



Disclaimer: This As-Is Study Report has been prepared based on information, documents, and inputs made available by the concerned stakeholders, as well as field interactions and secondary research. The analysis, findings, and observations presented herein are intended solely for informational and decision-support purposes. While due care has been taken in compiling the report, the authors and contributing organizations do not assume any responsibility for errors, omissions, or subsequent changes in the underlying information. The report reflects the present situation and may be subject to change. Neither the department nor the authors shall be liable for any direct, indirect, or consequential loss arising from reliance on this report. The report does not, in any way, constitute a legally binding commitment from the department or the authors.

FOREWORD

It is with great pride and deep appreciation that I present the As-Is Study Report on State IT Systems of **PHED West Bengal**. It is prepared under the Jal Jeevan Mission (JJM) as part of a national effort to assess, document, and strengthen the digital capabilities of rural drinking water departments across India. This report has been prepared in collaboration between SPM NIWAS and Arghyam. It helped in bringing together institutional expertise in rural water governance and philanthropic commitment to water security. A partnership that reflects the shared conviction that data-driven decision-making is fundamental to achieving universal and sustainable access to safe drinking water.

West Bengal's Public Health Engineering Department (PHED) stands as a remarkable example of institutional foresight and technological ambition. The department began its digital journey well before the launch of Jal Jeevan Mission. It has pioneered the GIS mapping of pipelines nearly six to seven years ahead of national priorities, and becomes the first state department to implement the e-Measurement Book application. This spirit of early action and innovation has placed West Bengal at the forefront of digital transformation in India's rural drinking water sector.

This report is organised around a comprehensive Digital Maturity Model for rural drinking Water. It is a structured framework developed to systematically measure the state IT capabilities across five layers of key stakeholders along the guiding principles of Citizen Centricity, Frontline Workers Empowerment, Agencies Efficiency, Departments Effectiveness and State Functionaries Interoperability. There are additional two layers for Technology Foundation and Infrastructure. Together, these capabilities provide a holistic picture of where West Bengal stands today, and where it must go next.

The findings of this report affirm that West Bengal possesses the institutional capacity and technical talent for innovation to lead digital transformation in India's rural drinking water sector. By addressing the identified gaps, through shared registries, middleware integration, and unified dashboards, the state can set a benchmark that others may follow.

I extend my sincere appreciation to the PHED West Bengal team, the field functionaries, and all stakeholders who contributed their time, knowledge, and institutional experience to this study. I also place on record my gratitude to **Arghyam** for their partnership, intellectual contribution, and steadfast commitment to the mission of universal water access. Their collaboration has meaningfully strengthened both the depth and the credibility of this report. I acknowledge as well the dedication of the technical team whose rigorous field interactions and analytical work have made this assessment possible.

It is my earnest hope that this report serves not merely as a record of the present, but as a compass for the future. This will help in guiding West Bengal towards a fully digital, equitable, and sustainable rural drinking water system where every citizen has access to safe water, and every decision is driven by data.



Priyatu Mandal, IAS,
Director SPM-NIWAS

MESSAGE

Water is not merely a resource; it is a right. And the ability to govern it well, to monitor it transparently, and to deliver it reliably to every household is one of the most meaningful tests of a state's institutional commitment to its people. It is in this spirit that Arghyam is proud to have partnered with SPM NIWAS in the preparation of this As-Is Study Report on State IT Systems — PHED West Bengal.

At Arghyam, our work has always been rooted in the belief that lasting change in the water sector requires more than infrastructure. It requires knowledge, accountability, and the systems to sustain both. This collaboration with SPM NIWAS is a natural expression of that belief. By bringing together the programmatic depth of SPM Niwas and Arghyam's long-standing engagement with water governance, this study offers something that neither institution could have produced alone. That includes a credible, field-grounded, and analytically rigorous picture of where West Bengal stands in its digital journey, and what it will take to go further.

What strikes me most about PHED West Bengal is not any single application or technology, but it is the institutional culture that produced them. A department that mapped pipelines on GIS before the national mandate, that digitised measurement books before the sector had standardised them. The state has also built an AI-enabled chatbot for its own field staff. This is not a department that waits to be told what to do. It is one that thinks ahead. That quality of institutional initiative is rare, and it is the most important foundation any digital transformation can have.

While the department has established a strong digital foundation, the next phase of evolution lies in strengthening system cohesion and integration. This includes enhancing interoperability across applications, deepening API-based integration with national platforms, and formalizing a structured grievance redressal mechanism. These areas reflect the natural progression of systems that have evolved rapidly and organically over time. The path forward is therefore one of thoughtful consolidation and integration, building on existing strengths rather than reimagining them.

This is precisely where studies like this one matter. Understanding the current state with clarity and without defensiveness is the prerequisite for purposeful transformation. We hope this report gives PHED West Bengal, its leadership, and its partners the shared language and common baseline needed to prioritise investments, align efforts, and move with intention.

I am grateful to the PHED West Bengal team for their openness and engagement throughout this process, and to the SPM-NIWAS team for their partnership and rigour. I also wish to acknowledge the technical team whose field interactions, institutional conversations, and analytical work gave this report its texture and credibility.

Arghyam remains committed to walking this journey alongside the states and institutions working to make safe water a lived reality for every Indian. We hope this report is a useful step on that path.



Anuj Sharma
CEO Arghyam

PREFACE

India's rural drinking water sector is undergoing a profound transformation. The Jal Jeevan Mission (JJM), launched in 2019, marked a decisive shift by committing to providing safe and adequate drinking water to every rural household. As the Mission transitions from its initial phase of rapid infrastructure creation to a phase focused on assured and sustained service delivery, the role of digital systems becomes increasingly critical. Ensuring reliability, quality, and accountability at scale requires a strong foundation of data-driven governance.

While flagship initiatives such as the Jal Jeevan Mission (JJM) have substantially expanded rural drinking water infrastructure across the country, ensuring equitable, reliable, and measurable service delivery at scale now requires a fundamentally stronger digital foundation. The next phase of transformation depends not merely on asset creation, but on building an interoperable, intelligent, secure, and scalable digital ecosystem capable of enabling data-driven governance, service monitoring, institutional coordination, and citizen-centric delivery.

In this context, the need for a sectoral Digital Public Infrastructure (DPI) for rural drinking water has emerged as a strategic national requirement. To support this objective, SPM-NIWAS and Arghyam jointly undertake a baseline assessment of existing digital solutions, platforms, and governance practices in the rural drinking water sector across selected states. The study aims to evaluate current digital maturity, identify interoperability gaps and sectoral challenges, and recommend appropriate DPI principles, characteristics, and architectural considerations to inform the sector's future vision, approach, and strategic roadmap.

India's experience with foundational and sectoral DPIs such as Aadhaar, Unified Payments Interface (UPI), and emerging digital ecosystems in health and agriculture demonstrates the transformative potential of federated, open, and interoperable digital architectures. In the rural drinking water sector, a DPI can enable seamless data exchange, improved coordination, and informed decision-making across stakeholders ranging from water sources and household taps to frontline functionaries and national institutions.

However, such a DPI must evolve from existing operational realities rather than be designed in isolation. It should build upon effective systems, address fragmentation, and strengthen areas that are inadequate. Accordingly, the As-Is Study of State IT Systems was undertaken as a foundational step toward developing a robust and contextually relevant DPI architecture for the sector.

This As-Is Study is conceived not as an audit, but as a diagnostic and collaborative exercise. The study seeks to identify existing gaps, assess institutional capacities, and understand operational realities across the sector. It adopts a multi-pronged approach comprising structured questionnaires across States and Union Territories, virtual consultations for broader stakeholder engagement, and in-person visits to selected states for deeper field-level insights.

To support a comprehensive assessment, a customized Digital Maturity Model for the rural drinking water sector has been developed. The model evaluates digital capabilities across multiple stakeholder layers, including citizens, frontline workers, implementing agencies, departments, and state-level functionaries, thereby enabling a holistic understanding of the ecosystem and informing future digital transformation strategies.

Among the states studied, West Bengal was identified for an in-depth assessment due to the scale, maturity, and diversity of its digital ecosystem, as well as its demonstrated institutional commitment to technology-led governance. The Public Health Engineering Department (PHED), West Bengal, represents one of the more advanced digital landscapes in the sector. Its investments in GIS-based asset mapping, mobile-first applications, water quality surveillance systems, and emerging AI-enabled tools offer valuable insights into both the possibilities and complexities of digital evolution.

At the same time, West Bengal's experience highlights an important reality: when digital systems evolve organically over time without a unifying architecture, challenges related to interoperability, integration, and system coherence inevitably emerge. These lessons are not unique to a single state; they are broadly applicable across the country and are highly relevant to the design of a national DPI.

This report presents a comprehensive understanding of the existing digital ecosystem of PHED, West Bengal, based on stakeholder consultations, field interactions, system demonstrations, and analysis of available documentation. The findings recognize the significant progress made by PHED, West Bengal in adopting innovative, mobile-first, and data-centric solutions. At the same time, they point to the need for greater interoperability, integrated platforms, and strengthened citizen-centric service mechanisms, including grievance redressal systems.

It is hoped that the insights and recommendations presented in this report will support the department in its ongoing digital transformation efforts and serve as a reference for other states undertaking similar journeys. More broadly, this study aims to contribute meaningfully to the design and development of a unified, resilient, and scalable Rural Drinking Water DPI, one that builds on existing strengths, addresses systemic gaps, and advances the long-term goal of ensuring safe, reliable, and sustainable drinking water for every rural household.

ACKNOWLEDGEMENT

The successful completion of this As-Is Study has been made possible through the invaluable support, cooperation, and openness of the Public Health Engineering Department (PHED), West Bengal. The department's willingness to engage deeply and share insights into its existing IT systems, processes, and institutional practices has been instrumental in enabling a comprehensive and meaningful assessment.

The department's willingness in sharing detailed insights into their existing IT applications, processes, and operational challenges greatly contributed to the depth and quality of this assessment. The opportunity to engage in in-person discussions and interactions with the departmental leadership and technical teams enabled a comprehensive understanding of the digital ecosystem and its role in rural water service delivery.

Special acknowledgement is due to **Dr. Animesh Bhattacharya, Former Engineer-in-Chief, PHED, West Bengal**, for his leadership and guidance. Sincere appreciation is extended to **Shri Alope Saha (Deputy SE, IT), Shri Subhasheesh Bhattacharya (Head of Data Centre), Shri Monojit Saha (Team Lead, IT), Shri Rajib Kumar Sarkar (Water Quality IT Head), and Ms. Soumyia Jit (Water Quality, SPMU)** for their valuable inputs and technical insights. The contributions of the SPMU team, including **Ms. Kalpana, Ankur, Manoj, and Ankush (Consultants, PHED)**, are also sincerely acknowledged for their active participation and support during the study. Gratitude is further extended to **Shri Gautam Daftari (Semaphore Computers Pvt. Ltd.)** for sharing key implementation perspectives.

The department extended full support in enabling structured interactions and discussions. They facilitated seamless access to their systems and teams throughout the study. This openness and cooperation have been instrumental in developing a meaningful, evidence-based understanding of the state's IT landscape.

This collaboration reflects the department's strong commitment towards advancing digital transformation and strengthening water service delivery systems. Their insights and cooperation have significantly enriched this study.

TECHNICAL NOTE

Towards Making a Drinking Water Digital Public Infrastructure (DW-DPI): Conceptualising the Digital Water Ecosystem of India

India's rural drinking water sector stands at a transformative juncture. Following the rapid expansion of infrastructure under the Jal Jeevan Mission (JJM), the sector's focus is now shifting toward long-term sustainability, operational efficiency, water quality assurance, and citizen-centric service delivery. This transition requires not only physical assets but also a robust digital foundation capable of enabling real-time governance, interoperability, accountability, and innovation across the ecosystem.

In this context, the need for a sectoral Digital Public Infrastructure (DPI) for rural drinking water has emerged as both a strategic and operational imperative. To inform this transition, these studies were undertaken to assess the sector's current digital maturity, identify interoperability gaps, understand operational and institutional challenges, and define key principles, architectural considerations, and building blocks required for a future-ready ecosystem.

Accordingly, detailed field studies and stakeholder consultations were conducted across multiple states. Comprehensive "As-Is Study Reports" were developed for Assam, West Bengal, Punjab, Gujarat, and Rajasthan, along with a consolidated national report. These studies document existing digital systems, institutional processes, data flows, governance mechanisms, and technological maturity within the sector. The insights derived from these reports serve as foundational inputs for shaping the strategic vision, implementation roadmap, and policy framework for a National Drinking Water Digital Public Infrastructure (DW-DPI).

The findings indicate that the next phase of sectoral transformation must be anchored in a federated, interoperable, and standards-driven digital ecosystem. The objective is not to build another centralized platform, but to establish common digital rails that connect schemes, assets, laboratories, institutions, field functionaries, and citizens. Such an approach enables seamless data exchange, reduces fragmentation, and fosters innovation across states and ecosystem participants.

A key priority in this journey is the creation of authoritative digital registries for water assets, schemes, laboratories, service entities, and sources. These registries will act as trusted “single sources of truth,” enabling lifecycle management, traceability, and data consistency across administrative and technological boundaries. Complementing this, the sector must adopt common metadata standards, open APIs, device interoperability specifications, and shared vocabularies to ensure seamless collaboration.

The integration of emerging technologies—including IoT-enabled monitoring, GIS-based asset mapping, SCADA systems, AI-driven analytics, and advanced water quality surveillance—will further strengthen operational resilience and enable proactive decision-making. However, technology adoption must remain aligned with field realities, sustainability considerations, and long-term maintainability.

Equally critical is the need for strong data governance, cybersecurity, and trust frameworks. As digital systems and operational technologies converge, ensuring secure, reliable, and privacy-aware data exchange becomes essential. Robust mechanisms for access control, auditability, and authentication will be key to building confidence across stakeholders.

The transformation must also prioritize the empowerment of frontline institutions. Village Water and Sanitation Committees, Gram Panchayats, engineers, and field operators form the backbone of service delivery. Providing them with mobile-first, multilingual, and user-friendly tools—supported by capacity building and institutional strengthening—will be central to success.

Finally, an open and interoperable DPI ecosystem can catalyze participation from innovators, startups, research institutions, and civil society, enabling scalable solutions without fragmentation or vendor lock-in.

The journey toward DW-DPI is ultimately a governance transformation—shifting the sector from reactive operations to proactive, data-driven service delivery. By building trusted digital foundations today, India can ensure safe, reliable, and sustainable drinking water for all.

“Think Federated, Build Trusted, Scale Sustainably.”

The Technical Team consisting of Mr. C.K. Dhar, Chief Technology Officer, SPM-NIWAS; Mr. Manu Srivastava, COO, Arghyam; Mr. Deepak Gupta, Director Digital Infrastructure, Arghyam, Dr. Prerna Pandey, Consultant Arghyam, which undertook this study under the active guidance of Mr. Ashok Kumar Meena , Secretary; Mr. Kamal Kishore Soan, Additional Secretary & Mission Director; Ms. Swati Meena, Joint Secretary (JJM); Pradeep Singh, Director; Ms. Ankita Chakravarty, Deputy Secretary, Department of Drinking Water and Sanitation (DDWS) extends its sincere gratitude to the officers of DDWS, Mr. Mohammad Ishfaq , Advisor, SPM-NIWAS, Mr. Prasenjit Paul, Consultant, SPM-NIWAS and all participating individuals, institutions and State officials who actively contributed to the study through their valuable insights, experiences and continuous support during the process.

Table Of Contents

Glossary	1
Executive Summary	2
Highlights	8
Strategic improvement area	10
Measurement of IT Advancement Capabilities	12
Guiding Principles	14
Digital Maturity Model (DMM)	16
West Bengal IT Capabilities Mapping	17
Citizens Applications	18
Capability Matrix	19
Grievance Redressal	21
Unique Tap Water ID (UTID)	22
Citizen Dashboards	22
Frontline Workers Applications	24
Capability Matrix	25
Pump Operator App	27
IEC Activities Dashboard	28
Agencies Applications	29
Capability Matrix	30
Jal Swapna App	32
Jal Mitra Mobile Application	33
Asset Management App	35
Water Quality App	36
ChlorStock Mobile App	38

Table Of Contents

Department Applications	40
Capability Matrix	41
Jal Sathi Chatbot	44
Jal Mitra Web Application	45
IEP/AIRP Plant Mobile and Desktop Apps	46
Smart Water Quality Monitoring and Surveillance (WQMS)	49
IoT and SCADA system	51
E-Measurement Book (E-MB)	53
Mega Scheme and Physical Progress Apps	54
State Functionaries	55
Capability Matrix	56
Technology Foundation	57
Capability Matrix	58
Infrastructure	59
Capability Matrix	60
Conclusion	62
References	63

List Of Figures

- Figure 1** - Key Digital Achievements
- Figure 2** - Stakeholders Mapping – State IT Systems
- Figure 3** - DMM Guiding Principles
- Figure 4** - DMM Maturity Levels
- Figure 5** - State IT Systems – Digital Maturity Model (DMM)
- Figure 6** - State IT Systems – West Bengal’s PHED IT Capabilities Scorecard
- Figure 7** - Schemes Progress Citizen Dashboard
- Figure 8** - Water Quality Citizen Dashboard
- Figure 9** - Citizens Facing Online Chlorine Dose Calculator
- Figure 10** - IEC Activities Dashboard
- Figure 11** - Workflow of Jal Mitra Application
- Figure 12** - Water Quality App
- Figure 13** - ChlorStock Mobile App
- Figure 14** - Jal Saathi Chatbot
- Figure 15** - Functionality Assessment Dashboard
- Figure 16** - AIRP Mobile App
- Figure 17** - Dashboard for the Physical Progress of AIRP
- Figure 18** - District-wise Progress Report of AIRP
- Figure 19** - Water Quality Laboratories in the State
- Figure 20** - Smart Water Quality and Surveillance Process Flow
- Figure 21** - Smart Water Quality and Surveillance Monitoring
- Figure 22** - Lab Dashboard
- Figure 23** - Real-time Water Quality Dashboard for Citizens
- Figure 24** - On Premise Data Centre Photos

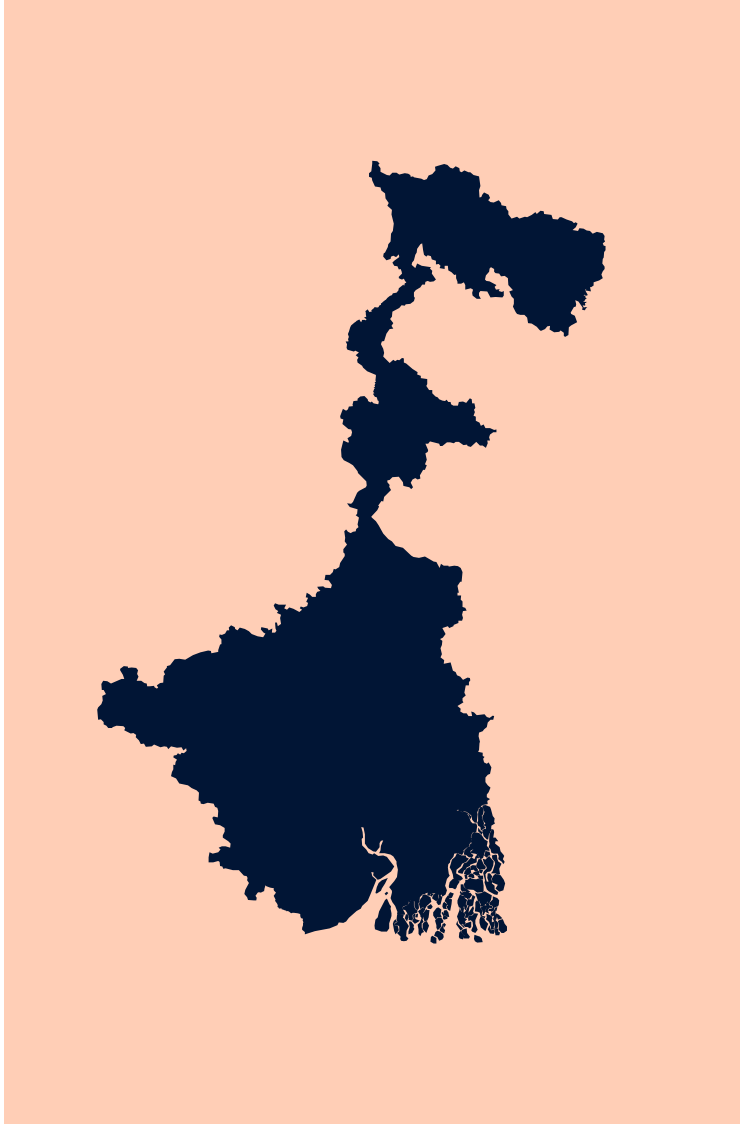
Glossary

JJM	-	Jal Jeevan Mission
FHTC	-	Functional Household Tap Connection
ISA	-	Implementation Support Agency
IMIS	-	Integrated Management Information System
WQMIS	-	Water Quality Management Information System
UTIDs	-	Unique Tap IDs
DPI	-	Digital Public Infrastructure
PHED	-	Public Health Engineering Department
PFMS	-	Public Financial Management System
GIS	-	Geographic Information System
JE	-	Junior Engineer
NJJM	-	National Jal Jeevan Mission
NABL	-	National Accreditation Board for Testing and Calibration Laboratories
AWC	-	Anganwadi Centre
CWPP	-	Community Water Purification Plant
AIRP	-	Arsenic/Iron Removal Plant
GPS	-	Global Positioning System
FTK	-	Field Test Kit
VWSC	-	Village Water and Sanitation Committee
DWSM	-	District Water and Sanitation Mission
SOP	-	Standard Operating Procedure
IEP	-	Iron Elimination Plant

Executive Summary



The Public Health Engineering Department (PHED), West Bengal's IT journey is a beautiful amalgamation of its rich heritage and futuristic thinking. The department started its IT journey much before the launch of the **Jal Jeevan Mission.** Some of the country's present-day priorities, like **GIS mapping of pipelines,** started almost 6-7 years ahead of time. PHED WB was the first state department to implement the e-measurement book application, causing a significant improvement in workflow efficiency. This futuristic thinking has put the department at the forefront of digitalisation.



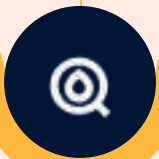
FHTC lifecycle management.

JAL SWAPNA



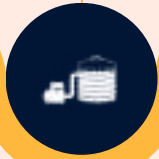
To capture lab test results manually.

WATER QUALITY



For monitoring and altering on the stock position of disinfectant at schemes.

CHLOROSTOCK



To manage large scale > 500Cr multi block schemes.

MEGA SCHEME



JAL MITRA

Functionality assessment, IEC activities tracking, orientation & trainings.

IEP AND AIRP

For supporting the real-time monitoring of water purification infrastructure.

PUMP

To record pump on-off time at schemes.

PHED West Bengal set up a fairly robust and diversified IT system ecosystem for its operations under the Jal Jeevan Mission and other departmental obligations. Historically, all the IT systems have been mobile-first, with functionalities ranging from household tap connection tracking to scheme progress monitoring, functionality assessment, water quality assessments, and GIS tagging.

This reflects the mobile-first approach in their IT strategy, which is essential for **GovTech, G2C and G2E platforms**; mobile apps enable easy access for citizens, field staff, and contractors. It becomes even more critical in sectors like **water supply**, where last-mile accessibility is key. Most of these apps are available on the Google Play Store, and some of them are also available on the iOS App Store. The user ratings of these apps are **4+** on average, reflecting their functional completeness and user-friendliness.



There is a suite of large backend applications, including the **Jal Mitra Web Application** providing monitoring, functional assessment and reporting of FHTCs, **Asset & Inventory Management Modules** for managing and reporting the lifecycle of assets and consumable stocks; the **Smart Water Quality Surveillance System** which enables real-time tracking of water quality, laboratory performance, NABL accreditation, and treatment technology operations; the **MIS Application** for managing the progress of schemes; the **e-Measurement Book Application** to record work measurements, generate bills, and process fund requisitions and several other applications providing backend services to mobile applications, aggregating data and displaying them in the form of interactive and user-friendly **dashboards**. The department has rich, **citizen-facing dashboards** that provide detailed information on FHTC progress, Water Quality, an online Chlorine Dosage Calculator and GIS maps.

The logo for Jal Mitra, featuring the name in white Bengali script on a dark blue rounded square background, which is set against a larger orange rectangular background.

Investment in Big Data & Analytics, Artificial Intelligence and Mobile First User Experience reflects innovative thinking. The department is developing a data lake solution, a modern way of storing and managing large volumes of data in its **raw, original format**—structured, semi-structured, or unstructured. The complete departmental data from 2003 has already been ingested into the data lake, making it a rich data repository. An AI-enabled WhatsApp chatbot called **Jal Saathi** has been built, which acts as a smart assistant to office staff and field engineers, providing on-demand answers to routine questions regarding schemes, financials, bills, work orders, etc., which otherwise would take significant time to navigate across multiple applications. Issuing **twelve-digit UTID** (Unique Tap Identification Digit) cards to consumers is again a good example of systematic thinking. The cards have the grievance helpline number, WhatsApp Bot number (in an advanced stage of deployment) and a QR code.

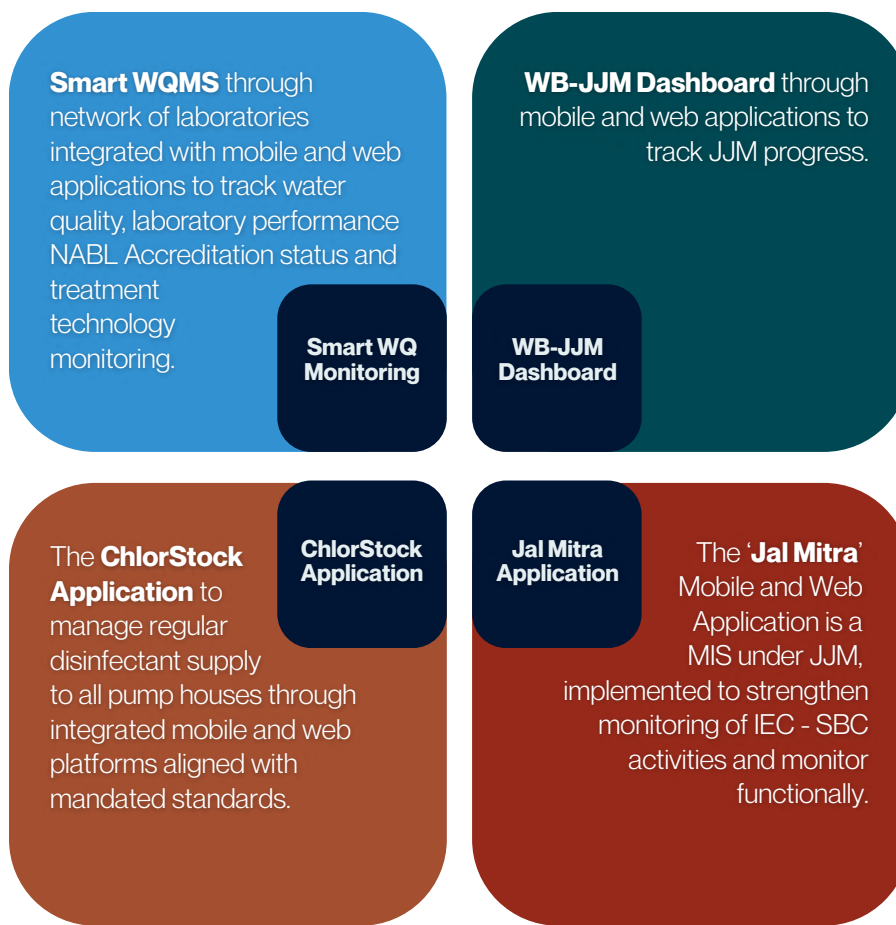


Figure 1: Key Digital Achievements

The department has its own **data centre** located within its building. It was felt that there were too many constraints and regulations associated with the State Data Centre or NIC hosting. The level of confidence in public cloud service providers is also low due to frequent cyber attacks. The department does not want to compromise on security; therefore, it chose to maintain its own data centre. Identity and access management are well managed using Single Sign-On (SSO) via Security Assertion Markup Language (SAML), giving a seamless experience to users accessing multiple applications.

THE PHED DATA CENTRE EMPLOYS 100% REDUNDANCY WITH SAN DEVICES UNDER 24X7 OEM WARRANTY, DAILY BACKUPS, AND A SECONDARY SAN BEING DEPLOYED OFFSITE.

100%
REDUNDANCY

DESPITE FACING DAILY CYBER ATTACKS. ACTIVE SAN CONFIGURATION PROVIDES 99.749% UPTIME (ISO 20K CERTIFIED), THOUGH THE FULL DR SITE REMAINS UNDER DEVELOPMENT WITH WEBEL CONSULTATION.

99.749%
UPTIME



Since the department has organically built these applications over a long period of time, the IT landscape is fragmented, with apps functioning in silos, with minimal to no integration. This demands manual interventions when reports need to be created from across multiple applications. This induces errors and inefficiency. A major gap exists in grievance redressal. The current mechanism lacks a formalized structure; complaints are received via multiple channels, including phone, email, and WhatsApp, and are manually logged into Excel and routed without a proper ticketing system – highlighting a key area for improvement.

West Bengal's PHED demonstrates strong institutional capacity and intent toward digital transformation. With a well-funded IT budget, internal development capabilities, long & trusted relationships with IT vendors, and a clear appetite for innovation, the state is well-positioned to become a North Star in our country in the space of rural drinking water management. By implementing shared registries, middleware integration, and unified dashboards, West Bengal can transition toward a fully digital, citizen-centric, and resilient water service delivery model.

Highlights

1. Strong Digital Infrastructure Foundation

Diverse Mobile Ecosystem: West Bengal PHED has developed and deployed a range of mobile and web applications— the Jal Swapna App, the Jal Mitra App, the Water Quality App, the ChlorStock App, the IEP & AIRP App, the Mega Scheme App, and the Pump Operator App—covering the full lifecycle of service delivery, including household onboarding, scheme execution, and quality monitoring.

Resilient Data Centre Setup: All backend services are hosted on an on-premise data centre featuring 100% SAN redundancy, daily backups, 99.749% uptime, and secure leased-line connectivity (STPI 50Mbps, BSNL 75Mbps).

2. Effective Institutional Readiness

In-House IT Capability: The department boasts a dedicated internal development team and a well-funded IT budget, enabling agile and customized technological solutions.

Security-Minded Approach: With measures like daily backups, geo-blocking of foreign IPs, and ongoing planning for disaster recovery, PHED has demonstrated strong security and resilience protocols.

Innovative Mindset: The development of the data lake and the AI-enabled Jal Saathi WhatsApp chatbot showcases inventive in-house innovation and responsiveness to staff needs.

3. Focus on Data Integration Pilots

There is an ongoing effort to implement a **data lake** to provide a unified source of truth for all datasets.

4. Coverage & Reach

Comprehensive FHTC Tracking: The combined use of Jal Swapna and Jal Mitra ensures scheme tracking across a wide network of villages.

Pilot Roll-Out of Unique IDs: Initiatives like UTID and QR code pilots demonstrate readiness to adopt household-level digital identity for future interoperability.

5. Water Quality Monitoring

Smart Water Quality Monitoring - A key achievement of PHED West Bengal is the Smart Water Quality Monitoring and Surveillance (WQMS) system, integrating a network of laboratories with mobile and web platforms. This system enables real-time tracking of water quality, laboratory performance, NABL accreditation, and treatment technology operations.

Dedicated Water Quality App: The department has developed a dedicated app to record test results, upload lab data, and support facilitator entries—ensuring the delivery of safe drinking water.

IEP/AIRP App - In a state faces acute arsenic issues, the department has responded with dedicated digital tools to monitor operational status and water quality performance of Arsenic/Iron Removal Plants (AIRPs) and Iron Elimination Plants (IEPs).

6. Community Engagement

There is active involvement of **ISA groups** in fieldwork, community awareness programs, school visits, and post-connection feedback gathering.

Community-level monitoring and mobilization, aligned with the spirit of participatory governance is encouraged.

7. Progress Transparency

Applications like the **Mega Scheme App** provides officials with real-time status updates on ongoing construction and physical progress.

Strategic improvement area



1. Lack of Interoperability with Centre IT Systems

- **Issue:** API integration with JJM-IMIS and WQMIS is currently nonfunctional; data entry remains manual.
- **Impact:** This causes reconciliation delays for over 38,000 villages and increases the risk of data mismatch.
- **Recommendation:** Revive and stabilize API integration with proper backend mapping and validation checks to ensure real-time data syncing with IMIS.

2. Fragmented Applications (Siloed Systems)

- **Issue:** Jal Swapna, Jal Mitra, Mega Scheme, and others operate in isolation without data exchange.
- **Impact:** Leads to duplicated entries, poor coordination, and fragmented scheme monitoring.
- **Recommendation:** Develop a middleware or shared services layer to enable data interoperability and task coordination across all apps.

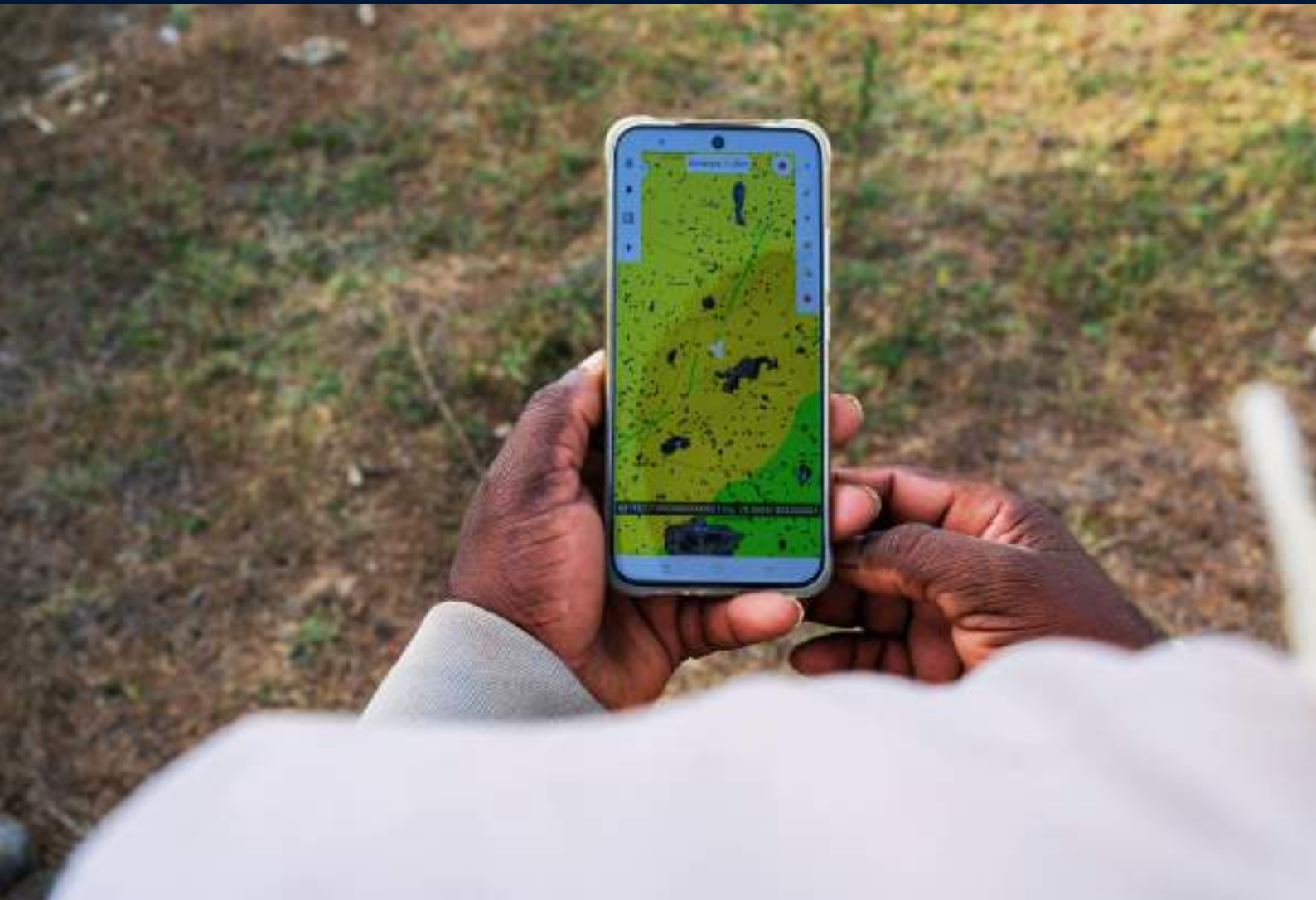
3. Manual Water Quality Monitoring

- **Issue:** Water quality data is collected and entered manually by facilitators and lab staff.
- **Impact:** This results in delays in reporting, an increased risk of errors, and poor integration with WQMIS.
- **Recommendation:** Digitize FTK test reporting, automate lab data upload, and ensure real-time linkage with WQMIS using unique household identifiers (UTIDs/QR codes).

4. Absence of Formal Grievance Redressal System

- **Issue:** Grievances are reported through multiple ad-hoc channels such as the state-level grievance system, via email, WhatsApp, and logged manually into Excel.
- **Impact:** There is no escalation system, leading to delays in resolution, and a lack of accountability.
- **Recommendation:** Establish a structured grievance portal with ticketing, response tracking, and citizen feedback loops.

Measurement of IT Advancement Capabilities



The development of IT applications in the rural drinking water sector across India is a mixed bag, with some States/UTs showcasing robust digital ecosystems, while others have yet to fully embrace the use of digital technology. Therefore, a States Information Systems **Digital Maturity Model (DMM)** has been developed to systematically measure, improve, and manage the States/UTs IT capabilities in the rural drinking water sector over time. The DMM is a structured framework for assessing the maturity of advancements in IT systems & applications in states's Rural Drinking Water Management. The model would provide structured inputs for IT governance and strategic digital transformation planning of States/UTs.

The model adopts a holistic, stakeholder-centric view of the rural water supply ecosystem, organizing stakeholders into five layers with citizens at the core: **Citizens, Frontline Workers, Agencies, Departments, and State Functionaries.**

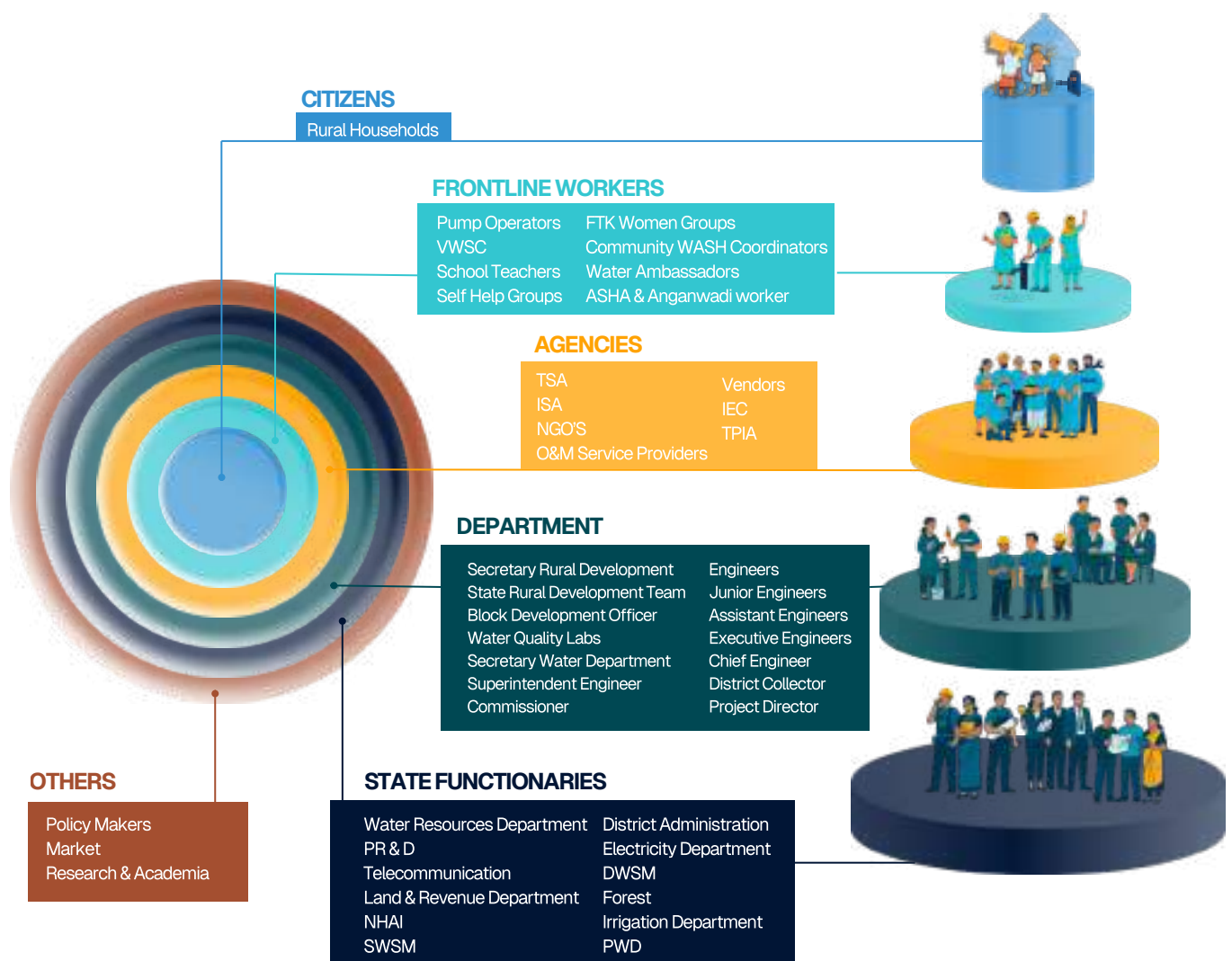


Figure 2: Stakeholders Mapping - State IT Systems

Based on a comprehensive analysis of water departments across several states, the above figure illustrates a holistic view of the stakeholders involved in the rural water management ecosystem. While the specific names and numbers of stakeholders may vary by state, this representation broadly captures the full spectrum of actors typically engaged in the system.

Guiding Principles

The **Digital Maturity Model (DMM)** is built on six foundational principles that ensure that digital transformation efforts in the rural drinking water sector under the Jal Jeevan Mission (JJM) are effective, inclusive, and sustainable.



Figure 3: DMM Guiding Principles

These guiding principles ensure that digital maturity assessment under the DMM remains not just technically robust but also socially relevant and mission-aligned. The model defines seven distinct capability areas per layer—except for Departments, which have fourteen distinct capabilities—resulting in forty-two unique capabilities system-wide. In addition, seven common capability areas, applicable across the ecosystem are grouped under a separate **Common Capabilities** layer to avoid duplication. Two foundational layers further support this model: the **Technology Foundation** layer, covering seven core application-related capabilities, and the **Infrastructure** layer, which includes seven capabilities related to hardware and connectivity.

In total, the model defines sixty-three capabilities across eight layers, with each capability evaluated against four maturity levels: **Not Assessed, Aspiring, Performing, and Leading**.





 NOT ASSESSED	 ASPIRING	 PERFORMING	 LEADING
<p>Information not available</p> <ul style="list-style-type: none"> • No data or documentation available to evaluate the status of this capability. • Capability has not been explicitly reviewed, implemented, or reported on. • Further inquiry or stakeholder engagement is needed to assess this area. 	<p>Early-stage Maturity</p> <ul style="list-style-type: none"> • The capability is either non-existent or in pilot stage, with limited institutional adoption • Processes are manual or partially digitized, lacking standardization and consistency • Ownership, governance, and user awareness around the capability are low or informal. 	<p>Operational Maturity</p> <ul style="list-style-type: none"> • The capability is functioning at scale with documented processes and routine usage by intended stakeholders • Systems or tools supporting this capability are integrated into workflows, and data is used for monitoring and reporting. 	<p>Strategic Maturity</p> <ul style="list-style-type: none"> • The capability is interoperable, scalable, and aligned with open standards or DPI principles • Data-driven insights, automation, or innovation are embedded in the capability's functioning. • The state actively shares learnings, tools, or assets with other regions.

Figure 4: DMM Maturity Levels

Digital Maturity Model (DMM)

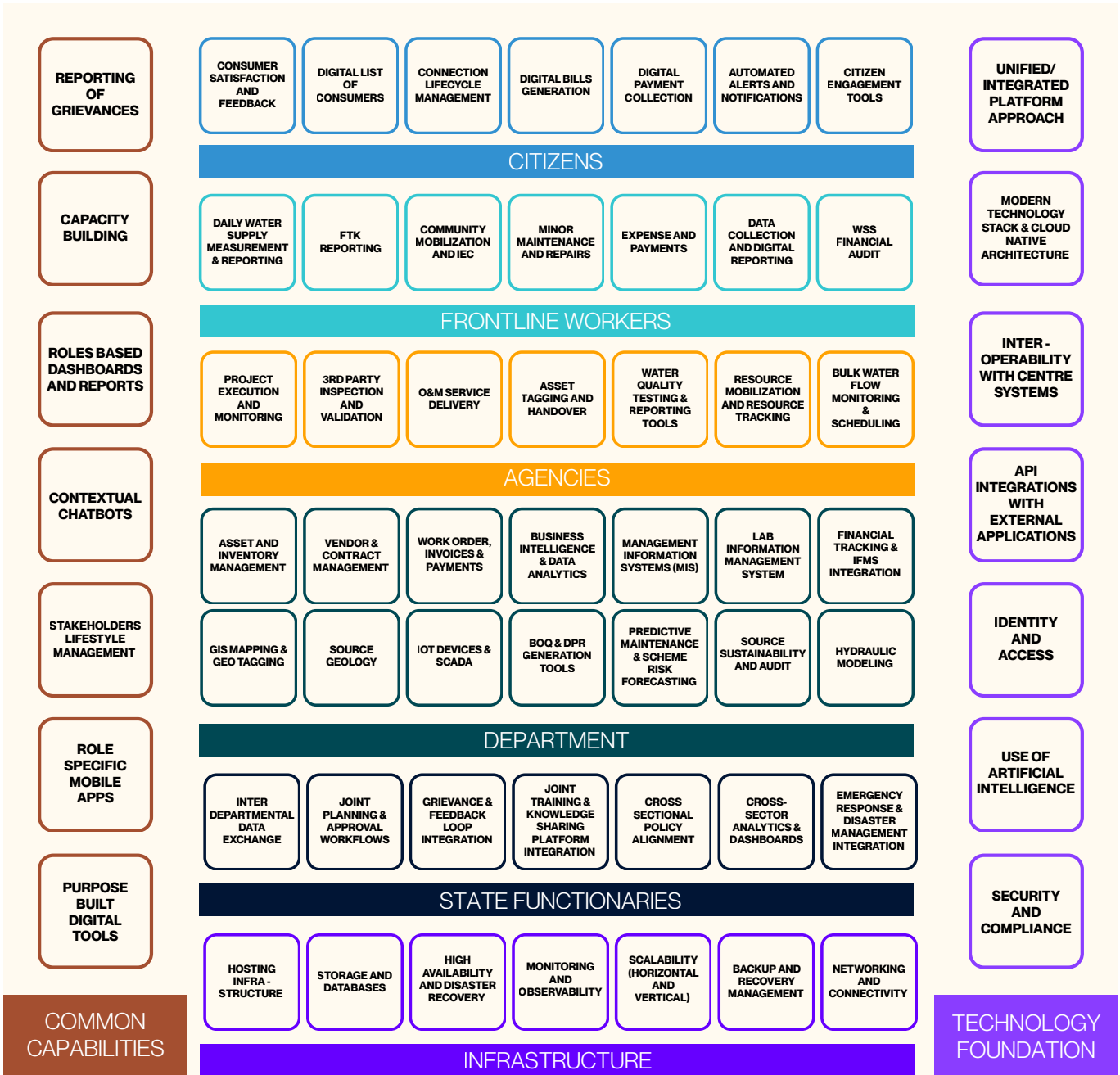


Figure 5: State IT Systems- Digital Maturity Model (DMM)

Citizens Applications



Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for consumers/citizens.

<p>CONSUMER SATISFACTION AND FEEDBACK</p>	<p>At present, there are no established processes and digital tools to conduct a proactive consumer satisfaction survey.</p>
 <p>DIGITAL LIST OF CONSUMERS</p>	<p>A digital list of consumers is maintained using the Jal Swapna mobile app, which is integrated with the Aadhar and Swachh Bharat Mission-Gramin (SBM-G) database. Consumer information is systematically collected at the FHTC level, with a Unique Tap Water ID (UTID) linked to scheme codes assigned to each connection. This ensures accurate mapping, service tracking, and grievance redressal.</p>
<p>CONNECTION LIFECYCLE MANAGEMENT</p>	<p>There is a well defined process supported by digital tools like the Jal Swapna mobile app to onboard new connections. A twelve-digit Unique Tap ID (UTID) is assigned to each connection, which is used in all consumer-related operations such as grievance redressal, and connection transfer, etc.</p>
<p>DIGITAL BILLS GENERATION</p>	<p>Digital billing is not currently implemented for rural consumers under JJM by PHED, West Bengal.</p>
<p>DIGITAL PAYMENT COLLECTION</p>	<p>While local O&M contributions may exist in certain community-managed models, there is no standardized, state-level tariff system under PHED.</p>
<p>AUTOMATED ALERTS AND NOTIFICATIONS</p>	<p>Consumer-focused alerts (e.g., SMS warnings for water disruptions or quality dips) are not part of the existing setup.</p>
<p>CITIZEN ENGAGEMENT TOOLS</p>	<p>A digital tool like Jal Kosh is under planning for better citizen engagement. UTID cards help engage citizens. Citizen-facing dashboards are powerful tools in this respect.</p>
 <p>REPORTING OF GRIEVANCES</p>	<p>There is no dedicated digital system to manage consumer grievances. Grievances are mainly reported through physical visits to the local offices or Village Water and Sanitation Committees (VWSCs), phone calls to departmental helplines, WhatsApp channels, and email, etc. Grievances are also reported via the state-level grievance system and PHED related grievances are notified to the department via email or WhatsApp.</p>

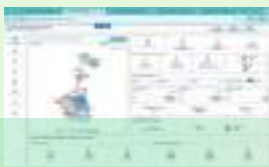


CAPACITY BUILDING

PHED, West Bengal actively engages in mass awareness campaigns, especially leveraging festive and community events to reach a broad citizen base. These efforts extend to localized orientation, capacity building, and AV-based IEC, tailored in vernacular languages.

There is a coordinated institutional mechanism (WSSO) for ongoing IEC/O&M awareness, which scales from the community to disaster response levels. Non-government partners (like UNICEF-supported groups and IMAGIN) have played a pivotal role in behaviour change and grassroots planning.

However, digital platforms (like social media, mobile apps, or SMS campaigns) for IEC are not prominently evident in current documentation —indicating an opportunity for digital expansion.



ROLE-BASED DASHBOARDS AND REPORTS

PHED, West Bengal has developed a very comprehensive and user-friendly citizen-facing dashboard, WB-JJM. The dashboard is available at the link <https://jjm.wbphed.gov.in/dashboard/home>. The dashboard provides detailed information on FHTC progress, schemes, and details of state PMUs. For a few schemes where IoT devices are deployed, real-time data like pump status, chlorine pump status, total ‘on’ time, water level, residual chlorine, water pressure in OHR, velocity etc. are displayed on the citizen-facing dashboard, providing complete transparency.

CONTEXTUAL CHATBOTS

At present, no chatbots are available for citizens.

STAKEHOLDER LIFECYCLE MANAGEMENT

The state boasts a robust consumer lifecycle management system, owing to a well-defined, evidence-based consumer onboarding process using the Jal Swapna Mobile App and the assignment of twelve-digit UTID.

ROLE-SPECIFIC MOBILE APPS

At present, there are no mobile apps available for citizens. There used to be an issue tracking mobile app for grievance reporting, which has been discontinued due to certain operational reasons. The department is in the process of planning a new mobile app for grievance reporting and management.

PURPOSE BUILT DIGITAL TOOLS

No information on the additional purpose-built digital tools for citizens.

Grievance Redressal

There is no dedicated digital system to manage consumer grievances.

Grievance redressal within PHED, West Bengal, is currently a manual and informal process that lacks the structure and traceability expected in a digital service delivery environment. Grievances are mainly reported through physical visits to the local offices or through the VWSCs via phone calls to departmental helplines, WhatsApp channels, email, etc.

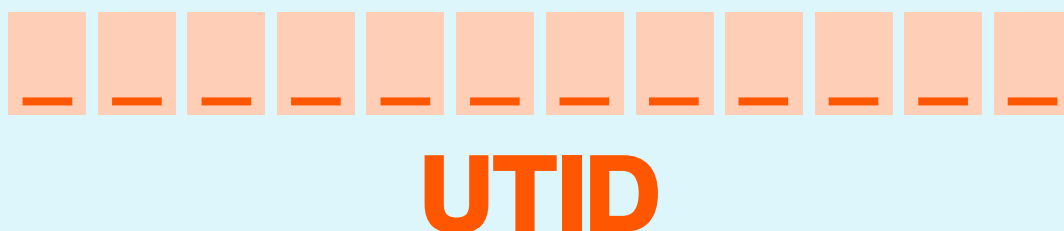


These messages are then manually transcribed into Excel sheets by department staff and shared in internal officer groups for follow-up. From there, messages are forwarded to the relevant field-level officials through informal communication channels. This entire process, while functional in a basic sense, suffers from several shortcomings: there is no case tracking, no unique ticket ID generation, no escalation workflow, and no formal acknowledgement system for the complainant.

As a result, grievances can be delayed or lost in follow-up, and there is little visibility for either the citizen or senior officials into their resolution status. The absence of integration between the grievance system and core service delivery platforms like **Jal Mitra or the Water Quality App** further limits the ability to take corrective action based on service feedback. Given the increasing emphasis on accountability and citizen engagement under the **Jal Jeevan Mission**, establishing a structured, digital grievance redressal platform with auto-routing, case IDs, status updates, and dashboard reporting is both a critical and urgent opportunity. Such a system would not only improve transparency but also help PHED close the feedback loop and respond to issues more effectively.

Unique Tap Water ID (UTID)

A digital list of consumers is maintained through mobile-based data collection at the **Functional Household Tap Connection (FHTC)** level. Consumer details are recorded from the Aadhaar card of the eldest household member, capturing attributes like name, age, and gender. Each FHTC is assigned a **Unique Tap Water ID (UTID)**, a **twelve-digit identifier** used for mapping connections and linking them to scheme codes. This UTID is also crucial for grievance management—citizens are required to provide it when submitting complaints through mobile apps, WhatsApp bots, or at the Gram Panchayat level. Data is geo-tagged, indicating whether the FHTC is functional and detailing its usage (drinking, cleaning, bathing, etc.), which helps maintain accurate service records and facilitates scheme-level reporting.



Citizen Dashboards

PHED, West Bengal has developed a very comprehensive and user-friendly citizen-facing dashboard. The WB-JJM dashboard is available at <https://jjm.wbphed.gov.in/dashboard/home>.

The dashboard provides detailed information on FHTC progress, scheme information, state PMU details, and, for a few schemes where IoT devices are deployed, real-time data like pump status, chlorine pump status, total 'on' time, water level, residual chlorine, water pressure in OHR, velocity etc. are displayed on the citizen dashboard, providing complete transparency. The dashboard also provides district-wise status of residual chlorine, total coliform, and E. coli in different PWSS for the month.

Frontline Workers Applications



Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for frontline workers.

DAILY WATER SUPPLY MEASUREMENT & REPORTING	Daily water supply is captured through the Jal Swapna app by the PHED staff, tracked via internal MIS and reflected partially in public dashboards.
FTK REPORTING (FIELD TEST KIT REPORTING)	Digitally reported via the Water Quality App; data uploaded to centralized dashboards; includes photo/GPS tagging.
COMMUNITY MOBILIZATION & IEC	Well digitized IEC processes & automation within the Jal Mitra Application.
MINOR REPAIRS MANAGEMENT	Not centrally digitized; field-level interventions are handled offline; no structured digital interface observed.
EXPENSE AND PAYMENT MANAGEMENT	Captured via MIS modules, reflected in Jal Swapna (project financials), and tracked through work orders and PFMS-linked dashboards.
DATA COLLECTION AND DIGITAL REPORTING	Implemented across Jal Mitra, Jal Swapna, and Water Quality Apps; manual field-level data entry but consistent backend aggregation and reporting.
WATER DISRUPTION AND REPORTING	Not separately reported or visualized publicly; no dedicated module or alert mechanism currently in Jal Mitra or Jal Swapna apps.
REPORTING OF GRIEVANCES	No separate channel for frontline workers' grievances.
ROLE-BASED DASHBOARDS AND REPORTS	Several dashboards are available for frontline workers providing near real-time information.
CONTEXTUAL CHATBOTS	No chatbot interface for frontline workers at present.



CAPACITY BUILDING

Community-based water quality surveillance: The state programme emphasizes community-linked labs and FTK use; frontline workers and community volunteers are oriented to sample collection, safe storage, and reporting.

Routine training via WSSO: WSSO conducts IEC & HRD activities year-round at the State/District/Block levels, including sessions for field staff during normal times and emergencies.

Block-level mobilisation through ISAs: Work orders show ISA teams running community sensitization on O&M, legal aspects (e.g., illegal connections), safe handling/storage, and WASH topics—frontline staff participate and reinforce messages in villages.

STAKEHOLDER LIFECYCLE MANAGEMENT

Stakeholders like pump operators, etc., are properly onboarded in the systems.

ROLE SPECIFIC MOBILE APPS

The Pump Operator App is in the initial stage of rollout for pump operators to record the on-off time of the pump via the app, so that functionality monitoring can be done.

PURPOSE BUILT DIGITAL TOOLS

No information is available on any additional purpose-driven digital tools for frontline workers.

Pump Operator App

The **Pump Operator App** is a digital tool being planned by PHED, West Bengal, to **streamline the monitoring of pump operations across rural water supply systems.**

The current concept for the app involves allowing pump operators to log the daily status of water pumps, specifically recording when the pump is switched on and off.



To provide proof of activity, the operators are expected to upload timestamped photographs as evidence. **This app will serve as a first step toward digitizing the operation and maintenance activities carried out at the grassroots level.**

However, at present, this app is only in the conceptualization and planning stage.

For it to be truly effective and sustainable in the long term, the application will need to go beyond manual inputs and incorporate automation features such as IoT-based sensors that can detect and transmit pump usage data in real time. Integration with the **Asset Management App** and **Jal Mitra** would enable cross-referencing of pump status with water supply coverage and functionality data.

This kind of digitization will empower the department to detect pump failures promptly, reduce downtime, and plan predictive maintenance. It aligns with the department's overall objective of moving from infrastructure provisioning to consistent and quality service delivery under the **Jal Jeevan Mission.**

IEC Activities Dashboard



Figure 10: IEC Activities Dashboard



Agencies Applications

Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for Agencies.

PROJECT EXECUTION & MONITORING	Agencies execute approved schemes by constructing water supply infrastructure, installing components, and coordinating with PHED and VWSCs. They also monitor work through inspections, geotagging, progress reporting, and quality checks, ensuring timely completion and compliance with standards.
THIRD-PARTY INSPECTION & VALIDATION	Digital tools are available for third-party inspection and validation.
O & M SERVICE DELIVERY	The Gram Panchayat Water & Sanitation Committee (GPWSC) operates the system and collects a monthly tariff from each household, which fully covers O&M expenses. It also manages meter reading, and grievance resolution.
ASSET TAGGING AND HANDOVER	The mission integrates with platforms like PM Gati Shakti to share geospatial infrastructure data (e.g., pipelines, reservoirs) for coordinated planning and asset tagging.
WATER QUALITY TESTING & REPORTING TOOLS	The state uses a Water Quality Management Information System (WQMIS) integrated with mobile apps for sample collection, verification, and approval. Around 217 water quality testing labs, including subdistrict, district, and state-level facilities, carry out periodic testing—typically every six months—for FHTCs.
RESOURCE MOBILIZATION AND RESOURCE TRACKING	No information is available.
BULK WATER FLOW MONITORING & SCHEDULING	Bulk metering is done for a few multi-village schemes
REPORTING OF GRIEVANCES	There is no separate channel for reporting the grievances of agency-level stakeholders.
ROLE-BASED DASHBOARDS AND REPORTS	Decent dashboarding and reporting are available.



CAPACITY BUILDING

Formal engagement of ISAs for community mobilisation & capacity building: Multiple districts engage ISAs to run sustained IEC and capacity-building cycles (e.g., Darjeeling & Kalimpong).

District Project Management Units (DPMUs): Engagements are recorded in PHED, tracking HRD/capacity work—these units help plan, supervise, and report IEC/CB activities.

Water-quality IEC embedded in lab operations: Ongoing work orders fund operational charges for PHED/NGO labs and NABL-related activities; agencies use these touchpoints for citizen messaging on testing and safe use.

CONTEXTUAL CHATBOTS

No chatbot or automated conversational interface is deployed for agency-level stakeholders.

STAKEHOLDER LIFECYCLE MANAGEMENT

Information is not available.

ROLE - SPECIFIC MOBILE APPS

There is a rich suite of mobile apps for operators, contractors and agencies to manage their field operations efficiently and effectively. Some of these apps include the Jal Swapna mobile app, the Jal Mitra mobile app, the Asset Management mobile app, the Water Quality mobile app, and the ChlorStock mobile app.

PURPOSE-BUILT DIGITAL TOOLS

There is no information available on any additional purpose-driven digital tools for agencies.

Jal Swapna App

The Jal Swapna app, also referred to as the **WB-JJM app**, is a core application developed by PHED, West Bengal, to enable contractors to register household tap connections under the Jal Jeevan Mission. Built using native Java technology, the app facilitates the onboarding of rural households, schools, and Anganwadis by allowing agencies to input essential demographic and connection details.



It has been integrated with **Swachh Bharat Mission-Gramin (SBM-G)** data to ease the identification of eligible households, and it offers a fallback mechanism where new entries can be created if a match is not found. This app plays a critical role in initiating the service lifecycle by establishing the presence of a **Functional Household Tap Connection (FHTC)**.

A **unique twelve-digit UTID** is assigned to each connection, and a QR code-based system is being piloted to help improve traceability. However, the app currently operates in isolation, without integration with **Jal Mitra** (used by ISA teams for functionality checks), resulting in duplicate workflows and potential data inconsistencies. UTID cards with embedded grievance redressal features are being piloted, linking twelve-digit IDs to Aadhaar-validated tap locations (lat/long captured via mobile GPS).

Additionally, there is no mechanism to automatically detect and prevent household duplication, which could affect data quality. While Jal Swapna has laid a solid foundation for digital tracking of FHTCs, it will require enhanced integration, validation, and linkage to other modules for it to function as a true building block in a future DPI ecosystem.

Jal Mitra Mobile Application

The **Jal Mitra mobile app** is a field-level digital tool developed by PHED, West Bengal, to facilitate the verification of Functional Household Tap Connections (FHTC) by **Implementation Support Agencies (ISAs)**.

জলমিত্র

It is a native Android application deployed on the Google Play Store, with a partial iOS version also available. **The app allows ISA personnel to visit households post-connection and assess whether the tap water connection is functional.** The process involves selecting a village, viewing the list of assigned FHTC connections, and updating the functionality status directly through the app. This information is then used for progress tracking under the Jal Jeevan Mission (JJM).



The mobile app has offline functionality and syncs with backend servers after twelve hours. An assessment is done on issues of water quantity, such as whether water is coming or not, whether it is coming regularly or not, and whether the tap is functional or has never been functional. Data is also collected on the usage of tap water, including whether water is used for drinking, cleaning, washing, bathing, or gardening. For water quality, assessment is done on parameters like smell, taste, and colour. There is a dedicated field to capture if the tap is broken. **Ten per cent of the FHTCs** are reassessed for verification. There is also no integration with grievance systems or water quality apps, which could provide a fuller picture of service delivery at the household level.

Despite its role as a key monitoring tool, Jal Mitra functions in isolation and would benefit greatly from integration into a unified DPI framework where functionality data, quality metrics, and grievance inputs can be cross-referenced in real time.

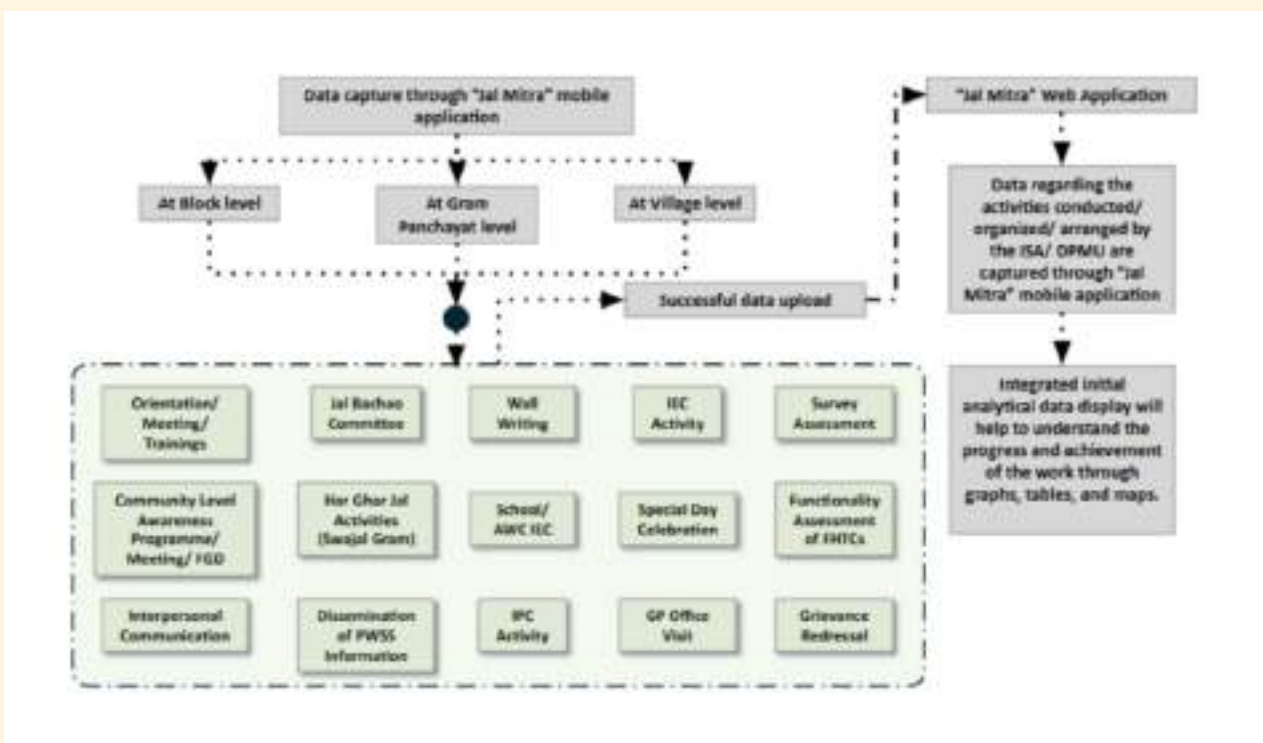


Figure 11: Workflow of Jal Mitra Application

Asset Management Application

The **Asset Management app** is a proposed digital tool that PHED, West Bengal, aims to develop to comprehensively map and manage physical infrastructure assets such as pipelines, water storage units, pumps, and treatment plants under the **Gati Shakti initiative**. A dedicated Gati Shakti compliance app automates spatial data validation, integrating with a historical data lake containing OCR-processed DPRs since **2003**.



The application is currently in the planning phase, with tenders floated to bring it to life. Once implemented, the app is expected to support the entire asset lifecycle—from installation and operational tracking to maintenance and performance monitoring. One of the core features envisioned for this app is GIS-based geotagging of assets, which would allow field officials to view asset locations on a digital map for better coordination and management.

In addition, a QR code-based system is planned to enable quick identification and real-time updates about asset conditions via mobile scanning in the field. This would help in inventory audits, preventive maintenance, and faster troubleshooting. The need for this app has become increasingly apparent as the department transitions from infrastructure creation to long-term service delivery and sustainability. Integration with other core applications like the Jal Mitra and Water Quality App would further enhance its utility by enabling cross-referencing of physical assets with service functionality and water quality parameters. A fully developed Asset Management App will not only provide visibility and control over field infrastructure but also align PHED with modern, data-driven governance practices under a DPI framework.



Water Quality Application

The **Water Quality App** is a critical tool used by PHED, West Bengal, to capture and monitor the results of water quality tests across various habitations and Functional Household Tap Connections (FHTCs). Developed by an external vendor, Sunanda International, the application enables both facilitators and lab technicians to input data either through a mobile interface or a desktop system. Around **230 labs** and mobile vans utilize the offline-capable app with a simplified UI for semi-literate ASHA workers, requiring mandatory forty-hour training certification.



The app is designed to help ensure that water supplied to rural households meets the required safety parameters. However, the application currently relies heavily on manual processes - particularly the manual entry of up to **40 parameters** for each sample tested. This not only makes the system time-consuming to use but also introduces the possibility of human error.

Additionally, while the app connects to the Ministry of Jal Shakti's **WQMIS** (Water Quality Management Information System), this linkage is not automated. Instead, data must be manually validated and pushed, creating a lag and inefficiencies in reporting. Furthermore, a major limitation is that the source code of the application remains with the vendor, restricting PHED's control and long-term scalability.

Despite these constraints, the Water Quality App plays a foundational role in ensuring safe drinking water, but it needs significant technical enhancements, such as auto-validation, real-time syncing, and departmental ownership, to align better with DPI standards.

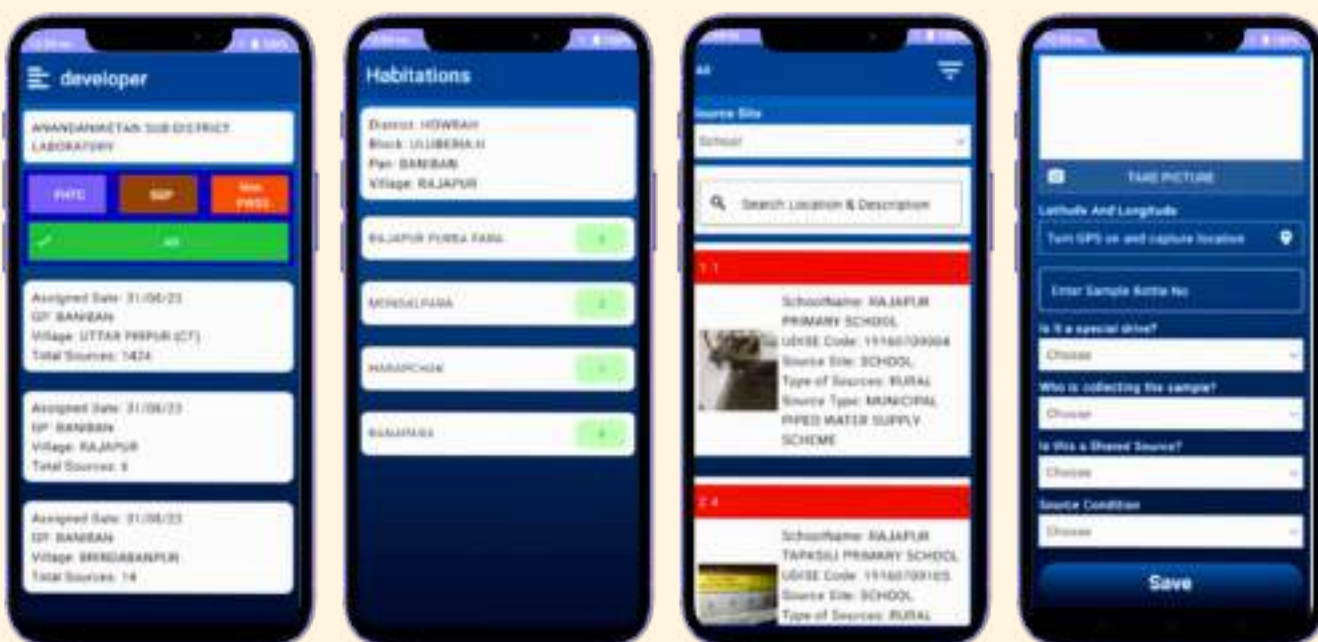


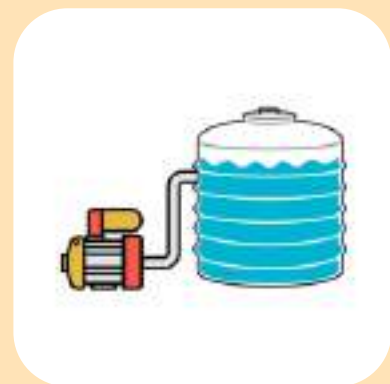
Figure 12: Water Quality App



ChlorStock Mobile App

Maintaining proper chlorine stock is essential to keep residual chlorine in distribution systems within safe limits—which is key to continuous disinfection and regulatory compliance under JJM’s water quality framework.

ChlorStock is a mobile/online tool placed under PHED’s “Water Quality” utilities that supports smart disinfectant (chlorine) stock management for piped water supply schemes across West Bengal.



The purpose is to help field staff and supervisors track chlorine inventory at the scheme level and ensure uninterrupted disinfection, thereby sustaining residual chlorine as per norms.

Key Functions

- Records the stock position of disinfectant at schemes.
- **Provides automated thresholding & alerts** (e.g., when stock falls near 20% of requirement) based on parameters like dose rate, supply hours, chlorine demand, and available chlorine—so teams can **reorder on time**.
- Enables the **sharing of alerts** with relevant stakeholders for timely action.
- The app is designed for **seamless monitoring of chlorination** in drinking water supply schemes.

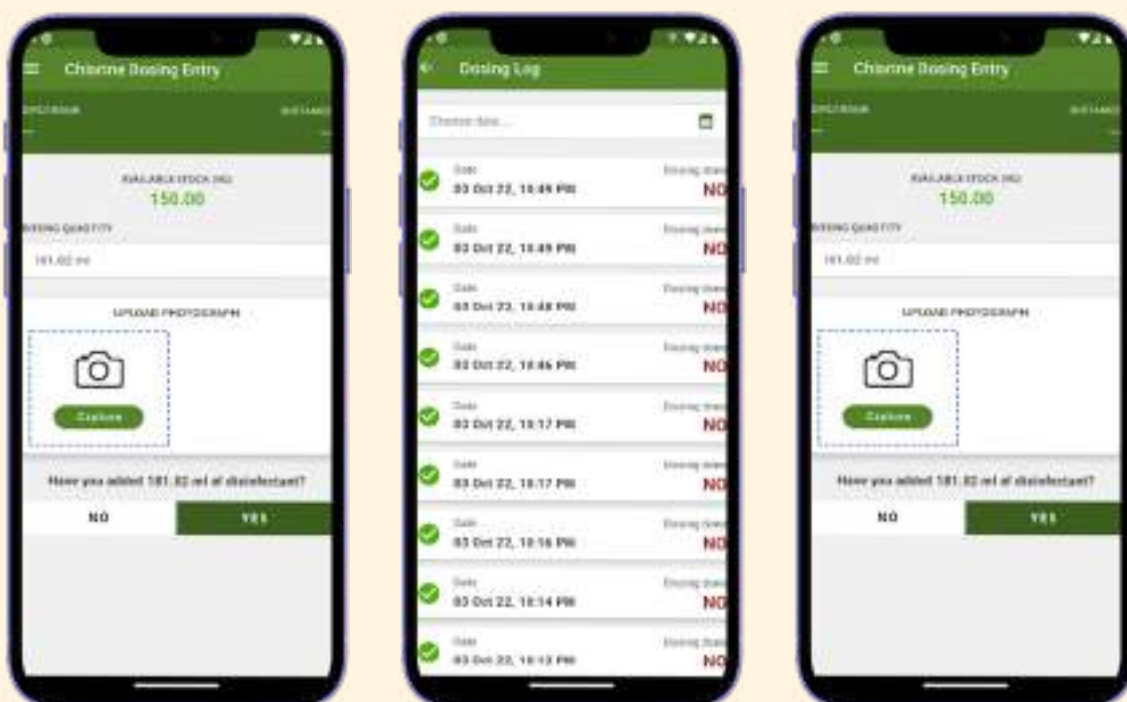


Figure 13: ChlorStock Mobile App


Department Applications



Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for Department.

ASSET & INVENTORY MANAGEMENT	Assets are tracked through an asset management app, with division-level asset registries and integration plans for Gati Shakti. Each scheme has a unique code mapped to IMIS and state databases, aiding asset traceability.
VENDOR & CONTRACT MANAGEMENT	Vendor registration systems are in place, with around ten to twelve vendors engaged. Source code is collected during procurement, and a mix of open-source and licensed technologies (Oracle, MS-SQL, MongoDB) is used.
WORK ORDER, INVOICES & PAYMENTS	The e-Measurement Book (e-MB) system digitally records work measurements, generates bills, and processes fund requisitions, and it is mainly handled by junior engineers. Pump operator payments are linked to motor readings.
BUSINESS INTELLIGENCE & DATA ANALYTICS	State dashboards and WQMIS enable monitoring of water quality, scheme progress, and grievance redressal.
MANAGEMENT INFORMATION SYSTEMS (MIS)	Multiple apps, including Jal Mitra and lab-testing tools, collect consumer, scheme, and operational data, feeding into the central MIS for scheme monitoring and reporting.
LAB INFORMATION MANAGEMENT SYSTEM	WQMIS manages data from 217 labs (district, sub-district, and state levels), enabling sample tracking, quality monitoring, NABL compliance, and integration with mobile/web apps for water testing cycles.
FINANCIAL TRACKING & IFMS INTEGRATION	IFMS is present.
GIS MAPPING & GEOTAGGING	GIS mapping and geotagging are used to digitally map all water supply assets, such as pipelines, reservoirs, treatment plants, and household connections. Each asset is geotagged with precise coordinates and linked to scheme data in IMIS and state databases, enabling better planning, monitoring, and integration with platforms like Gati Shakti for infrastructure coordination.
SOURCE GEOLOGY	No information is available.

IOT DEVICES & SCADA	<p>Over 250 IoT devices—mainly chemical, flow, and pressure sensors—are deployed to monitor parameters like residual chlorine and TDS. SCADA systems are operational at around five sites, with more planned. This enables remote monitoring and control of select schemes.</p>
BOQ & DPR GENERATION TOOLS	<p>No information is available.</p>
PREDICTIVE MAINTENANCE & SCHEME RISK FORECASTING	<p>No information is available.</p>
SOURCE SUSTAINABILITY AND AUDIT	<p>Such action is not taking place currently, but it is planned in the future.</p>
HYDRAULIC MODELING	<p>Hydraulic modelling is not happening in the department.</p>
 CAPACITY BUILDING	<p>WSSO acts as the nodal unit for IEC/HRD: The WSSO page explicitly assigns the responsibility to plan, organize, and implement IEC/HRD on safe water and sanitation—including during disasters—covering statewide coordination with districts and blocks.</p> <p>State dashboards/work-order tracking to steer IEC: The PHED's JJM portals list scheme categories like Support-IEC and Support-WQMSP, with value, agency, timelines, and progress—used by department staff to monitor delivery and course-correct.</p> <p>Convergence with partners: Public records show collaboration with ISAs/NGOs (e.g., SIGMA Foundation pilots with UNICEF) that combine digital monitoring with citizen communication—state staff oversee and integrate such learnings.</p>
REPORTING OF GRIEVANCES	<p>No information is available on a grievance reporting system for employees.</p>
ROLE-BASED DASHBOARDS AND REPORTS	<p>MIS and dashboards are available for internal tracking of physical and financial progress, though access is primarily role-specific to officials. With dedicated initiatives like data lake, this area will be further strengthened.</p>
CONTEXTUAL CHATBOTS	<p>A WhatsApp-based, AI-enabled chatbot named Jal Saathi has been rolled out, which connects with a centralized data lake and provides an intuitive interface to answer common questions on scheme progress, financial tracking, water quality, etc.</p>

**STAKEHOLDER
LIFECYCLE
MANAGEMENT**

With SSO in place, there is a well-defined process for staff lifecycle management.

**ROLE SPECIFIC
MOBILE APPS**

Jal Saathi is not a native mobile app, but it provides a user-friendly mobile interface.

**PURPOSE-BUILT
DIGITAL TOOLS**

Mega Scheme App & IEP/AIRP Apps are great examples of purpose-built digital tools.

Jal Mitra Web Application

The Jal Mitra web application is a comprehensive suite of modules that serves as the backbone of the digital ecosystem of PHED, West Bengal. One of the major purposes is monitoring, functional assessment and reporting of FHTCs.

This desktop-based web application is a publicly accessible digital dashboard implemented by PHED, Government of West Bengal, as part of the state's Jal Jeevan Mission (JJM) implementation. It serves as a real-time monitoring and transparency platform for tracking the progress of FHTCs, water quality testing activities, and financial expenditures. The system is hosted on the official JJM portal of the state (<https://jjm.wbphed.gov.in>) and operates as a key public interface to disseminate scheme progress to citizens, officials, and stakeholders.



Figure 15: Functionality Assessment Dashboard

IEP/AIRP Plant Mobile and Desktop Apps

West Bengal PHED uses specialized digital tools to monitor the operational status and water quality performance of Arsenic/Iron Removal Plants (AIRPs) and Iron Elimination Plants (IEPs) as part of its piped-water supply schemes. These systems allow the tracking of plant deployment, physical progress, and contamination levels in arsenic and iron-affected areas, integrated into PHED's broader Water Quality Dashboard.



The IEP (Iron Elimination Plant) and AIRP (Arsenic Iron Removal Plant) apps are digital solutions being deployed by PHED, West Bengal, to support the real-time monitoring of water purification infrastructure. These apps are intended for use by plant operators to track the operational status and effectiveness of treatment systems designed to remove iron and arsenic from water sources. The functionality includes uploading photos of the plant during operation and recording water quality test results both before and after filtration. This would provide the department with valuable insights into whether these critical purification units are functioning optimally in the field. While the apps are still in the planning phase and not yet fully rolled out, their design aligns with PHED's broader goal of ensuring water safety and reliability at the last mile.

However, for these apps to be truly effective, they will need to incorporate sensor-based data collection, real-time status alerts, and integration with the Water Quality app and central monitoring dashboards.

These enhancements would help flag issues such as system breakdowns or inefficiencies in real time, enabling proactive maintenance and higher accountability.

The successful deployment of these apps would mark a key advancement in PHED's shift from infrastructure creation to service-level monitoring and could serve as a model for other states dealing with similar groundwater contamination challenges.

There are two applications -

- 1) **Android mobile app** - Used by the field staff to enter the AIRP details in the system, with verified location data.
- 2) **Desktop application** - Used by the office staff to monitor the status of AIRP plants and other reporting.



Figure 16: AIRP Mobile App



Figure 17: Dashboard for the physical progress of AIRP

The table displays the district-wise details progress report of AIRP for District: Malda. It includes columns for project name, status, and various progress indicators.

Sl. No.	Project Name	Overall Status	Physical Progress	Financial Progress	Administrative Progress	Other Progress	Remarks	Action
1.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
2.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
3.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
4.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
5.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
6.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
7.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%
8.	Project Name: Subsidy for... (Project Name)	Completed	100%	100%	100%	100%	100%	100%

Figure 18: District wise progress report of AIRP

Smart Water Quality Monitoring and Surveillance (WQMS)

A key achievement of PHED West Bengal is the **Smart Water Quality Monitoring and Surveillance (WQMS)** system, which integrates a network of laboratories with mobile and web platforms. This system enables real-time tracking of water quality, laboratory performance, NABL accreditation, and treatment technology operations. The digital dashboard captures the complete water quality workflow—from sample collection to test report generation—while also monitoring calibration, certificate validity, and chlorination dosage optimization in **Piped Water Supply Schemes (PWSS)**. The impact areas include better laboratory oversight, prompt treatment plant optimization, and decision support for water quality management.

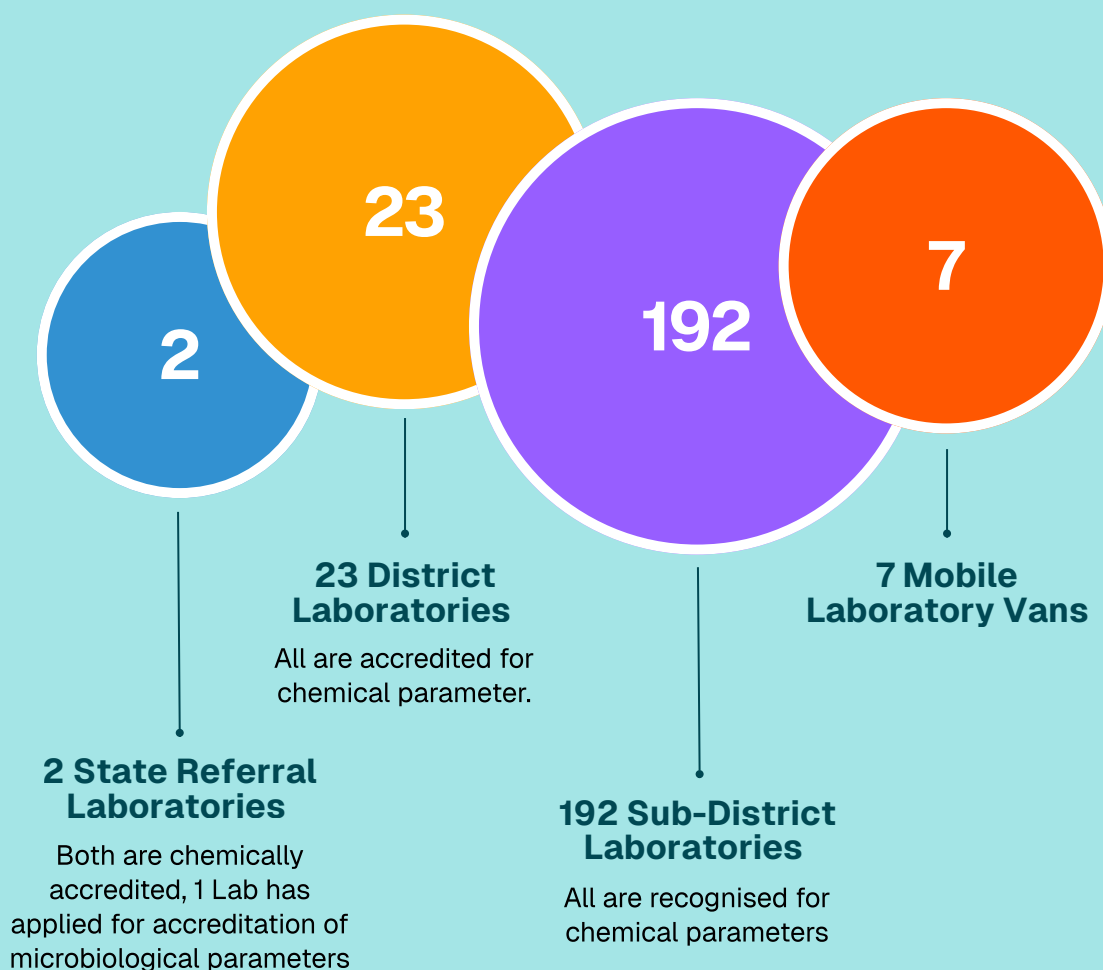


Figure 19: Water Quality Laboratories in the State

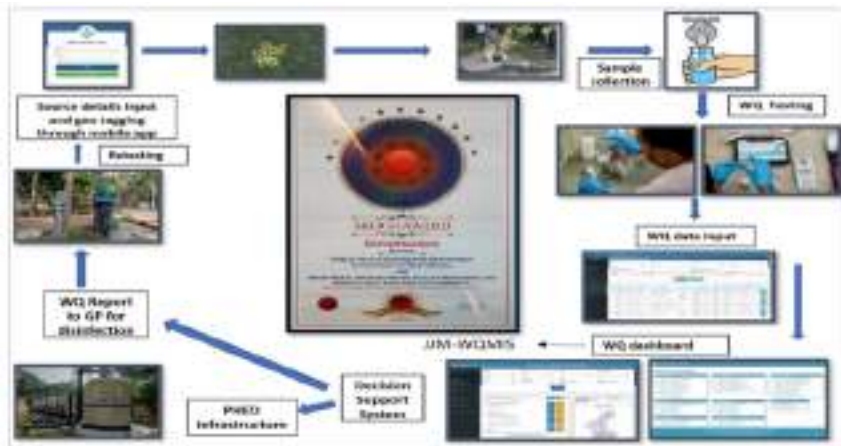


Figure 20: Smart Water Quality and Surveillance Process Flow

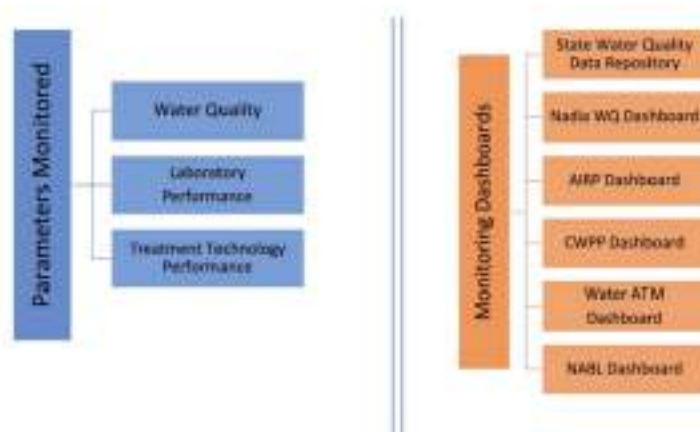


Figure 21: Smart Water Quality and Surveillance Monitoring



Figure 22: Lab Dashboard

IoT and SCADA system

In PHED West Bengal, many schemes are already equipped with IoT devices, while others are in the proposal stage. Currently, over **250 IoT installations** are operational across various schemes, incorporating chemical, flow, and pressure sensors. The chemical sensors primarily monitor key water quality parameters such as residual chlorine and total dissolved solids (TDS), while flow and pressure sensors support network performance tracking and anomaly detection. In select locations, bulk meters have also been installed to measure and manage large-scale water flows.

On the **SCADA** side, the department has initiated deployments in a limited number of schemes, with around five sites currently operational. These SCADA setups integrate with IoT devices to provide centralized monitoring and control capabilities. Operators can remotely track pump operations, valve positions, and sensor data in real time, enabling a quicker response to faults and improved operational efficiency. As the program scales, the integration of IoT and SCADA is expected to strengthen data-driven decision-making, predictive maintenance, and overall service reliability.



Below figure shows the citizen-facing dashboard getting near real-time feed from IoT enabled Scheme.

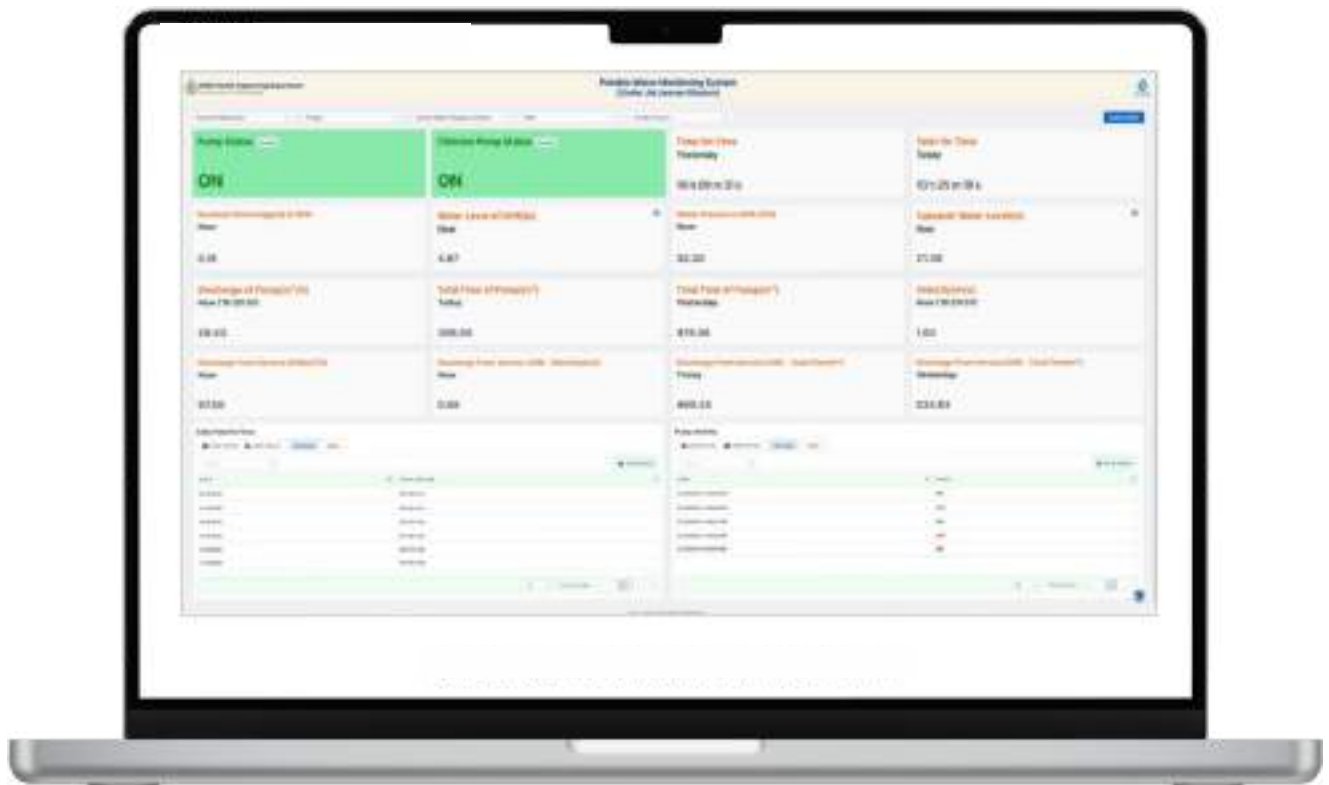


Figure 23: Realtime Water Quality Dashboard for Citizens

E-Measurement Book (E-MB)

The **E-Measurement Book (E-MB)** is a digital tool developed by PHED to record work measurements, generate bills, and process fund requisitions. Data is stored locally on desktops, and junior engineers actively use it, streamlining documentation and billing while improving efficiency and transparency in project execution. PHED West Bengal is the first department in the State to have e-MB. Currently, only the desktop web version of the application is available, but efforts are underway to build a mobile interface as well.

The application is mainly used by junior engineers, and they are very excited about this initiative. It has significantly improved their efficiency; earlier, it used to take **two to three days** to complete the bill, which now takes only a fraction of a second.

- PHED uses **e-MB** for bill management and fund requisition.
- Integration exists between **DPR, finance, and scheme tracking**.
- Payment to pump operators and facilitators is linked to their tasks (e.g., **₹150** per water sample collected).



Mega Scheme and Physical Progress Apps

The **Mega Scheme** and **Physical Progress Apps** are essential tools used by PHED, West Bengal, to track the physical execution and progress of various water supply schemes under the Jal Jeevan Mission. State-specific scheme codes (which are non-aligned with central numbering) require manual one-to-one mapping during DPR submissions, causing version control challenges.

These applications are designed as mobile-first dashboards that enable department officials and field engineers to record real-time updates on infrastructure development, such as **pipeline installations, construction of overhead tanks, and other civil works**. These apps provide visual insights into project status, timelines, and milestones, helping higher authorities monitor overall implementation progress.

However, one of the primary limitations is that these apps function separately from key household-level tools like **Jal Mitra and Jal Swapna**. As a result, there is duplication in data entry and disjointed reporting that make it difficult to get a consolidated view of end-to-end service delivery.

Moreover, these apps do not currently leverage IoT or sensor-based technologies that could automate verification of field activities and improve accuracy. For instance, photo uploads and manual status entries are used instead of automated timestamps or sensor inputs.


Despite their value in capturing progress data, integrating these applications with other core systems and enhancing them with automation and real-time tracking capabilities would significantly elevate PHED's ability to manage large-scale projects more efficiently and transparently under a DPI framework.

State Functionaries



Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for State Functionaries.

 <p>INTER DEPARTMENTAL DATA EXCHANGE</p>	<p>There is interfacing with the WB Electricity Board, where electric meter readings with latitude and longitude are collected at the site, entered into a central database and shared with PHED. With this data, PHED analyses various dimensions such as the existence of wasted electric connections causing unnecessary expenditure and outlier sites in electricity consumption. This helps in isolating problems with pump motors.</p> <p>The Jal Swapna app integrates with the SBM-G database to fetch family IDs at the time of onboarding new consumers.</p> <p>There is integration with the Aadhaar platform for verifying and fetching consumer details at the time of issuing new connections.</p> <p>PM Gati Shakti compliance is under planning through the Asset Management app, with integration of historical DPRs. It is still in its early stages and is currently isolated to spatial validation only.</p> <p>Grievances are logged at the CMO grievance desk and also through CPGRAMS, but at the PHED end, these grievances are received only via email.</p>
<p>JOINT PLANNING & APPROVAL WORKFLOWS</p>	<p>Not assessed; information not available at present.</p>
<p>GRIEVANCE & FEEDBACK LOOP INTEGRATION</p>	<p>Not assessed; information not available at present.</p>
<p>JOINT TRAINING & KNOWLEDGE SHARING PLATFORM INTEGRATION</p>	<p>Not assessed; information not available at present.</p>
<p>CROSS-SECTORAL POLICY ALIGNMENT</p>	<p>Not assessed; information not available at present.</p>
<p>CROSS-SECTOR ANALYTICS & DASHBOARDS</p>	<p>Not assessed; information not available at present.</p>
<p>EMERGENCY RESPONSE & DISASTER MANAGEMENT INTEGRATION</p>	<p>Not assessed; information not available at present.</p>



Technology Foundation

Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for Technology Foundation.

UNIFIED / INTEGRATED PLATFORM APPROACH	<p>PHED, West Bengal employs a fragmented ecosystem of specialized applications rather than a unified platform. Real-time integration between apps is limited. However a project has been undertaken to build a data lake which will absorb data from multiple applications and provide a unified data bed for analytics and insights.</p>
MODERN TECHNOLOGY STACK & CLOUD NATIVE ARCHITECTURE	<p>Owing to multiple applications, there is a large set of technologies used; a majority of them are in the open source category, such as Java, Android, PHP, Laravel, MongoDB, JSP, Spring, MySQL, and PostgreSQL. At the database level, proprietary solutions like Oracle and MS-SQL are also used heavily.</p>
INTEROPERABILITY WITH CENTRE SYSTEMS	<p>There is minimal to no interoperability with the Centre's IMIS application. No API integration exists; 2 PostgreSQL some data is taken from APIs and manually entered into the systems. There is a huge gap between the Centre's and State's data taxonomy, which results in duplicate data entry. On WQMIS, data is pushed via API but it also requires manual validation. The department mentioned that the APIs of the Centre's WQMIS are very slow.</p>
API INTEGRATIONS WITH EXTERNAL APPLICATIONS	<p>There is no API integration with external applications.</p>
IDENTITY & ACCESS	<ul style="list-style-type: none"> • SSO via Google SAML • Two-factor authentication + CAPTCHA for all systems. • Role-based access: <ul style="list-style-type: none"> ◦ Junior engineers (e-MB) ◦ ISAs (Jal Mitra) ◦ Lab technicians (Water Quality Apps)
USE OF ARTIFICIAL INTELLIGENCE	<p>The department has recently started using AI technologies to build digital tools. The Jal Saathi chatbot is a WhatsApp based AI-enabled application which connects with the data lake at the backend and provides an interface to department staff by responding to day-to-day queries, increasing their efficiency. The department is also experimenting with OCR tools to extract and serve DPR content to engineers.</p>
SECURITY AND COMPLIANCE	<ul style="list-style-type: none"> • Two-tier physical security • Next-generation firewall is being used • Intrusion Prevention System (IPS) is deployed • Zero-day attack mitigation is present • Login from new machine is detected automatically and accordingly extra security steps are mandated for additional security. • Captcha is auto-enabled • Two-Factor authentication



Infrastructure

Capability Matrix

Below table outlines the mapping of a Capability from DMM to the West Bengal IT systems for Infrastructure.

<p>HOSTING INFRASTRUCTURE</p>	<p>The department has its own data centre located within its premises. The department felt that there were too many restrictions and regulations associated with State Data Centre or NIC hosting. The level of confidence in public cloud service providers is low owing to frequent cyber attacks. The department does not want to compromise on security, therefore, it chose to maintain its own data centre. There is greater liberty with their own data centre. Google Accounts are taken from the India Data Centre for emails.</p>
 <p>STORAGE AND DATABASES</p>	<p>Since there are multiple IT applications, there is a variety of databases used, the primary one being Oracle.</p> <p>Managed MySQL (Digital Ocean) is used for structured transactional data, with automated backups.</p> <p>PostgreSQL with PostGIS is used for geospatial data storage.</p> <p>Redis is used for caching and session storage.</p> <p>Object storage with versioning is used for document management.</p> <p>The volume of data is high. Approximately ~2GB data is added to various data stores daily. There are two SAN disks, one for primary operations and another secondary disk for de-duplication.</p>
<p>HIGH AVAILABILITY & DISASTER RECOVERY</p>	<p>At present there is no disaster recovery (DR) site commissioned. The DR site was planned four to five years back. A huge disruption due to a cyclone damaged the DR site. Planning is underway to set-up another DR site in Bangalore.</p>
<p>MONITORING & OBSERVABILITY</p>	<p>Monitoring and observability tools are in place to track system performance and service health.</p>
<p>SCALABILITY (HORIZONTAL & VERTICAL)</p>	<p>Scalability is currently vertical due to the monolithic architecture, but performance is enhanced through advanced indexing, optimized queries, and potential sharding for future growth. Horizontal scaling is constrained because of the monolithic architecture.</p>
<p>BACKUP AND RECOVERY MANAGEMENT</p>	<p>Backup strategies include daily and weekly automated database backups, Redis snapshotting, and version-controlled document recovery, ensuring data integrity and disaster recovery readiness.</p>
<p>NETWORKING AND CONNECTIVITY</p>	<p>There are two internet lines—STPI (50 Mbps) & BSNL (75 Mbps)—at the data centre. Connectivity is quite consistent at field locations in terms of IoT devices; real-time data flow is working well.</p>



Figure 24: On Premise Data Centre Photos



Conclusion

West Bengal's implementation of the Jal Jeevan Mission has demonstrated a strong commitment to leveraging digital tools for rural water supply management. With applications like Jal Swapna, Jal Mitra, and the Water Quality app, the Public Health Engineering Department (PHED) has created a mobile-first ecosystem that addresses core service delivery functions such as household onboarding, FHTC functionality verification, and water quality monitoring. The department's internal innovation—evident in solutions like the Jal Saathi WhatsApp chatbot and upcoming initiatives like IEP/AIRP Plant apps, Pump Operator app, and Asset Management app—underscores its forward-looking approach. These tools form a foundational digital infrastructure that positions the state well for future DPI (Digital Public Infrastructure) integration.

However, despite this progress, the ecosystem faces critical challenges due to operational silos, manual workflows, and a lack of system-wide integration. Apps currently function independently, leading to duplicate data entry, fragmented reporting, and limited interoperability. Essential modules like grievance redressal remain informal and unstructured, with no ticketing or feedback loop. Technical limitations such as vendor lock-in for the Water Quality App and the absence of internal validation for Jal Mitra data introduce concerns around data accuracy and governance. Additionally, the absence of IoT integration or automation in most field tools restricts real-time performance monitoring, especially for infrastructure-heavy components such as pumps and treatment plants.

To transform into a truly citizen-centric and resilient water service model, PHED, West Bengal must now focus on building a cohesive digital ecosystem—anchored in shared registries, API-based data exchange, and real-time dashboards. This will require formalizing grievance systems, enabling cross-module data validation, automating asset and functionality monitoring, and ensuring full departmental ownership of software assets. With its strong institutional readiness, in-house IT talent, and evident appetite for innovation, West Bengal is well-positioned to lead by example in scaling up Digital Public Infrastructure within the Jal Jeevan Mission framework.

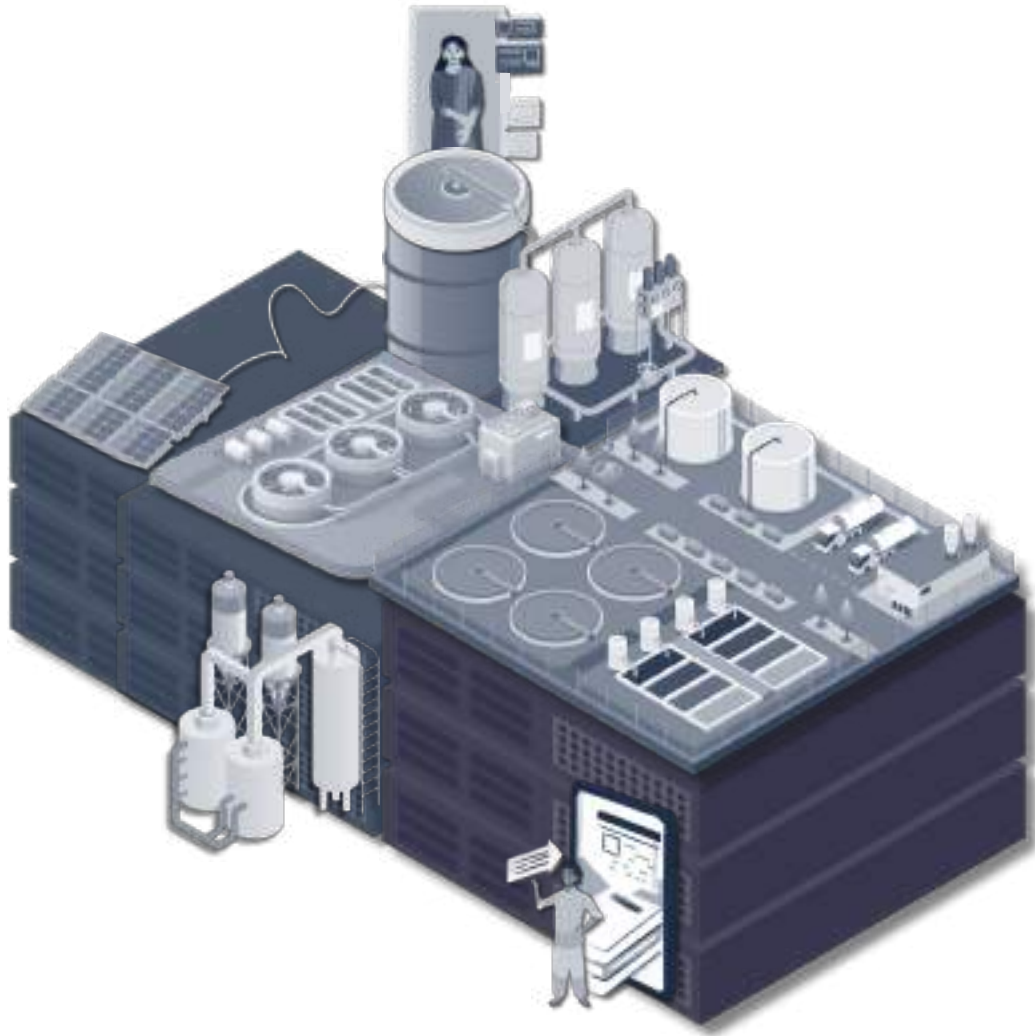
References

[1] Presentation given by Unicef in “All State Workshop on Digital Initiatives” held in New Delhi on 11th July 2025

[2] Report on IoT Implementation and PWMS Dashboard under Jal Jeevan Mission – West Bengal Submitted by: Electro Plaza Projects Pvt. Ltd. (EPP)

[3] <https://jjm.wbphed.gov.in/dashboard/home>

[4] Public Health Engineering Department, Government of West Bengal, available at <https://wbphed.gov.in/en/home>



Arghyam

599, 12th Main Road, HAL II Stage, Indiranagar, Bengaluru - 560068.

info@arghyam.org

080 4169 8941

www.arghyam.org