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'Conservation Management Strategy for Water Resource Sustainability in Campus'

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ABSTRACT:

Sustainability as a matter of fact has been an integral part of every step towards development of a town. Historical towns have developed in integration with sustainability when reviewed. Water Resource sustainability with its usage for habitation has been going critical day by day, where as availability of water is not at all a problem at most of the places and times. In campus planning sustainability in usage of water has observed a long way. There are some developments in town observed with leading approach to sustainability to make others to follow it. Authors have made an attempt to describe the water usage conservation management strategy at the educational institution campus analyzing the sustainability achievement during its usage. For that the authors have studie done such institutional campus in Nagpur District along with the residential facilities where water re source management was a challenge. It witnesses the thoughtful working on water sustainability aspects viz. reduce, reuse and recycle. The discipline of natural environment has inspired them to go in order definitely achieving the water resource sustainability.

KEY WORDS:

Demand, Supply, Storage, Conservation, Irrigation, Filtration, Waste, Treatment

1. Introduction :-

The word sustainability means the ability to support life, to comfort, and to nourish. For all of human history, the Earth has sustained human beings by providing food, water, air, and shelter. Sustainable also means continuing without lessening. Development means improving or bringing to a more advanced state, such as in our economy. Thus, sustainable development can mean working to improve human's productive power without damaging or undermining society or the environment—that is, progressive socio-economic betterment without growing beyond ecological carrying capacity: achieving human well-being without exceeding the Earth's twin capacities for natural resource regeneration and waste absorption

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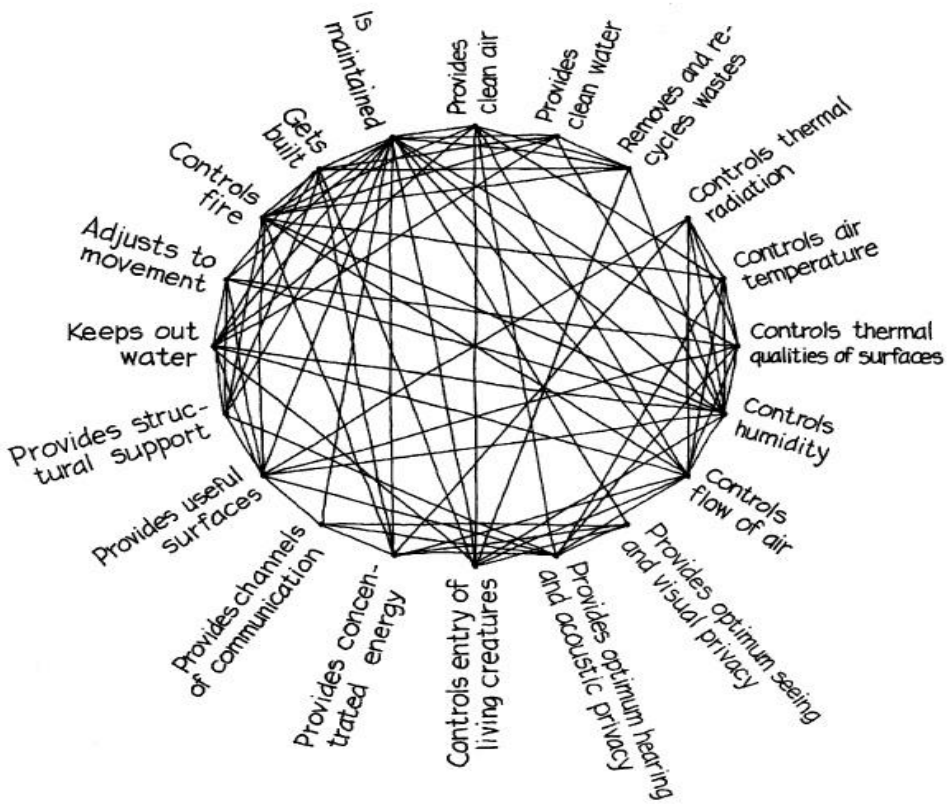
2. Sustainable Development and water resource :-

Sustainable Development in Architectural context can be obtained by judicious use of natural resources which is required by a building to stand. The diagram shows the functions which must be carried out by any type of building.



(Fig.1: The functions carried by the building and their interrelation)

Any building development requires prerequisite i.e. availability of clean water and moreover sustainability of water. Therefore, water resources management is one of the most important challenges the world faces due to an increase in the number of construction. It is difficult to think of a resource more essential to the health of human communities or their economies than water. Humans cannot live for more than several days without water, shorter than for any source of sustenance other than fresh air. In meeting their demand for water, societies extract vast quantities from rivers, lakes, wetlands, and underground aquifers to supply the requirements of cities, farms, and industries.

A graphical distribution of the location of water on earth is as follows.
The green column on the left shows that 97% of the water on the earth is salt water located in oceans, seas, salt water lakes, bays and other salt water bodies, the other 3% is fresh water which we can live on.

The brown column in the middle shows that 68.7% of fresh water is in icecaps and glaciers (frozen water) and it is not available for most animals and plants. Thus frozen water equals 1.74% of the total (fresh and salt) water on Earth. 30.1% of fresh water on earth can be found underground and it is called as groundwater. Some groundwater is accessible for humans, plants and animals and some is not accessible for use. The last small amount that makes up the total freshwater on Earth is our surface water (0.3%). Surface water is all the water we see on the Earth's surface that is not salty such as lakes, rivers, creeks and wetlands.

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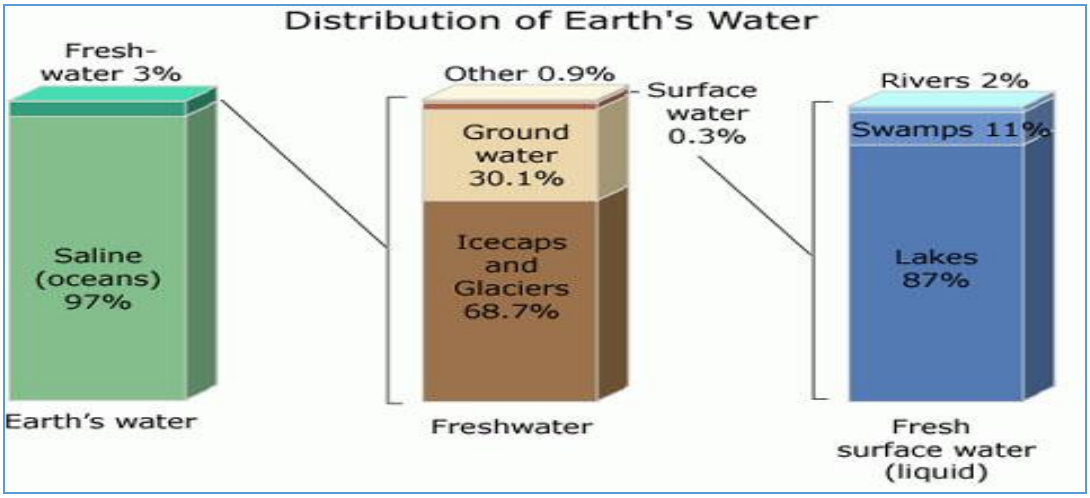
The blue column on the right shows the final breakdown of the 0.3% surface water which is part of the 3% of fresh water on Earth. This means we are now looking at approximately 0.021% of the total water (fresh and salt) on Earth. This is not a lot of water. Of the tiny amount of water that makes up our freshwater (0.3%) 87% is in lakes, 11% in swamps and 2% in rivers. This is where we get most of the water that we use on daily basis.



(Fig.2: Distribution of the location of water on earth)

As we can see most of the water on Earth is located in oceans, seas and bays with rivers containing an extremely small amount of total water on earth. It is important to note at this point that oceans, seas and bays are not fresh water bodies and icecaps and glaciers contain water that humans cannot get across to. This means that according to this graph the best water supply on Earth comes from our groundwater resource with our lake system the next best option. Fresh groundwater sources worldwide contain approximately 4.2 trillion Olympic-sized swimming pools. This information is valuable as it allows us to become aware of the fact that although our planet appears to have endless water resources and more water than we could want this is in fact not the cast. The water available to the ever increasing world population and the environment is located in very small sources which need to be preserved and sustained for future generation to not only enjoy but to survive.

3. Sustainability of Water:-

Water sustainability could be defined as supplying or being supplied with water for life or, perhaps more precisely, as the continual supply of clean water for human uses and for other living things. Water is, after all, a renewable resource, so sustaining its uses is possible. But it turns out at we can have too much water or tooA little water to meet our needs. Various forces affect the nature, timing and availability of water, which change through time. We shall call these forces the "Drivers" at play in the world today.

The following four drivers have caused precipitous changes in water quantity, availability, and quality:

i. **Population Growth:** Population has been growing since the dawn of civilization and it has been estimated that humans already use approximately 54% of all freshwater available. More water is required to satisfy the needs of a growing population. Globally, where population densities are low, the threat of severe water shortage is lessened. But where population densities are high, any decline in water availability or increase in population may be disastrous. It is often said that we do not have problems with the amount of precipitation, but rather with its distribution. This distinction may be of

little consequence because it is not generally possible to redistribute water from water-rich areas to water-short areas, at least not in poor and developing countries.

ii. **Climate Change:** Our climate is changing and it is primarily due to human activities. A warmer sea causes thermal expansion of the ocean and sea level rise while a warmer planet causes a decrease in snow cover an increase in longer ice-free periods on northern lakes and the Arctic Ocean, and altered migrations of many plant and animal species.In addition, there is some indication that the timing of large precipitation events is changing with more events in the spring and fall and fewer in the summertime, when crops are canopied. This change means that more rainfall runs off the land with less evapotranspiration than previous patterns. Runoff is more problematic than increasing precipitation because it causes flood events of great economic and social consequence.

iii. **Land Use Change:**In addition to population growth, the way we use the land is changing rapidly. People seek to create wealth and develop a better way of life through land resources. In the process, they convert land for agricultural, industrial, and/or municipal uses, which often requires more water or results in the degradation of water quality.

iv. **Global Poverty:** Development professionals recognize that problems of population, climate, environment, and development will never be solved without first addressing global poverty. Poverty renders all other actions to mitigate climate or land use change of secondary importance and low priority. We are alreadyappropriating more than half of the world's freshwater resources for human useand the average supply of water per person is decreasing. There are still 900-million people who do not have access to safe drinking water and more than 2 billion who lack adequate sanitation. Millions of children below the age of 5 are still dying from clearly preventable waterborne diseases.Will there be enough freshwater for the 9- to 10-billion people projected by 2050?

These four drivers cause profound problems for human families in gaining access to quality water. Unless we can overcome or adapt to these driving forces, future generations will inherit a legacy of declining and degraded water resources. Our relationship with water and how we use water must evolve to meet this challenge. Therefore sustainability of water must be practiced.

4. Case selection

For the study purpose the institutional campus in a small town is considered. Being a small town the availability of resource is not a problem but with the continuous use the resource is limiting.
The site selected from the Nagpur district with the Coordinates 21.402126°N 79.304008°E. The academic building works in one shift i.e. during day time and have users up to 3000 whereas the residential facility users are up to 1001.

5. Study of Water supply management

Water supply

There are 9 bore-wells
The main over-head tank contains1 lakh liter of water while the ground source reservoir contains 1.5 lakh liter of water.

Supply of Ro water

30 % of Ro i.e. reverse osmosis water is used for drinking and each bottle contains 20 liter of water.

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70% is wasted and the treated water is used for the gardens in the campus.

Distribution

Both hostels (girls/ boys) get 100 liter water per day.
Water utilize by the whole campus a day is 3.5 lakh liters.
There are about 45 bottles with a average of 4 person in each gets one bottle a day.
Total daily consumption is about 750 liters per hour.

Usually the regular consumption is about 5000 liters but in summer the consumption goes upto 6000 liters.
On an average each department gets 5 cans of ro water i.e. 100 liters per department.

Drainage

Usually the whole drain water gets disposed by means of nahlas (drainage lanes).
Some part of nahla is open and some part is under the ground.

(Fig.3: Site Plan of a Campus showing sources of water supply)

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Total water requirement

Capacity of girl's hostel	= 450
Capacity of boy's hostel	= 351
Quarter residents	= 200
Total	=1, 001

Water required for each person = 135 liter/day

∴ . Water required for 1001 person = 1, 001 x 135

= 1, 35,135 liter

= 1, 36, 000 liter

On an average @ 1, 50, 000 liter is used daily by others in campus

∴ . Total water required for the whole campus

= 1, 36, 000 + 1, 50, 000

= 2, 86, 000 liter

Water utilization

Water for hostel	= 5 bottles/day
Each bottle of 20 liters	
∴ . Water for hostel	= 20 x 5 = 100 liter
∴ . Water for both hostel/day	= 2 x 100 **= 200 liter**
∴ . Water used by whole campus	**= 3, 50, 000 liter**
Water used by quarters	= 45 x 20 = 900 liter
(45 quarter with 4 person avg.)	= 900 x 4 = **3, 600 liter**
Total water used	= 200 + 3, 50, 000 + 3, 600
	= 3, 53, 800 liter
The required water	= 2, 86, 000 liter.
The used water	= 3, 53, 800 liter
(on daily basis)	

∴ .**the difference of 67, 800 liter can be considered to meet out the fluctuations in daily water requirements.**

Now, on overall:-

30% of water is used & 70% is wasted.

∴. Water used	= 30% of 3, 53, 800 liter
	= 1, 06, 140 liter
∴ . Water wasted	= 3, 53, 800 – 1, 06, 140
	= 2, 47, 660 liter

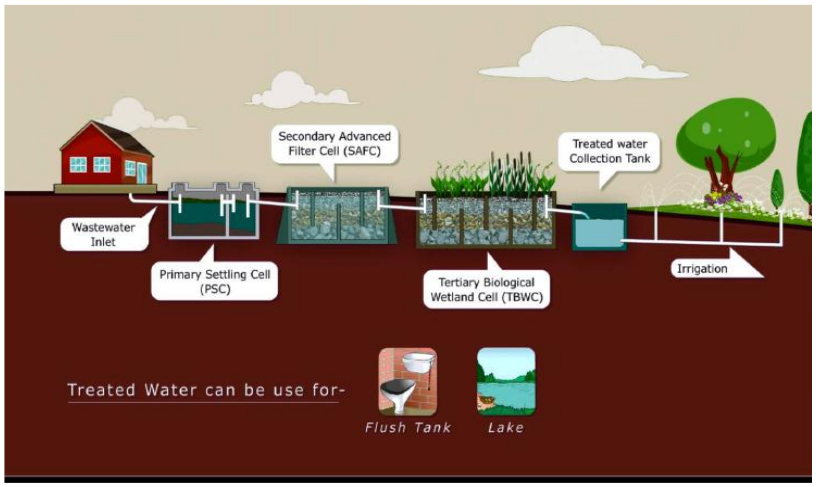
Now, to reuse this wasted water to optimize the use of water we can adopt following solutions.

6. Inferences and suggestions

1. Reduced Use of Water : The use of water is controlled by supply monitoring to each building.
2. Water Reused: The waste water is used for gardening and washing purpose.
3. Recycle use: The drain water which is thrown outside the campus via drainage lanes can be treated and reused in campus itself.

For ex. we can use phytoride system to recycle the waste water. This recycled water contains no specific odor but its smells normal. It can be used in washing cars, flushing, gardening, etc. This water when used for all these work, then, 70% wasted R.O. water can be utilized in domestic purposes and this is how the use of regular water can be optimized.

In general, by using this system we can recycle ≥ 80% of wasted water i.e. 2, 47, 660 liter is wasted. Therefore, 1,98,128 liter water can be recycled.



(Fig. 4: Phytoride system to recycle the waste water)

The campus observes the pits for experimentation purpose but not yet been utilized for the recycling purpose at campus scale.

7. Conclusions :-

The site comprises of 9 bore wells as source of groundwater also water from municipal corporation is also supplied twice a day. The water is collected in tanks on certain points in campus which gets treated and supplied on the conservatory basis manually.
In present scenario, the site is using both possible sources of water.
Two R's of resource conservation management are used well in a campus but needs to use recycle techniques. The waste water which gets disposed of in drainage lanes, should also be treated, recycled and reused so that, the use of water shall be optimized.

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