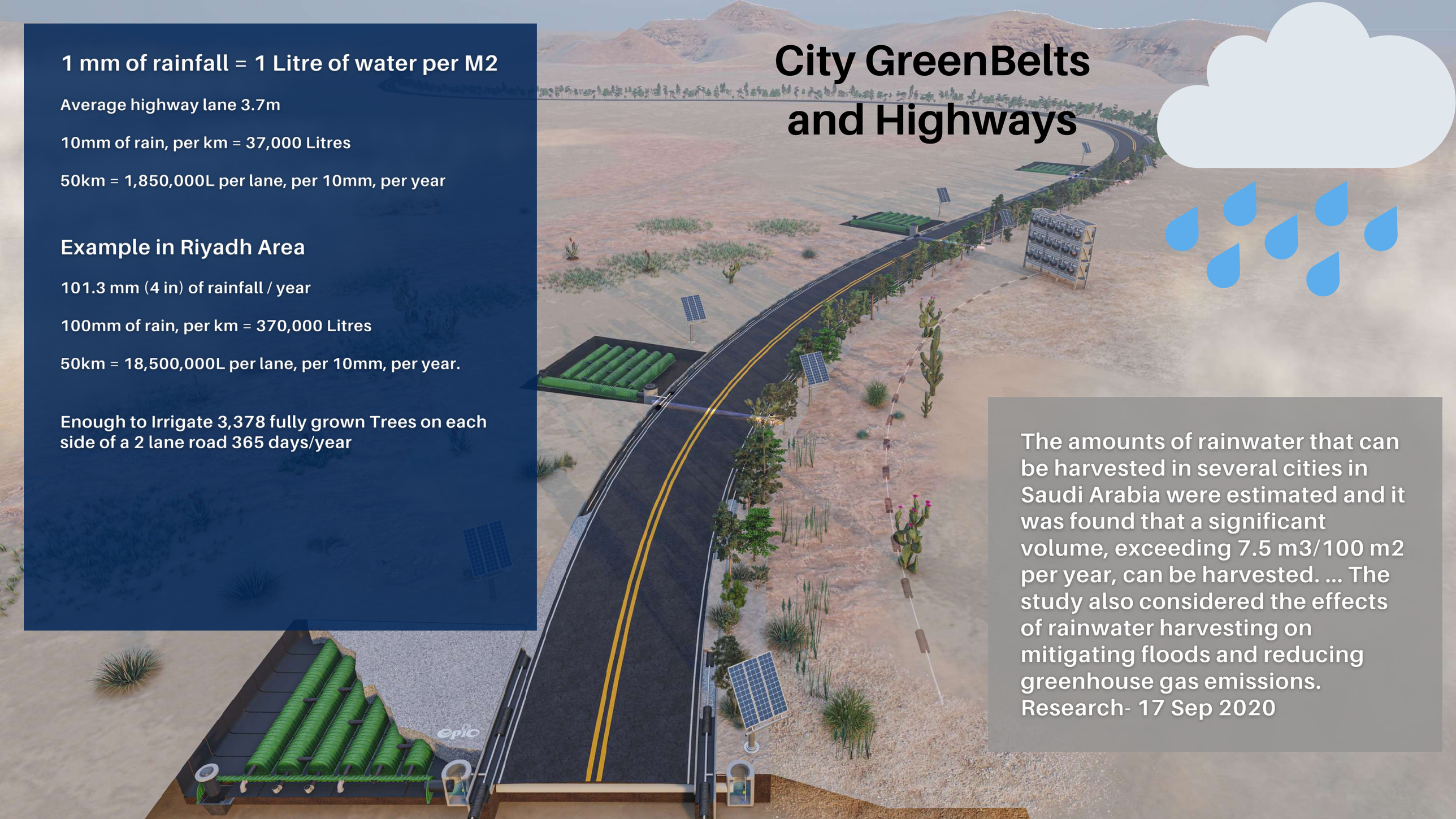
Example in Riyadh Area

101.3 mm (4 in) of rainfall / year

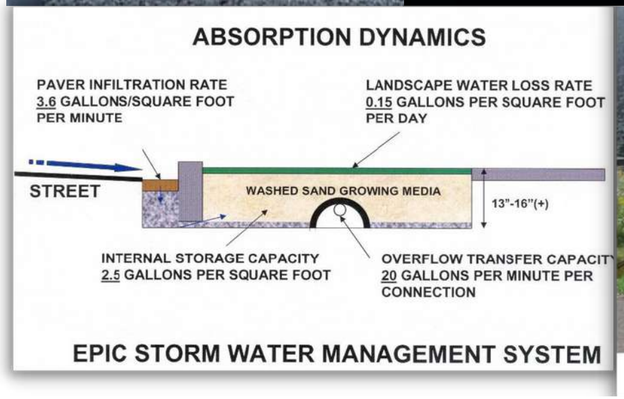
100mm of rain, per km = 370,000 Litres

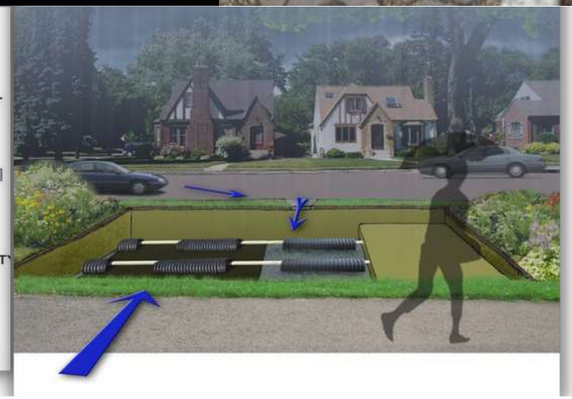
50km = 18,500,000L per lane, per 10mm, per year.

Enough to Irrigate 3,378 fully grown Trees on each side of a 2 lane road 365 days/year

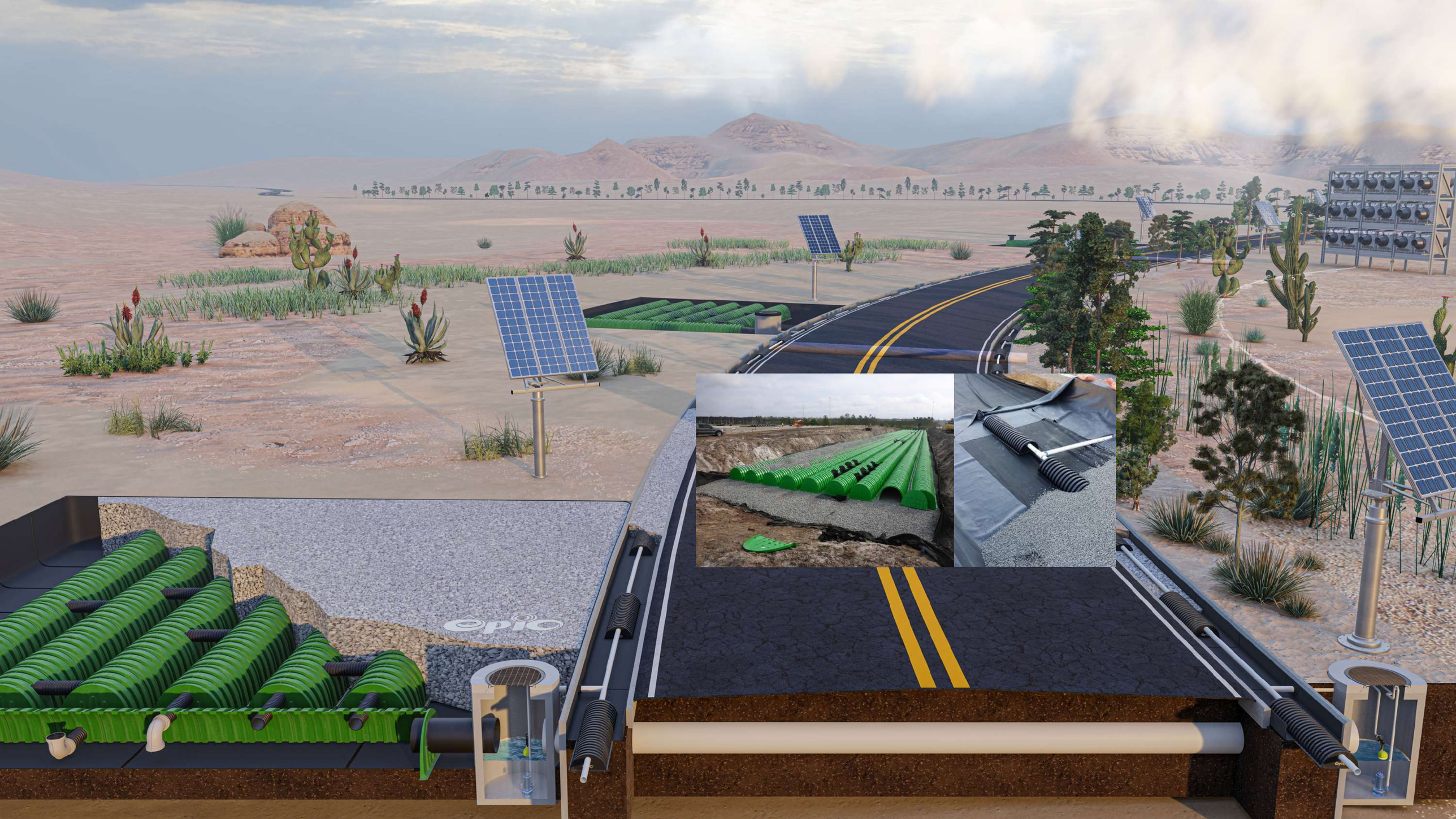


The amounts of rainwater that can be harvested in several cities in Saudi Arabia were estimated and it was found that a significant volume, exceeding 7.5 m3/100 m2 per year, can be harvested. ... The study also considered the effects of rainwater harvesting on mitigating floods and reducing greenhouse gas emissions. Research- 17 Sep 2020





City and Suburbia Hardscape Water Capture Solutions



Artificial Cooling

The largest negative feature of artificial turf surfaces is the high temperature rise of the infill material on sunny days. Various measurements and studies have demonstrated that temperature can quickly exceed 120° F when ambient air temperatures of the surroundings are as low as 80° F and even rise to above 150° F when ambient air temperatures approach 90° F on sunny days.
Extensive temperature measurement tests on identical test plots were conducted June 22-27 in a suburb of Phoenix AZ.

The purpose was to measure temperature differentials between a conventional Field Turf Infill material and foundation versus a Field Turf Infill surface constructed over an EPIC foundation. Test results subsequently verified by an independent testing laboratory showed significant cooling of the infill material by 25.8° – 28.6° F degrees, and an infrared cooling reduction of 20.0° – 24.8° F degrees when conventional Field Turf fabric and Infill material is placed over and EPIC base. Additionally when a modification of the conventional infill material was made, temperature reduction by 50.7° F degrees in the infill material and 42.1° F degrees in the infra-red emissions were observed.

Septic

The unique and proven properties of EPIC technology will become the eventual new standard in Leach Line Construction as the technology becomes more widely known by Health Department Regulators and tried with an expanding consumer base. Capillary rise brings moisture to the aerobic root zone for efficient microbiological degradation and nutrient distribution to plants. What is yucky to humans is yummy to plants.

EPIC delivers moisture and nutrients to plant root zones without human exposure. The simplicity of design, the reliance on gravity and capillary physics as the operating forces, and cost savings in installation and subsequent maintenance will make EPIC the technique and product of choice by design engineers, owners, and installers.

Sewer Mining

The unique and proven properties of EPIC technology gives additional water treatment and reuse options for Health Department Regulators and Water Treatment Plant operators. Black water has been demonstrated to be safely reused for landscape plants with the EPIC system. Capillary rise brings moisture to the aerobic root zone for efficient microbiological degradation and nutrient distribution to plants. What is yucky to humans is yummy to plants. EPIC delivers moisture and nutrients to plant root zones without human exposure. The simplicity of design, the reliance on gravity and capillary physics as the operating forces, and cost savings in installation and subsequent maintenance will make EPIC the technique and product of choice by to reduce impact on waste water treatment plants while reducing the need for potable water in landscape irrigation.

Solar Distiller

The EPIC Solar Distiller converts contaminated water into clean, distilled, drinking water by a simple, passive, thermal process using the Sun. Each unit produces +/- 4 Liters (1 gallon) per unit per day. Many units may combine linearly to scale up distilled water volumes.

The EPIC solar distiller operates passively, by recirculating water slowly by solar pump. Saline or contaminated water wicks into a shallow EPIC sand profile by capillary rise. The profile is isolated within a thermal space, to be heated by the sun via glass and mirror. Condensation forms on the glass and mirrors to be collected and stored in drinking vessels.

1 EPIC Chamber Internal Volume Capacity is 43.9 Litres of Sea Water

1 EPIC Chamber can Produce 4.5 Litres of fresh water a day

1 Km2 Installation can potentially produce 2,250 cubic meters of water per day which is sufficient to irrigate 150,000 trees- assuming a trees consume 15 litres a day

Salt Water Irrigation

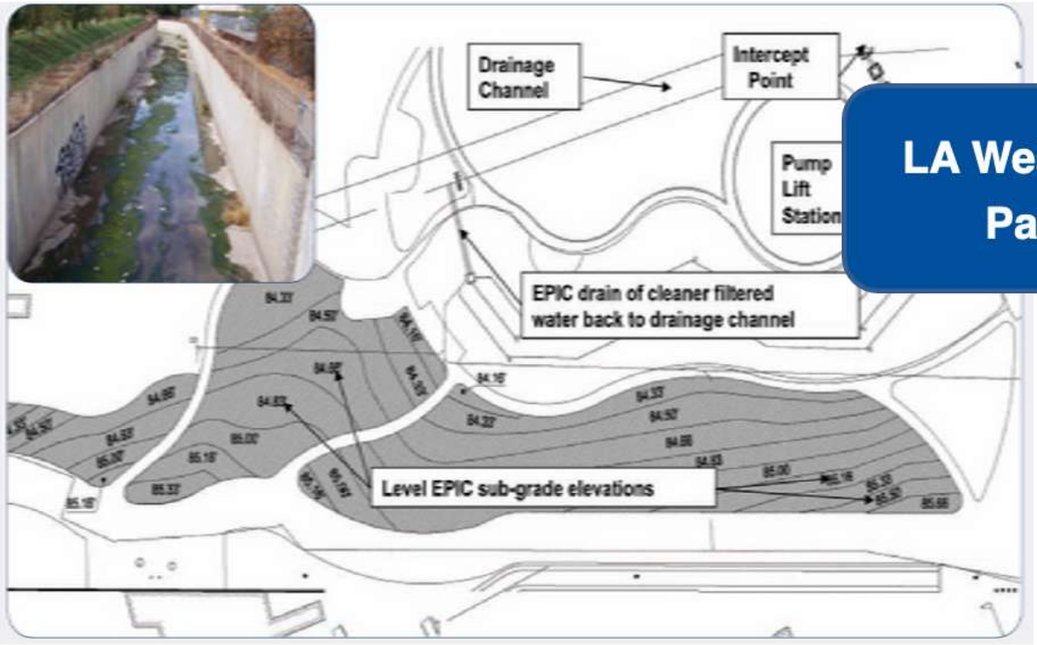
In 2004, EPIC representatives gave a groundbreaking presentation to the American Society of Landscape Architects (ASLA) Annual Conference. The revolutionary topic demonstrated was salt water irrigation, without salt buildup, using the EPIC system. There are over 72 different species of salt tolerant trees, shrubs, flowering plants and turf grasses. Saline tolerant plants are propagated from local tidal pools and able to grow in the washed sand profile of the EPIC system.

A solar pump recirculates ocean water passively, at low flow, for the plants to extract water from the EPIC profile for growth. Excess saline drains back to the ocean, without excessive brine concentrations. EPIC essentially creates an artificial tidal pool, growing landscapes from ocean water.


EPIC can easily be deployed in remote areas
Yas Island

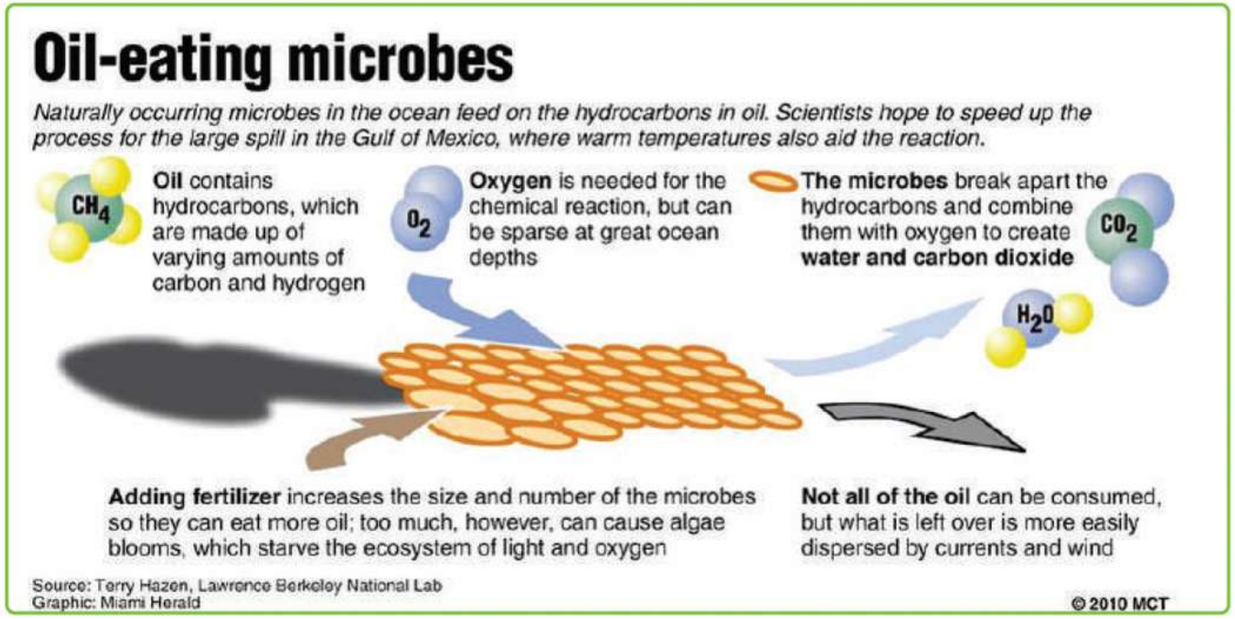
Biofiltration & Irrigation

The EPIC System™ is a very effective bio-filtration system which has both environmental and aesthetic benefits. The EPIC System™ increases the capacity to filter large volumes of storm water runoff, allow infiltration back into the groundwater if desired or, reuse the stormwater within a living profile as an irrigation source and increase plant health and viability. These solutions function with minimal maintenance as a long -te rm sustainable water management solution.

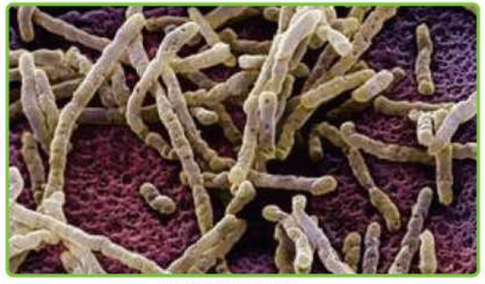


The EPIC System™ is being used in the LA Westside Park Rainwater Irrigation project to clean the waters flowing from the drainage channel. Water flowing from the drainage channel is intercepted and pumped into the EPIC system™ below the park for irrigation and after bio-filtration, is released back into the drainage channel.

EVAPORATIVE PONDS BIOFILTRATION AND IRRIGATION

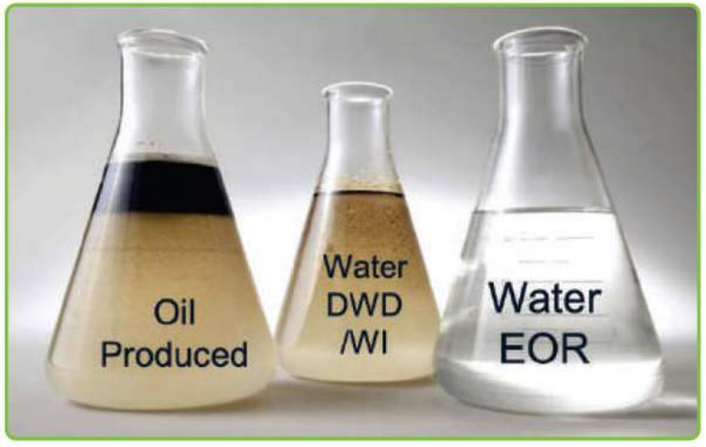


BIOFILTERING PRODUCED WATER FOR AND IRRIGATING SURROUNDING LANDSCAPE



BACTERIA COLONY

EPIC ELIMINATES POLISHING/TERTIARY STAGE TREATMENT

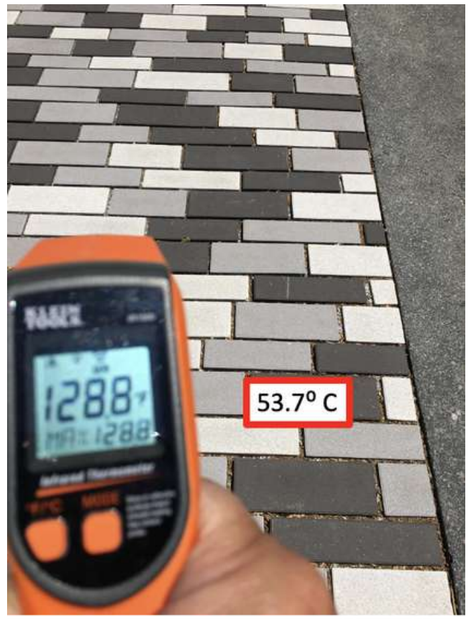


NOT NEEDED

EPIC Passive Cooling - Surfaces & Buildings

Hardscapes can be more than just walking or driving surfaces!

- **EPIC profiles can capture and filter water**
- **EPIC profiles can provide beneficial heat exchange**
- **Separate or in conjunction in same system**



Temperature on pavers

Incoming air temperature

EPIC gravel base without liner

Airflow bubble

EPIC Gallery