

# ***Water Shortages & flooding***



***Rain Water Conservation needs a different approach, indeed.***

# *The Urban Storm-water Challenge*

- *Climate Change is Real.*
- *Rain Patterns have changed.*
- *Droughts & Deluge happen in the same region.*
- *Rivers and water bodies are decaying.*
- *Soak Basins & Green Vistas are usurped.*
- *Clean water resources are dwindling.*
- *Life on this planet will become yet more expensive.*

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# *The Urban Storm-water Challenge*



*Climate Change is Real, Floods and Droughts Now Happen Concurrently*

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# *The Urban Storm-water Challenge*



*Climate Change is Real, Floods and Droughts Now Happen Concurrently*

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# *The Urban Storm-water Challenge*



*Changing Rainfall patterns cause frequent water logging on the roads*

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# *The Urban Storm-water Challenge*



*Most of our cities are now unable to cope sudden bursts of Rain.*

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# *The Urban Storm-water Challenge*



*Every Monsoon, we witness such scenes in one city or another.*

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# *The Urban Storm-water Challenge*



***Polluted Storm water can backflow into rainwater harvesting wells.***

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# *Storm water buildup is a real Challenge*



*Water logging causes massive damage to infrastructure*

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# *Storm water buildup is a real Challenge*



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# *Storm water buildup is a costly affair*



*Frequent repair of the drains is needed after every Monsoon.*

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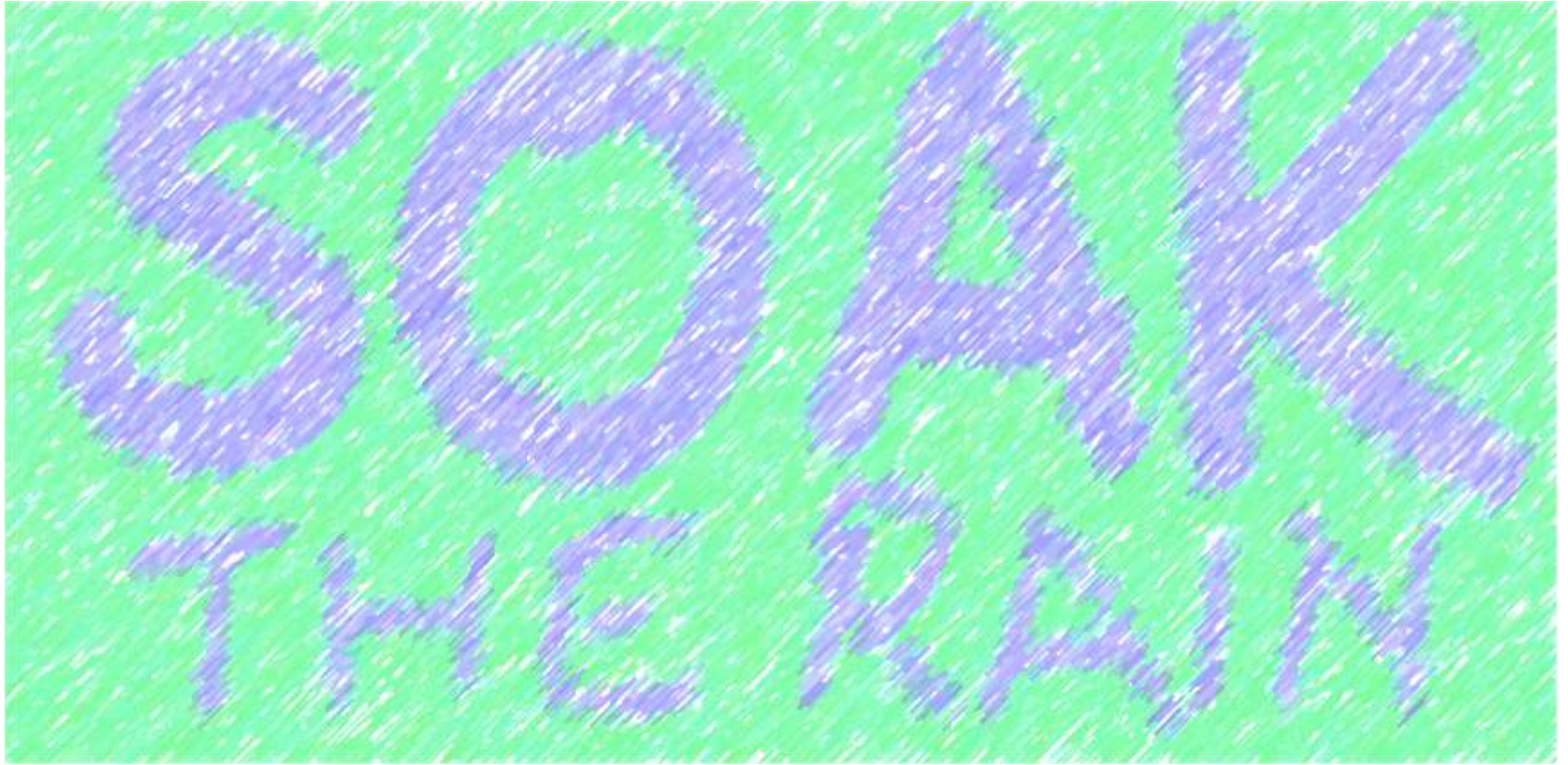


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# *The Ideal Solution for Water Crisis*



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# *Green Solutions for Soaking the Rain*



*Under drained Bio-swales have been added to urban landscape globally*

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# *Green Solutions for Soaking the Rain*



***Underdrained swales along the roads reduce the Highway maintenance costs.***

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# *Green Solutions for Soaking the Rain*



***Bioswales with underground Geocellular blocks are actually cheaper***

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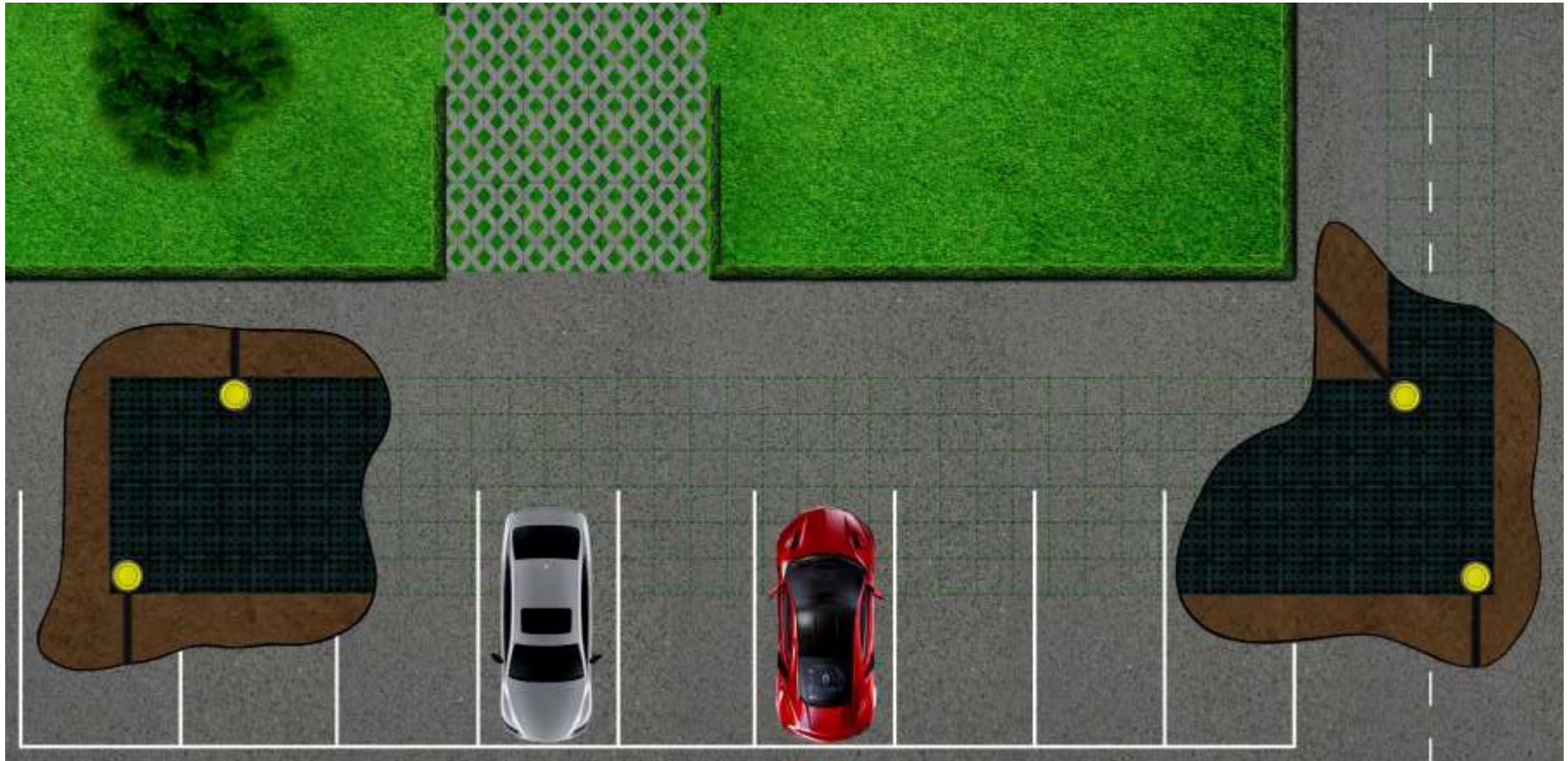
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# Green Infrastructure without loss of land



**Rigofill ST Blocks can withstand 60 Ton load vehicular traffic**

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# *Green Solutions for Soaking the Rain*



*Green drains require much less maintenance and look good as well*

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# *Underdrained Bioswales*



***Rigofill ST Geocellular blocks increase the detention capacity of green drains.***

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No  
water logging  
on the roads !



*Rigofill ST Blocks are used worldwide under the road & green drains*

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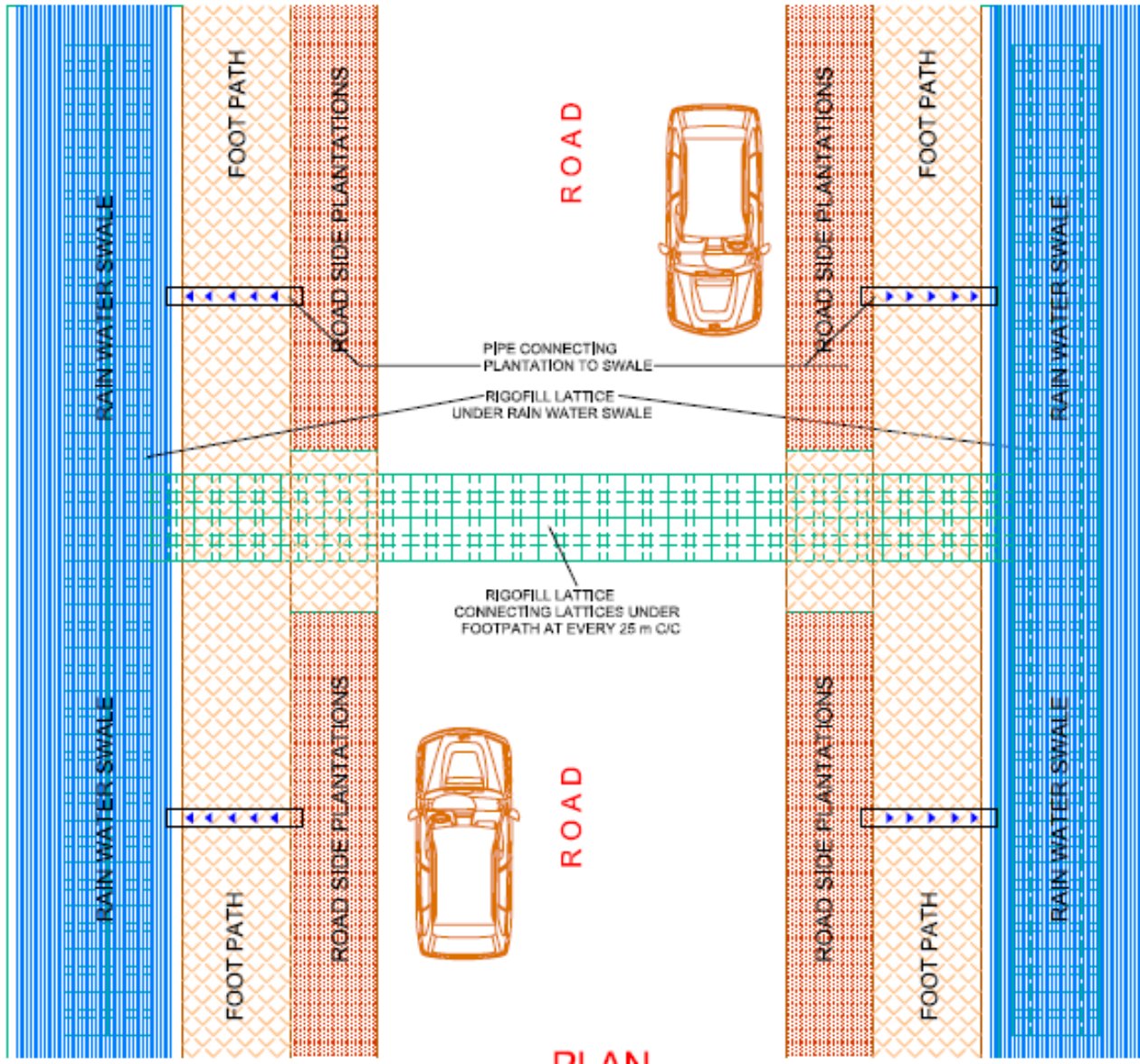
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# Bioswales with Rigofill-ST

*Underground  
drainage  
channels are  
created along the  
road and under  
median or  
carriageways.*



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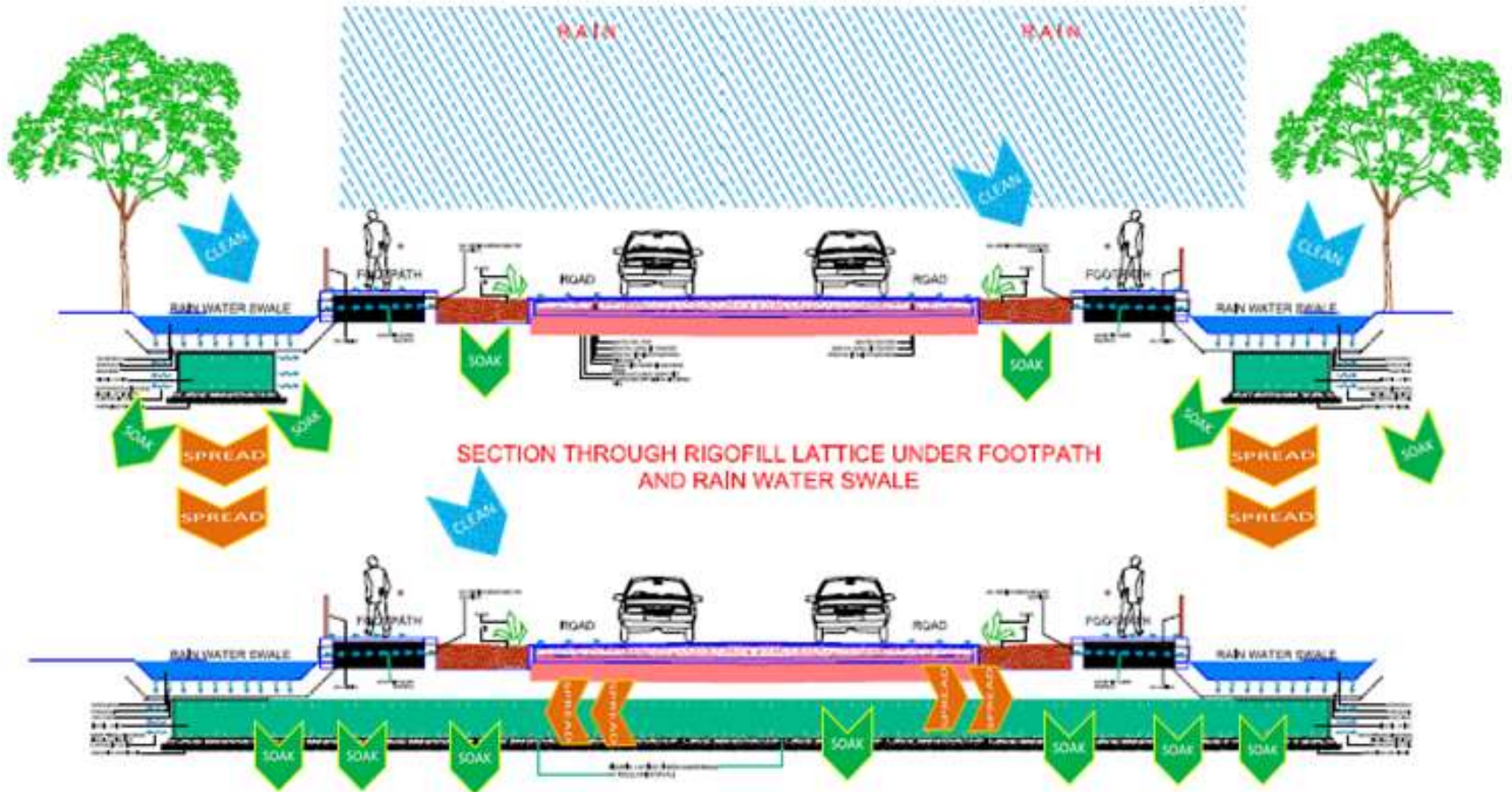
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# Bioswales with Rigofill- ST



**Stormwater drains under the road infrastructure.**

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# Collection of runoffs with Vegetated Swales



*Vegetated swales collect, detain, transport & infiltrate the rainwater.*

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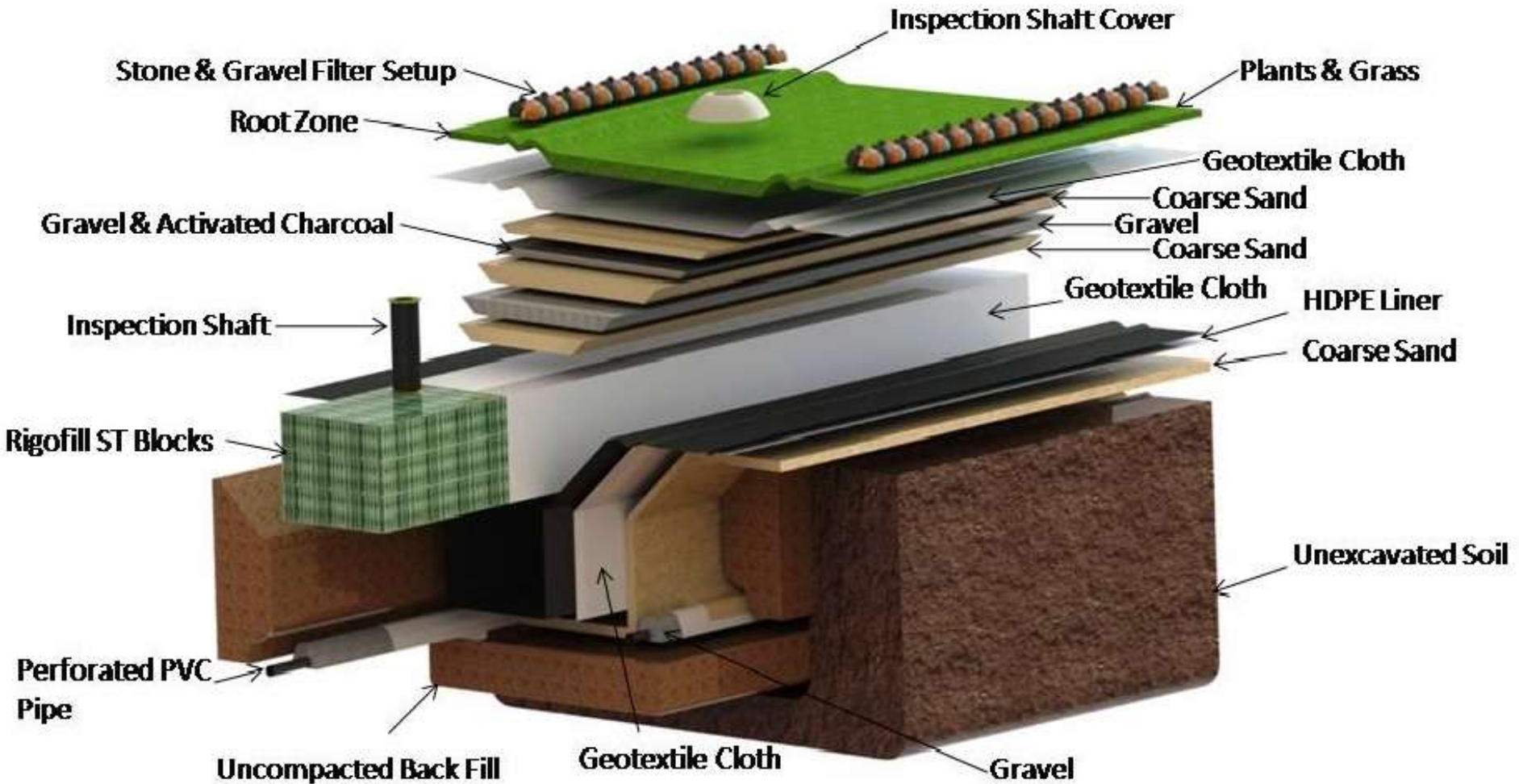
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# Bioswales with Rigofill- ST



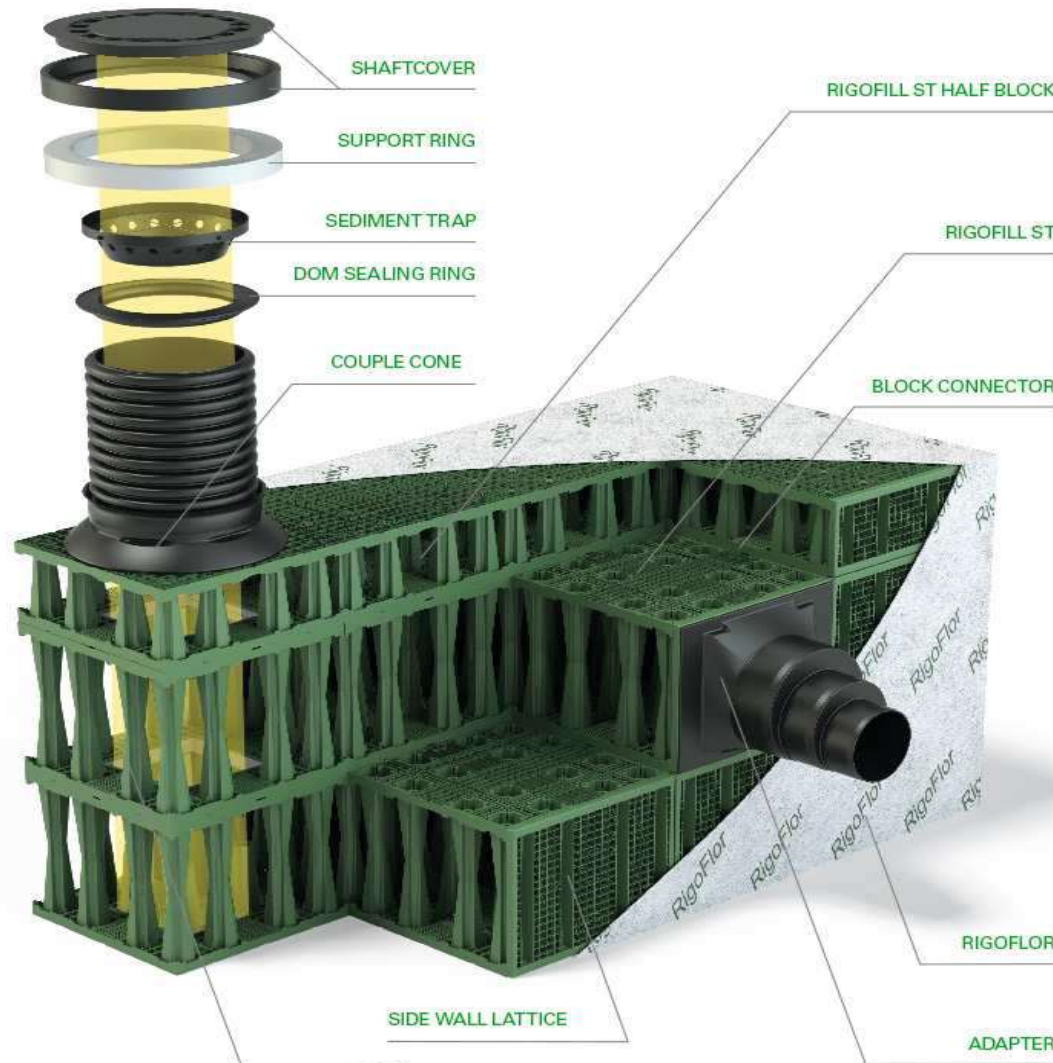
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# Rigofill-ST-The Green Street Champion



**Vertical load  
over 450  
kN/m<sup>2</sup>**

**Lateral load  
over 110  
kN/m<sup>2</sup>**

**One of the strongest  
available Geocellular  
Blocks for Urban  
Stormwater Mitigation**

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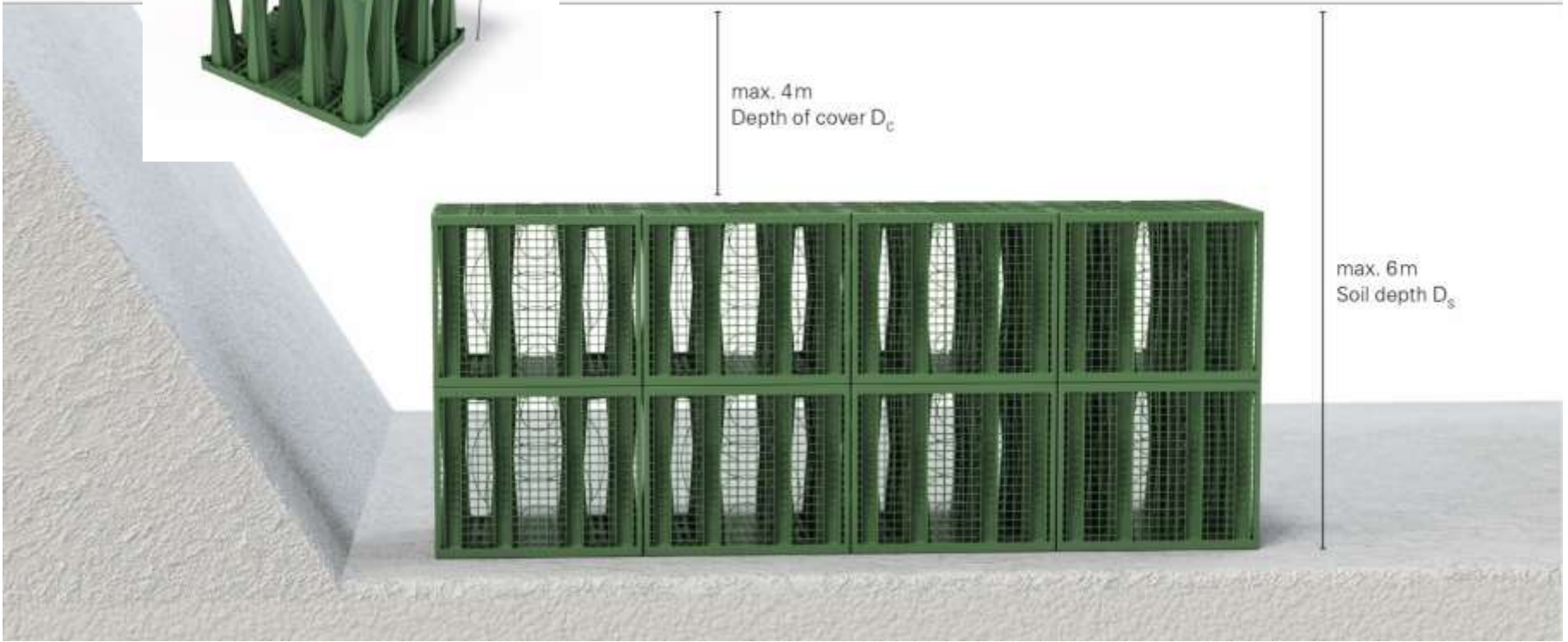
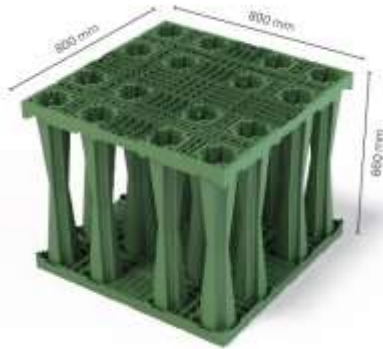
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# Rigofill-ST the Green Street Companion



**Underground Soak basins with ZERO land costs.**

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# Storm-water containment with Rigofill-ST



**Underground Soak basins are created in congested areas to reduce runoff.**

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# Rigofill-ST offers a sturdy solution



**Rigofill-ST supports Heavy Traffic- 60 Tons gross weight vehicles !**

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# Cut and Cover Solution



**Green drains can be placed under the roads with heavy payload**

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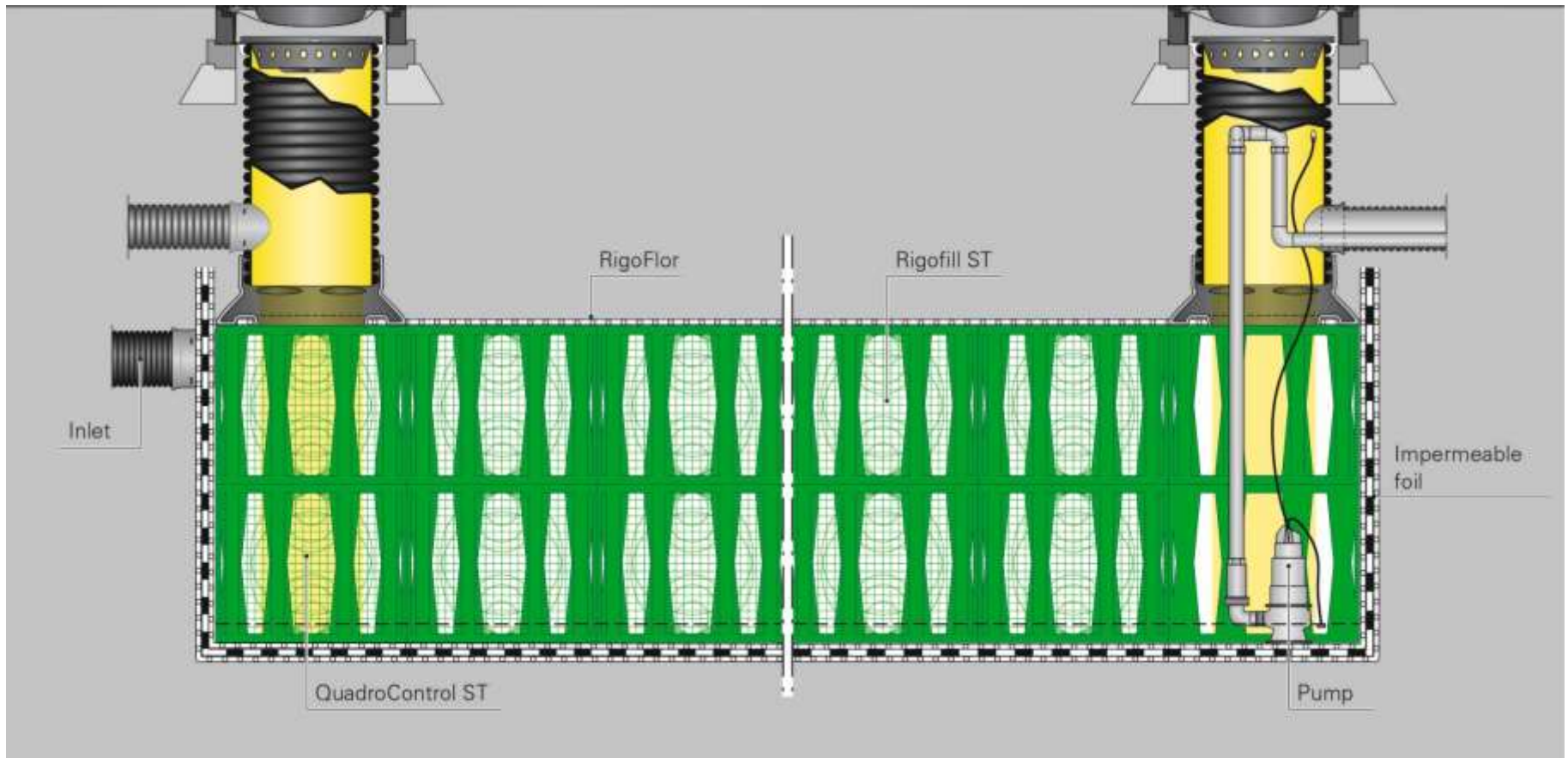
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# Storm-water Management with Rigofill-ST



**Store Rainwater where it falls- without any loss of land !**

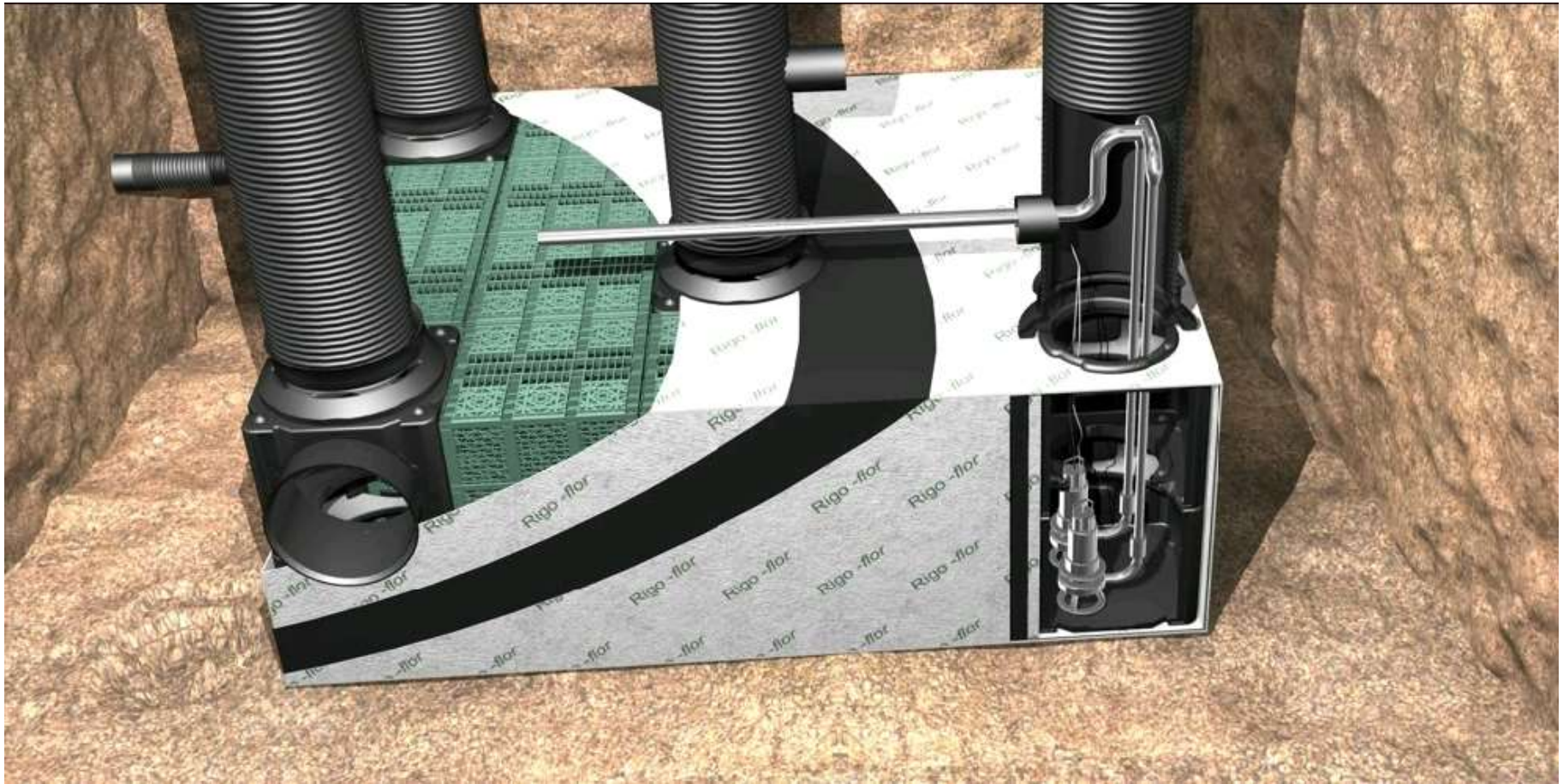
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# Complete Storm Water Management



***Rigofill ST System is also used as Fire water storage tanks***

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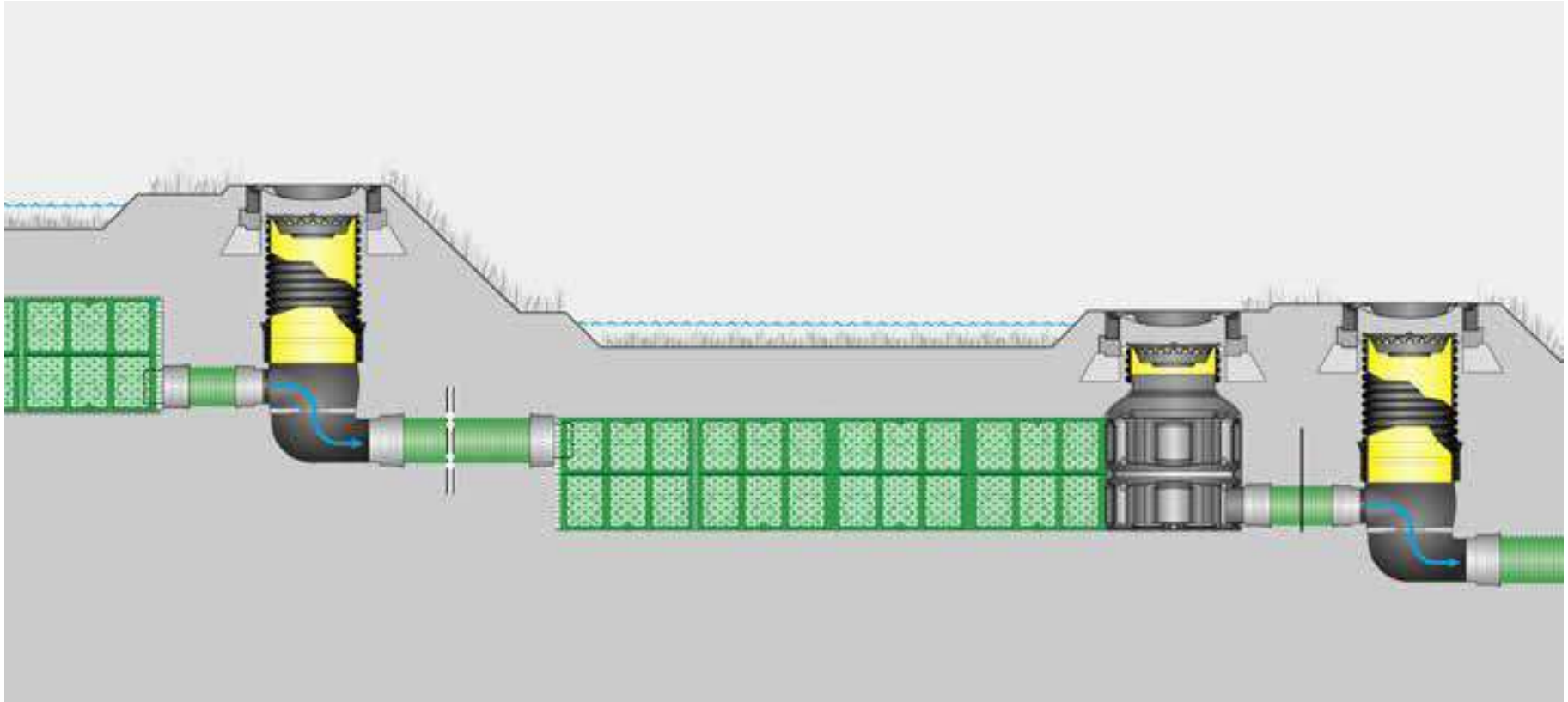
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# *Cross Section of Attenuation Swales*



***Vegetated swales with Rigofill-ST hold the storm water runoffs underground and limit its enormity.***

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# *Complete Storm Water Management*



*Rigofill ST blocks used for trench building.*

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# *Storm-water Management with Rigofill-ST*



*Storm-water transported in sealed channels under the road*

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# *Sewage Volume Containment*



***Separation of storm-water from sewage is an obligation by law***

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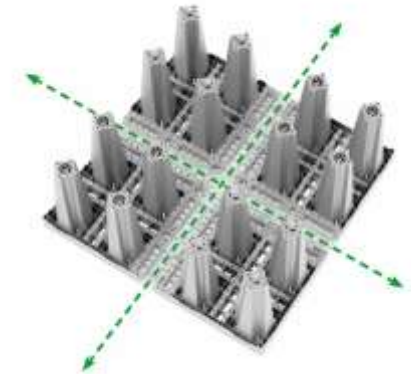
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# Easy to inspect and clean, if needed



**Rigofill-ST basins can be 100% inspected with commonly available cameras.**

# *Underground Storm water basins*



*Storm water is collected and detained under trafficked areas and released into soil. Water logging on the roads is thus prevented and the harvested rain water is kept separated from sewage.*

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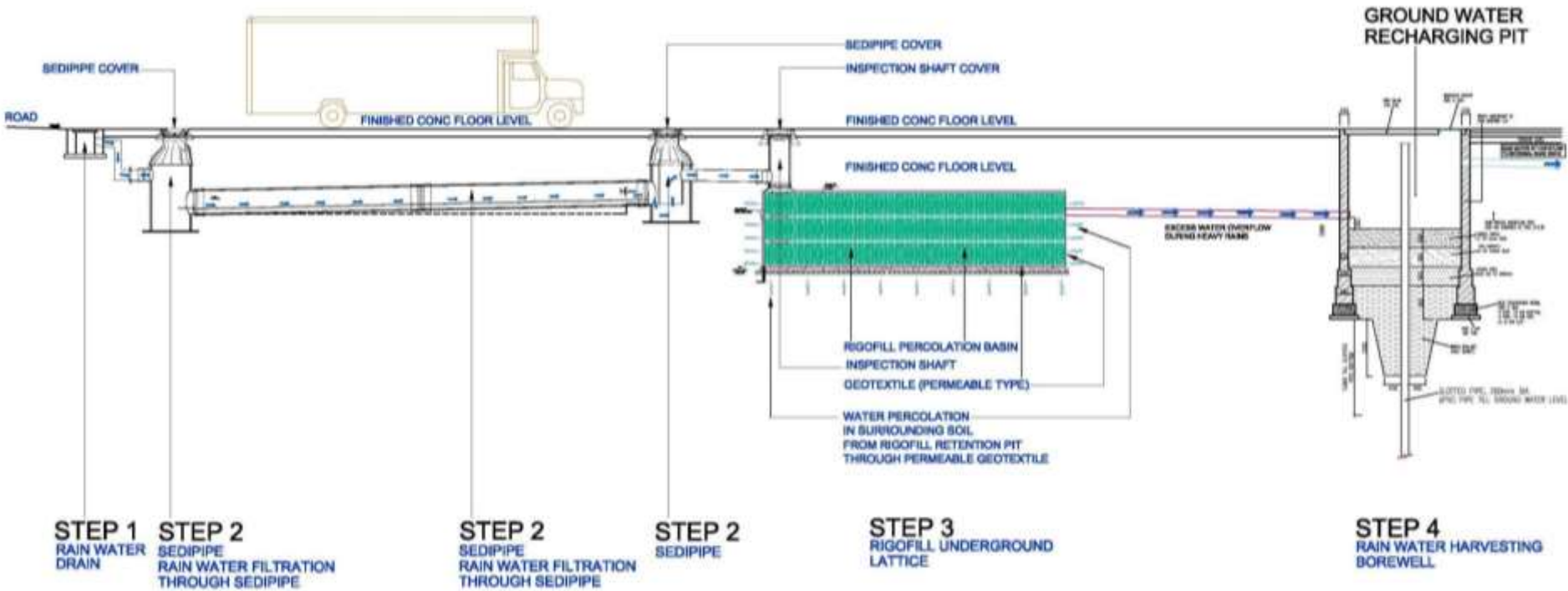
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# Rapid Evacuation via Sedipipe



**Copious volumes of clean rain water can be safely collected and pre treated before infiltration or storage in underground basins.**

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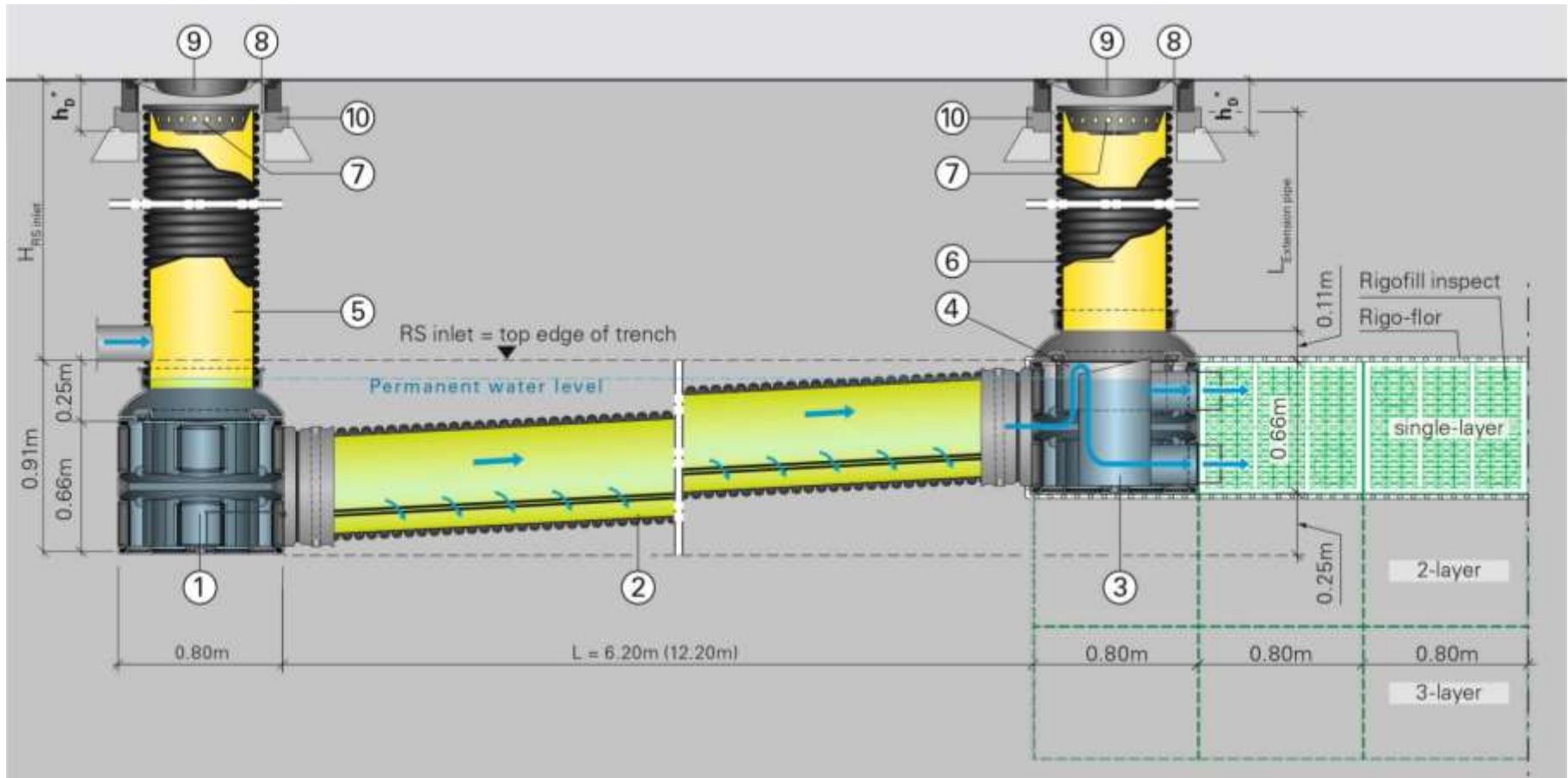


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# Speedy Pre-Treatment and Infiltration



**Pre treatment @ 20-40 liters per second without electricity or filters.**

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# *Sedipipe is a Gravity based Pre-Treatment.*



*Silt and light oils are separated from the storm water collections from the road, before its release into the basins to protect groundwater.*

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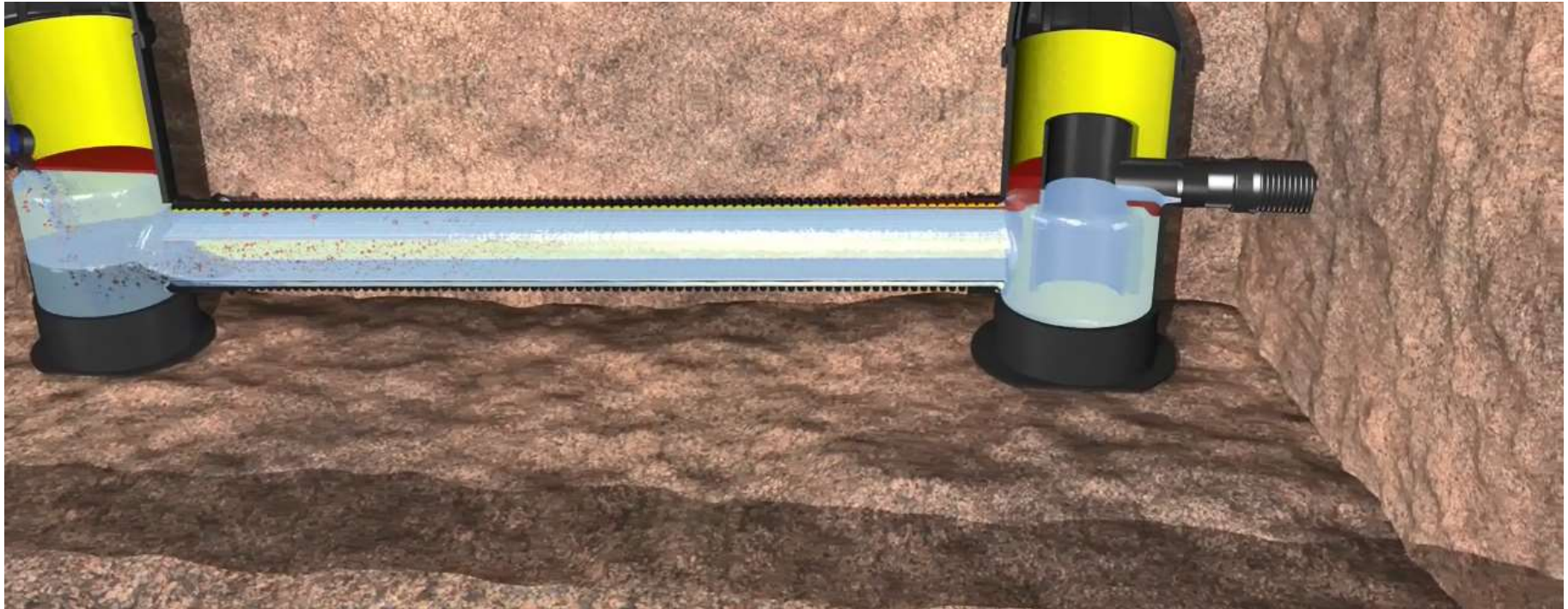


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# *Pre-Treatment, prior to release into ground.*



*Existing storm-water drains are connected to Sedipipe system. This patented technology from Frankische, uses gravity, surface tension and flow separation technology to trap silt and light oils prior to releasing cleaner water into the Rigofill basins.*

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# *Expertise in Storm-water Management*



*Pre treatment of Stormwater prior to infiltration meeting the pollution norms.*

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# *Expertise in Storm-water Management*



***Rigofill-ST are lined with sturdy HDPE Liner to hold rainwater for years.***

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# RWH System Cost Recovery Matrix

**Apartment Configuration & Water Requirement mapping for a Condominium in New Delhi Region in about 10 Acre land**

Plot Length	300	M	Plot Width	140	M
Carpet area/Flat	200	sqm	Floor Plate	1360	sqm
Super area/Flat	340	sqm	Built Up area	21760	sqm
Flats/Floor	4	units	Utility Buildings	2000	sqm
Floors/Tower	14	units	Total Built-up Area	23760	sqm
Towers	16	units	Total Flats	896	Units
Person /flat	4	units	Total Persons	3584	Units
Water/person	150	Litres	Daily Need	537600	Litres
Irrigation/Sqm/day	1	Litres	Horticulture	42000	Litres
Washing/Cleaning/Sqm	0.25	Litres	Washing	10000	Litres
Water Supply Rate per KL	150	INR	Total Water Consumption	589600	Litres
Daily Water Consumption	590	KL	Cost per Day	88500	INR
No of Rainy Days/annum	35	Days	Possible Savings/Annum	31	Lakhs

**Rainwater is harvested in slow sand filters and stored in Rigofill-ST basin.**

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# *Clean & Green India*



*Urban Settlements can be kept cleaner by inserting green drains along the roads, which are much easier to maintain.*

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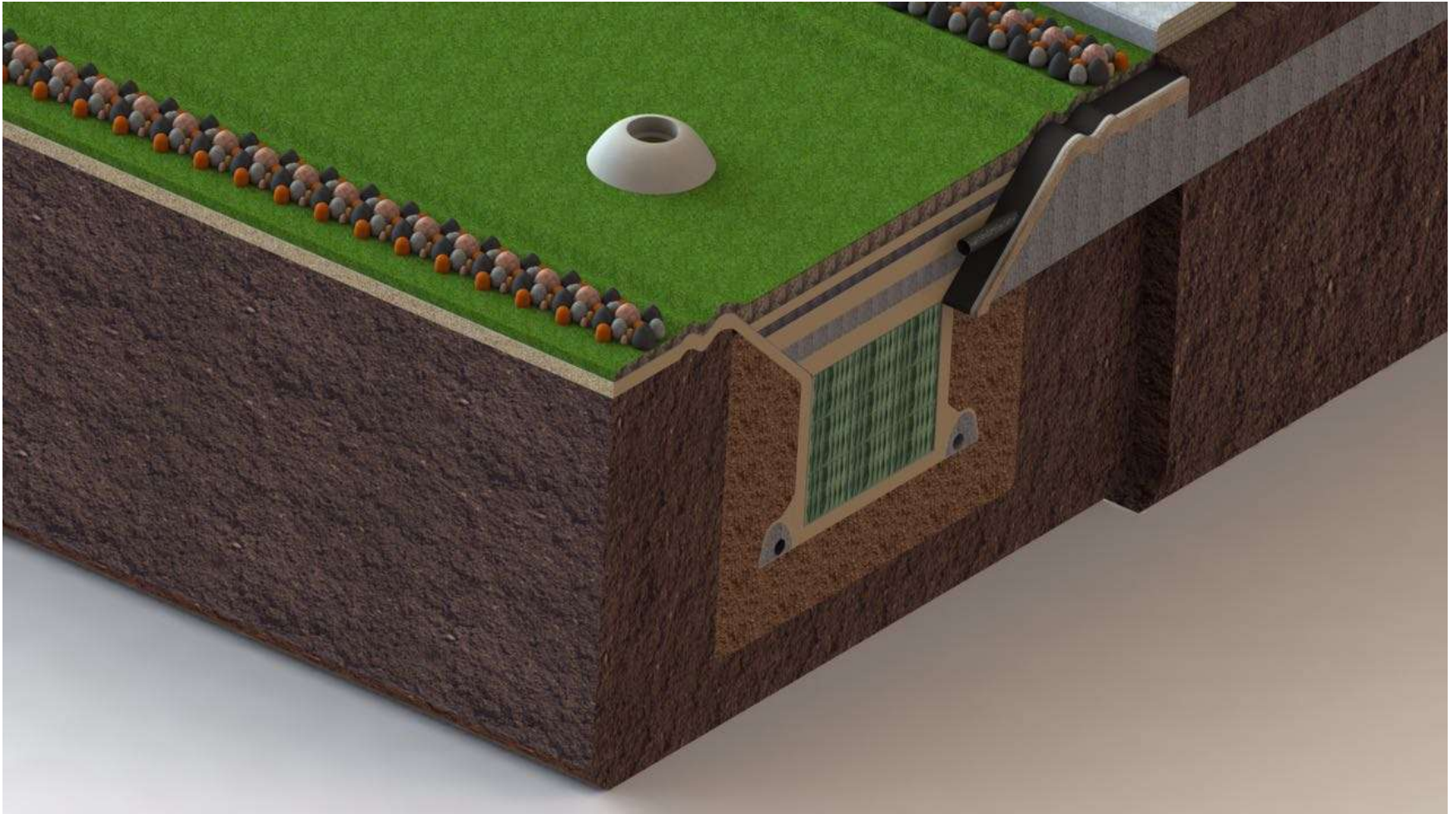
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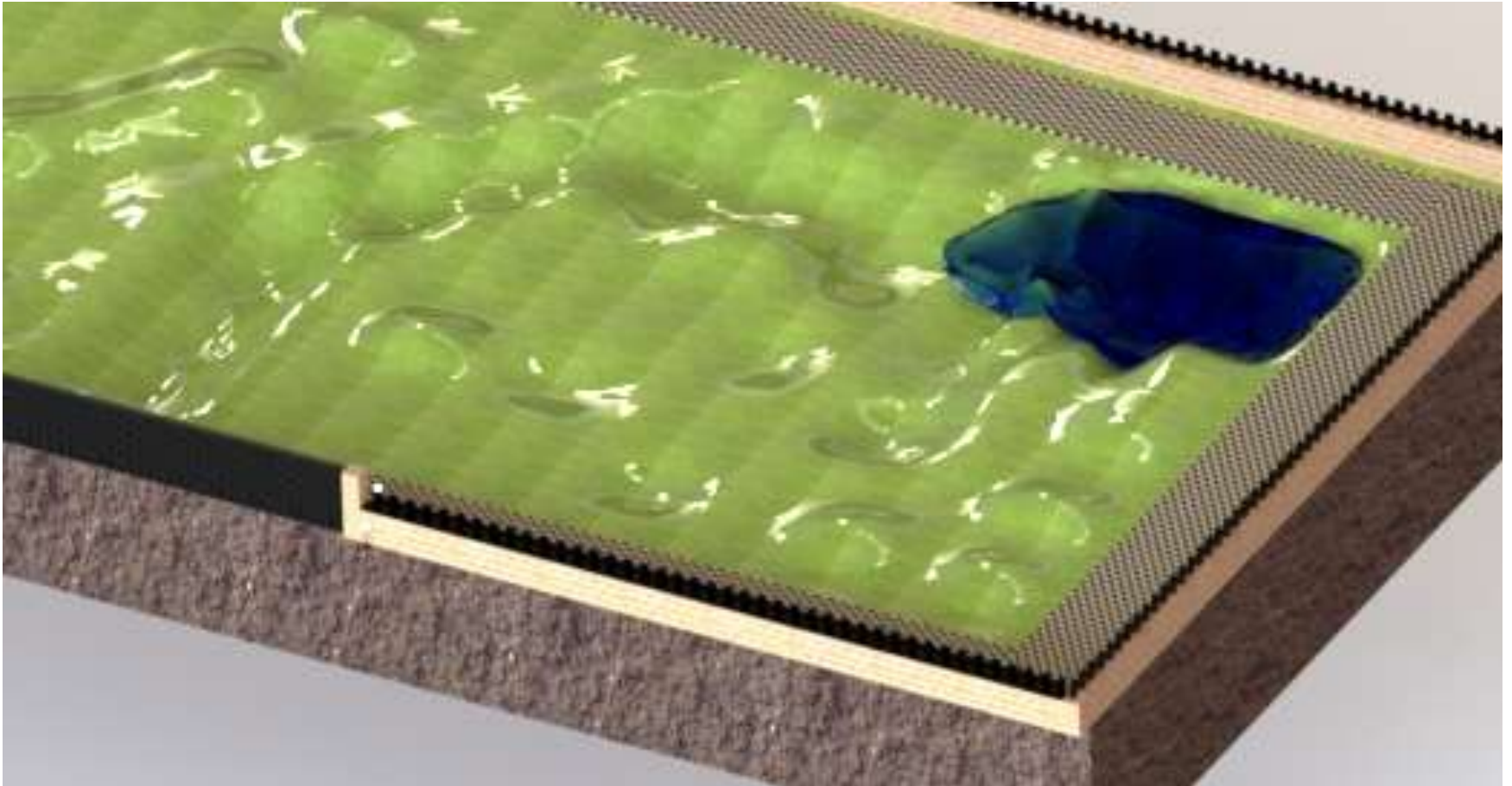
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# *Soak Rainwater where it falls*



# *Soak Rainwater where it falls*



*Landscaped rain gardens with Rigofill- ST Blocks to hold rainwater*



# *The Looming Water Crisis*

Period	Drought Situation
1870 to 1898	Very Few Droughts in this period
1899	Very Severe Drought
1900 to 1930	A Drought every 3 Years
1930 to 1950	A Drought every 15 Years
1950 to 1999	A Drought every 5 Years
2000 to 2015	5 Drought Years
2016	Partially a Drought Year
2017	Early Drought in South India, Rains catching up
2020-2050	Possibly a Drought Every alternate year

***Studies predict that droughts will become yet more frequent!***

# *The Looming Social Crisis*



*Studies show that unemployment and water shortages are the breeding ground for social unrest, do we really have to let our people suffer in this modern era !*

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# *Soak Rainwater where it falls*



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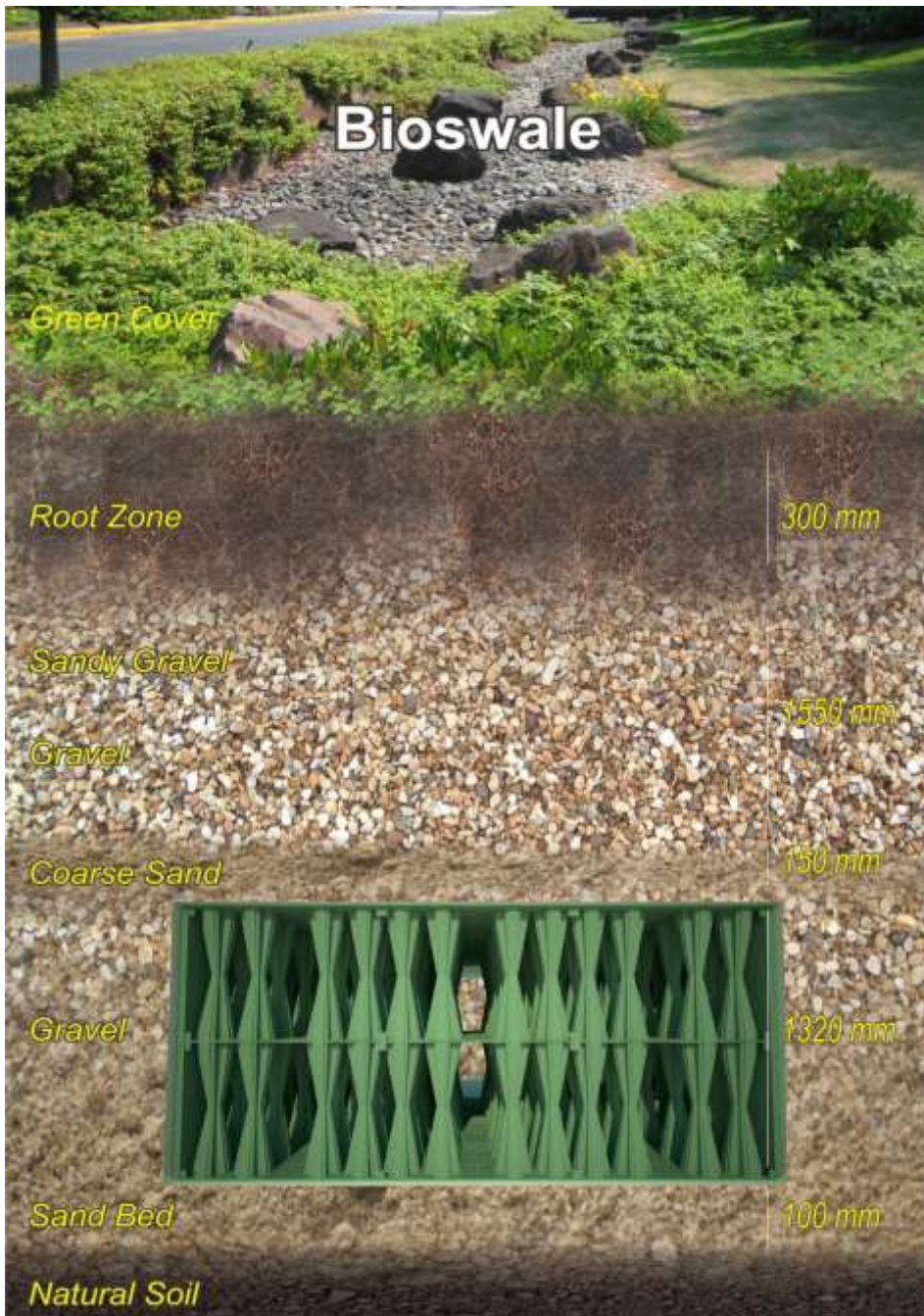


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# *The Potential!*

**Gurgaon City**

**Average Rainfall-**

**20mm/day**

**Approximate Area**

**732 KM2**

**Rainwater Collection-**

**34,989 ML**

**per Rainy Day**

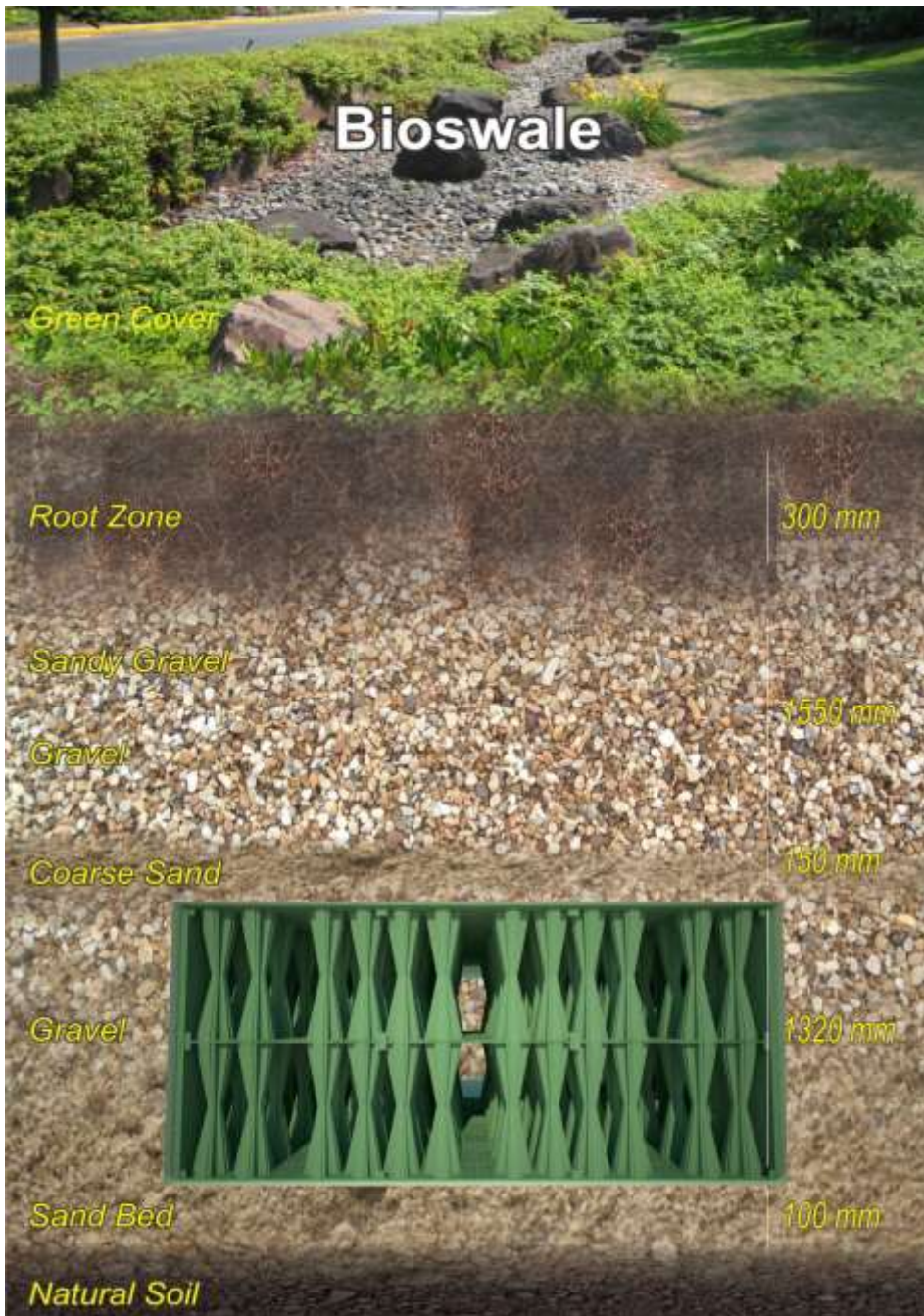




# Rain Water Harvesting Potential of Gurgaon District

Average Rain Fall	20	mm/day	Runoff	Effective	Daily Built-up
Area of Gurgaon District	732	Km2	Ratio	Area Km2	Litres
Paved Area	20%	87.4	80%	69.92	1,398,400,000
Circulation Roads	15%	65.55	70%	45.885	33,587,820,000
Parking	3%	13.11	60%	7.866	1,573,200
Green Areas	10%	43.7	10%	4.37	655,500
Rivers, Ponds & Drains	15%	65.55	0%	0	0
Agricultural Land	37%	161.69	5%	8.0845	808,450
<b>The possible Storm Water Build-up in Litres</b>					<b>34,989,257,150</b>
					<b>Million Litres</b>
					<b>34,989</b>

*Estimated Calculation for general awareness purposes only.*



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# **The Potential!**

## **Mumbai**

**Average Rainfall-  
30mm/day**

**Approximate Area  
603 KM2**

**Rainwater Collection-  
49,413 ML  
Per Rainy day**





# Rain Water Harvesting Potential of Mumbai District

Average Rain Fall	30	mm/day	Runoff	Effective	Daily Built-up
Area of Mumbai	603	Km2	Ratio	Area Km2	Litres
Paved Area	60%	361.8	80%	289.44	8,683,200,000
Circulation Roads	16%	96.48	70%	67.536	40,724,208,000
Parking	2%	12.06	60%	7.236	4,341,600
Green Areas	10%	60.3	10%	6.03	964,800
Rivers, Creeks & Drains	8%	48.24	0%	0	0
Marshy/ Salt Pans	4%	24.12	10%	2.412	241,200
<b>The possible Storm Water Build-up in Litres</b>					<b>49,412,955,600</b>
					<b>Million Litres</b>
					<b>49,413</b>

*Estimated Calculation for general awareness purposes only.*

# Let's Conserve, what we got.



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# *Rain Water Conservation within tight spaces*



***Terraclean Rain water filter & Rigofill-ST Geocellular blocks***



*Let's Conserve, what we have got.*





# Let's Get Inspired !



*The traditional wisdom in India had always emphasized the need of clean source of water and the step wells were an important tool for water conservation in ancient India.*



# *Let's Get Inspired !*



*Water bodies were built across the ancient India with great care and passion, as the resource has been precariously insufficient. The Rajput rulers provided sufficient capacities within their forts to counter the invaders.*



# Let's Get Inspired !



*Sometimes the ancient rulers spent fortune in building such ornate structures to provide employment to the locals in the time of drought when agriculture wasn't possible; thus the locals will treat the water judiciously.*



# *Let's Get Inspired !*



*Depending on the location, the step-wells vary in shape and sizes but these structures are found universally across the Indian landscape, mostly close to the place of worship.*

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# *Let's Get Inspired !*



*Some of the ancient water bodies were architectural marvels not without a reason. These water sources were treated with reverence and care so that the precious resource was well protected and justifiably used.*

# *Let's Get Inspired !*



*Some of the water bodies built as step-wells to provide access to ground water which will percolate into the drawing chambers through the infiltration basins near the rivers.*



# Let's Get Inspired !



*Though the architectural element might vary, the presence of step-wells all across India emphasizes the fact that water conservation methods were well understood by the ancient Indian rulers.*



# *Let's Get Inspired !*



*Worshiping of water sources has been a religious practice to aid water security, the presence of these water bodies around the temples ensured that sanitary conditions around the water bodies were well implemented.*



# Let's Get Inspired !



*Some of the step-wells within the fortresses collect all the stormwater runoff and prevent flooding of the dwelling units, as the forts were mostly on higher ground and fully paved. Ancient SuDS in practice!*

# Let's Get Inspired !



*Today these water bodies are not only the representative of the glorious Indian past, but can also serve as a stark reminder that despite being a well endowed country, water security has persistently been a challenge!*



# Let's Get Inspired !



*Women in rural India still use some of these water bodies for fetching potable water supplies. Only a minority of such structures have been conserved in their original glory and sanitary conditions.*

# Let's Conserve the rain underground



*Rigofill-ST blocks create the much needed void spaces under the paved and trafficked areas to collect, detain and infiltrate rain water into the ground without any land costs with heavy traffic above.*



# *Conserve, the way, World does!*





# Conserve, the way, World does!



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# *Conserve, the way, World does!*





*Let's Conserve, whatever we got.*





*Let's Conserve, whatever we got.*



# Let's Conserve, it doesn't cost much.

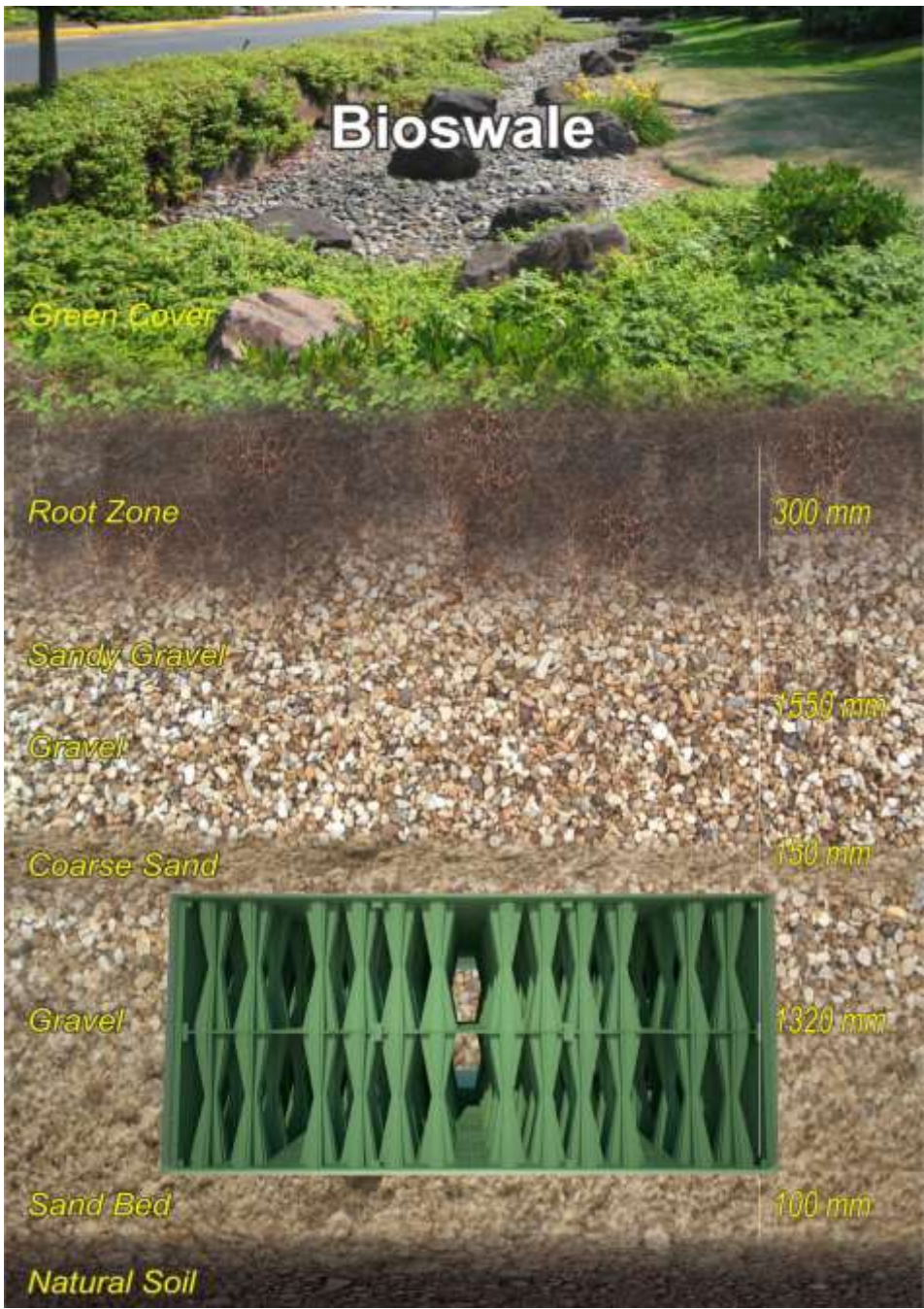
## Infiltration Pit Cost Estimation

Target Detention Capacity of the Pit	350	Cum	862	Blocks
Number of Blocks in Depth	1	Blocks	0.66	Meters
Number of Blocks in Width	20	Blocks	16	Meters
Number of Blocks in Length	43	Blocks	35.2	Meters
Total Volume in the Blocks	Underground		358	M3
Water Stored in Engineered Media	Underground		296	M3
Free Board in Vegetation Area	Surface		169	M3
<b>Total</b>	<b>Mitigation Volume</b>		<b>823</b>	<b>M3</b>
Underground Detention	Per KL	₹ 18,389	Including Taxes	
<b>Underground Detention</b>	<b>Per KL</b>	<b>₹ 14,703</b>	<b>Without Taxes</b>	
Total Storm Water Mitigation	Per KL	₹ 14,612	Including Taxes	
<b>Total Storm Water Mitigation</b>	<b>Per KL</b>	<b>₹ 11,684</b>	<b>Without Taxes</b>	

Indicative prices, subject to change with currency fluctuation, soil conditions, local labour and raw material rates.



# Bioswale



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## • **SUDS - ADVANTAGES**

- **Proven Green technology.**
- **Environmental friendly.**
- **Ground Water Recharge.**
- **Saving in current water bills.**
- **Savings from Evaporation losses.**
- **Water for Horticulture.**
- **Water for fire fighting tanks.**
- **Water for flushing toilets.**
- **Raw water for potable use.**
- **Better civic infrastructure.**
- **No Puddles or Ugly ponds.**
- **Easier to Clean dry areas.**
- **Happier Citizens.**
- **Stable Government.**
- **Higher GDP Growth.**

