

Application of GIS Tools for Groundwater Management under Atal Bhujal Yojana

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Introduction

Water is a fundamental resource for life. Groundwater has become an increasingly important natural resource catering to the freshwater requirements of various sectors in India. Sustainable development and efficient management of this scarce resource has become a challenge. Groundwater has steadily emerged as the backbone of India's agriculture and drinking water security. The contribution of groundwater is nearly 62% in irrigation, 85% in rural water supply and 50% in urban water supply. Groundwater is an annually replenishable resource but its availability is non-uniform in space and time (CGWB, 2022). Water is a scarce and precious national resource to be planned, developed, conserved and managed as such, and on an integrated and environmentally sound basis, keeping in view the socio-economic aspects and needs of the States. It is one of the most crucial elements in developmental planning. As the country has entered the 21st century, efforts to develop, conserve, utilize and manage this important resource in a sustainable manner, have to be guided by the national perspective (National Water Policy 2012).

In recent years, there have been several promising attempts at groundwater management with community participation in different parts of the country. These include the Andhra Pradesh Farmer Managed Groundwater Systems (APFAMGS); and Water budget-based holistic water management in Hiwre Bazaar village in Maharashtra. These pilot initiatives have demonstrated how demand for groundwater can be reduced if timely information on groundwater availability is provided to communities, multiple agencies work together and communities are engaged in the planning process. Most of these success stories of participatory groundwater management are community driven. With time, the government and the policymakers have recognized the potential of the community in groundwater management and the need to institutionalize such initiatives through convergence of Government initiatives with emphasis on demand side management and behavioural change for ensuring long term sustainability of groundwater in the country. Atal Bhujal Yojana is a major step in this direction.

Atal Bhujal Yojana (Atal Jal)

The Atal Bhujal Yojana was inaugurated on the 95th birth anniversary of Bharat Ratna Shri Atal Bihari Vajpayee and is under implementation since April 2020. The duration of the scheme is for five years from 2020-21 to 2024-25. The total outlay of the scheme is Rs. 6000 Crores, funded by the Government of India and the World Bank. The scheme is being implemented in 8220 Gram Panchayats (GP) of 229 Blocks in 80 districts of the select water stressed areas of seven states viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

Objective

The goal of Atal Bhujal Yojana is to demonstrate community-led sustainable groundwater management which can be taken to scale. The major objective of the scheme is to improve the management of groundwater resources in select water stressed areas in identified states. The scheme is targeted at sustainable groundwater management, mainly through convergence among various ongoing schemes with the active involvement of local communities and stakeholders. This will ensure that in the scheme area, the funds allocated by the central and state governments are spent judiciously to ensure long-term sustainability of groundwater resources. The convergence of funds, aided by a strong data base, scientific approach and community participation shall further result in incentives to state governments for suitable investments. It also aims at bringing about behavioral change at the community level through awareness programs and capacity building for fostering sustainable groundwater management in the participating states. It offers a complete techno-managerial and social solution for the availability of water to the villagers/local community. A core aspect of the program is centered around community participation to prepare the water budget of the gram panchayat resulting in the formulation of the Water Security Plan. Atal Bhujal Yojana aims at making the states responsive in creating an enabling environment for a paradigm shift in groundwater management.

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Areas under Atal Jal

The states for implementation of the scheme, viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh have been selected according to a number of criteria, including degree of groundwater exploitation and degradation, established legal and regulatory instruments, institutional readiness, and experience in implementing initiatives related to groundwater management. The districts, blocks and gram panchayats for implementation of the scheme in the identified states have been finalized by the respective States. Atal Bhujal Yojana attempts for de-mystification of science wherein the complex scientific knowledge of hydrology and hydrogeology is made simple and easy to understand by the community.

Components of Atal Jal

The Atal Jal scheme has two components, viz. Institutional Strengthening and Capacity Building (IS&CB) and the Incentive Component.

Institutional Strengthening and Capacity Building (IS&CB)

The IS&CB component is aimed at strengthening the groundwater governance mechanism in the participating states. It strengthens the institutional arrangements and capacity in the states for enabling them to sustainably manage their groundwater. The various components under IS&CB include training and capacity building activities to enhance institutional capacity for effective groundwater management at all levels, engagement of District Implementation Partners (DIPs) viz. community-based organizations (CBOs)/ non-governmental organizations/etc, to establish monitoring & evaluation (M&E), engaging the independent verification and other program management components. The District Implementation Partners (DIPs) consist of one or more NGOs / CBOs hired by the SPMU and shall facilitate handholding of the GPs in various aspects of the scheme, including the development of water budgets and Water Security Plans (WSPs); community mobilization; formation/strengthening of Water User Associations (WUAs); data collection; information, education, and communication (IEC) activities.

Incentive Component

The Incentive Component is aimed at rewarding/incentivizing the states for various measures aimed at ensuring the long-term sustainability of groundwater resources. Through a combination of institutional strengthening, community mobilization, convergence among ongoing schemes and incentivization of good performance, the scheme aims to bring synergy among various ongoing schemes and ensure benefits and dividends at minimal cost in the identified ground water stressed areas. Under this component, funds are disbursed for incentivizing or rewarding the states that achieve certain pre-defined targets against the identified Disbursement Link Indicators (DLIs).

Disbursement Linked Indicators (DLIs)

These are result indicators linked to the disbursement of funds under the Incentive component of the scheme. Funds are disbursed subject to the achievement of the result indicators by the implementing agencies. Selection of DLIs has been guided by (i) activities that need to be done for sustainable management of groundwater, (ii) measurability and ease of verification and (iii) capacity of stakeholders to achieve the results. Taken together, these DLIs, while focusing on the objective of the scheme, provide incentives for achieving key milestones towards the ultimate goal of the scheme i.e. improving groundwater management with community participation. Five DLIs have been selected out of which the first four DLIs incentivize the activities leading to sustainable management of groundwater while the fifth DLI is related to the outcome of the four DLIs. The DLIs have been defined as below:

1. Public disclosure of groundwater data/information and reports (DLI#1)
2. Preparation of Community-led Water Security Plans (DLI#2)
3. Public financing of approved Water Security Plans through the convergence of ongoing/new schemes (DLI#3)
4. Adoption of practices for efficient water use (DLI#4)
5. Improvement in the rate of decline of groundwater levels (DLI#5)

To support and strengthen the groundwater monitoring mechanism on groundwater quantity and quality, various works and equipment are procured under Atal Bhujal Yojana. These include the construction of piezometers and installation of Digital Water Level Recorders, procurement of Water Quality Testing Kits, Water Flow meters, Water Level Indicators/sounders and Rain Gauges.

Data Repository under Atal Jal

A dedicated web portal including Management Information System (MIS) and Mobile Application has been developed under the Atal Bhujal Yojana for progress monitoring, data capture and preparation of Water Security Plans at the level of Gram Panchayats. The Atal Jal portal and Mobile application is hosted on NIC Cloud.

Key features of MIS & Mobile application are:

- Capturing demographic data at gram panchayat level
- Separate MIS module for the preparation of gram panchayat-wise WSPs
- Modules to capture details about Social & Environmental safeguard tools, along with monitoring the physical and financial progress of the scheme.

- Online facility for registration and management of various training and capacity building programs being organised under the scheme.
- GIS-based “Map view” for dissemination & display of data at a public level.
- Collection of information at the field level viz., groundwater monitoring, rainfall monitoring, geo-tagging of artificial recharge & water conservation structures, and social events through mobile application (both Android & iOS).
- Dissemination of data for public view through mobile app and decision making at the user level.

ArcGIS tools are being used extensively for several activities under Atal Bhujal Yojana, ranging from the data management and visualization under DLI#1, preparation of maps and locating possible sites for interventions in the Water Security Plans under DLI#2, Cumulative Impact assessment studies, etc. This paper, however, focuses on the utility of the ArcGIS application in building a user friendly platform for disclosure of data to the public, and has been elaborated in the next section.

Public Disclosure of Groundwater Data/ Information and Reports

Atal Bhujal Yojana has collated the data related to groundwater level as well as quality being monitored and maintained by various agencies viz., Central Ground Water Board (CGWB) & State Ground Water Department in the seven participating States. One of the key aspects of Atal Jal is to bring in behavioral changes in the community, from the prevailing attitude of consumption to conservation & smart water management. It is imperative that this message is driven across all levels, especially at the grass-root level, so that the objectives of the scheme are achieved.

Additionally, to bring the groundwater data to the masses, in the form of information, it is imperative to showcase the outcomes of a scheme on a single click. ArcGIS has evolved to collate and manage huge database over time by providing user friendly features. Using the ArcGIS platform, it has been attempted to publish and disseminate more than 3000 water level observations, 1500 water quality observations, 60000 existing artificial recharge structures & water conservation structures and 7 lakh existing wells in the gram panchayats falling under the participating states for Atal Bhujal Yojana. Other than the groundwater data, various other parameters viz., Rainfall, groundwater resource comparison, block-level hydrogeological reports have been disclosed through the additional features provided by ArcGIS Enterprise version.

GIS Application for Dissemination of Data

A dedicated web GIS application, using ArcGIS Enterprise, has been developed for the disclosure of data in public domain (Fig.1).

The application can be accessed through

<https://ataljal-arcgis.mowr.gov.in/GIS>. The application offers various features to view, analyze and download data with respect to the groundwater level & quality, artificial recharge structures & water conservation structures, and interventions proposed for groundwater management in selected gram panchayats under Atal Bhujal Yojana.

Features of the GIS Application

The GIS application offers various features to visualize and perform analytical operations to obtain the desired results. The key features are elaborated below:

Map View

This interface offers multiple tools to visualize and download the data within a selected frame or area of interest such as:

1. Location of ground water level observation wells, water quality observation wells, existing artificial recharge structures & water conservation structures, wells inventoried and registered through Atal Jal mobile application.
2. Zoom to layer with statistical summary at zoom extent.
3. Locate incidents, area calculation and buffer zone analysis (Fig.2)
4. Query analysis within area of interest
5. Data search and download report

Charts & Graphs

This interface redirects the application to analyze the groundwater resource information for selected administrative boundary (Fig. 3), such as

1. District wise rainfall report (Actual, Normal & Deviation)
2. Block-wise groundwater availability and withdrawal
3. Well hydrographs (Pre & Post-monsoon water level for a specified period)

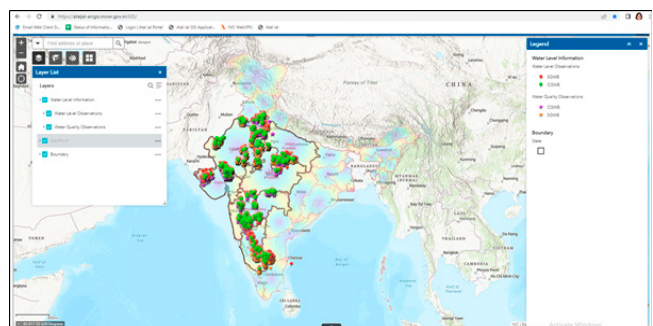


Fig. 1. Web-GIS application for Atal Bhujal Yojana

Dashboard

Dashboard offers a summary statistic to view the significant details of the achievements of the scheme so far (Fig. 4). The numbers are also reflected as the point locations on the map. The statistics can be obtained for a specific area through selection of state, district, block and gram panchayat.

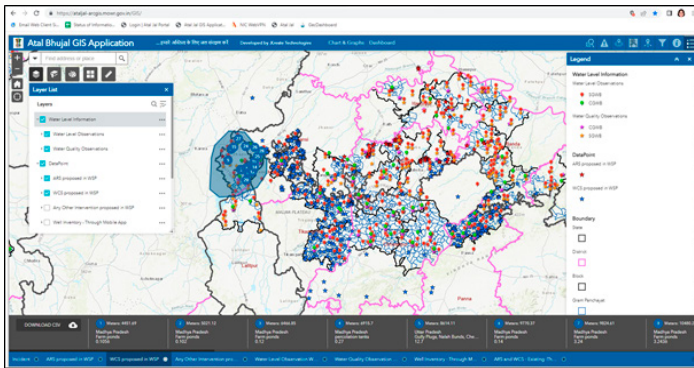


Fig. 2. Locate, visualize, count and download information within a desired incident (polygon)

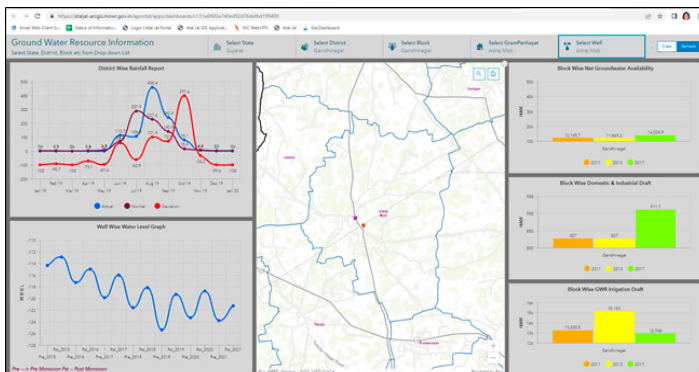


Fig. 3. Ground water resource information including charts & graphs

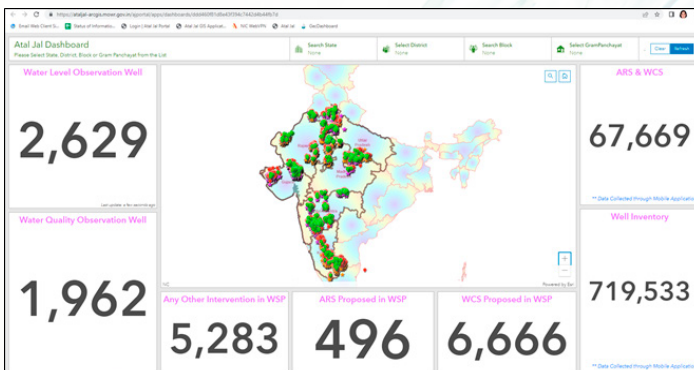


Fig. 4. Atal Jal Dashboard

Conclusion

The scheme is expected to result in multiple benefits including i) improvements in sustainability of ground water resource in target areas, ii) positive contributions to the sustainability component of Jal Jeevan Mission, and to the goal of doubling farmers' income and iii) Inculcation of behavioral changes in the community to foster improved ground water management. Some realistic future expectations of the scheme are Informed & participative decision making, Community mobilization & empowerment leading to behavioral change, which can only be achieved once the stakeholders are well informed about the criticalities in the ground water science. Any decision, at any level, can be taken through practical analysis of the scenarios. Through this paper, an attempt has been made to widely publicize the Atal Bhujal Yojana and sensitize the users about the ground water scenario, for effective management of ground water resources by the stakeholders. The application is dynamic in nature and the information is updated on a frequent basis. The development and enhancement of the application will be done on a continuous basis to make it more user friendly as well as providing advance analytical features for information extraction and planning process.

References:

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