CENTRAL GROUND WATER BOARD
DEPARTMENT OF WR, RD & GR
MINISTRY OF JAL SHAKTI
GOVERNMENT OF INDIA

BHUJAL SAMVAD

JAN TO MAR, 2024, VOL.24

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MESSAGE

It gives me great pleasure to present before you the latest release of Bhujal Samvad volume 24 which includes major accomplishments of Central Ground Water Board during Jan-March, 2024. We are delighted to announce that CGWB has participated in International Conclave, 2024, Shillong. During the event, the Honorable Chief Minister of Meghalaya, along with the Minister of Water Resources, Meghalaya, have graced pavilion of CGWB, which is featured in the Infocus Section.

Central Ground Water Board participated as mentor and evaluator in Smart India Hackathon (SIH), a nationwide initiative conceptualized under the leadership of the Hon'ble Prime Minister. This initiative aims to offer students a distinctive platform to devise innovative solutions that enhance livelihoods. The details are elaborated in the 'Cover story' section.

The newly introduced section Bhujal Talk Series, encompassing presentations by distinguished speakers features the topic "Relevance of Ideology of Swami Vivekananda and Shri Ramakrishna Paramahamsa in Man Making and Nation Building".

Our 'Report' section focuses on comprehending inland salinity issues in groundwater and devising management strategies for the arid to semi-arid region of Mathura city, Western Uttar Pradesh, India. The 'Pathshala' segment focus on sharing knowledge related to hydrogeology, and in this volume, it covers the relevance of "Ground water Monitoring: A step towards Management of Ground water Resources.

The Shodh section features research papers authored by officers of Central Groundwater Board, published in reputed journals. This indicates the commitment to scientific research and advancements in groundwater management.

For more information or to contribute to the Bhujal Samvad's success, the contact email provided is mediacell-cgwb@nic.in. This publication aims to raise awareness and promote sustainable groundwater management practices in India.

भूजल संवाद

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CONTENTS

Pampa Sarovar or ***Congress Bavi*** : A heritage well in Belagavi, Karnataka
It was built in 1927 by ***Shramdaan*** and is a symbol of sustainable utilization of resources

IN FOCUS

Beginning of a new era of collaboration between CGWB and ICAR. Dr. S. K. Ambast, Chairman, CGWB convened a meeting of senior officers of CGWB and representatives of ICAR at Bhujal Bhawan, Faridabad on 3rd January 2024. Possible areas of cooperation for groundwater management were discussed.

CGWB pavilion at International Water Conclave, 2024, Shillong.

Hon'ble Chief Minister of Meghalaya along with Minister for Water Resources, Meghalaya visited CGWB's Pavilion at the International Water Conclave, 2024, Shillong.

Central Ground Water Board, WCR, Ahmedabad participated in 10th Vibrant Gujarat Global Trade Show 2024 (9th -13th Jan 2024) at Hall no 7 (Atmanirbhar Bharat) Posters display depicting various activities of CGWB and Various Schemes/programs of Ministry of Jal Shakti

Dr. S. K. Ambast, Chairman CGWB at the All India Secretaries Conference on water vision 2047 at Mahabalipuram Chennai.

Viksit Bharat Sankalp 2024 was held in Rishikul, Haridwar where in CGWB, Dehradun participated in the exhibition and displayed its activities, schemes and showcased the achievements. Ministry of Jal Shakti won the best stall award in the Viksit Bharat Sankalp 2024.

Dr S K Ambast, Chairman, CGWB and Sh Anurag Khanna, Member (N&W) visited Bastawa and Indroka Dam sites in Jodhpur district.

Dr. Ratikanta Nayak, RD & Director (Admn), CGWB presented "Status of Groundwater in India: Implications for Drinking Water Sustainability" at National Workshop on JJM in Lucknow, Uttar Pradesh. The session was chaired by the Secretary, DDWS, MoJS

Regional Directors' Review meeting was held at CGWB, SR, Hyderabad on 10th & 11th Feb 2024. The meeting was chaired by Dr.S K Ambast, Chairman, CGWB. All the Members, Regional Directors, HOOs & OICs of SUOs have participated in the meeting.

Inauguration of Anicut at Village Indroka Bas, block Lohawat (under AR Project Phase-3, Rajasthan) by the Hon'ble Minister of Jal Shakti Shri Gajendra Singh Shekhawat along with Shri Gajendra Singh Khinwsar, Hon'ble Health Minister , Govt. Of Rajasthan

COVER STORY

Harnessing opportunities of open innovation (Smart India Hackathon-2022) for developing software solutions for groundwater studies

Rumi Mukherjee, S N Dwivedi and Dr G Praveen Kumar, CGWB, CHQ, Faridabad

In 2022, Smart India Hackathon - Junior was also introduced for school students to build a culture of Innovation and problem-solving attitude at the school level.
Doordarshan and All India Radio were the media partners of SIH 2022 whereas Shell and AWS were the sponsoring partners.
Central Ground Water Board has consistently participated in SIH since its inception in 2017.

Mentoring during Event

Smart India Hackathon (SIH) is a nationwide initiative envisioned under the leadership of Honourable Prime Minister to provide students with a unique platform to bring out solutions through innovations that help improve lives. It is the world's largest open innovation model and has become an important mega annual event especially among engineering students from across India. The first Smart India Hackathon was held in the year 2017 in which 40,000 students participated. India has come a long way in promoting implementation of new ideas which is reflected in India's ranking in Global Innovation Index published by the World Intellectual Property Organization. India's ranking was 81st in 2015 out of 132 economies and was raised to 46th in 2021. It further improved to 40th in 2023.

SIH 2022 was the fifth edition after the first 4 editions of SIH 2017, SIH 2018, SIH 2019 and SIH 2020. Smart India Hackathon 2022 was jointly organised by Ministry of Education's Innovation Cell, All India Council for Technical Education, Persistent Systems, and i4c.

In 2022, CGWB provided 3 problem statements for development of softwares which are widely used by professionals working in ground water sector.

Problem Statements

- **User friendly data visualization tool for interpretation of groundwater isotope data.**

Stable isotope data can contribute to a better understanding of groundwater recharge process, estimation of evaporative effects, characterization of the catchment area, surface water groundwater connection and groundwater mixing properties which are crucial for improved groundwater management. Over a period of more than four decades, a large number of isotopic measurements on groundwater have been made in different parts of the country in connection with several local investigations. Centralized data repositories have become increasingly important as a means for archiving information and analytics of the resources. However, to date a centralized database for the management of groundwater isotope data doesn't exist.

It was desired that a web interface and an associated App be designed which provides a comprehensive compilation of stable isotope groundwater data. Key information to be stored may include hydrogen and oxygen isotope ratio, water type, collection date and time, site location, project information etc.

Expected Outcome is a web based searchable database on Isotope that will collect stable isotope data from public domain to create maps and graphs which can be used for the interpretation of the stable isotope values of groundwater.

- **Standalone desktop application for analysis, visualization and interpretation of hydro chemical data.**

Characteristics of cations and anions in groundwater represent the unique physiochemical characteristics caused by the groundwater's interaction with rock and soil while flowing in the aquifer. Understanding of the hydro chemical characteristics and evolution of groundwater is significant for rational management of groundwater resources. Various diagrams such as piper diagram, durov diagram, gibbs diagram, chadah diagram etc. are used to represent hydro chemical data.

As on date there is no Indian version of a standalone desktop application for analysis and interpretation of hydrochemical data and a freeware for use by ground water professionals, researchers, students, teachers and others is required.

Expected Outcome is the development of a standalone software with interactive tools for analysis and interpretation, assessing suitability of water for various purposes and diagrammatical representation and classification of water samples.

- **Application for pumping test data analysis**

The pumping test (or 'aquifer performance test') is the standard and most widely used method for determining the hydraulic parameters of aquifers such as Transmissivity, Storativity, Specific Yield. Analysis and interpretation of pumping test data is a tedious process and is usually done using computer applications. However, there are no Indian software available for this purpose.

Therefore, a standalone desktop application for analysis and interpretation of pumping test data is desired which can be distributed as freeware for use by ground water professionals, researchers, students, teachers and others. Modules for interpretation involving standard methods like Theiss, Theiss recovery and Jacob methods are to be made part of the software application.

The various stages of the competition

CGWB nominated three officers form CHQ, Faridabad, namely Ms Rumi Mukherjee, Sc D, Sri S N Dwivedi, Sc D and Dr G Praveen Kumar, Sc D as evaluators as well as mentors for SIH 2022. These officers were also part of the jury members for selecting the winners in the SIH 2022 grand finale.

The 25 entries relevant to the three problem statements provided by CGWB were evaluated based on 4 criteria- Novelty, Appropriateness, Technical Feasibility and Impactness in a scale of 0-5.

Problem Statement ID	Problem Statement Title of CGWB	Number of Ideas allocated	Number of ideas evaluated
BV798	Standalone Desktop application for pumping test data analysis	5	5
RK1114	User friendly data visualization tool for interpretation of groundwater isotope data	7	7
RK1115	Standalone desktop application for analysis, visualization and interpretation of hydro chemical data.	13	13

5 teams each for Problem Statements RK1114 and RK1115 were finalists based on the average marks scored for all the 3 evaluators. There were 2 teams which reached the final for the problem statement BV 798.

THE FINAL EVENT

The grand final for the software version SIH 2022 was held from August 25th to August 26th,2022. There were 75 higher educational institutes to represent Smart India Hackathon nodal centres to host the final event. The selected student teams, industry representatives, design mentors, and evaluators travelled to the assigned physical centres.

Prin. L. N. Welingkar Institute of Management, Development and Research, Mumbai was the venue for Grand Final of the Problem Statements of Ministry of Jal Shakti.

The SIH 2022 was 36 hours nonstop event in which the participating teams developed the software's as per the problem statements given by various ministries and the industries under the overall guidance of the designated mentors and the evaluators. There were three judges for each problem statement. There were 3 rounds of evaluation and several sessions of mentoring. The winners were declared based on the average markings of all the 3 rounds.

The prize money was 1 lac each. In case of joint winners of two teams, the prize money was equally distributed.

For the problem statement on Standalone desktop application for analysis, visualization and interpretation of hydro chemical data, there were 2 joint winners.

Mentors, Evaluators & Organizers of SIH

Team Hydrophilic led by Anurag Ramashrai Singh of Thakur College of Engineering & Technology Mumbai and Team Conquerers1 led by Shivam Singh of Bundelkhand University, Jhansi. They could develop a prototype which with some more refinements can turn into a working software.

For the problem statement on Pumping Test Data Analysis the Team - Code. Linguists led by Dhairyashil Anil Ghatage of Sinhgad Technical Education Society, Pune were the winners.

For the problem statement on Isotope Data Analysis, the Team Brute Forces led by Yashasvee Dwivedi of Bundelkhand Institute of Engineering and Technology, Jhansi were the winners.

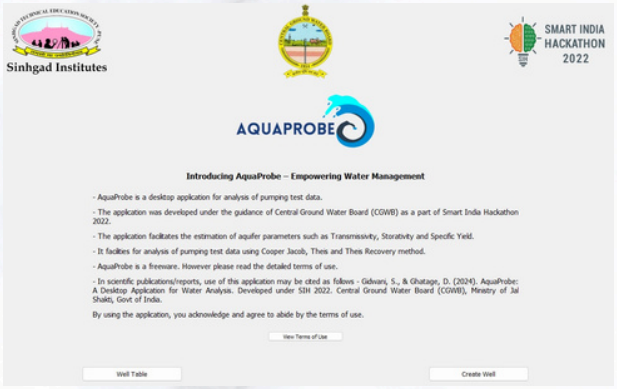
The Mumbai leg of the Smart India Hackathon conducted at Welingkar Institute saw the participation of 31 teams and 225 bright students competing for solutions of 8 problem statements.

FOLLOW UP

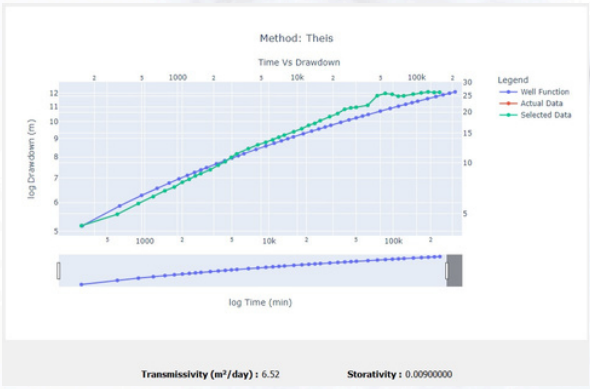
Subsequent to the grand finale of SIH2022, a directive was received from Ministry of Education to explore the possibility of development and deployment of Smart India Hackathon (SIH2022) Winning Projects. CGWB developed all the three winning prototypes into full-fledged software applications with the willing student teams by providing internship to the winning teams for a period of 6 months during which the students worked remotely from their college and were given a monthly stipend/internship of Rs 5000 per month.

The teams of the three applications have completed the development of software and the beta version of the software application will be released soon which is proposed to be hoisted in CGWB's website and will be made accessible to all.

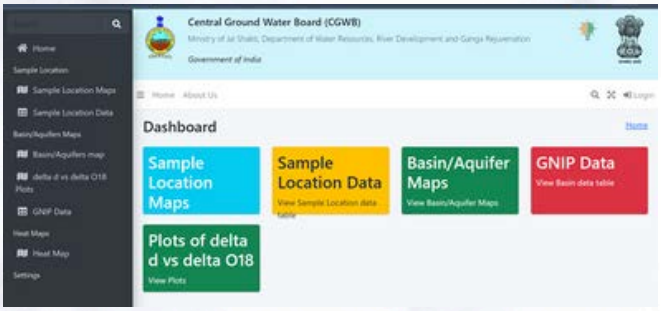
Some snapshots of the three applications and the outcomes generated are indicated in the Plates given below



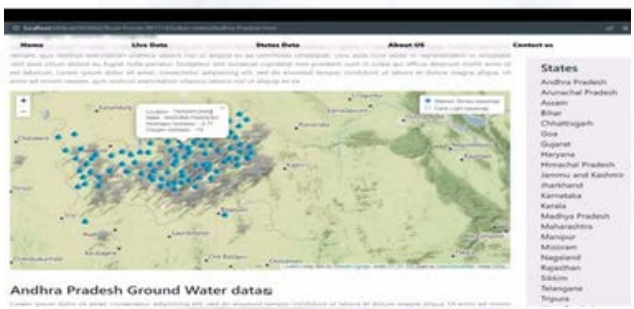
Home Page for Standalone Desktop Application for Pumping Test Data Analysis



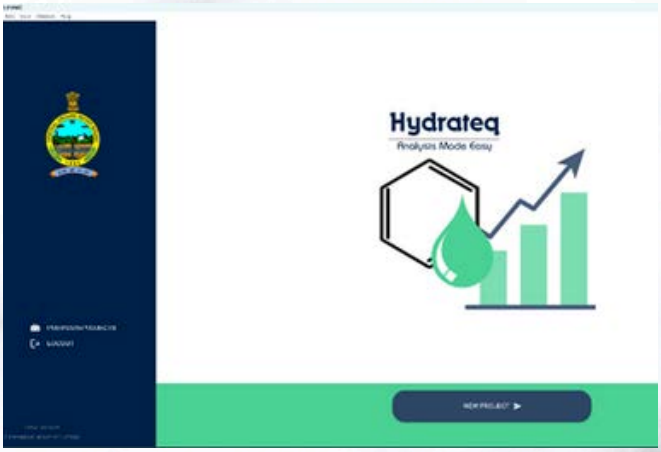
Analytical report generated for Theis Method



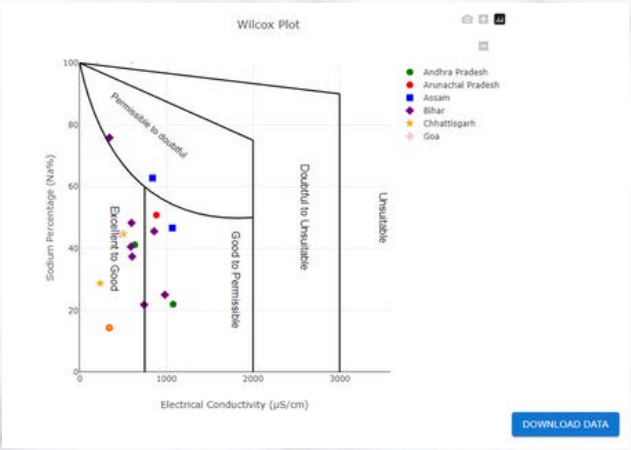
Home Page for visualization and interpretation of groundwater isotope data



Isotope Data visualization



Home Page for visualization and interpretation of hydrochemical data



Wilcox Plot generated from the application

CONCLUSION

The software solutions developed for the problem statements of SIH 2022 given by CGWB have been developed into full-fledged working software's and are ready to be launched and placed in CGWB's website.

This is a unique and great feat because all the three software's are the first Indian versions for these products and will be available free of cost to the users for download and replication after giving proper citations. This is an apt instance of 'Make in India' products and will give boost to **'Atma Nirbhar Bharat'**.

REPORT

UNDERSTANDING INLAND SALINITY PROBLEMS IN GROUNDWATER AND MANAGEMENT STRATEGIES IN ARID TO SEMI-ARID REGION OF MATHURA CITY, WESTERN UTTAR PRADESH INDIA

Dr. Shamshaad Ahmad (CHQ, CGWB Faridabad)

Introduction

In India, a large proportion of the rural (about 80%) and urban (about 50%) populations rely on groundwater for their domestic needs. However, water quality has been deteriorating over the years due to both natural geological formations and human activities. This problem is particularly acute in densely populated areas, major industrial zones, and regions with shallow water table conditions. The Mathura city and Saidabad areas of Mathura district face a persistent problem of high salinity and other chemical constituents that impact the environment. The concentration of Na, K, Cl, and HCO3 is high in shallow aquifers as compared to deep aquifers. CGWB assessed the groundwater quality in shallow aquifers of India and found that the Mathura district showed a high concentration of Electrical Conductivity (EC > 3000 µS/cm), Chloride (Cl > 1000 mg/l), Fluoride (F > 1.5 mg/l) and Nitrate (NO_3 > 45 mg/l). The interaction between Yamuna river and groundwater shows that EC increases as the distance of groundwater increases from the river thereby, indicating less influence of river water on groundwater with increasing distance at Mathura area.

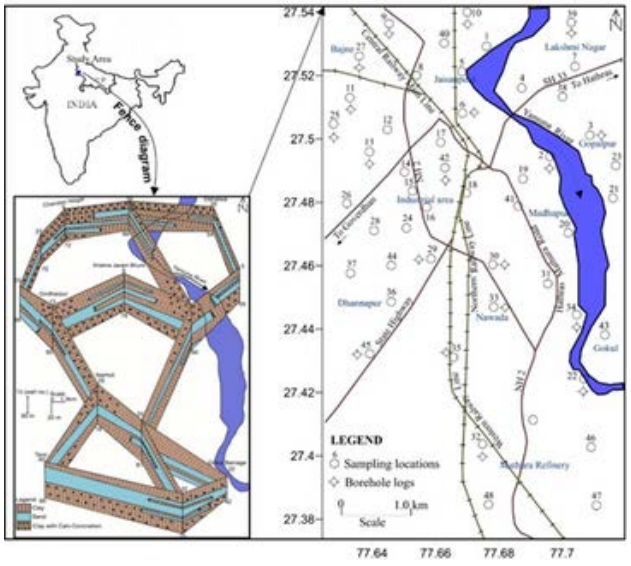


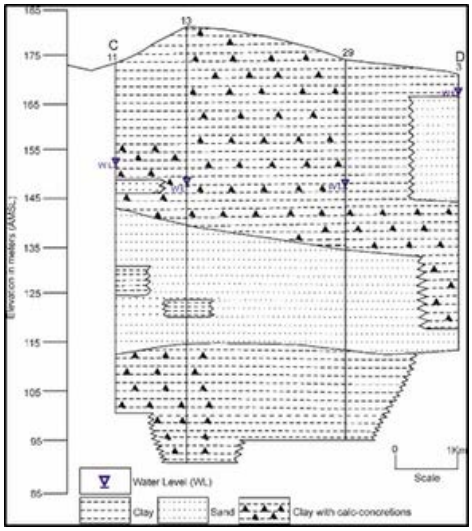
Figure 1 : Map showing location of sampling, borehole logs and fence diagram of the area

It is crucial to study the hydrogeochemical characteristics of the aquifer system in different seasons to explain the process of groundwater growth in the Mathura aquifer system and to explain how groundwater quality varies with time.

Geology and hydrogeological framework

A major portion of the Mathura district is situated in a marginal alluvial plain, with some parts lying in the central alluvial plain of the Ganga basin and is underlain by Quaternary alluvial deposits made up of older and younger alluviums. The quaternary alluvium comprises various grades of sand and clay associated with occasional interbeds of calc. concretion. To ascertain the sub-surface configuration of the aquifer system, lithological logs of various boreholes were utilized to construct the fence diagram and hydrogeological cross-sections.

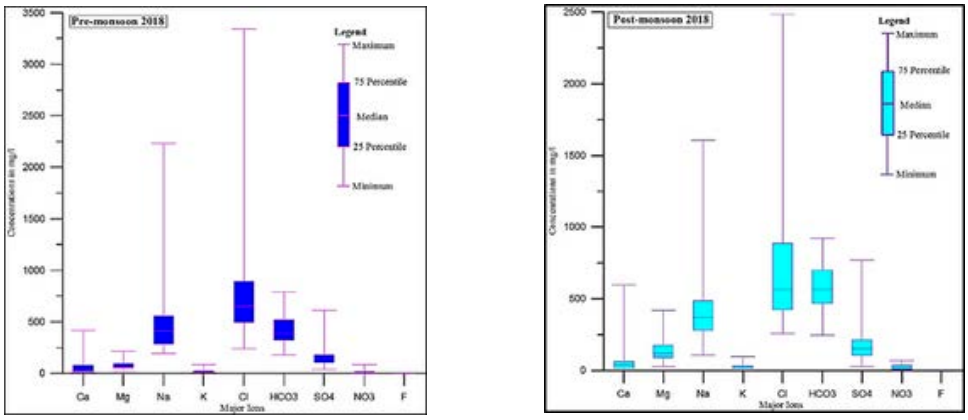
The fence diagram (Fig. 1) demonstrates that the top clay with thickness ranges from 6 to 42 m appears across the whole area with interbedded calc. concretion. The thickness of this layer is more in the north-western and central parts as compared to southern and eastern parts of the area. An alternate disposition of clay and thin sand layers occurs in the central part. The clay layer is underlain by a 21m thick granular zone in the central part and comparatively thick in the southern part with a thickness of 25 m. Aquifer material is constituted of fine to medium-grain sand.



The hydrogeological cross-section revealed that top clay with calc. concretion kankar is occurring throughout the area, ranging in thickness from 30 m in the well no. 11 and 54 m in the well no. 3 of the section. Within this clay layer, single 21 m thick sand lens is encountered in the eastern part. This clay layer is underlain by a thick granular zone with thickness varying from 30 m to 3 m from west to east respectively. Transmissivity and Hydraulic conductivity values of the area ranged from 62.7 to 183 m2/day and 3.5 to 20.1 m/day respectively. Transmissivity is relatively low in Mathura as compared to other parts of the Central Ganga Plain (CGP) because of the preponderance of clay material.

General chemical characteristics

The average concentration of Na, Mg, Ca, K is 491, 77, 57, and 21 mg/l in June and 66, 140, 434 and 28 mg/l in November, respectively, whereas the average values of Cl, HCO_3, SO_4, NO_3 and F are 788, 424, 183, 15.4 and 0.68 mg/l and 816, 587, 202, 21.5 and 0.8 mg/l in November season, respectively.



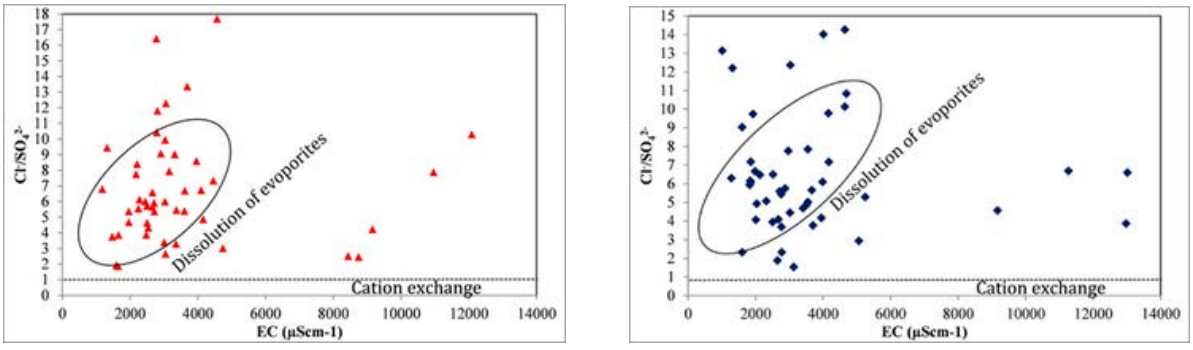
(a) (b)

Figure 2 : Box-Whisker plot of major ion

Figures 2a and b provide a convenient way of viewing the minimum, 25 percentile, median, 75 percentile and maximum values for a large group of samples. The concentration of Na and SO4 showed the highest median and high scattered distribution values in June and Ca, Na and SO_4 in November seasons, whereas the lowest median and least scattered distribution were observed in Ca, Mg, NO3 and F in pre-monsoon and Mg, K, NO3 and F in post-monsoon 2018. The concentration of Cl showed the least median value and highest scattered distribution. The order of relative abundance of major ions is Cl> Na> HCO_3> SO_4> Mg>Ca> NO_3> F in June and Cl> HCO_3> Na> SO_4> Mg>Ca> NO_3> F in November. Overall, the results of chemical data demonstrate that the concentration of major ions is excess in groundwater.

Evolution of Groundwater Salinity

Overall groundwater is slightly alkaline and hard to very hard type. EC is one of the significant pollutants produced by irrigation in arid and semi-arid regions and it increases salt concentration and loads in groundwater due to mineral weathering. Based on the EC values about 52% and 48% of samples in June 2018 and 54% and 46% of samples in November fall under medium conductivity (Class II) to high conductivity (Class III), respectively. Overall the groundwater was found brackish to slightly saline type except for five samples of each season which show very high EC values greater than 6000 µS/cm. The presence of significant values of Na, K, and Cl in groundwater is indicated by high EC values. The results of chemical data demonstrate that the concentration of SO_4^{2-}, Cl-, Na+ and EC is excess in groundwater. As a result, it is essential to check any potential relationships between their ionic ratios. The Cl^-/SO_4^{2-} vs EC ratio can be used to determine how evaporite dissolution, such as halite and gypsum, evolved as a function of EC. The ratio also depicts the presence of salinity in the form of residual salts. The trajectory of this ratio (Fig. 3 a and b) demonstrates that salts are dominant in both seasons. This ratio reveals that salinity increases in proportion to the ratio. Overall, it appears that the dissolution of evaporites is the dominant process influencing groundwater chemistry. This view is also supported by the outcomes of saturation indices of evaporite minerals including halite (NaCl) and gypsum which are highly undersaturated.



(a) (b)

Figure 3 Ionic ratio of Cl^-/SO_4^{2-} vs EC for the evaluation of salinity in the area

Total dissolved solids (TDS) comprise inorganic salts such as Cl, SO4, HCO3, NO3, Na, Mg, Ca and K as well as a small quantity of dissolved organic materials dissolved in groundwater. The average TDS values are 2182 mg/l and 2223 mg/l in June and November 2018, respectively.

Factors influencing the groundwater quality

Overall, it is observed that the concentration of Na, K, Ca, Mg, Cl, HCO3, SO4 are high in the aquifer system of the area. This is borne out of the unique hydrogeological and climatological conditions of the area. The unique hydrogeological setup is in the form of thick clay layers with kankar indicating a paleo-climate favouring deposition of clay for a longer time. The presence of a thick clay layer in the sub-surface geology enables the waters to have a relatively longer residence and sluggish percolation time in the zone of aeration which increases the concentration of Na, K, Cl, and HCO3 in the aquifer system. Besides geogenic factors, various anthropogenic pollutants contribute to groundwater pollution such as the toxic effluents that may be released from various industries, sewage discharge, septic tank leakages, and landfill leachates. Groundwater pollution is also caused due to agricultural activities in the peripheral region mainly by irrigation return flows which contribute to higher mineralization of groundwater.

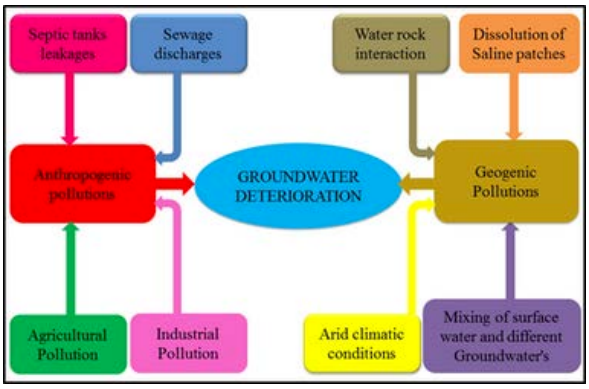


Figure 4 : Pictorial representation of factors that govern the water quality of the study area.

Conclusion and Recommendation

The groundwater quality and geochemical behaviour of the aquifer in Mathura City, Western Uttar Pradesh, India, were assessed. Overall groundwater is alkaline, brackish, and hard to very hard type. The relationship between electrical conductivity (EC) and Cl-/ SO_4^{2-}demonstrates an increase in salinity proportional to the ratio confirming evaporitic dissolution as the dominant process to control the groundwater chemistry. Box whiskers plot showed that mean trends of cations and anions are Na>Mg>Ca>K and Cl> HCO3> SO4> NO3>F, respectively, in both seasons. Overall, groundwater quality is poor, and it is crucial to find alternate drinking water sources or treat the groundwater before consumption. Based on the findings it is concluded that the study area has two major issues (i) Declining water table and (ii) water quality. Therefore, recommendations are made based on the findings of the study.

- It is recommended that Rooftop Rain Water Harvesting should be adopted for recharging aquifers in urban areas.
- In rural areas where the thickness of clay is more, rainwater should be collected in tanks and injected into aquifers by recharge shafts or boreholes. In areas where the thickness of clay is less, recharge pits or trenches should be made.
- It is observed that the difference in TDS from groundwater to Yamuna river water samples is approximately 1000 mg/l. Therefore, it is suggested that during the excess flow of the river in the rainy season, the water can be utilized for recharging the aquifer.
- Since water is hard to very hard, therefore, some water softening techniques like lime soda and ion exchange process are suggested.
- The sewage network requires strengthening to stop the further alteration and pollution of groundwater. The water supply system also requires strengthening and maintenance to avoid the loss of potable water through leakages.
- It is recommended that urban landfills, waste dumps and effluent channels should either have a concrete floor or use sheets of impermeable film to prevent the leaching of water pollutants.

Thus, a careful and effective management of groundwater in terms of quality and quantity is required for the resource to be used in future.

GROUNDWATER MONITORING: A STEP TOWARDS MANAGEMENT OF GROUNDWATER RESOURCES

Rajesh Kumar, CHQ, Faridabad

Introduction

Groundwater is a crucial natural resource of water. It accounts for about 50% of urban water demands and 85% of rural domestic water needs. Groundwater is also a significant contributor to surface water resources. During dry weather, the flow in streams and the water in lakes and wetlands are sustained by the discharge of groundwater.

Importance of Groundwater level monitoring

Ground-water systems are dynamic. It continuously adjusted according to short-term and long-term changes in climate, groundwater withdrawal patterns and land use patterns. Groundwater level measurements from observation wells are the principal source of information about the hydrological stresses acting on aquifers and how these stresses affect groundwater recharge, storage, and discharge. Continuous and systematic measurements of groundwater levels are crucial for evaluating variations in the groundwater resource over time, building groundwater models, and predicting trends. These measurements also help in developing, implementing, and monitoring the effectiveness of groundwater management and protection programs.

Common Instruments for Groundwater Level Monitoring

Groundwater level measurements can be made manually or automatically. Manual water-level recorders give a visual or audio signal when their probe is submerged in water or touches the surface of the water. On the other hand, automatic recorders have sensors/small probes installed in the monitoring wells, which measure the water-level/pressure change and temperature data at pre-set intervals. The data thus generated can be stored and downloaded from the data logger during inspection visits or telemetrically transmitted to a data server enabling remote monitoring.

Recent years have seen the development of various methods and tools for monitoring groundwater levels and fluctuations as science advances. These include numerical modeling methods and satellite-based monitoring methods etc.

STEEL TAPE

Before lowering the tape into the well, the lowest 5–7 m of the tape is lightly coated with chalk to indicate where it becomes wet.

ELECTRIC TAPE

When the probe touches the surface of the water and completes the circuit, the sounder makes a beeping sound.

DIGITAL WATER LEVEL RECORDER (DWLR)

Records the water column pressure then converts it to water level and transmits it to a data server.

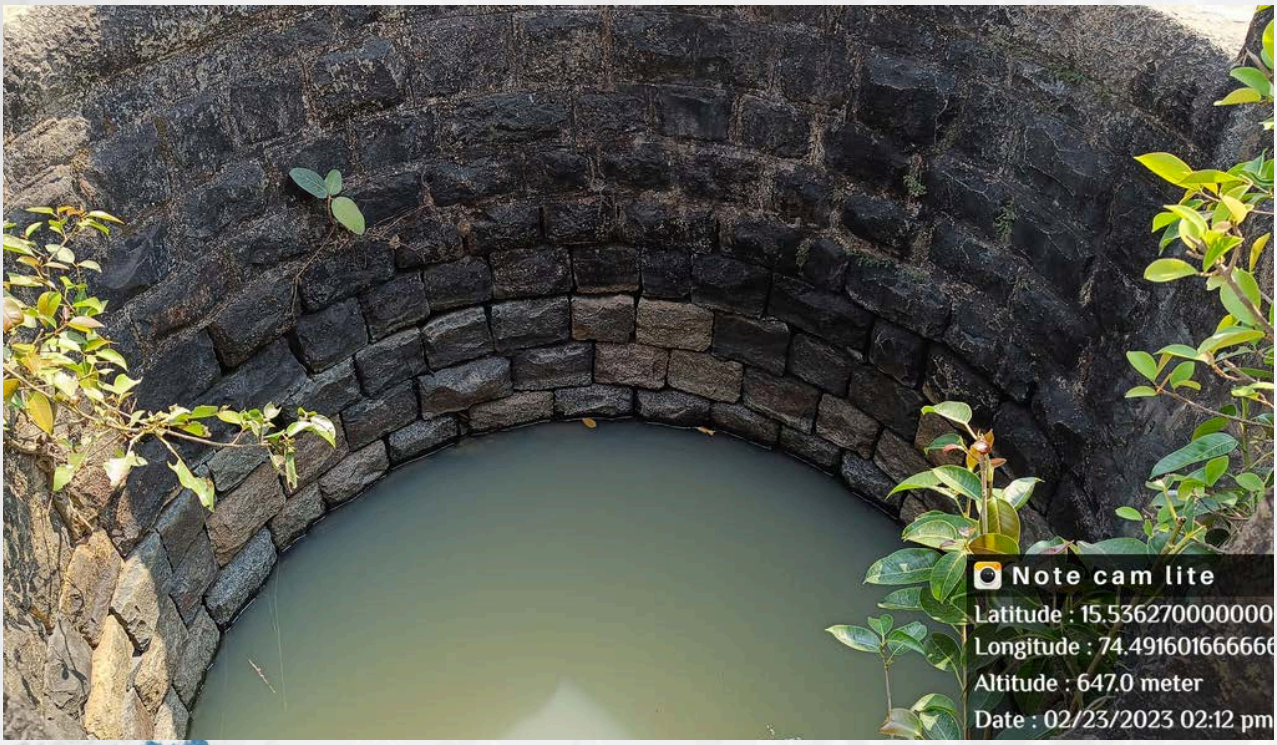
Spatial Distribution of Groundwater Monitoring Network

Groundwater measurements should be representative of the actual regional state of groundwater in the aquifer. Therefore, groundwater level measurements should be taken from fixed dedicated non-pumping observation wells. Dedicated monitoring wells are designed and constructed specifically for measuring groundwater levels. The advantage of using dedicated groundwater monitoring wells is that they can determine the effects of groundwater extraction on each aquifer system and determine interconnections and vertical gradients between them.

The establishment of groundwater monitoring stations should be based on factors that influence the occurrence of groundwater. The topography of the surface, hydrology, geology, aquifer property, climatic conditions and land and water use settings will all influence the occurrence of groundwater. In India, more than 25000 monitoring stations (which includes Dug Wells, Piezometers, springs) are established in different provinces to monitor the groundwater level scenario of the country. The following figure shows the manual groundwater level monitoring at a dedicated monitoring station.

Frequency of monitoring

The frequency of water level measurement is the most important component to understanding the behavior of the aquifer in space and time. The long-term groundwater level data records help to determine the hydraulic properties of aquifers, long-term changes of groundwater in storage and the generalized direction and gradient of groundwater flow. The monthly or quarterly groundwater level monitoring can be done manually during the Pre-monsoon, Mid-monsoon, Post-monsoon and Rabi seasons (maximum crop sown period).



High-frequency groundwater level data records can also capture short-term changes in groundwater storage which may be due to common environmental factors such as shallow and unconfined aquifers, rapid groundwater flow and recharge rate, aquifers with greater withdrawal and more variable climatic conditions. It confines the most realistic fluctuations in the groundwater level. Some automated/telemetric monitoring methods can take the high-frequency groundwater level data over a fixed time interval (hourly, weakly).

Precautions during Groundwater Level Monitoring

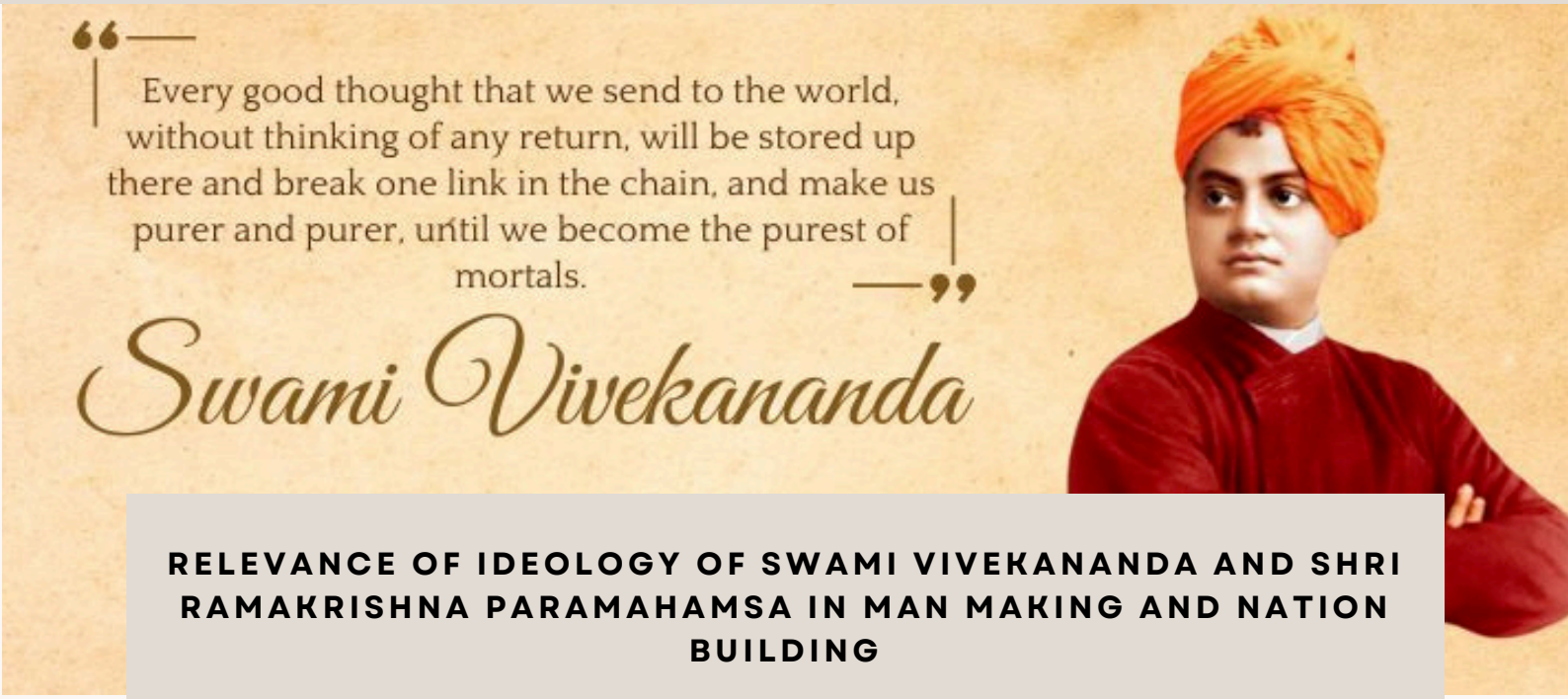
- The measuring point of observation well is established and fixed.
- Each monitoring site has a unique ID to avoid duplicity.
- The water level measuring instruments are fully calibrated against reference tape and tested.
- The well must be free of obstructions as obstructions can cause measurement errors.
- The height of the measuring point (extended casing) should be subtracted from the observation data to obtain the depth of water level with reference to the surface.
- Necessary corrections should be made if the well casing is angled

Analysis of groundwater level monitoring data records

The information gathered from groundwater monitoring is valuable for analyzing trends in groundwater levels. This data can help determine the hydraulic properties of aquifers, as well as short-term and long-term changes in groundwater storage, direction and gradient of groundwater flow, and other related factors. By examining the interrelationship of groundwater level data with other relevant data sources, a better understanding of the impact on groundwater resources can be established.

The results should support the sustainable management of groundwater resources by offering insights into natural processes and human impacts and ensuring the resilience of water supplies against the challenges posed by climate change, population growth, and economic development.

BHUJAL SAMVAD TALK SERIES



RELEVANCE OF IDEOLOGY OF SWAMI VIVEKANANDA AND SHRI RAMAKRISHNA PARAMAHAMSA IN MAN MAKING AND NATION BUILDING

Dr. Pothula Srinivasa Brahmanand, Project Director, WTC, ICAR-IARI

In continuation with the Bhujal talk Series which was initiated at CHQ, Faridabad inviting both internal and external experts to deliver presentations. Dr. Pothula Srinivasa Brahmanand, Project Director, WTC, ICAR-IARI, New Delhi addressed the topic of "Relevance of Ideology of Swami Vivekananda and Shri Ramakrishna Paramahamsa in Man Making and Nation Building". A brief overview of his insightful talk is outlined below.

Sri Ramakrishna, born on February 18, 1836, in Kamarpukur, West Bengal, has resumed the charge of the priest of Dakshineswar Kali Temple from 1856, and experienced intense visions of Mother Kali, shaping his devotion. His encounters with various faiths led to significant realizations, including God through Islam in 1866 and Christianity during 1873-74. A pivotal moment occurred in 1881 with his meeting with Swami Vivekananda, shaping the future of spiritual discourse. Swami Vivekananda, born on January 12, 1863, embarked on a transformative journey that reshaped the spiritual landscape of India and the world. Witnessing the struggles of the masses in India from 1890 to 1893 deeply moved him, fueling his resolve to bring about societal change. Vivekananda's historic address at the World's Parliament of Religions in Chicago in 1893 garnered global attention, where he eloquently spoke about Hinduism and universal spirituality. In 1897, he established the Ramakrishna Mission, dedicated to service and spiritual upliftment.

Upon his return from the West in 1897, Swami Vivekananda credited all his achievements to the influence of his Master, Sri Ramakrishna.

"If there has been anything achieved by me, by thoughts, or words, or deeds, if from my lips has ever fallen one word that helped anyone in the world, I lay no claim to it, it was his. If this nation wants to rise, take my word for it, it will have to rally round his name".

Vivekanand urged people to cultivate faith, optimism, and inner strength, echoing Sri Ramakrishna's teachings and emphasized on Advaita Vedanta philosophy, emphasizing on unity of all existence, a core teaching of Sri Ramakrishna. Through his words and actions, Vivekananda continued to spread Sri Ramakrishna's message, inspiring countless individuals to pursue personal growth and contribute to the welfare of society.

“The history of the world is the history of a few men who had faith in themselves. That faith calls out the divinity within. You can do anything. You fail only when you do not strive sufficiently to manifest infinite power. As soon as a man or a nation loses faith, death comes. “

Swami Vivekananda’s ideas on education and society were deeply rooted in the philosophy of Vedanta and his vision for the regeneration of India.

“Education is the manifestation of the perfection already in man. To me the very essence of education is concentration of mind, not the collecting facts. If I had to do my education over again, and had any voice in the matter, I would not study facts at all. I would develop the power of concentration and detachment, and then with a perfect instrument I could collect facts at will “

Swami Vivekananda's emphasis on "Man: The Maker of his Destiny" was a central theme in his teachings. He believed that individuals have the power to shape their own destinies through their thoughts, actions, and choices.

“We are responsible for what we are, and whatever we wish ourselves to be, we have the power to make ourselves. If what we are now has been the result of our own past actions, it certainly follows that whatever we wish to be in future can be produced by our present actions; so, we have to know how to act.’

Swami Vivekananda had a profound perspective on the relationship between science and religion, or spirituality emphasizing their complementary roles in understanding the universe and human existence. While science explores the material world, religion and spirituality delve into the realm of the unseen and metaphysical. The distinction between the brain and mind is crucial; the brain is the physical organ, while the mind encompasses consciousness and higher faculties. Emphasizing the importance of humanity, science devoid of compassion and ethical considerations can lead to harmful outcomes.

The description of Swami Vivekananda by our great leaders reflects the profound impact he had on individuals across generations. Leaders often characterize him as a visionary thinker, a spiritual luminary, and a tireless advocate for social reform and empowerment. They highlight his ability to bridge the gap between Eastern and Western philosophies, emphasizing the universality of his teachings. Swami Vivekananda is revered for his message of self-confidence, service to humanity, and the pursuit of spiritual enlightenment.

His journey came to a sad end on July 4, 1902, leaving behind a legacy of wisdom, service, and the pursuit of unity among all humanity. continuing to inspire generations worldwide.

“It may be that I shall find it good to get outside my body to cast it off like a worn-out garment. But shall not cease to work. I shall inspire men everywhere, until the world shall know that it is one with God”

Shodh

Research Publications by CGWB Officers in Reputed International Journals

Title: Severe Disease Burden and the Mitigation Strategy in the Arsenic-Exposed Population of Kaliprasad Village in Bhagalpur District of Bihar, India

Biological Trace Element Research

Kumar A., Kumar K., Ali M., Raj V., Srivastava A., Kumar M., Niraj P.K., Kumar M., Kumar R., Kumar D., Bishwapriya A., Kumar R., Kumar S., Anand G., Kumar S., Sakamoto M., Ghosh A.K..

Abstract : The present study was carried out in the village Kaliprasad of Bhagalpur district of Bihar to know the arsenic exposure effect in the exposed population. A total of n = 102 households were studied, and their water and biological samples such as urine and hair were collected and analyzed in a graphite furnace atomic absorption spectrophotometer (GF-AAS). The assessment of arsenic-exposed village population reveals that the villagers were suffering from serious health-related problems such as skin manifestations (hyperkeratosis and melanosis in their palm and soles), breathlessness, general body weakness, mental disorders, diabetes, hypertension (raised blood pressure), hormonal imbalance, neurological disorders, and few cancer cases. About 77% of household hand pump water had arsenic level more than the WHO recommended level of 10 µg/L, with highest level of 523 µg/L. Moreover, in 60% individual's urine samples, arsenic concentration was very high with maximum 374 µg/L while in hair 64% individuals had arsenic concentration above the permissible limit with maximum arsenic concentration of 11,398 µg/kg. The hazard quotient (HQ) was also calculated to know the arsenic risk percentage in children as 87.11%, in females as 83.15%, and in males as 82.27% by groundwater. This has surpassed the threshold value of 1×10−6 for carcinogenic risk (CR) in children, female, and male population group in the village. Hence, the exposed population of Kaliprasad village are at very high risk of the disease burden.

Title: Hydrological assessment of the Gundlakamma sub-basin through SWAT modeling: integration of land use land cover (LULC) and climate changes

Journal of Water and Climate Change

Sivakumar Babu K.V., Achuthan A., Ahmad S.

Abstract : Gundlakamma sub-basin faces challenges with increasing water demand and climate change impacts, requiring innovative solutions for sustainable water management. The study was conducted to improve the long-term utilization of water resources in Andhra Pradesh. To accomplish this, the study attempts to estimate LULC change detection and its impact on water resources by analyzing the performance of the soil and water assessment tool (SWAT) model. From 2005 to 2021, the amount of cropland decreased while built-up land increased, indicating urban growth. The SWAT model identifies hydrological processes and assesses the temporal and spatial distribution of water resources in the watershed. Statistical parameters results reveal that a good match was found between actual and modeled flows with Nash-Sutcliffe efficiency (NSE) and coefficient of determination (R2) greater than 0.75 for both calibration and validation periods. The area has average annual precipitation, surface runoff, water yield, and actual evapotranspiration of 949.96, 215.6, 469.24, and 429.15 mm, respectively. The SWAT model's fascinating outcomes demonstrate that it could be a promising decision support tool for predicting water balance and water yield in other watersheds of Andhra Pradesh for sustainable water management of water resources where water quality and quantity are critical issues.

Title: Groundwater Geochemistry and Identification of Hydrogeochemical Processes of Fluoride Enrichment in the Consolidated Aquifer System in a Rain Shadow Area of South India

Environmental Science and Engineering

Gayen A., Datta S., Arun Kumar A.V., Joji V.S., Vijesh V.K.

Abstract: The present study on fluoride contamination in surface water and groundwater in and around Attappady tribal area of Palghat district, Kerala State, India reveals that fluoride dispersal is controlled by country rocks and their structures along with hydrogeomorphology and drainage network. The leaching of F− in groundwater is also controlled by semi-arid climate, which is the result of very less rainfall (936 mm) in the area. Total 42 samples including both surface water and groundwater have been collected during both pre-monsoon and post-monsoon periods and have been analyzed for fluoride apart from other chemical parameters. High fluoride (>1.50 mg/L) in groundwater has been observed in major parts of the Attappady area. The surface water contain fluoride within the range of 1.22–2.86, whereas groundwater in phreatic aquifers have the range of 2.18–2.56 mg/l and deeper fractured aquifers have the fluoride range of 3.20–4.20 mg/l during pre-monsoon and post-monsoon periods, respectively. Maximum fluoride concentration (4.20 mg/L) is recorded in the east-central part of Attappady. Low rainfall and high rate of evaporation promote the dissolution of fluorine-bearing minerals and help in increasing the F− content in groundwater. Fluoride contamination is geogenic in nature and major contribution is made by the hornblende-gneiss formation (1.67 mg/l).

Title: Revamping India's groundwater monitoring network

Current Science

Dwivedi S.N., Chowdhuri S.R., Satapathy S., Nayak R.

Abstract: Groundwater level is the most important parameter in any study involving the evaluation, development and management of groundwater resources. Systematic monitoring of groundwater levels, which commenced with the establishment of the Central Ground Water Board (CGWB), has been of immense use in addressing several challenges like prioritization of areas for groundwater recharge, delineating areas prone to waterlogging, estimation of storage change in the aquifers, estimation of groundwater flow, etc. In a major boost to strengthen groundwater monitoring in the country, the Government of India has sanctioned a special project under which CGWB has envisaged to construct 9000 purpose-built wells (piezometers) in identified priority areas, which will be equipped with digital water-level recorders (DWLRs) and telemetry devices for acquisition and transmission of groundwater levels at increased frequency. The intended uses of the long-term high-frequency data include monitoring short-term and long-term changes in the groundwater levels, groundwater storage and recharge to the aquifers, monitoring the effects of climatic variability, estimating transboundary flow, assessing regional effects of groundwater development, quantifying impacts of water conservation and artificial recharge projects, and improved understanding of groundwater and surface water interactions. High-frequency groundwater level data also have the potential for steering multiinstitutional collaborative research projects in the country, particularly for studying the impact of groundwater extraction on land subsidence, the relationship between groundwater levels and tectonic disturbances, and climate change impacts on the groundwater regime.

SOCIAL MEDIA HIGHLIGHTS

Central Ground Water Board
@CGWB_CHQ

मुख्य अभियन्ता, केन्द्रीय जल आयोग, लखनऊ की अध्यक्षता में केन्द्रीय भूमि
केन्द्रीय जल आयोग के क्षेत्रीय कार्यालयों द्वारा उत्तर प्रदेश के विभिन्न राज्य वि
#तृतीया_त्रैमासिक_संवाद कार्यक्रम आयोजित किया गया।
@JalShaktiMin
Translate post

Central Ground Water Board
@CGWB_CHQ

CWC & CGWB organized a Quarterly Dialogue with concerned departments of Govt. of Jharkhand.
@JalShaktiMin

Central Ground Water Board
@CGWB_CHQ

Officers of CGWB, NR, Lucknow and GSI, Lucknow completed post-monsoon sampling in Hathras, Mathura and Aligarh districts of Uttar Pradesh as per MoU signed with GSI on "Study on Uranium, Lead, Arsenic, Fluoride & Mercury contamination in groundwater".
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

CGWB, WCR, Ahmedabad organised one day Tier III Training Programm at Gatrad Village, Daskroi, Ahmedabad.
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

Workshop on Continuously Operational Reference Stations (CORS) organized by Survey of India in Jaipur, Rajasthan. Officers & Officials of CGWB, Western Region, Jaipur attended the Workshop
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

CGWB pavilion at International Water Conclave, 2024
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

CGWB, SWR, Bengaluru organized Public Interaction Program at Dhempe College of Arts and Science, Panaji city, North Goa district on 08.2.2024. A total of 91 college students participated in the program.
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

Ms. Debashree Mukherjee, Secretary, DoWR, RD & GR, Govt of India visited CGWB's Pavilion at the International Water Conclave, 2024, Shillong.
@DoWRRDGR_MoJS

SOCIAL MEDIA HIGHLIGHTS

Central Ground Water Board
@CGWB_CHQ

Media clippings of Public Interaction Programme orga
SWR, Bangalore in Goa

Central Ground Water Board
@CGWB_CHQ

Dr S K Ambast, Chairman, CGWB chaired an online meeting h
between Officers of CGWB and Joint Implementation Group (
India-Australia MoU. Prof. Basant Maheshwari and his Team,
Prof Ramesh Sharda & Prof. Lakshmi Iyer presented the MyWe
Application

Central Ground Water Board
@CGWB_CHQ

Dr. Ratikanta Nayak, RD & Director (Admn), CGWB present
Groundwater in India: Implications for Drinking Water Sust
National Workshop on JJM on 16-17 Feb in Lucknow, Uttar
session was chaired by the Secretary, DDWS, MoJS @DoW

Central Ground Water Board
@CGWB_CHQ

CGWB SECR Chennai organised a PIP in association with T
Agricultural University & ITC group as " Water Mela" at Cimt
Dhayamalar Scientist E delivered speech on Groundwater
TN & adaption of Water use Efficiency methods. @DoWRRI

Central Ground Water Board
@CGWB_CHQ

World Water Day 2024 was celebrated at CGWB, CHQ, F
Chairman, CGWB delivered a speech during the event.
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

An Exploratory Well with Air Compressor discharge of 10.1
m3/day) was successfully constructed at Alladi Madhyam
Kendra (MSK), Salanpur block, Paschim Bardhaman distri
@DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र, लखनऊ ने 'भूजल प्रबंधन' विषय पर बागपत जिले के
बिनौली ब्लॉक में प्राथमिक विद्यालय, शाहपुर बानगंगा में एक जन संवाद कार्यक्रम का
आयोजन किया। @DoWRRDGR_MoJS

Central Ground Water Board
@CGWB_CHQ

CGWB UR, Dehradun has organised Public Interaction programme on
"Water conservation and Local Ground Water Issues" at Nanhi Pari
Seemant Engineering institute, Pithoragarh, Uttrakhand.
@DoWRRDGR_MoJS

COLLECTABLE

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1. Sh. T. B. N. Singh, Member (CGWA) attended Inaugural function of International Seminar at Kolkata and delivered a presentation on Need for CGWA Guidelines for regulation and Management of GW Resources.
2. CGWB, NWR Chandigarh organized a Public Interaction Program on Ground water and its management management at Brahmrishi College of Education, Virat Nagar, Panchkula, Haryana.
3. केन्द्रीय भूमि जल बोर्ड, पश्चिमी क्षेत्र, जयपुर द्वारा राजभाषा हिन्दी कार्यशाला का आयोजन किया गाया। कार्यशाला में पश्चिमी क्षेत्र, जयपुर, एकक कार्यालय, जोधपुर कार्यालय के अधिकारियों एवं कर्मचारियों ने भाग लिया ।
4. Ms. Debashree Mukherjee, Secretary, DoWR, RD & GR, Govt of India visited CGWB's Pavilion at the International Water Conclave, 2024, Shillong.
5. Dr. S. K. Ambast, Chairman, CGWB delivered a speech at Water Technology Centre of Indian Agricultural Research Institute, New Delhi
6. GWRE-2023 of Chhattisgarh has been approved by the Permanent SLC in Presence of Sh. Rajesh Sukumar Toppo, IAS, Special Secretary, WRD, Chhattisgarh.
7. Dr. S. K. Ambast, Chairman, CGWB alongwith a team of officers visited Central Arid Zone Research Institute (CAZRI), Jodhpur and interacted with Dr. O.P. Yadav, Director, CAZRI

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1. Dr. S. K. Ambast, Chairman, CGWB chaired an online meeting held between Officers of CGWB and Joint Implementation Group (JIG) under India-Australia MoU.
2. केंद्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र में चतुर्थ राजभाषा हिन्दी की कार्यशाला एवं चतुर्थ हिन्दी कार्यान्वयन समिति की बैठक का आयोजन किया गया।
3. Release of Ground Water Quality Report of West Bengal and Dynamic Groundwater Resource Estimation of West Bengal, Sikkim and Andaman & Nicobar Island by Smt. Debashree Mukherjee, Secretary, MoJS, GOI and Joint Secretary , Sh Subodh Yadav during their visit to CGWB, ER, Kolkata.
4. अंतराष्ट्रीय महिला दिवस के उपलक्ष में मुख्यालय फरीदाबाद में महिला दिवस का आयोजन किया गया, श्री सुनील कुमार अम्बस्ट अध्यक्ष, श्रीमती अनीता श्याम सदस्य, श्री रतिकांता नायक निदेशक प्रशशन, श्री तपन चक्रवर्ती कार्यालय प्रमुख एवम समस्त महिलाएं उपस्थित रहीं ।
5. Officer of CGWB WCR Ahmedabad carried out Preliminary Yield Test of Piezometer drilled at Khanderi village, Paddhari Taluka, Rajkot District. Depth of well drilled was 69.50m, tapping Phreatic Aquifer in Basaltic formation with average discharge of 2.45 lps.
6. CGWB, Kolkata celebrated "Mission LiFE: Lifestyle for Environment" Campaign by organizing two Public Interaction Programmes at Kharagpur-I and Keshpur Blocks of Paschim Medinipur District, West Bengal. Various activities were organized amongst School Childrens.
7. Officer of CGWB WCR Ahmedabad carried out Preliminary Yield Test of Piezometer drilled at Mota Khabda village, Lalpur Taluka, Jamnagar District. Depth of well drilled was 100m, tapping Phreatic Aquifer in Basaltic Formation with average discharge of 0.517 lps.

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1. CGWB, SUO, Agartala organised the *RGI- Tier-III Training Programme on Capacity Building for Participatory Ground Water Management* at NandanNagar, Ward No.-6, Agartala, Tripura.
2. CGWB, Kolkata celebrated "Mission LiFE: Lifestyle for Environment" Campaign centred around the theme of "Adopting Lifestyle Change for Ensuring Groundwater Sustainability" at Nodiha and Gourandih, of Paschim Bardhaman, West Bengal.
3. An Exploratory Well with Air Compressor discharge of 10.12 LPS (874.37 m3/day) was successfully constructed at Alladi Madhyamik Shiksha Kendra (MSK), Salanpur block, Paschim Bardhaman district, West Bengal.
4. World Water Day 2024 was celebrated at CGWB, CHQ, Faridabad
5. Dr. S. K. Ambast, Chairman, Chairman, CGWB and Sh Anurag Khanna, Member (North) visited Bastawa and Indroka Dam sites in Jodhpur district
6. CGWB, SWR, Bengaluru organized Public Interaction Program at Dhempe College of Arts and Science, Panaji city, North Goa district . A total of 91 college students participated in the program.
7. Dr. S. K. Ambast, Chairman visited SECR Chennai and reviewed the progress and addressed various issues and grievances of staffs and officers.

COLLECTABLE

1. CGWB, Chennai organized Public Interaction Programme at Kadaiyampatti block, Salem District, Tamil Nadu on "Groundwater management and health issues of Flouride
2. Dr. S. K. Ambast, Chairman CGWB at the All Secretaries Conference on water vision 2047 at Mahabalipuram Chennai.
3. CGWB, NWHR, conducted a Public Interaction Programme at Government Higher Secondary School, Jaganoo, Udhampur.
4. CGWB, NR, Lucknow organized a PIP at Acharya Shri Vidyasagar Higher Secondary School, block-Madawara, diatrict-Lalitpur under the banner of Aspirational Block
5. CGWB SECR Chennai organised a PIP in association with Tamilnadu Agricultural University & ITC group as " Water Mela" at Cimbatore. Ms.D. Dhayamalar Scientist delivered speech on Groundwater Scenario of TN & adaption of Water use Efficiency methods.
6. क्षेत्रीय निदेशक, केन्द्रीय भूमि जल बोर्ड, उत्तरी क्षेत्र, लखनऊ की अध्यक्षता में केन्द्रीय भूमि जल बोर्ड एवं केन्द्रीय जल आयोग द्वारा उत्तर प्रदेश के विभिन्न राज्य विभागों के साथ चतुर्थ त्रैमासिक संवाद कार्यक्रम आयोजित किया गया।
7. Geophysical Training under NHP at RGNGWTRI, Raipur.

Central Ground Water Board,
Bhujal Bhawan, NH-IV,
Faridabad - 121001