Technologies For Creating Green Cities

GREEN SYSTEMS

www.greensystems.net
Rainwater Harvesting
Permeable Paving
Vertical Gardens
Rooftop Gardens

restoring beauty to our world
through intelligent water management
Sustainable Water Resources Management

Scientific & Modular Rainwater Harvesting

Focus of Presentation –

1. General Awareness
2. Introduction to Rainwater Harvesting
3. Concept of Modular Technology: the sustainable practice
4. Inefficiency in Harvesting Rainwater Addressed
5. Other requirements: Technical, Maintenance, Climatic Conditions, etc
6. Examples of successful installations: India and Abroad

Pleas and Remarks
Ground Water Depletion – Study by NASA

RED means very positively UNSUSTAINABLE!!

Shows groundwater withdrawal as a percentage of groundwater recharge

Groundwater variation observed in northwestern India between 2002 and 2008
## CGWB/CGWA - Legal Requirements

Abstraction wells are allowed based on recharge measures. Inefficient Recharging Systems = **UNSUSTAINABLE** groundwater withdrawal.

<table>
<thead>
<tr>
<th>Category</th>
<th>Stage of Development (%)</th>
<th>Recycle / Reuse</th>
<th>Other Water Conservation Practices</th>
<th>Withdrawal permitted (%)age of proposed recharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe</td>
<td>&lt; 70</td>
<td>Mandatory recycling and reuse of water</td>
<td>Water audit measures to be adopted</td>
<td>RWH to be adopted.</td>
</tr>
<tr>
<td>Semi-critical</td>
<td>70 – 100</td>
<td>Efficient utilization of recycled water and reuse of water should be mandatory.</td>
<td>Water audit measures to be adopted</td>
<td>At least 50% recharge is made mandatory.</td>
</tr>
<tr>
<td>Critical</td>
<td>90 – 100</td>
<td>Efficient utilization of recycled water and reuse of water should be mandatory.</td>
<td>Water audit measures to be adopted</td>
<td>The quantum of recharge should be <strong>equal to or more than the proposed withdrawal.</strong></td>
</tr>
<tr>
<td>Over-exploited</td>
<td>&gt;100</td>
<td>Efficient utilization of recycled water and reuse of water should be mandatory.</td>
<td>Water audit measures to be adopted</td>
<td>Withdrawal may be permitted up to 60 % of proposed recharge. Also withdrawal should not exceed a maximum limit of 1500 m3/day for each unit.</td>
</tr>
</tbody>
</table>
Water Resources Management

Focus of Presentation –

1. General Awareness
2. Introduction to Rainwater Harvesting
3. Concept of technology adopted
4. Shortfalls of Conventional Methods Addressed
5. Other requirements: Technical, Maintenance, Climatic Conditions, etc
6. Examples of successful installations: India and Abroad
7. Do’s and Don’ts
Conventional Method to Recharge Groundwater
Reasons for Groundwater Decline
Conventional RWH Filtration

Horizontal Roughening Filter and Slow Sand Filter

Filter for large roof tops

Sand Filter

Charcoal Water Filter
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MODULAR & SCIENTIFIC RAINWATER HARVESTING

Recharge || Retention || Detention || Percolation

Rainwater Harvesting Tank

By leaving the top of the tank open to infiltration excess water within the soil profile can be captured for reuse.
MATERIALS USED in a Modular Tank

Geotextile

Waterproof Liner (for Storage and reuse only)
Installati on
Process
Overview

1. Recharge Well Drilling
2. Pit Excavation
3. Base Preparation
4. Geotextile Installation
5. Module Assembly
6. Module Installation
7. Module being wrapped with Geotextile
8. Module wrapped in Geotextile
9. Backfilling post installation
10. Levelled surface after backfill
11. 1 month post completion
Flexible Applications of Modular Technology

Rainwater Harvesting for GROUNDWATER RECHARGE using Recharge Wells
Flexible Applications of **Modular Technology**
Rain Water Harvesting **for STORAGE AND REUSE**
Flexible Applications of **Modular Technology**

RWH **Reuse and Groundwater Recharge**

**Storage Tank + Percolation Pit**

[Diagram showing a submersible pump, an overflow pipe, a liner, and an infiltration tank.]

- **Submersible Pump**
- **Overflow Pipe**
- **Liner**
- **Infiltration Tank**

Pump irrigation water source
Flexible Applications of Modular Technology Harvesting
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Clogging Issue Addressed – using Modular Technology

Clog-Free Function and Low Maintenance Cost :- Owing to “External Filtration”

- Designed to eliminate clogging
- Minimizes annual maintenance cost
- Performs efficiently over long term and serves its purpose – Sustainability

Time for cleaning: 1 to 3 days by 2 or more workers
Maintenance Cost: INR 30,000 to 1,45,000 or more every year

Time for cleaning: 2-3 hours by 1 person
Maintenance Cost: INR 0 to 5,000 per year
Dual Step EXTERNAL FILTRATION
for Easy and inexpensive maintenance, Clog-free performance

**Step – 1**

De-silting Chamber/Oil Filter

- Designed for any flow situations
- Pre-manufactured, short time of installation
- Designed for **easy and low cost maintenance**

**Step – 2**

Patented Micro-Filter

- Removes particles up to **180 microns** in size
- Suitable for flow situations of 72 cum/hr
- Pre-manufactured, short time of installation
- Extremely easy to maintain – at little or no cost

Easy Maintenance
Eco-friendly Material and Design

- **25 – 35% Smaller (Greener) Footprint**
  - Eliminates Filter Media and Free Board

- **98% Recycled and recyclable Material**
  - No free-board

- 95% void

**Concrete Storage Tank**

**Modular Storage Tank**

**Actual Project Details**

<table>
<thead>
<tr>
<th>Recharge Pit Location</th>
<th>Proposed Artificial Structures using Conventional Method</th>
<th>Installed Artificial Recharge Structures using Cross Wave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>No. of recharge wells</td>
<td>Dimensions</td>
</tr>
<tr>
<td>Area Pit 1</td>
<td>78m x 7.5m x 5.8m</td>
<td>32m x 7m x 2.07m</td>
</tr>
<tr>
<td>Area Pit 2</td>
<td>58m x 7.5m x 5.8m</td>
<td>24m x 7m x 2.07m</td>
</tr>
<tr>
<td>Area Pit 3</td>
<td>45m x 7.5m x 5.8m</td>
<td>19m x 7m x 2.07m</td>
</tr>
<tr>
<td>Area Pit 4</td>
<td>29m x 7.5m x 5.8m</td>
<td>12m x 7m x 2.07m</td>
</tr>
</tbody>
</table>
Construction Time - Cut Short by 80% using "Modular Technology"

Time:

Modules can be installed in a couple of days to few weeks as compared to 3-4 months of conventional technology.

Conventional Methods - using Brick or Concrete; **Duration of Construction:** 3 Weeks to several months

Using Modular Technology
**Duration of Construction:** 2 to 10 days
Safety Issues Addressed using Modular Technology

Safety:-

Honey-comb shape ➔ Accident Free

Conventional Rainwater Harvesting Structure
- Prone to accident, if left open

Modular Tank installed underground - Safe for schools
Quality Assurance

Matrix Module

Geotextile

Water Proofing Liner

<table>
<thead>
<tr>
<th>Surface Area</th>
<th>95% void</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>85% recycled Polypropylene + 15% Atlantis propriety selected materials</td>
</tr>
<tr>
<td>Biological &amp; Chemical Resistance</td>
<td>Unaffected by moulds and algae, soil-borne chemicals, bacteria and bitumen</td>
</tr>
<tr>
<td>Service Temperature</td>
<td>-8°C to 55°C (-21.2°F to 131°F)</td>
</tr>
</tbody>
</table>

Ultimate Load/ Unconfined Crush Testing:

<table>
<thead>
<tr>
<th>Crush Load</th>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 t/m²</td>
<td>34 psi</td>
</tr>
<tr>
<td>Displacement</td>
<td>11 mm</td>
<td>0.433&quot;</td>
</tr>
<tr>
<td>Temperature</td>
<td>8-14°C</td>
<td>46-57°F</td>
</tr>
</tbody>
</table>

Side Load:

<table>
<thead>
<tr>
<th>Crush Load</th>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longside</td>
<td>18 t/m²</td>
<td>25 psi</td>
</tr>
<tr>
<td>Shortsides</td>
<td>12 t/m²</td>
<td>17 psi</td>
</tr>
<tr>
<td>Displacement</td>
<td>10 mm</td>
<td>0.394&quot;</td>
</tr>
<tr>
<td>Temperature</td>
<td>17°C (±3)</td>
<td>63°F (±6)</td>
</tr>
</tbody>
</table>
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Completed Surfaces

Auditorium, Municipal Corporation of Faridabad

AG Industries, Bawal, Haryana

Honda, Manesar

Rotary Public School, Gurgaon CSR project of RITES

District Magistrate’s Office, Allahabad Development Authority
Successful Installations
(India and Abroad)

<table>
<thead>
<tr>
<th>Capacity</th>
<th>6,00,000 Litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Breweries - Below parking lot</td>
</tr>
<tr>
<td>Catchment</td>
<td>Surface &amp; Stormwater</td>
</tr>
<tr>
<td>Location</td>
<td>Tatcham, United Kingdom</td>
</tr>
<tr>
<td>Capacity:</td>
<td>1,200,000 Litres</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Application:</td>
<td>Automobile Manufacturing Facility - Below lawn</td>
</tr>
<tr>
<td>Catchment:</td>
<td>Surface &amp; Rooftop</td>
</tr>
<tr>
<td>Location:</td>
<td>Rajasthan, India</td>
</tr>
<tr>
<td>Capacity:</td>
<td>1,000,000 Litres</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Application:</td>
<td>Gabba International Cricket Stadium - Below the sports field</td>
</tr>
<tr>
<td>Catchment:</td>
<td>Rooftop of Grandstands and the Sports Field</td>
</tr>
<tr>
<td>Location:</td>
<td>Brisbane, Australia</td>
</tr>
<tr>
<td><strong>Capacity:</strong></td>
<td>4,25,000 Litres</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Application:</strong></td>
<td>Hotel Complex - Below parking lot</td>
</tr>
<tr>
<td><strong>Catchment:</strong></td>
<td>Surface &amp; Rooftop</td>
</tr>
<tr>
<td><strong>Location:</strong></td>
<td>Texas, United States of America</td>
</tr>
<tr>
<td><strong>Capacity:</strong></td>
<td>7,300,000 Litres</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Application:</strong></td>
<td>Shopping Centre - Below Carpark</td>
</tr>
<tr>
<td><strong>Catchment:</strong></td>
<td>Stormwater run-off</td>
</tr>
<tr>
<td><strong>Location:</strong></td>
<td>British Columbia, Canada</td>
</tr>
</tbody>
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Don'ts

- Don’t neglect RWH structures
- Don’t discharge wastewater into RWH structures
- Don’t do it for the sake of law as a minimum
- Don’t cheat yourself by finding loopholes in the law
Do’s

- Adopt RWH for maximum potential at a given site
- Maintain RWH structures regularly and religiously
- Adopt efficient methods for harvesting rainwater