

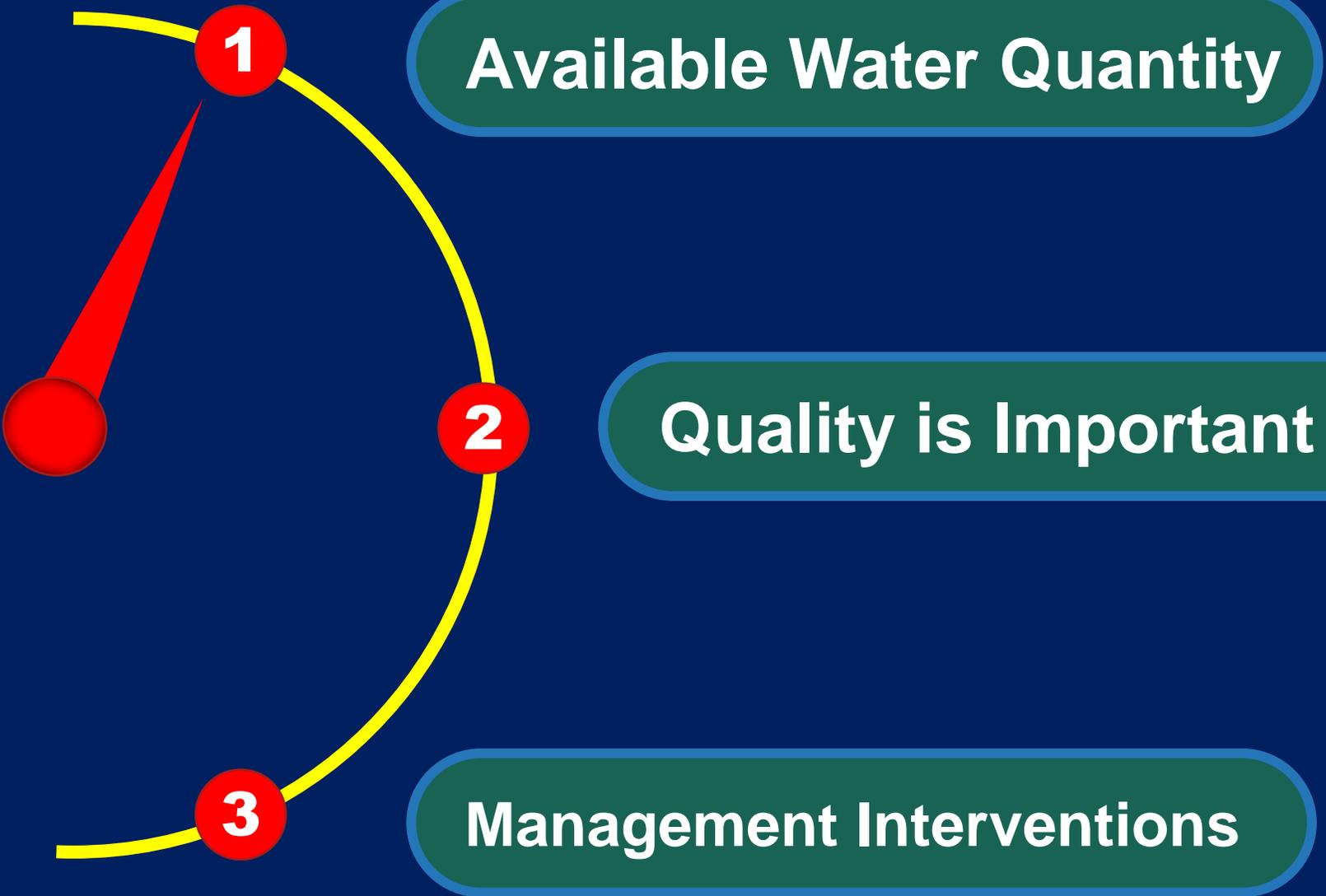
Water Management – Some Aspects of Quantity & Quality

Jagdish Kumar Bassin
Environmental Consultant (Freelance)

**Global Innovation Water Solutions: Preparing
the Water Sector for 2030 and Beyond**



Presentation Sections



“Where there was water, humanity thrived and survived. In the present times, we humans search for water as distant as the moon. At the same time, we have been negligent in preserving water resources on our own planet.”

—Shri. Ram Nath Kovind
Hon'ble President of India

NITI Aayog Sep 2021

Available Water Quantity

Elements of Survival of Life on Earth

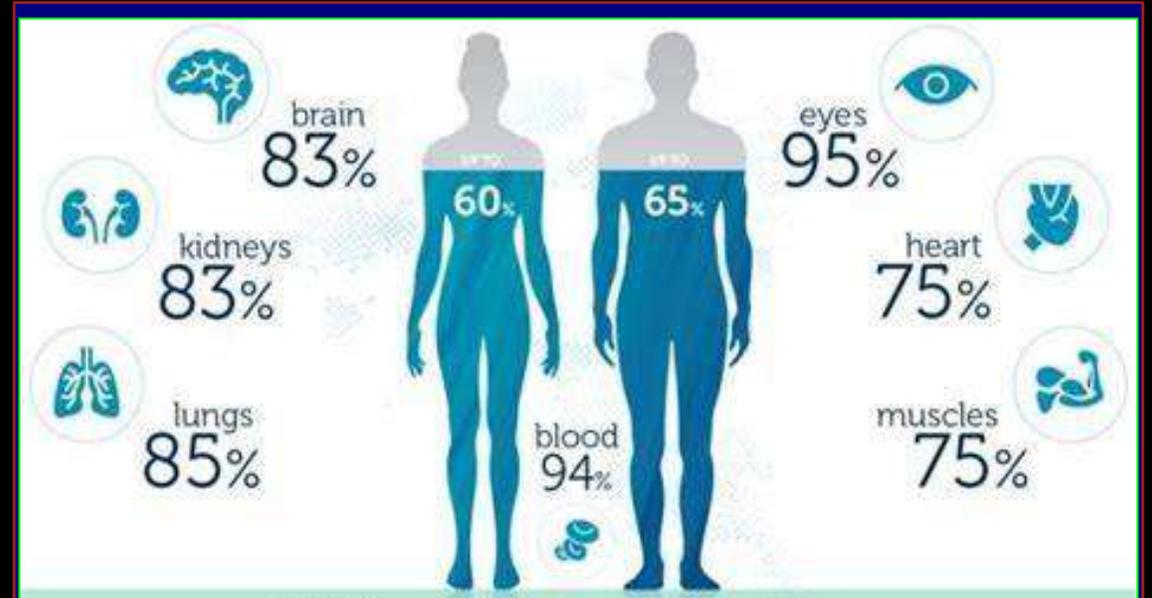
We consume 7kg, 4kg, 1kg per day, respectively. (**Body is 65-70% water**)

Also, their cost is inversely \propto to their necessity for life.

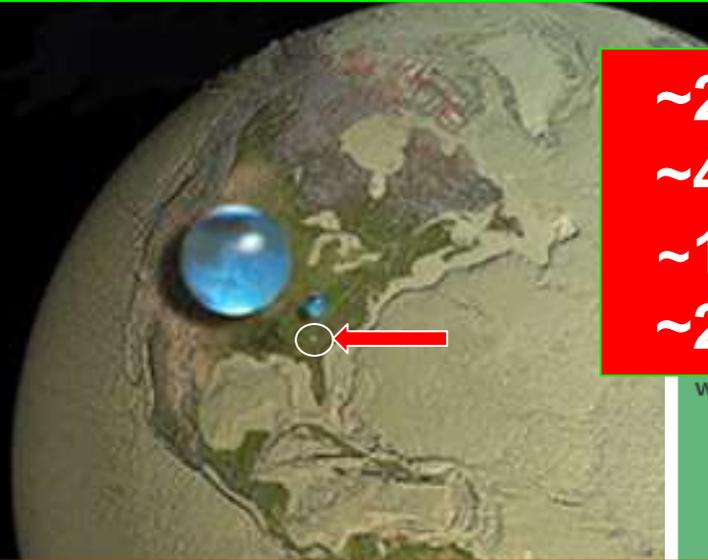
All are **NATURAL** resources – given to us by Mother Nature in quantities adequate enough to meet our needs

And, as yet these are **Non-manufactured**

Of all planets, life exists only on **Earth**; attributable to availability of three key elements essential for life, – **Air, Water, & Food**, which,



Available Quantity of Water



Where is Earth's Water?

- ~2.45 % of World's Land Area (3.28Mkm²)
- ~4.12 % of World's Fresh Water Resources
- ~18 % of World's Population
- ~20 % of world's livestock population

In 2011, per capita water availability had dropped to 1545 m³/year

- ✓ All water (sphere of 1376 km dia) = **1386 Mkm³ = 1386M BCM**
- ✓ Fresh water- ground, lakes, swamps, and rivers (sphere of 273 km dia) = **10.64 Mkm³ = 10.64M BCM**
- ✓ **In lakes & rivers (sphere of 56 km dia) = 0.093 Mkm³ = 93000 BCM** 

Ref: <http://ga.water.usgs.gov/edu/earthhowmuch.html>

WRI Global Water Stress: 17 Countries (25% Popu^{ln}) Face Extremely High Water Stress

1. Qatar
 2. Israel
 3. Lebanon
 4. Iran
 5. Jordan
 6. Libya
 7. Kuwait
 8. Saudi Arabia
 9. Eritrea
 10. United Arab Emirates
 11. San Marino
 12. Bahrain
 13. India
 14. Pakistan
 15. Turkmenistan
 16. Oman
 17. Botswana
- Pop^{ln} 3 times the total of rest

Source/Chart: CEOWORLD magazine research and the World Resources Institute (WRI)

Population in 2011 & projection C & I

$$C_t = 1.34 * (1.004)^t$$

$$I_t = 1.19 * (1.0137)^t$$

I will be equal to C in 12.35 years

Six largest cities, were nearly dry.

- ✓ In 2018, Cape Town narrowly avoided their "Day Zero" water shut-off.
- ✓ In 2017, Rome rationed water to conserve scarce resources.

Global Withdrawal has more than doubled since 1960s due to growing demand – and

they show no signs of slowing.

RO, Desalination & Intelligent Irrigation



Remote Irrigation - Automated Irrigation

FMS CONTROL

The System | FMS

(farmmanagementsystem.com.au)

FMS Control is the web application used to monitor and control your irrigation equipment. Accessible from any internet-enabled device, the software enables you to manage your irrigation online, using your computer at home or a smartphone when you're away.

Climate Change causing more Extreme events

- ✓ **Some 700 million people could be displaced by intense water scarcity by 2030.**
- ✓ Four billion people experience severe water scarcity for at least one month each year.
- ✓ Over two billion people live in countries where water supply is inadequate.
- ✓ Half of the world's population could be living in areas facing water scarcity by as early as 2025.
- ✓ By 2040, roughly 1 in 4 children worldwide will be living in areas of extremely high water stress.

Situation, if We Do Not Wake-up even NOW

**Water
Bank**



**There is Not
Enough
Balance in
your Account**

- ✓ Composite Water Management Index released by NITI Aayog in 2018 predicted that 21 major cities (Delhi, Bengaluru, Chennai, Hyderabad & ors) are racing to reach zero GW levels by 2020, affecting access for 100M people.
- ✓ Although prediction did not come true, but the trends indicated are not unreal. Still need careful planning.
- ✓ Population growth and ever increasing water demand render the areas to be ranked as 'water stressed' condition.
- ✓ To obviate this situation or to adapt to it, **water management is essential.**
- ✓ **Not only for Quantity but also for Quality Management.**

“What people don’t understand is like when water gets polluted, it’s an entire aquifer. There’s a whole fascinating world that exists underneath our feet that we don’t see, therefore we don’t relate”

—Erin Brockovich

NITI Aayog Sep 2021

Quality is Important



Why Water Quality is Important?

There is hardly any organ or part of body that is not affected by one or more constituents of water

The health implications of poor water quality are enormous, and water and sanitation related diseases are responsible for 60% of the environmental health burden in India (Planning Commission, 2008).

Cobalt	Paralysis	Selenium	Hair loss
Manganese	Manganism (Psychic disorder)	Thallium	Hair loss
Lead	Delays physical & mental development of children	Arsenic	Nasal cavity cancer
Mercury	Neurological disorder	Nickel	Nasal sinus (Shortness)
Methyl-Hg	Affects CNS (Minamata)	Fluoride	Mottled teeth
Selenium	Numbness in fingers & toes	Selenium	Brittle teeth
Cyanide	Thyroid Problems	Cobalt	Lung Irritation
Cyanide	Thyroid Problems	Chromium	Respiratory (Lung cancer)
Iodine	Thyroid Problems	Calcium	Lung cancer
Copper	Long term exposure - Liver damage	Ammonia	Lung Oedema
Nickel	Liver damage	Beryllium	Lung damage
Lead	Kidney problems	Selenium	Numbness in fingers & toes
Thallium	Kidney problems	Cobalt	Lung Irritation
Arsenic	Cardio-vascular disorder	Asbestos	Asbestosis (Cancer)
Mercury		Selenium	Circulatory problems
Cadmium			
Copper			
Lead			
Fluoride			
Selenium			
Arsenic			
Beryllium	Granulomatous skin ulceration	Copper	Short term exposure - GIT
Nickel	Skin allergy	Beryllium	Intestinal lesions
Chromium	Allergic dermatitis	Chlorinated HC	Damage fat cells, Loss of weight
Silver	Argyria (skin discoloration)	Strontium 90	Replaces Ca in bones (toxic), bone deformities
Beryllium	Intestinal lesions	Fluoride	Pain & Tenderness of bones
Chlorinated HC	Skin damage		
Cadmium	Cramps		

Water Quality Hazards & Impacts

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Farming ban along Yamuna to stay: NGT

New Delhi: The NGT has refused to entertain a farmers' body plea seeking modification of its earlier order prohibiting cultivation of edible crops and vegetables on the floodplains

of Yamuna. The green panel said Yamuna's water was "highly" polluted, which is injurious to health and hence it cannot be used for irrigation. PTI



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EXPRESS

Read to Lead

Actions desirable against Pollution

'निर्माण कार्यों में एसटीपी के पानी का ही करें इस्तेमाल'

जसं, ग्रेटर नोएडा : ग्रेटर नोएडा प्राधिकरण क्षेत्र में निर्माण कार्यों के लिए सिर्फ एसटीपी से शोधित पानी का ही इस्तेमाल कर सकेंगे। प्राधिकरण जल्द इस प्रविधान को अनिवार्य रूप से लागू करने जा रहा है। इसके बाद यदि कोई निर्माण कार्यों



पानी बहुत अनमोल है। इसे संभाल कर खर्च करें। भूजल स्तर तेजी से नीचे जा रहा है। घरों में आरओ से निकलने वाले वेस्ट वाटर का इस्तेमाल पौधों की सिंचाई, कपड़े धुलने व अन्य कार्यों के लिए करें। उसे फेंकें नहीं। - सुरेंद्र सिंह, सीईओ, ग्रेटर नोएडा प्राधिकरण व कमिश्नर मेरठ मंडल

इस्तेमाल करने की व्यवस्था लागू करने के निर्देश दिए हैं। प्राधिकरण सिर्फ सात रुपये में एक हजार लीटर शोधित पानी उपलब्ध कराएगा। सीवर विभाग के प्रभारी कपिल सिंह ने बताया कि जिस किसी को एसटीपी से शोधित पानी चाहिए वह प्राधिकरण

- Mandating the use of treated wastewater for all infrastructure development- construction projects & parks.
- Rules need framed under EPA-86.
- Greater NOIDA Authority have already taken action.

Wastewater Generated: WQ Hazards

❖ Domestic & Industrial Wastewater (WW)

- ✓ discharged untreated in Yamuna → section of the river an open sewer. (22km stretch: ~2% of length)
- ✓ Virtually no effort to control agricultural non-point pollution arising from fertilizers, pesticides & derivatives → all water bodies contaminated
- ✓ Unsatisfactory actions by administration → situation getting worse

❖ Current WW Treatment facilities leave much to be desired

- ✓ A significant part of urban centres is not seweraged → all WW generated cannot be taken to treatment plants (**Decentralisation?**)
- ✓ Even when WW is taken to STP, poor O&M ensure that they are either non-functional or are working at much reduced efficiencies.

WQ Hazard in WDS & Wastage of Water



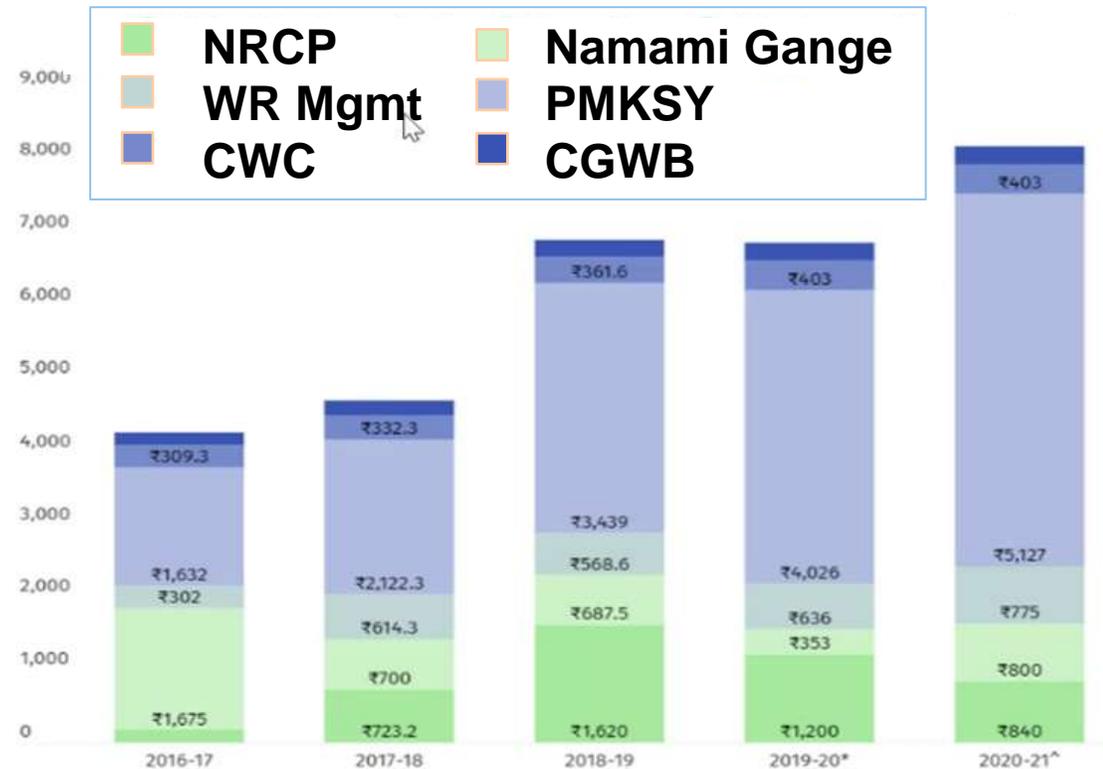
*Only when the last tree is cut,
Only when the last river is polluted,
Only when the last fish is caught,
will we realize that one can't eat money*

Management Interventions



Climate Change & Impacts on WR - NWM

Centre's Spending On Water Resources, River Development And Ganga Rejuvenation Departments



Note: *Revised estimate; ^Budget estimate; #Allocation from National Clean Energy Fund
 Source: Union budget documents for 2017-18 ([here](#) and [here](#)), 2018-19 ([here](#) and [here](#)), 2019-20, 2020-21
 Data visual by Shivani Pathak, Gulal Salil

What Could be Done: Irrigation/Domestic/Industry

- Bottled water Standards have been in place in IS-14543-2004 (Packaged drinking water) and IS-13428:2005 (Packaged Natural Mineral water)
- Standard specifications of Drinking water quality IS-10500:2012.
- Domestic RO units should be banned across the country (TDS<500mg/L).
- Water leaving WTP & storage reservoir must meet IS-10500 specifications
- No. of parameters to be tested should be increased in view of the new and emerging pollutants THMs, Heavy Metals, pesticides, etc. (22/110/352)
- Spurious packaged water have cropped up posing risk.
- Water is the raw material for this industry, so should they not be charged 50 times the water tariff for other industry which only use water?**

Interventions – GW & SW

- ✓ Source protection – no waste in rivers, lakes, reservoirs, village ponds
- ✓ Catchment area treatment – non-point pollution check
- ✓ Regulatory framework based on Monitoring – Data Collection & Analysis
- ✓ The rivers will cleanse themselves – have assimilative capacity
- ✓ Capacity Building, Awareness – WQ effects on health (Rural)
- ✓ R&D to study – Effect of Urbanization & Industrialization on SW Quality
- ✓ Data be available in public domain for easy access even by farmers
- ✓ More stress on GW recharge at all levels. Energy efficient tubewells

- ❑ **Quantity of water supply be proportional to verified GW Recharged (metering), incentivize the stakeholders**
- ❑ **In general R&D to increase WUE in agriculture (20% reduction)**

Ways of Tackling High Water Stress

❖ Basic 3 ways:

- ✓ Increase agricultural efficiency (NWM WUE → 20%)
- ✓ Reduce, Reuse, Recycle, Recover, and Treat WW; (NAPCC-NWM)
- ✓ Invest in Grey & Green infrastructure; can work in tandem with Built infra

❖ Let Live Our Rivers (MJS: NWM/ NMCG/ NRCP). River is alive if it can:

- ✓ flow & maintain a regime; recharge GW; provide habitat for aquatic life; replenish nutrients in flood plains & prevent incursion of salinity from sea;
- ✓ play a role in the economic, cultural & spiritual life of society
- ✓ Supportive capacity & Assimilative capacity.

EFA Notified 09.10.2018

- ❑ Stipulating science based **Env. Flow Assessment (EFA)** in major rivers
- ❑ **Statewide Environmental Flows Advisory Group (EFAG)** and **Statewide Science Advisory Committee (SSAC)** to oversee basin-specific efforts

What Could be Done for Storage capacity

For enhancing water storage (we have only 219 m³/capita)

Rural:

- ✓ Low height check dams in each village
Each village to have small reservoir to meet its own demand and recharge GW
- ✓ Overflow from check dams → drains & rivulets → GW Recharge will increase
- ✓ Revive traditional sources (tankas / wells / baoris, etc)

Urban:

- ✓ Create water bodies where possible
- ✓ Revive defunct / encroached WBs where possible
- ✓ RWH strict implement at every level

- ❑ **Competing needs prioritization necessary. (Demand side mgmt.)**
- ❑ **Water as a Common good to be managed by community.**

Public Water Supply Safety- 3rd DWQG

- ❑ Water supply agencies → the task of supplying safe & good quality drinking water to consumers.
- ❑ WSP is a system wherein risk assessment & mgmt. is central.
- ❑ WSP should be adopted by our ULBs, Water Boards, and PHEDs. These agencies must be enabled to develop their own WSPs.
- ❑ End point Tap sample analysis does not safeguard against bacteriological contamination (Results known Next day).
If water was contaminated, it has caused the damage because the contaminated water is already consumed.
- ❑ Now that every HH is provided with a tap, WSPs assume more importance in rural areas as well. **(Rules need framed)**

Controllable Wastage in Home saves water



**191 Million
Households.
106M house tap**



percent of homes have
leaks that waste 90 gallons
or more per day

Replace old toilets
with WaterSense labeled
models & save



13,000
gallons of water savings
for the average family



A shower leaking at

10 Drips

per minute wastes
more than

500

gallons per year



A leaky faucet dripping at the rate of
one drip per second can
waste more than

3,000 gallons

per year



REPAIR

leaks by checking faucet washers
and gaskets for wear and replacing
them if necessary



Harnessing Water from Air & Others

Air-O-Water
Airowater Pvt Ltd



- ❑ ***Humankind has a common future. We survive or perish together - North, South, East & West.***
- ❑ **If Climate Change is to be controlled, all countries will have to radically alter their development patterns.**

Q?

THANKS FOR PATIENT LISTENING

**THANKS ARE DUE TO ORGANISERS
& Dr Anil K. Garg for inviting to be
present among this august gathering**

