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Gist of KURUKSHETRA

VOL.01 June 2019

Drinking Water for Rural India

ENSURING SAFE AND ADEQUATE DRINKING WATER

COMMUNITY PARTICIPATION IN QUALITY DRINKING WATER SUPPLY

TECHNOLOGY INNOVATIONS FOR SAFE DRINKING WATER SUPPLY

PUBLIC HEALTH AND ACCESS TO DRINKING WATER

INFRASTRUCTURE OF RURAL DRINKING WATER SUPPLY

CSE 2018 Results

11 Ranks in Top 50 | **28 Ranks in Top 100** | **183 Ranks in the Final List**

Rank 11
Pujya Priyadarshni

Rank 16
Dhodmise Trupti Ankush

Rank 21
Rahul Jain

Rank 24
Anuraj Jain

RANK 31
Mainak Ghosh

RANK 32
Sameer Saurabh

RANK 33
Awhale Manisha Manikrao

RANK 36
Deepesh Kedia

RANK 39
Patil Hemanta Keshav

RANK 41
Alok Kumar

RANK 43
Akshay Agrawal

RANK 52
Prateek Singh

RANK 53
Sumit Kumar

RANK 56
Dileep Mishra

RANK 59
Chahat Bajpai

RANK 60
Anya Das

RANK 61
Girdhar

RANK 63
Vishal Sah

RANK 65
Preeti

RANK 70
Suraj Patel

RANK 72
Dilip Pratap Singh Shekhawat

RANK 76
Akash Bansal

RANK 77
Shivansh Awasthi

RANK 80
Khushboo Gupta

RANK 81
Jay Shivani

RANK 85
Smit Santosh Lodha

RANK 89
Sawan Kumar

RANK 94
Jivani Kartik Nagjibhai

RANK 106
Sushil Kumar

Incredible Results Since 2013

CSE 2017

5 Ranks in top 50 | **34 Ranks** in top 100 | **236 Ranks** in the final list


Rank 3
Sachin Gupta


Rank 6
Koya Sree Harsha


Rank 8
Anubhav Singh


Rank 9
Soumya Sharma


Rank 10
Abhishek Surana

CSE 2016

8 Ranks in top 50 | **18 Ranks** in top 100 | **215 Ranks** in the final list


Rank 2
Anmol Sher Singh Bedi


Rank 5
Abhilash Mishra


Rank 12
Tejaswi Rana


Rank 30
Prabhash Kumar


Rank 32
Avdhesh Meena

CSE 2015

5 Ranks in top 50 | **14 Ranks** in top 100 | **162 Ranks** in the final list


Rank 20
Vipin Garg


Rank 24
Khumanthem Diana Devi


Rank 25
Chandra Mohan Garg


Rank 27
Pulkit Garg


Rank 47
Anshul Agarwal

CSE 2014

6 Ranks in top 50 | **12 Ranks** in top 100 | **83 Ranks** overall selections


Rank 4
Vandana Rao


Rank 5
Suharsha Bhagat


Rank 16
Ananya Das


Rank 23
Anil Dhameliya


Rank 28
Kushaal Yadav


Rank 39
Vivekanand T.S

CSE 2013

5 Ranks in top 50 | **62 Ranks** in the final list


Rank 9
Divyanshu Jha


Rank 12
Neha Jain


Rank 23
Prabhav joshi


Rank 40
Gaurang Rathi


Rank 46
Udita Singh

Gist of Kurukshetra June 2019 Issue

Drinking Water for Rural India

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Chapter 1: Ensuring Safe and Adequate Drinking Water

Water is undoubtedly an important public good. A water-secure nation will not only provide clean and safe drinking water to its citizens but also would ensure a healthy and economically productive society. Provision and access to clean and safe drinking water and sanitation are vital to improving the overall health of the country's billion-plus population.

Recognizing the Need:

- Article 47, Constitution of India: confers the state with the duty of providing clean drinking water and improving public health standards.
- United Nations Conference on Environment and Development (UNCED): has selected 'leaving no one behind' as the theme for this year's Water Day.
- Goal 6, Sustainable Development Goals 2015-2030: talks about ensuring the availability and sustainable management of clean water and sanitation.
  - Goal 6.1: Achieving universal and equitable access to safe and affordable drinking water for all.

U.N Initiatives:

- United Nations had included among the Millennium Development Goals (MDGs), the objective of halving the number of people lacking adequate access to clean water by 2015.
- Sustainable Development Goals (SDG) are MDGs next edition.
  - In SDG, 17 Global Goals have been identified.
  - Clean water and sanitation is the sixth goal of SDGs.
  - Under SDG, it is targeted to achieve the following global goals by 2030:
    1. Universal and equitable access to safe and affordable drinking water for all.
    2. Access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
    3. Improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Statistics on Clean Drinking Water:

- United Nations:
  - 2.1 billion people do not have safe drinking water at home.
  - 80% of those who have to use unsafe and unprotected water sources, reside in rural areas.
  - More than 700 children under five years of age die every day from diarrhoea due to unsafe water and poor sanitation.
  - Women and girls are responsible for water collection in 8 out of 10 households.
  - Nearly 2/3 of the world's population experiences severe water scarcity at least for 31 days per year.
  - The intense impact of water scarcity could displace 700 million people by 2030.
  - Water consumption of the world is doubling every 20 years, which is more than twice the rate of increase of our population.
- Central Water Commission:
  - Only about 1123 km^3, (690 km^3 from surface water and 433 km^3 from groundwater) can be used due to topographical constraints and spatio-temporal variations in resources.
- National Sample Survey Office (NSSO) (2011-12):
  - 88.5% households in rural India had improved source of drinking water and among these, 85.8% had sufficient drinking water.
  - 46.1% of the rural households do not have drinking water facilities within their premises.

- World Health Organization:
  - It recommends around 50 Ipcd (litres per capita per day) of safe drinking water.
  - 84% of Indians who don't have access to clean water and sanitation live in rural communities.
- Review of the Millennium Development Goals, United Nations:
  - Out of the 35 Indian states, only 7 have achieved full coverage of having a safe water source for their villages.
  - Ground water in most cities and around 19000 villages contains fluorides, nitrates, pesticides, etc. beyond the permissible limits.
- Planning Commission,2010:
  - Between 1995 and 2004, the proportion of unsafe districts (semi-critical, critical and overexploited), the proportion of area affected and population affected has grown from 9% to 31%, from 5% to 33% and from 7% to 35% respectively.

Government Initiatives in India:

- Access to Drinking Water in Rural India Rural drinking water supply is a state subject in India.
- The country has already spent an estimated Rs. 1,105 billion on providing safe drinking water since the First Five Year Plan was launched in 1951.
- Bhore Committee (1946): The 'Environment Hygiene Committee' advocated for the provision of safe water supply to cover 90 % of India's population within a timeframe of 40 years.
- Accelerated Rural Water Supply Programme (1972): It aimed at speeding up coverage of drinking water supply.
- Swajal Dhara (1999): Focused on empowering and involving local communities in tackling water and sanitation issues.
- International Water Supply and Sanitation Decade (1981-1990): Aimed at 100% safe drinking water coverage of both rural and urban population.
- 73rd constitutional amendment (1994): The amendment incorporated specific provisions of entrusting the responsibility of drinking water supply to Panchayati Raj Institutions (PRIs).
- Technology Mission for Drinking Water (1986): It was renamed as Rajiv Gandhi National Drinking Water Mission in 1991.
- National Water Policy (1987): It gave a concrete direction to the approach adopted to create sustainable water infrastructure.
- Department of Drinking Water Supply (1999): It was created in the Ministry of Rural Development.
- Bharat Nirman: Focused on creating good quality water infrastructure in rural areas.
- National Rural Drinking Water Programme (NRDWP): Assists States in providing adequate and safe drinking water to the rural population.
  - NRDWP now targets providing rural populations with 40 litres of water daily to cover domestic uses.
  - A performance audit of the NRDWP was conducted by the Comptroller and Auditor General (CAG) of India in 2018 to assess how far the objectives of the programme were achieved between 2012 and 2017.
  - It found that insufficient community involvement, lack of long term sustainability plan, over-reliance on depleting groundwater resources and lack of focus on operation and maintenance of created infrastructure is not serving the purpose of building water secured rural India.
- 'Har Ghar Jal': It has been recognized as a goal to be achieved by 2030.
- Strategic Plan: In 2011, the Ministry came out with a strategic plan for the period 2011-22. The plan identified certain standards for coverage of habitations with water supply, including targets for per day supply of drinking water.
- Swajal: It is a pilot project designed as a demand driven and community centred programme to provide sustainable access to drinking water to people in the rural areas.
  - It was originally launched as a pilot scheme in February 2018 in six States of Bihar, Maharashtra, Madhya Pradesh, Uttar Pradesh, Uttarakhand and Rajasthan.
  - Later, it was extended to all the 112 aspirational districts identified by NITI Aayog.

- Atal Bhujal Yojana: It is a World Bank-aided scheme based on community participation to ensure sustained groundwater management in overexploited and ground water-stressed areas in seven states.
  - It has been found that 1,034 blocks out of the 6,584 assessed blocks in the country are overexploited.
- National Water Quality Sub-Mission (NWQSM): It was started as a sub-programme under NRDWP.
  - It aims to address the urgent need for providing clean drinking water in already identified 28,000 arsenic and fluoride affected habitations.
- Swajal Dhara: It is a programme to enable the rural community shoulder the responsibility in management, operation and maintenance of water supply systems at village level, in a decentralized, demand-driven, community-managed approach.
- National Rural Drinking Water Quality Monitoring & Surveillance Programme: It was launched to further strengthen community participation in the drinking water sector.
  - Under the programme, five persons in each Gram Panchayat are trained to carry out regular surveillance of drinking water sources for which 100% financial assistance including water testing kits, are provided by the Government.

Government Institutions Related to Drinking Water:

- Central Water Commission (CWC) regulates the use of water to irrigate surface waters, the industry and potable water. It also mediates in disputes related to the inter-state water allocation.
- Central Groundwater Board (CGWB) monitors groundwater levels and rates of depletion and the production of water resource inventories and maps.
- National Rivers Conservation Directorate (NRCD) oversees the implementation of Action Plans to improve the quality of the rivers in India.
- Central Pollution Control Board (CPCB) promotes basin-wide pollution control strategies.
  - It liaises with State Water Pollution Control Boards for laying down standards for the treatment of sewage and effluents.
  - The Board is also responsible for action in the case of non-compliance by agencies.
- The Ministry of Drinking Water and Sanitation is the nodal Ministry for the overall policy, planning, funding and co-ordination of the National Rural Drinking Water Programme (NRDWP) for rural drinking water supply in the country.
- Ministry of Agriculture (MoA) deals with planning, formulation, monitoring and reviewing of various watersheds based developmental project activities.
- Central Bureau of Health Intelligence (CBHI) performs the collection, compilation, analysis and dissemination of the information on health conditions in the country.
- Bureau of Indian Standards (BIS) is responsible for the drafting of standards pertaining to drinking water quality.

Challenges:

- Due to a 3-fold increase in population during 1951-2010, the per capita availability of water in the country decreased from 5177 m^3/ year in 1951 to 1588 m^3/ year in 2010.
  - As per the report submitted by the Committee on Restructuring the Central Water Commission (CWC) and the Central Ground Water Board (CGWB) 2016, if the current pattern of demand continues, about half of the demand for water will be unmet by 2030.
- There is a lack of installed drinking water supply capacities.
- India also suffers from low level of socio-economic development, education and awareness about the access and usage of water.
- Water resources are not evenly distributed. The unequal spatial distribution could be easily observed by the fact that the Brahmaputra and Barak basin, with only 7.3% of the geographical area and 4.2% of the country's population, have 31% of the annual water resources.
- A person in rural India has to spend, on average, 20 minutes to fetch drinking water.

- Climate change poses fresh challenges as more extreme rates of rainfall and evapotranspiration intensify the impacts of floods and droughts.
- With an annual groundwater extraction rate of 251km^3, India is the world's biggest consumer of groundwater. 60% of the districts face groundwater over-exploitation.
- Water pollution is also a major issue.
- There exists demand pressure from various sectors, changing cropping pattern, high rate of urbanisation and industrialisation.

Solutions:

- Different states in India face completely different water related challenges and thus ''one size fits all'' approach would not be applicable.
- Rainwater harvesting is one of the most important initiatives which can help in a long way in sustaining the supply of safe drinking water in the rural areas.
  - The Central Government is working on a master plan envisaging construction of about 23 lakh artificial recharge and rainwater harvesting structure in rural areas and 88 lakh in urban areas.
  - Central Ground Water Board has prepared a conceptual document entitled 'Master Plan for Artificial Recharge to Ground Water in India'.
- Panchayati Raj Institutions (PRIs) need to make the drinking water supply schemes truly functional.
- There is need for regulatory mechanism by the State governments to check the overexploitation of water resources.
- Better data on water quality and quantity, and a robust hydrological information system is needed.
- Sub-basin level water management: Several basins are inter-state thus it would require the riparian states to come to a consensus, which is a complex process and would take time. Therefore, water management at the sub-basin level should be initiated.
- Water source improvement: Currently, as per CPCB report 2018, 351 river stretches on 275 rivers across the country have got polluted due to the discharge of both municipal and industrial waste water over the years. Also, the groundwater quantity and quality is degrading at an unprecedented rate which needs an immediate response.
- Integrated water and waste management: Open defecation, domestic solid waste, wastewater and waste from cattle are the major cause of water contamination in rural areas and it has high negative health impacts as well. Therefore, sanitation management would be a crucial element in achieving water security.
- Supply and access augmentation: On the supply side, wastewater reuse and recycling and rainwater harvesting should be encouraged across the country without further delay. On the access front, households and farms with poor access to water should be targeted on priority.
- Demand side management: The Government will have to come up with innovative policies, incentives and subsidies, for increased adoption of water efficient practices and agro-ecology based crop selection in the agriculture sector as the groundwater sources are finite.
- Capacity building of institutions involved in water resources management is the need of the hour.
- Institutional and legislative reforms: Water is segregated amongst so many institutions that accountability is difficult to be defined. There should be an umbrella agency that controls the governance of the water sector.
- Revival of traditional wisdom: The community needs to be made the guardian of water resources in their locality.
- Preparedness for disasters: Drinking water is heavily affected during disastrous events, thus people should be made aware of actions to be taken for restoring drinking water sources.

Case Studies:

- Tamil Nadu: In 2001, the state government made it compulsory for each household to have rainwater harvesting infrastructure and the results are now reflected in the improvement of overall water quality within 5 years.
- Bangalore and Pune: In a similar experiment, housing societies were required to harvest rainwater.

- Kadwanchi village, Maharashtra: The efforts by the local community to improve water availability have been lauded in a UN report that highlights the importance of finding nature-based solutions to meet global water challenges.
  - The villagers also built nine check dams apart from de-silting nearly 25 km of stream.
  - The report notes that reservoirs, irrigation canals and water treatment plants are not the only water management instruments at disposal.
- Sponge City, China: The city aims to recycle 70% of rainwater.
- Ramgarh, Rajasthan: The villagers construct 'beris', a traditional system of rainwater harvesting. Shaped like matkas (pitcher), these shallow wells are dug up in areas with gypsum or bentonite beds which prevent rainwater from percolating downwards but guide them towards the wells through capillary action.

Conclusion:

It is to be remembered that in order to widen the access and availability of drinking water in rural areas, every effort to preserve and use the water judiciously with active participation of the village communities must be made.

Chapter 2: Community Participation in Quality Drinking Water Supply

Historically, communities in India managed water and had their unique mechanism of fighting climate extremes.

Reasons for Deterioration of Water in Rural Areas:

- Rapid depletion of ground water level due to over extraction by Agriculture and Industry sectors.
- Uncontrolled construction activities in rural areas and encroachment of the erstwhile water bodies.
- Siltation of rural water bodies and reduction of water bodies.
- Erratic rainfall and droughts or drought-like conditions.
- Water pollution due to incessant and increased use of pesticides, fertilizers and effluents coming from industry.

Role of Community in Water Quality Management:

- Under the 73rd Constitutional amendment, Gram Panchayats have been assigned planning and managing rural water supply and sanitation systems as one of their prime duties.
- Community has an important role in maintaining not only hygiene near the drinking water sources, but also in improving the ways and means by which water is collected and stored to avoid contamination during collection, storage and use.
- Community involvement enhances the economic viability of operation and maintenance, better upkeep due to inherent community belongingness and also increases the lifespan of the system so created.
- In order to arrest problems of arsenic and fluoride contamination in drinking water, NITI Aayog had recommended commissioning of community water purification plants and advocated for last mile connectivity of piped water supply schemes in 2016.
- The effective implementation of these schemes demands active engagement of community through PRIs, Self-Help Groups (SHGs) and Cooperatives in rural areas.
- The community through PRIs needs to take up responsibility of being programme implementing agencies (PIAs) not only to plan and install drinking water projects and extract water for drinking purposes.
- The National Rural Drinking Water Quality Monitoring and Surveillance Programme, has institutionalized the community participation of district and state-level laboratories for the monitoring of drinking water sources at the grass root level through Gram Panchayats.

Functions of the Community:

- Social mobilization, initiation of need analysis, preparation of water security plan and village action plan.
- Discuss and deliberate on sustainability of drinking water schemes, explore new revenue sources like user fees, operation and maintenance fees, etc. for smooth operation and maintenance of water systems.
- Preparation of water safety plan to ensure water quality.
- Ensuring convergence with line departments of district, to plan and execute water conservation projects under PMKSY, MGNREGA, etc. to ensure water recharge and increased water availability in rural areas.
- Setting up technical support cells in consultation with the District/Block administration to ensure convergence in the community and near the project areas.
- Coordination with District/Block level authorities for fund utilization, adopting technologies and monitoring of water schemes.
- Arranging social audit of water schemes from time to time in consultation with district line department officials.
- Arrange training and capacity building programmes on water collection, storage and usage for grass root workers like ASHA workers, Anganwadi workers, science teachers, high school girl children, Panchayat members, retired army officials, etc.
- Conducting periodic sanitary survey.
- Monitoring water availability, water sources and quality of water and arrange awareness camps.

- Ensuring availability of water testing kit for each Gram Panchayat and regular testing of water in accredited labs.

Case Study:

- Water and Sanitation Management Organisation (WASMO), Gujarat:
  - It is an autonomous entity aimed at facilitating community managed drinking water facilities in rural areas of Gujarat.
  - The thrust is on capacity building and empowerment of Pani Samiti (Village Water and Sanitation Committee) towards planning, execution and maintenance of village level water supply infrastructure such as underground sumps, elevated storage reservoirs, stand-posts, pipelines, bathing and washing facilities and cattle troughs.
  - Rainwater harvesting has become the rule for recharging the local water supply sources.
  - The relentless work to ensure sustainable safe drinking water in Gujarat's rural areas was bestowed the 2010 Commonwealth CAPAM International Award.

Way Forward:

- Central and State Governments need to provide timely and adequate technical and financial support and an enabling environment for PRIs and local communities like SHGs and cooperatives.
- A shift in approach is required to 'area-specific development interventions' from 'universalization of programmes/schemes'.
- An independent mapping of development status at frequent intervals is the need of the hour to identify localities within the community itself with greater developmental issues relating to supply of safe drinking water.

Chapter 3: Technology Innovations for Safe Drinking Water Supply

Appropriate technologies and innovations can play a pivotal role in making available safe and clean drinking water to the rural population in our country. If technologies and innovations are equipped with the insight of traditional knowledge system of India, then drinking water supply in rural parts of the country can be realized. A rational approach is also essential to achieve this goal.

Testing of Drinking water:

- Bureau of Indian Standards (BIS) has specified drinking water quality standards in India to provide safe drinking water to the people.
- It is necessary that drinking water sources should be tested regularly to know whether water is meeting the prescribed standards for drinking or not and, if not, then, the extent of contamination/unacceptability and the follow-up required.
- In the short term, chemical constituents in groundwater do not change much, therefore testing once a year for chemical contaminants is adequate.
- Testing for bacteriological contamination is recommended 4 times a year, once in every season.
- However, every year it should be carried out at least twice, during pre-monsoon and post-monsoon seasons.

Drinking Water Treatment:

- The choice of treatment technologies would be largely determined by the quality of water and the nature of demand.
- Few of the basic water treatment technologies/ methods are discussed below:
  - Slow sand filters (SSF): It purifies the water efficiently by reducing turbidity and bacterial contamination.
  - Chlorination: Being a strong oxidant, chlorine is used to remove taste and odour, as well as biological contamination.
  - Solar Disinfection (SODIS): A clean and transparent PET plastic bottle is filled with water and kept in direct sunlight for 6 hours during noon on sunny days and two days if the sky is more than 50 % clouded. It has no chemical and external energy requirements thus making it an affordable choice. It removes 99.9 % of microorganisms.
  - Capacitive deionization (CDI): It is a technology in which a separator channel (with a porous electrode on each side) removes ions from water.
  - Ozonation: It is based on the ozone infusion into the water for chemical water treatment.
  - Ultra Violet filters: ultraviolet light is used to kill microorganisms in water.
  - TERAFIL is a burnt red clay porous media used for filtration & treatment of raw water into clean drinking water. This technology has been developed by the Council of Scientific & Industrial Research (CSIR).
  - OS-Community scale Arsenic Filter is an organic arsenic filter which is developed by IIT Kharagpur.
  - Other Technologies: Flocculent treatment, Ceramic candle, and Ion Exchange (IEX).

Reverse Osmosis Plants:

- A large majority of contaminants are removed in reverse osmosis (RO) technology through a semipermeable membrane.
- The World Health Organization recommends that humans get between 10 — 20% of our daily needs for minerals from drinking water.
- The human body absorbs minerals 30% faster and easier from water than it does from food.
- The Bureau of Indian Standards (BIS) has given acceptable/permissible limits to the number of minerals in drinking water.
- Water that is too high on a certain type of minerals might cause health problems.
- Ministry of Drinking Water and Sanitation (MDWS) maintains a MIS portal to keep track of the number.
- RO, as a purification technology, is infamous because of the huge quantity of reject water, the system ejects in the process of purification.
- The reject water contains highly concentrated minerals, which can further aggravate the groundwater levels in the region.

- It can be channelled for use in local school toilets, as it is done in some of the Rajasthan villages.
- RO technology tends to filter out or remove essential minerals as well, even when they are well within permissible limits.
- Therefore, RO Plants should be set up only in places that have water quality problems, as certified by water quality laboratories.

Water App for monitoring water supply schemes:

- The RWS mobile App has been developed by the Ministry in technical collaboration with National Informatics Centre for monitoring of schemes on state, district, block, panchayat and village levels.
- Using this App, the user can upload the photographs of beneficiaries /Source /Delivery Points using a Smartphone.
- At present this facility has been provided to state government officials, as a tool for reporting the progress of NRDWP to the central Ministry.

Drinking Water Quality Monitoring:

- The Integrated Management Information System (IMIS) facilitates the Ministry and the line departments to monitor the coverage status of rural habitations and population with potable drinking water.
- The system has details of over 16 lakh habitations and more than 60 lakh drinking water supply schemes which include both Piped Water Supply schemes, stand posts/taps and spot sources like open wells, hand pumps etc.
- The status of quality affected habitations and population and its coverage with safe potable water is regularly monitored on this platform.
- The system also provides a platform to the district and block water testing laboratories to upload the water sample test reports.
- SMS and email automation is also used to generate daily basis SMS alerts and sent to Ministry officials for monitoring of daily MPR reported, expenditure habitation covered etc.

Communication and Educational Innovation:

- The internet has inspired innovations in the areas of water and sanitation, which have long needed fundamental changes in terms of available information and communication technology.
- With the internet and other new technological tools, simple, appropriate technologies for the supply of water can be implemented within weeks rather than years.
- In the past, as a part of the Millennium Development Goal 7, United Nations created an innovative program called WASH (Water, Sanitation and Hygiene) which is essential for all time in improving people's health, education and lifestyle, as well as in reducing poverty around the world.

Chapter 4: Public Health and Access to Drinking Water

Approximately 21% of communicable diseases are waterborne and 75% of water-related deaths are of infants under five years. Access to safe and adequate drinking water and adequate sanitation facility for communities has been recognized as a leading step towards universalization of health care in India.

Water and Public Health:

- The basic physiological requirement for drinking water has been estimated at 2 liters per person per day.
- UNICEF estimates the contribution of water-related diseases to almost 4 million child deaths each year globally.
- According to one study in The Lancet, 105,000 children lost their lives in 2015 to water-induced diarrhoea.
- Official NRDWP data reveals that around 60,000 of all habitations are exposed to water contaminated by arsenic and fluoride.
- A study of quality affected habitations by category of contaminants shows that as many as 4.07 Cr rural population are suffering from water contamination that varies from fluoride, arsenic, iron, salinity, nitrate, heavy metals, etc.
- India loses 73 million working days due to water-borne diseases.

Transmission of Diseases:

- Contaminated water and poor sanitation are linked to transmission of diseases such as Cholera, Diarrhoea, Dysentery, Hepatitis A, Hepatitis E, Typhoid, and Polio.
- In addition to these water-transmitted diseases, there are water-borne, water-related and water-washed diseases.
- Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.
- The water borne diseases are considered public health problems due to a number of reasons:
  - Their potential to cause large outbreaks.
  - High disease burden.
  - For being major causes of admissions and outpatient visits to the hospitals and health facilities mainly amongst young children.
  - For many water borne diseases, no specific treatment is available and prevention is the best approach.
  - These diseases spread rapidly and may cause panic in the community.

Challenges:

- Availability of water also affects the effective functioning of healthcare facilities.
  - In India, in March 2017, nearly 20% of Health Sub-Centres and 4% of Primary Health Centres in rural India did not have access to running water.
  - In 2015, WHO & UNICEF jointly developed WASH FIT (Water and Sanitation for Health Facility Improvement Tool) to support small, primary health care facilities in low- and middle-income settings.
- When water comes from improved and more accessible sources, people spend less time and effort in physically collecting it, meaning they can be productive in other ways.
- Better water sources also mean less expenditure on health, as people are less likely to fall ill and incur medical costs, and are better able to remain economically productive.
- Children are particularly at risk from water-related diseases.

Conclusion:

As the global development community and India is focusing on advancing universal health coverage and addressing the social determinants of health, improved provision of safe drinking water should be prioritised.

Chapter 5: Infrastructure of Rural Drinking Water Supply

There is an urgent need to develop and implement new ways of storing, conserving protecting and distributing water.

Infrastructure of Rural Drinking Water supply:

- Earlier, drinking water to the rural population has been provided through hand pumps, tube wells and piped water supply.
- But now the thrust area is piped water supply, preferably through a balanced mix of sustainable surface and groundwater based resources.
- 18% of rural households had been provided with Piped Water Supply (PWS) household connections.
- There is also significant variation in piped water coverage across States.
- The Central Government aims to cover 90% rural households with piped water supply and 80% rural households with tap connections by 2022.
- It is recorded that more than 80% of rural habitations have been covered under the National Rural Development Water Programme (NRDWP) in other words created drinking water infrastructure in the rural areas followed by partially covered habitations (15.59 %).
- It is further noted that 60,365 quality affected habitations with arsenic, fluoride, brackishness, iron, etc. had been provided safe drinking water.
- If it goes at this pace, piped drinking water ('Har Ghar Jar) could be provided to the rural people of the country before 2030.

Drinking Water Infrastructure under SWAJAL in Aspirational districts:

- The Ministry of Drinking Water and Sanitation (MoDWS) launched SWAJAL, which is a community demand driven, decentralized, single village, preferably solar powered, mini Piped water supply programme for the 112 aspirational districts in 27 States identified by NITI Aayog.
- The aspirational districts have low coverage of habitations with piped water supply as compared to National Coverage.
- Gram Panchayats in partnership with rural communities and State Sectoral agencies are being involved in the execution of the scheme and also operate and maintain the scheme.
- Swajal would ideally be implemented as groundwater based Piped Water Supply (PWS) scheme in all the habitations of these districts.
- The States Governments are advised to access the funds under the "Flexi Funds" under NRDWP.
- 5% of the funds (both Central and state share put together) under NRDWP can be utilized by the State for funding Swajal.
- In order to build the capacity of the field officials, a first of its kind Training of Trainers (ToTs) programme has been organized by the Ministry with assistance from UNICEF in the recent past.

Infrastructure of Water through Convergence, for Swachh Bharat Mission (SBM):

- The availability of enough water for sanitation purposes needs to be taken into account on priority.
- A conjoint approach to water and sanitation is being adopted through convergence with the National Rural Drinking Water Programme (NRDWP) and the SBM (Gramin).
- Villages which have been declared ODF are given priority for Piped Water Schemes under NRDWP.
- The field observations revealed that this incentivised approach has motivated/boosted the people to achieve open defecation free and getting PWSS.

Operation and Maintenance (O&M) of Infrastructure of Rural Drinking Water Supply:

- An efficient O&M of a water supply system is to provide safe drinking water as per designed quality and quantity.
- Operation: It refers to the timely and daily operation of the components of a Water Supply system such as head works, treatment plant, machinery and equipment, conveying mains, service reservoirs and distribution system etc., effectively by various technical personnel, as a routine function.

- Maintenance: It is defined as the act of keeping the structures, plants, machinery and equipment and other facilities in optimum working order. It includes preventive /routine maintenance and breakdown maintenance.
- As per the records, expenditure for O&M on running, repair and replacement costs of drinking water supply projects, the States allocate a maximum of 15% NRDWP allocation. This is being shared by 50:50 (Central and State).
- The community-based O&M of drinking water projects, undertaken by Gram Panchayats, is an initiative aimed at enhancing the provision of safe drinking water to rural communities through community-managed drinking water projects.
- The Village Water and Sanitation Committee (VWSC), a Committee under State Panchayat Raj Act, undertakes the following activities assist the Panchayat in such activities.

Chapter 6: History of Drinking Water Management

The importance of water resource management has been recognised since ancient times.

Timeline:

- The Indus Valley Civilization had many provisions related to water supply and sanitation:
  - Public and private baths in urban areas.
  - Sewage was disposed of through underground drains built with precisely laid bricks.
  - A sophisticated water management system with numerous reservoirs was established.
- The Roman Empire had formalized the role of the state in improving health.
  - Romans brought pure water to all their cities through aqueducts, drained marshes to combat malaria and built sewerage systems amongst other initiatives.
- Around 1840, the experiments of two British epidemiologists John Snow and William Budd on Cholera and typhoid concluded that the diseases spread through drinking water.
- By the beginning of the twentieth century, clean water was being counted as one of the pillars of public health.

Rajasthan's Traditional Water Management Systems:

- Rajasthan is India's largest state by area, accounting for more than 10% of the country's geographical area.
  - While the state supports about 5% of the human population and 20% of the livestock, it possesses just 1.2% of the total surface water and only 1.7% of the groundwater available in India.
  - During the 1970s and 1980s, the era of Green Revolution in India, there was widespread use of groundwater in Rajasthan and the pressure on groundwater is further increasing due to population growth and an increased number of industries.
  - About 80% of the area of the state has witnessed groundwater depletion and many towns and villages have experienced a shortage of drinking water, particularly in summer months.

Traditional Rainwater Harvesting (TRH) Structures of Rajasthan:

- These structures catered to the local needs, utilised local resources and were based on the wisdom and knowledge handed down from generation to generation.
  - They were replenished each year with monsoon rain and served the people all round the year.
  - Many community TRH structures also had temples or religious associations with them and became centres of pilgrimage.
  - Many were built with royal patronage or rich businessmen.
- The main TRH structures in Rajasthan are as follows:
  - **Kundi** is a circular underground well with a saucer-shaped catchment area that gently slopes towards the centre where the well is situated. A wire-mesh across water inlets prevents debris from falling into the well pit. The sides of the well-pit are covered with lime and ash. Most wells have a dome-shaped cover for protection.
  - **Kui / Beri** is a 10-12 meter deep pit dug in tanks to collect the seepage. The mouth of the pit is made narrow to prevent the collected water from evaporating. The pit gets wider under the ground so that water can seep into a large surface area. The structures are generally covered with wooden planks.
  - **Baori / Ber** is a community well, whose water is used mainly for drinking. Most of these are built by banjaras (mobile trading communities) for their drinking water needs.
  - **Jhalara** is a human-made tank, essentially meant for community bathing and religious rites.
  - **Nadi** is a small excavated or embanked village pond used for storing water from an adjoining natural catchment during the rainy season.
  - **Toba** is a natural ground depression within a catchment area. It is usually flanked by groves of shady trees, which helps in reducing evaporation of water.
  - **Tanka** is a small circular or square underground tank constructed with lime mortar or cement plaster.
  - **Khadin** is a construction designed to harvest surface run-off water for agriculture. An earthen bund is put in place on which trees and grasses are established. These help in stabilising the bund and reducing evaporation losses.

- **Johad** is a small earthen check dam that captures and conserves rainwater, improving percolation and recharging ground water.
- **Anicut** is a structure constructed across a stream. It uses an earth fill section with a spillway and is designed to hold sufficient water to submerge a substantial upstream area during the rainy season.

Dysfunctional State of TRH Structures:

- The main reasons for the dysfunctional state of TRH structures are:
  - Availability of other sources of water (piped water, hand pumps and canal water).
  - Requirement of financial resources for their use and maintenance.
  - Requirement of time and labour to use water from these structures.
  - Lack of ownership and participation of the community.
  - Tendency to disregard age old and time tested lifestyle in favour of the latest technology in the name of modernisation.

Revival Strategies for TRH Structures:

- **Tarun Bharat Sangha (TBS)** has been working on the revival of johads since 1986.
  - TBS relied on community participation by undertaking padyatras and involving religious leaders.
  - The entire work was done without relying on any engineers and guided entirely by the traditional wisdom of the people.
  - Rajendra Singh, who runs the NGO, was awarded the Ramon Magsaysay award for community leadership in 2001 and the Stockholm Water Prize (known as the Nobel Prize for Water) in 2015.
- **Jal Bhagirathi Foundation (JBF)** founded in 2002 has been working in the area of water security for the Marwar region, comprising seven districts in the western part of the state.
  - JBF promotes the revival and construction of TRH structures by using inexpensive, simple and traditional technology.
- **Gramin Vikas Vigyan Samiti (GRAVIS)** has built over 7,000 tankas and over 600 beris in the Thar Desert area.
- **Samajik Vikas Sansthan** has promoted restoration of existing ponds and underground water storage systems and construction of new ones in Shekhawati area.
- **Mewar Krishak Vikas Samiti** has constructed about 30 nadis in Rajsamand district.
- **The Bhoruka Charitable Trust** has encouraged villagers in Churu district to build and renovate kundis and johads.
- Under their Corporate Social Responsibility (CSR), some corporates have also been involved in supporting the revival of TRH structures.
- **The Central Arid Zone Research Institute (CAZRI)**, Jodhpur has developed an improved technology of tanka construction using stone masonry with cement plaster and cement concrete.
- In 2016, the state government launched a comprehensive scheme to ensure effective implementation of water conservation and water harvesting related activities in rural areas.
  - Besides budgetary support, for the first time ever, the state government has created an online crowd-funding portal where donations for the scheme are accepted.
  - Following the Union Government's Model Bill for Ground Water Management (2011) and National Water Policy (2012), the State Government has made rainwater harvesting mandatory for all public establishments and all properties in plots covering more than 500m^2 in urban areas.

TIDBITS

1. Yoga: Art and science for Healthy Living

Yoga is essentially a spiritual discipline based on an extremely subtle science which focuses on bringing harmony between mind and body. It is an art and science for healthy living.

Importance of Yoga:

- According to Yogic scriptures, the practice of Yoga leads to the union of individual consciousness with the universal consciousness.
- The literal meaning of the Sanskrit word Yoga/ Yuj is 'Yoke' which is joining of an individual's soul energy with that of God's (supreme soul).
- "Yoga" also refers to an inner science comprising of a variety of methods through which human beings can achieve union between the body and mind to attain self-realisation.
- The aim of Yoga practice (sadhana) is to overcome all kinds of sufferings that lead to a sense of freedom in every walk of life with holistic health, happiness and harmony.

A Brief History of Yoga:

- Agastya, the saptarishi, who travelled across the Indian subcontinent, crafted this culture around a core Yogic way of life.
- The rishis were able to exercise Yoga and attain samadhi (enlightenment) by developing their meditative skills and letting go of attachment to the mind.
- The ancient Indian Philosophy, that is Yoga, is deeply rooted in spirituality-promoting components, including niyama (self- discipline), pratyahara (detachment from the senses) and dhyana (meditation).
- A number of seals and fossil remains of Indus Valley Civilisation with Yogic motifs and figures performing Yoga sadhana suggest the presence of Yoga in ancient India. The seals and idols of mother Goddess are suggestive of Tantra Yoga.
- The presence of Yoga is also available in folk traditions, Vedic and Upanishadic heritage, Buddhist and Jain traditions, Darshanas, epics of Mahabharata including Bhagavad Gita and Ramayana, theistic traditions of Shaivas, Vaishnavas and Tantric traditions.
- The great sage Maharishi Patanjali systematised and codified the then existing Yogic practices, its meaning and its related knowledge through Patanjali's Yoga Sutras.

Global Acceptance of Yoga:

- Yoga has been India's answer to fancy fitness regimes followed in the west.
- Following attendance at the World Parliament of Religions in Chicago in 1893, Swami Vivekananda introduced Yoga to the USA.
- International Day of Yoga is celebrated every year on 21st June.
- Western world has picked up yoga-asana which is being mainly viewed as good fitness regime for common man.
- But real Yoga (Kriyayoga) is in private or secret domain i.e. secret between Guru and disciple.

Components of Yoga:

- Yoga is made of eight essential elements: Pranayama (controlling breathing), Dhyana, Pratyahara (not letting external factors influence oneself), Dhaarna (retention), Samaadhi (trance), Yama (control), Niyama (self-restraint), and Aasana (posture).
- For each dimension, there are standard yoga protocols, modules and human resource available which can be explored to promote Yoga.

Yoga for Fitness:

- With automation and changes in lifestyles physical fitness is now considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations.
- Many sources cite mental, social and emotional health as an important part of overall fitness.
- Yoga is reported to reduce stress and anxiety, improves autonomic functions by triggering neuro-hormonal mechanisms by the suppression of sympathetic activity.
- Yoga was also found to be beneficial as an adjunct to conventional medical management of hypertension, coronary artery disease and diabetes.
- Yoga may also be useful in reducing medication requirements in patients with diabetes, hypertension and could help prevent and manage cardiovascular complications.
- Many backward, forward and twist asanas such strengthen the body.

How does Yoga Work?

- Yoga cleanses the accumulated toxins through various shuddhi kriyas and generates a sense of relaxed lightness through Yogic sukshma vyayama (simple micro movements for all joints and ligaments of the body).
- Adoption of a Yogic lifestyle with proper nourishing diet, creates positive antioxidant enhancement thus neutralizing free radicals while enabling a rejuvenative storehouse of nutrients packed with life energy to work on anabolic, reparative and healing processes.
- Improves control over autonomic respiratory mechanisms though breathing patterns that generate energy and enhance emotional stability.
- Integrates body movements with the breath creates psychosomatic harmony. In Yoga the physical body is related to annamaya kosha (our anatomical existence) and the mind to manomaya kosha (our psychological existence).
- Yoga particularly improves the body's blood circulation which further assists in normalizing blood pressure and hypertension.
- In effect, levels of stress hormone called cortisol are drastically reduced. Good hormones namely dopamine, serotonin, etc. then flow in abundance which are essential to absorb food nutrients (vitamins, iron, calcium etc.).
- Vitamin D also rises and digestion improves when solar plexus is balanced through kriyas like

Sun Salutation (Surya Namaskar).

Pranayama:

- Raja/ Ashtanga yoga scientifically controls both mind and body, combining features of Hatha yoga (asanas, pranayama) and silent meditation, to gain spiritual energy.
- Pranayama involves various practices relating to inhalation (Puraka) and exhalation (Rechaka) as well as retention of the breath (Kumbhaka), such as, Nadi-Shodhan/Anulom-Vilom, Bhastrika, Shitali, etc.
    - Pranayama yoga leads to the purification of Nadis which ultimately helps to awaken Kundalini.
    - Nadis are nerves/tubes in the body which are not physically visible but carry pranic currents throughout the body to keep us alive.
    - Kundalini is the elementary energy lying dormant at the base of the spine.
    - This is the energy of breath which flows in pattern through nadis and focuses itself by forming intersections along spinal column called Chakras.
    - These are roughly 72,000 Nadis, but three important ones are Ida, Pingala and Sushumna.

2. World Environment Day

- World Environment Day (WED) is celebrated on the 5th of June every year.
- It was established in 1972 during the United Nations Conference on the Human Environment, which led to the creation of the United Nations Environment Programme (UNEP).
- Its aim is "encouraging worldwide awareness and action for the protection of our environment".
- In 2018, India was the host for World Environment Day and the theme was focussed on Plastic Pollution, which is one of the most challenging environmental concerns today.
- In 2019, China hosted the World Environment Day celebrations on the theme, 'Air Pollution'.
- Currently, about 4 billion people, 92 % of Asia and the Pacific's population, are exposed to levels of air pollution that pose a significant risk to their health.

U.N Recommendations:

- A report by the U.N titled Air Pollution in Asia and the Pacific: Science-based Solutions details 25 measures that will deliver benefits across sectors:

1. Strengthen emission standards for road vehicles in collaboration with environmental agencies, transport agencies, oil companies and vehicle manufacturers, among others.
2. Regularly maintain and inspect vehicles by introducing legislation and enforcement of regular mandatory emission checks and maintenance.
3. Mainstream electric vehicles by developing fiscal and non-fiscal policies to promote electric mobility.
4. Provide better mobility options by improving public transport system and walking and cycling infrastructure
5. Control dust from construction and roads by suppressing construction and road dust through dust control measures and increasing green spaces.
6. Reduce emissions from international shipping by requiring low-sulphur fuels and control of particulate emissions.
7. Improve post-combustion control by introducing measures to reduce sulphur dioxide, nitrogen oxides and particulate emissions at power stations and in large-scale industry. Ex.: flue gas desulphurization for sulphur dioxide, selective catalytic reduction for nitrogen oxides, and high efficiency particulate matter controls like fabric filters, multistage electrostatic precipitators.
8. Strengthen industrial process emissions standards by introducing advanced emissions standards in industries.
9. Introduce efficient brick kilns technology by introducing more efficient technologies such as zig zags, vertical shaft brick kilns and tunnel kilns.
10. Control methane from oil and gas production by encouraging recovery of oil production and associated petroleum gas.
11. Improve solvent use and refinery controls by introducing low-solvent paints for industrial and do-it-yourself applications.
12. Use environmentally-friendly refrigerants by ensuring full compliance with Kigali Amendment to phase-down hydrofluorocarbons which are commonly used in air conditioning, refrigeration and a host of industrial products.
13. Provide clean cooking and heating options such as electricity, natural gas, liquefied petroleum gas, etc.
14. Strictly enforce bans on household waste burning.
15. Provide incentives for improved energy efficiency in households.
16. Increase renewable electricity generation by providing incentives to foster extended use of wind, solar and hydro power for electricity generation.
17. Improve energy efficiency for industry by including energy efficiency targets for industry in national development plans.
18. Recover coal mining gas by encouraging pre-mining recovery of coal mine methane gas.
19. Improve livestock manure management by introducing covered storage and efficient application of manure.
20. Strengthen management of nitrogen fertilizer application by efficient application of ammonium nitrate fertilizer, neem coated urea, urease inhibitors, etc.
21. Better management of agricultural crop residues by banning open burning.

22. Prevent forest and peatland fires by improving and enforcing forest, land and water management and fire prevention strategies. This includes fire spread protection zones, fire alarm and brigade system, prohibit access to forests during droughts, and ban on land clearing.
23. Promote more efficient rice production practices such as intermittent aeration of continuously flooded rice paddies (e.g. alternate wetting and drying — practice of allowing the water table to drop below the soil surface at one or multiple points during a growing season).
24. Stop biogas leakage from wastewater treatment by introducing two-stage treatment with biogas recovery.
25. Improve solid waste management.

3. Toilets Help Revive Weaving Industry

- The Sambalpuri sarees handloom is a centuries old family occupation in the Sonepur district of Odisha.
- The district is home to predominantly a tribal community, one of the poorest in the State.
- Prior to the commencement of the Swachh Bharat Mission Gramin (SBM-G) in October 2014, sanitation coverage of the district was a meagre 3.94 %.
- It took a long time for people to stop the practice of defecating in the open near the river banks where there was easy access to water.
- In addition, health impacts and issue of women dignity always existed.

Agents of Change:

- The district Swachh Bharat Mission team engaged in intensive behavior change IEC (Information Education and communication) and IPC (Interpersonal communication) campaigns during which communities were mobilized to construct and use toilets.
- Swachhagrahis were trained and Nigrani Committees were formed in all villages to rigorously carry out morning and evening follow up in common open defecation areas.
- In addition, they organized various awareness building activities such as sanitation rallies, village awareness drives, focused group discussions, etc.
- Over the last two years, as many as 1,27,748 individual household toilets were built, ensuring 100% sanitation coverage.
- Sonepur was declared open defecation free (ODF) on 31st March 2019.

Game changer for Weavers:

- It saved valuable time owing to which the families could spend more productive time on weaving which resulted in increased household income.
- Access to toilets is saving significant time for weaving communities which can be used for more saree orders.

4. World Book Day

- In its General Conference held in 1995, UNESCO chose 23rd April as the World Book Day.
- It is a tribute to the value that authors and books add to our knowledge and ideas, transcending beyond boundaries of space and time.
- Popular fiction and non-fiction titles as well as other segments in publishing like K-12 (Kindergarten to 12th Grade), higher education and test preparation books form the core of the publishing industry in India.
- Publishing industry needs to assimilate emerging technological aspects and realize the demographic variations that impact book readership and hence the market.
- There is a need of vernacular publishing which has a potential market.
- It is pertinent to note how books are also fast becoming one of the top choices for web series, television series and other digital platforms in addition to cinema, which has always had a long-standing relationship with books for its stories.
- Digital publishing, audio books and reading on the Kindle are fast catching up.

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