

Sustainable Urban Water Management for Goa

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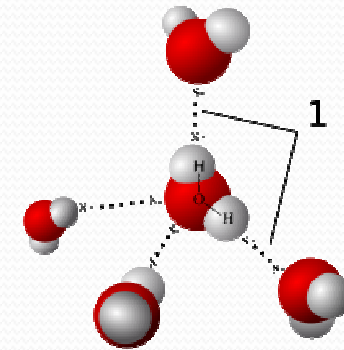


Importance of Water

- Water is life. It is a precious natural resource so vital for sustaining life on the earth
- Mankind has been using water since its appearance on earth. Civilizations grew in the proximity of water.

Water ?

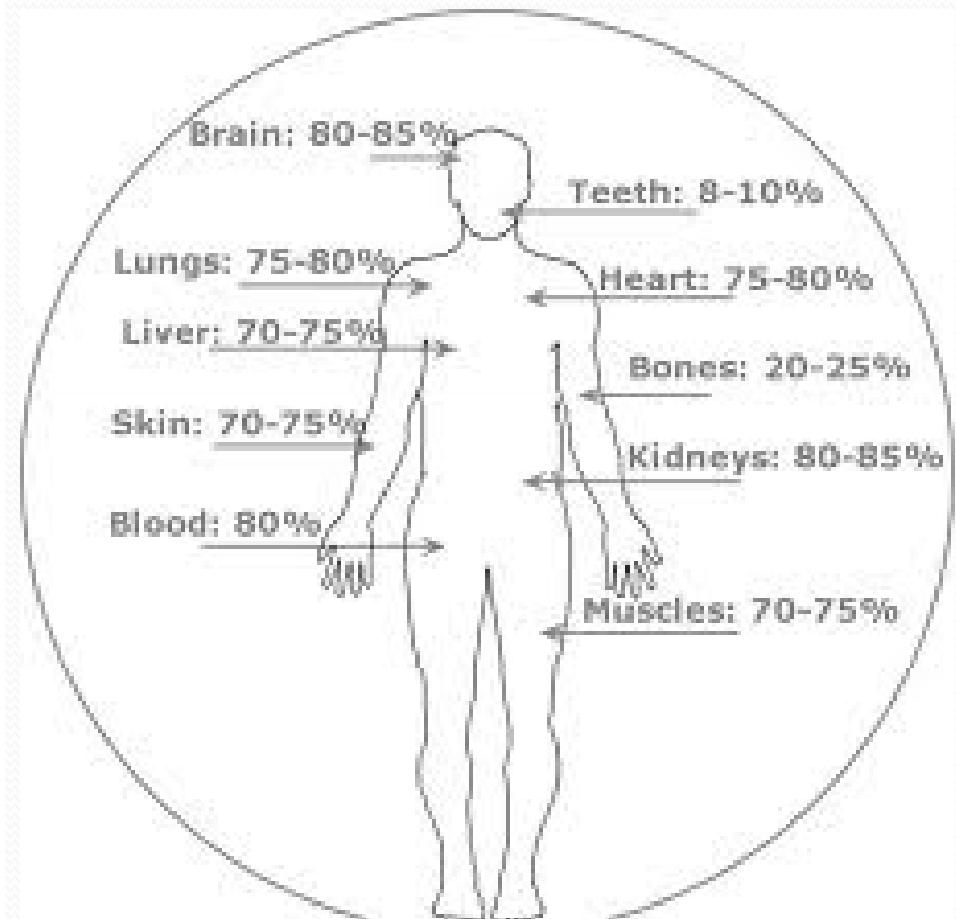
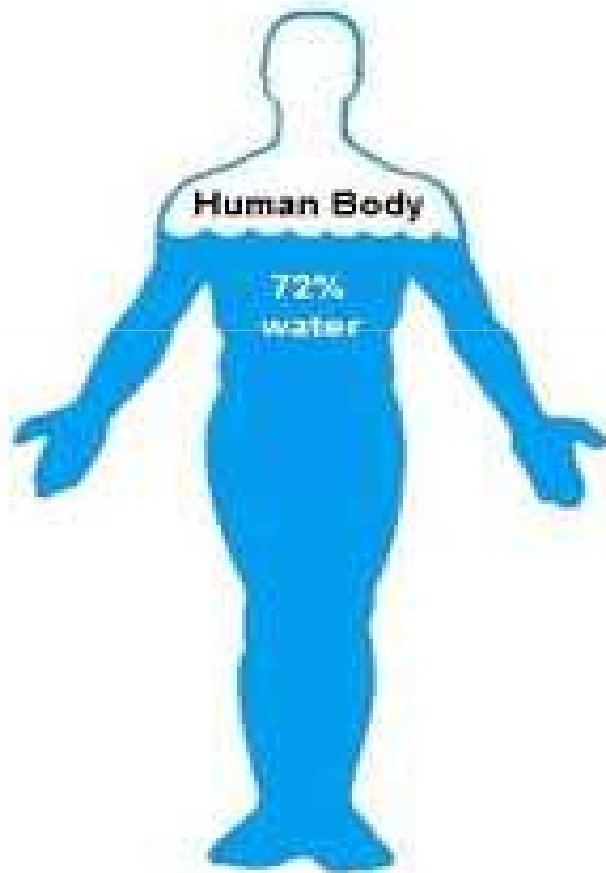
- Water is a chemical compound with formula H_2O
- Its Density is 1000 kg/cum
- Molar Mass is 18.0153 g/Ml)
- Boiling Point is 99.98 °C
- Melting Point is 0.0 °C



- 3/4th of Earth covered with water
- Of the water available, about 97.30% is saline
- Of the small quantum of fresh water which is available, 77.20% is stored as ice caps and glaciers, 22.40% as ground water and soil moisture, 0.35% in lakes and swamps, 0.04% in atmosphere and less than 0.01% in streams

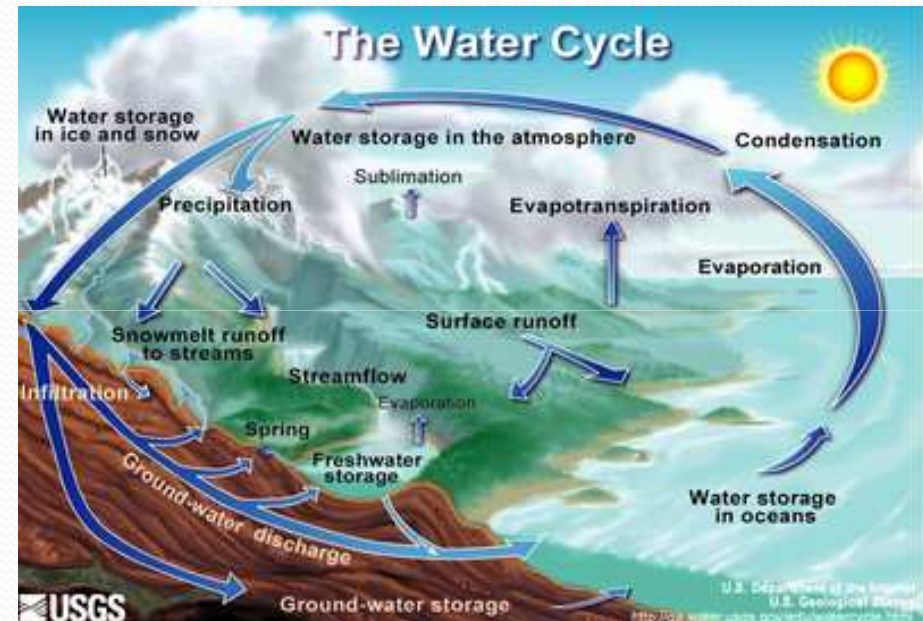


Composition of human body



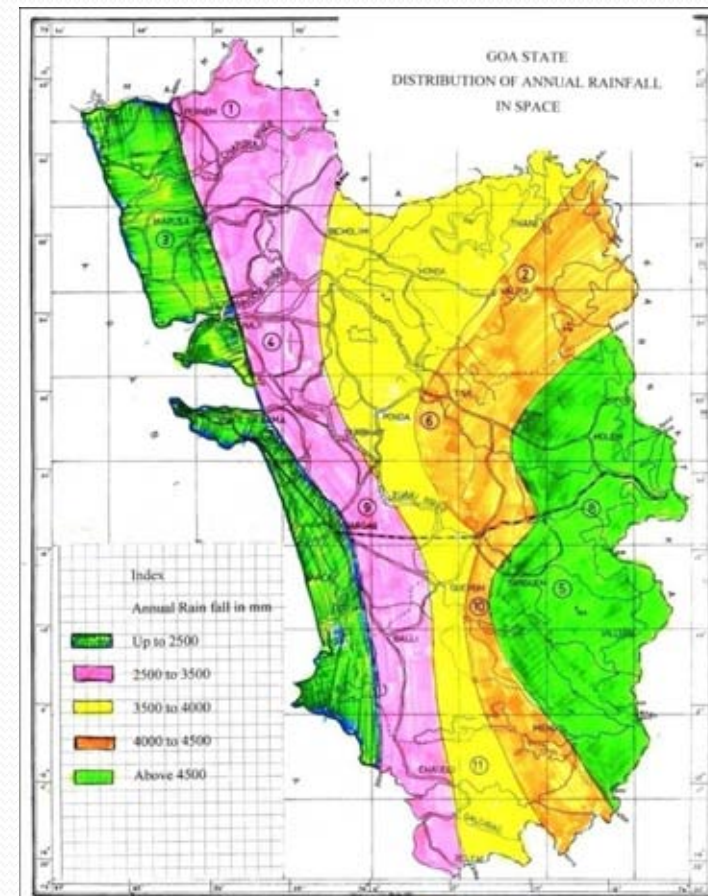
Surface & Ground Water

- The water resources can broadly be classified into two namely the Surface Water Resource and the Ground Water Resource
- Both are dependent and interconnected since they are linked by the same Hydrological cycle



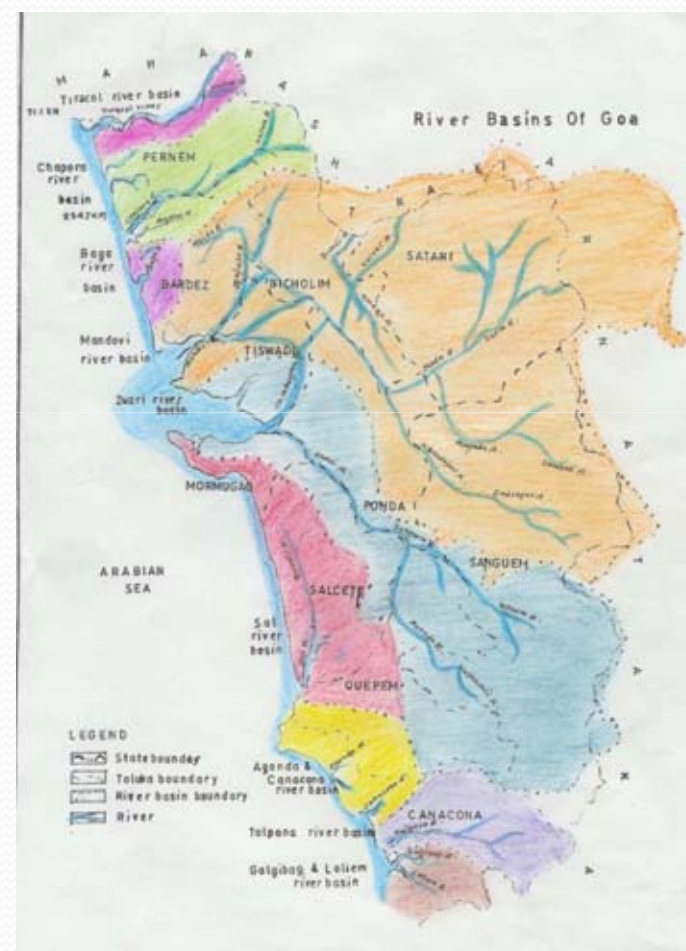
Goan Scenario

- Unlike other parts of the country, State of Goa being located on the west coast of the country receives copious rainfall by the South West Monsoons.
- Rainfall pattern is heaviest at the mountain ranges and on its western slopes, which gradually reduces towards the coastal plains.
- The entire precipitation is however limited to the monsoon period of just four months from June to September.



River Basins

Sr No	River Basin	Length within the State	Length within the salinity zone	Basin area in Sq kms
1.	Terekhol	26.00	26.00	71.00
2.	Chapora	32.00	32.00	255.00
3.	Baga	10.00	10.00	50.00
4.	Mandovi	52.00	36.00	1580.00
5.	Zuari	145.00	42.00	973.00
6.	Sal	40.00	14.00	301.00
7.	Saleri	11.00	5.00	149.00
8.	Talpona	32.00	7.00	233.00
9.	Galgibag	14.00	4.00	90.00
	Total			3702.00



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Water resources of Goa

- The entire water resource should not be mistaken as available for harnessing. As mentioned earlier, many of these rivers are tidal prone up to a distance of 20 to 40 kms and hence the utilizable part of the yield should be identified basin wise.
- In the post monsoon period the effluent river flows start dwindling and very few rivers or rivulets remain perennial. This obviates the developmental water resources scenario to be a necessary blend of storage and run of the river schemes for optimal surface water utilization.

Ground water resources

- The macro level surveys indicate ground water draft of about 137.44 MCM as estimated by CGWB.
- The Ground water utilization in Goa is to the tune as 33% which is considered as safe.
- However there are some stressed areas especially the coastal region, industrial areas and urban areas.
- Goa was one of the foremost to implement the Goa Ground Water Regulation Act, 2002 and the stressed areas have been notified as Scheduled areas.
- Goa has already notified the Ground Water Cell under Chief Engineer-WRD and also appointed the Ground Water Officers under the Act.
- Goa has been implementing the Goa Ground Water Regulation Act, 2002 in right perspective phase wise.



Constraints in water utilization

- Goa has a copious rainfall however limited to only 4 months
- The good drainage patterns ensure that the surface water drains very fast and meets the riverine system
- The rivers are saline and prone to tidal variations for 20 to 30 kms U/S
- The undulating terrain of Goa ensures that most of the prospective storage projects fall in the western ghats and reserve forest area.
- Though the recharge of ground water is very fast, the hydrogeology of major part of Goa cannot retain the percolating water, resulting in shortages in the months of April and May.
- Siltation of rivers due to mining and other effects
- Point pollution of ground water in the Industrial Zones and Coastal areas.



Need for water management

- Till recently it was thought that water was inexhaustible. However the population explosion and industrialization accompanied by urbanization has brought tremendous pressure on the water resources.
- Hence the need for a systematic water security/management is the need of the hour



Urban Areas

The following scenario may be seen

Year	Population	No of towns /cities	Urban Population	% of Urban to Total Population
1961	5,89,997	11	87,329	14.80
2001	13,47,668	44	6,70,577	49.76
2011	14,58,545	70	9,06,814	62.16

This paradigm shift in population has increased the stress on resources , which include the water resources of the State of Goa



Urban Water Management

- Efficient water management is crucial to public health, viable economy and livable urban environment.
- Effective, efficient management of water resources is essential to a sustainable urban area.
- Water must be supplied for domestic, commercial, industrial uses, must be supplied for irrigation and also maintaining and enhancing local environment.
- Storm water must be managed to avoid drainage congestion and flooding and environmental damage
- Used water must be collected and managed.



Management of Water Resources

The management of Water Resources can be envisaged in the following scenarios:

- Planning
- Development
- Innovations
- Protection
- Regulations

The Management of Water Resources in Urban Areas is also envisaged in the above scenarios



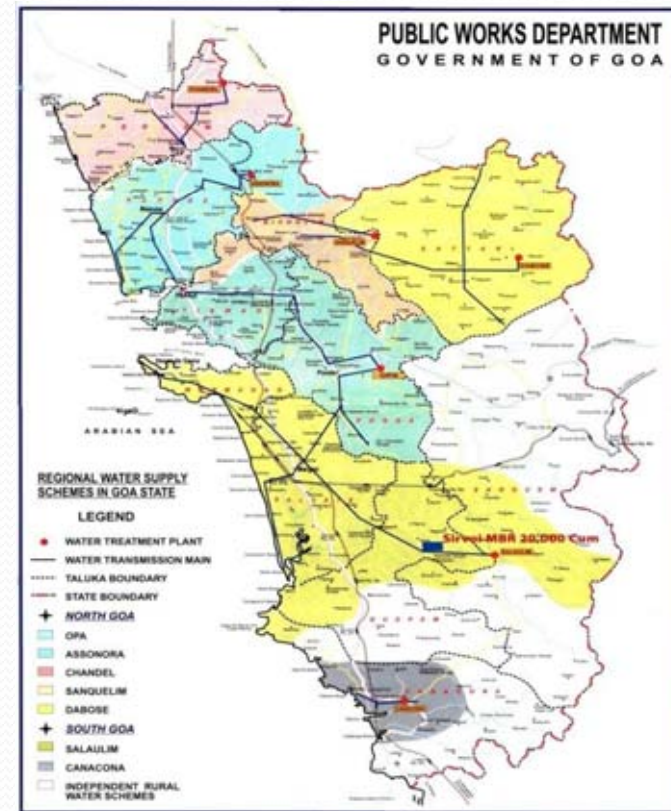
DEVELOPMENTAL SCENARIO


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Drinking water

- The present scenario of drinking water is as follows:

Scheme	Capacity	Areas Covered
Chandel	15 MLD	Pernem
Sanquelim, Podocem	52 MLD	Bicholim, Sattari
Assnora	100 MLD	Bardez
Dabose	5 MLD	Sattari
Opa	125 MLD	Ponda, Tiswadi
Panchwadi	10 MLD	Ponda, Sanguem
Salaulim	260 MLD	Sanguem, Quepem, Salcette, Mormugao
Chapoli	15 MLD	Canacona




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- In Goa almost all municipal and urban areas are covered by drinking water.
 - Issue is to supply water @ 135 lpcd for 24X7
 - Shortfalls
 - Management
 - Maintenance
 - Innovations???



Storm drainage

- Towns/cities in Goa had very good drainage systems
- Development along with concretization has increased the runoff, reducing the infiltration and percolation to ground water regime
- Development has also created an ardent need to look into the augmentation of the existing drainage system.
- Some of the cities have low lying areas which acted as detention basins during heavy precipitation and high tides, which are to be preserved in right earnest as these are connected with drainage system.
- Every municipal city should have an inventory of their storm drainage system and envisage creating a master plan for future



PROTECTION SCENARIO

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Fury of Water

Though Water is the necessity of life, it also plays a havoc in the form of

- i) Floods
- ii) Drainage congestion
- iii) Anti-sea Erosion

Though the recurrence of the floods in Goa is minimal as compared to the calamities in other part of the countries, the occurrence of heavy precipitation in conjunction with high tides have leads to drainage congestions in some parts of the territory leading to floods.

Goa also has a long coastline of about 187 kms and has been experiencing sea erosion along the coastline.

Coast line affected



Sr No	Taluka	Village	Coastline length	Affected length
1.	Pernem	Tiracol	1.50	-
		Kerim	2.00	1.64
		Paliem	0.75	-
		Arambol	3.00	0.25
		Mandrem	2.00	1.00
		Morjim	3.00	1.00
2.	Bardez	Anjuna	5.00	0.35
		Calangute	4.00	0.60
		Candolim	4.00	1.36
		Nerul	1.50	0.75
3.	Tiswadi	Panaji	5.00	2.00
		Taleigao	3.00	0.50
		Calapur	1.00	-
		Bambolim	1.50	-
		Siridao	1.50	-
4.	Marmugoa	Marmagoa	6.00	-
		Chicalim	1.50	-
		Chicolna	2.00	-
		Issoriem	1.50	-
		Sancoale	0.75	-
		Pale	1.00	-
		Velcao	1.00	-
		Cansaulim	1.75	1.35
		Arossim	1.50	1.10
5.	Salcette	Varca	3.00	1.26
		Uttorda	5.50	0.60
		Majorda	0.75	0.50
		Consua	0.75	0.50
		Betalbatim	0.75	1.90
		Colva	1.00	1.80
		Sernabatim	1.50	-
		Benaulim	0.75	-
		Orlim	1.00	-
6..	Quepem	Kanaginim	3.00	0.26
7.	Canacona	Khola	14.50	3.73
		Agonda	6.00	4.80
		Poiginim	2.00	0.80
		Lolien'	9.00	1.46



REGULATION OF WATER RESOURCES

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Regulations

- The Irrigation Act, 1973 and The Ground Water Regulation Act, 2002
 - Permission to utilize surface water
 - Registration of old wells, permission for new, permission to transport and develop ground water
- Air and Water Acts monitored by GSPCB
 - Pollution aspects



PLANNING SCENARIO

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Planning envisaged for Urban water management

Goa has seen a sharp ascending trend in urbanization. This has increased the stress by leaps and bounds on the infrastructure and resources. Even the rural areas on the border of the cities are converting to urbanization. Hence planning of the Urban areas needs a relook.

- Relook in ODPs and RIP to include water management
- Plan for conservation of water bodies
- Master Plan of drainage for urban areas
- Keeping green areas to aid the hydrological cycle
- Permission for wells given by health department?
- Setbacks for water bodies?




INNOVATIONS

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Envisaging innovations in water use

- ‘Out of box’ thinking in inadequate service coverage or regional imbalance in availability of water
 - Giving bulk supply to municipal bodies for onward distribution?
 - Involvement of private sector participation/involvement in distribution?
 - Resorting to recycling, rainwater harvesting, conjunctive use, etc for better management
 - Supply of water in two pipelines?
 - Use for recycled water?
 - Need for institutional and fiscal reforms?

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- Use of locally available storages
 - Use of effective treatment technologies
 - Evolving multi-purpose systems from single-purpose system
 - Improvement of D.O. and B.O.D. in water bodies

Such innovative thinking and implementations have to be evolved for a best functional model



SUMMARIZING

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Summarizing

There is a need to plan, develop, utilize and regulate the water resources in a optimal and eco-friendly manner involving a blend of traditional and technological innovative methods to preserve this precious resource for posterity.



THANK YOU

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