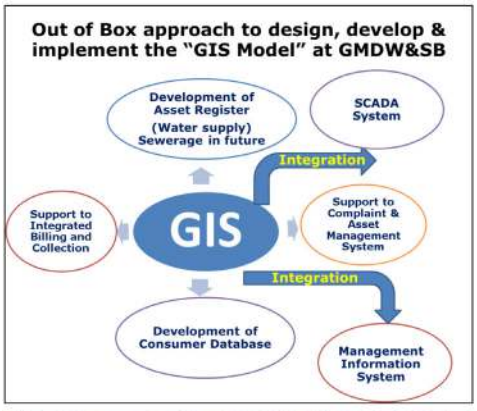
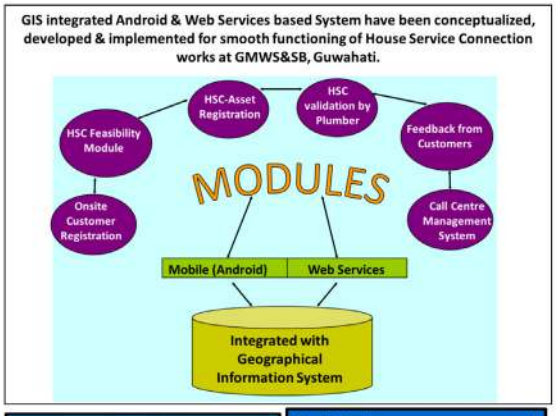
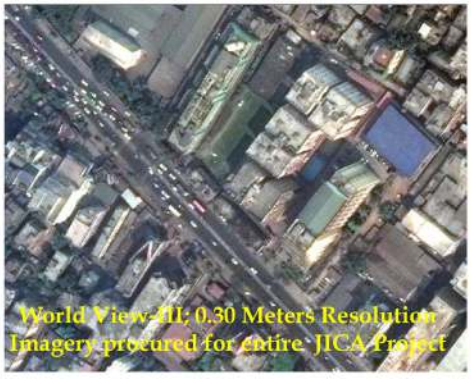
Treated Water Supply Management in Urban Areas

By xxxxxxxxxxxxxxxxxxxxxx







A case study on how the city of Agra improved its water network

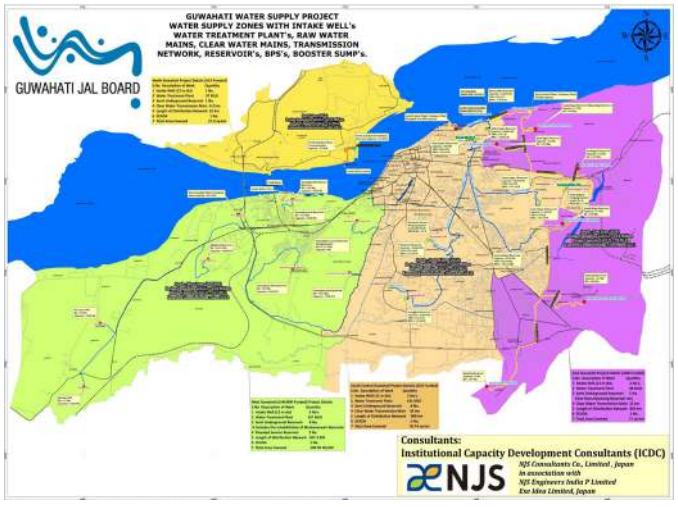
The Rs 34-billion Agra Water Supply Project delivers an adequate supply of treated water 24/7 to Agra. Undertaken by NJS Engineers for Uttar Pradesh Jal Nigam, the project included construction of a 144 million-litre-per-day water treatment plant, sedimentation tank, and a 130-km transmission pipeline. Rehabilitation and repair of two water treatment plants, overhead tanks, clear water reservoirs and distribution networks were also undertaken.

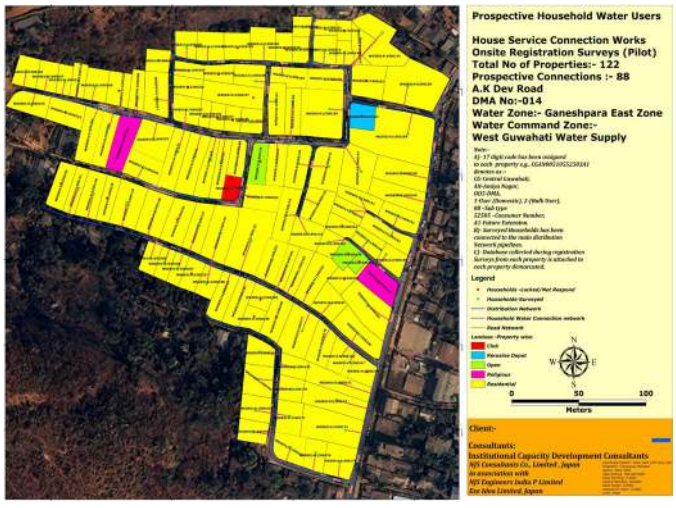
Project

U.P. Jal Nigam, a government corporation that is responsible for supplying water throughout the state of Uttar Pradesh, India, initiated an improvement project to meet the increasing potable water demands and service levels of Agra city. The distribution pipe network was old and supplied intermittent water service.

The distribution network installation, leakage prevention, and rehabilitation were challenging due to high volume of non-revenue water. The network was evaluated to determine solutions that would enable 24/7 delivery of treated water to the growing city populace. A GIS-based spatial database of assets was developed, and WaterGEMS was used to create a hydraulic model for existing, intermediate, and future water supply zones. Through this, the agency prepared the GIS-based asset database, project area database and land acquisition database to develop water network hydraulic models.

The INR 30 billion project included constructing a new water treatment plant, a sedimentation basin, transmission conduit pipes and feeder mains, and repairing two existing water treatment plants and filtration and purification systems. These applications were essential in planning system rehabilitation, improvement and expansion as well as establishing efficient operational strategies and reducing non-revenue water.





Solution

The project team modeled the current distribution system and analyzed it under four different scenarios using OpenFlows WaterGEMS, providing the foundation for the hydraulic improvement and rehabilitation scheme. With integrated modeling and engineering applications the team developed an existing water asset database, performed design reviews, and conducted structural analysis in a collaborative environment, streamlining workflows and processes throughout the project lifecycle.

The model was used to evaluate network flow, capacity, and pressure; plan system rehabilitation, improvement, and expansion; monitor non-revenue water; and develop efficient operational strategies.

Outcome

An interoperable software shortened design review time, reduced drawing production by 35%, and saved INR 300 million on the project. This project positively impacted the community by providing automated water connections to 100% of all households the network serves as well as a 24/7 continuous water supply. This new system helps Agra regain its position as one of the best infrastructure cities in the world enabled by smart technology.

Software

The structural engineering of the water distribution network was designed and reviewed using STAAD.Pro and a GIS database was prepared with Open Cities Map. The organization also used software to create a water-based asset database that included intake wells, treatment plants, boosting pumping stations, transmission mains, and the distribution network.

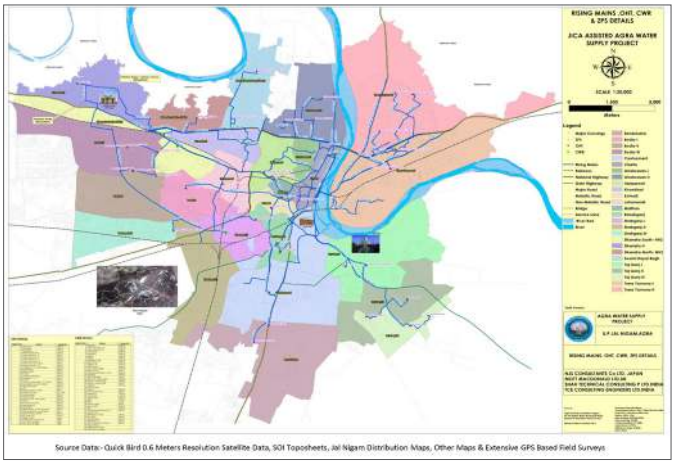
The hydraulic model built with WaterGEMS provided a complete representation of the city of Agra's water distribution system, including all of the pipelines, pump stations, tanks, and control valves. The model was used to determine which pipes to replace, how to setup control valves, and where to draw boundaries for pressure zones and district meter areas. Without the model, a manual approach to alternatives would have been random, untested, and inefficient.

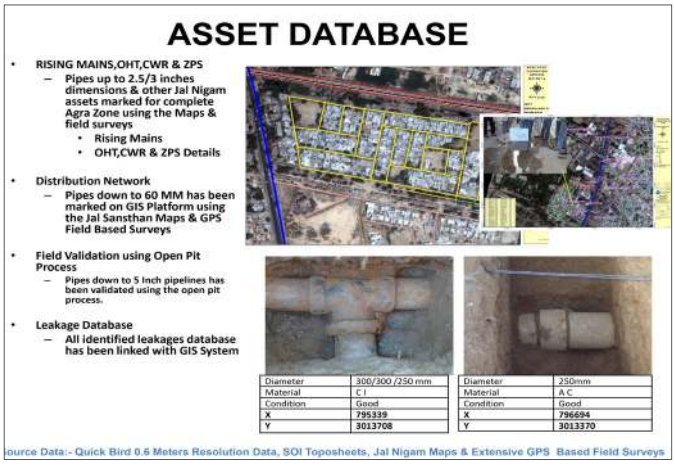
Outcome/Facts

- The Agra Water Supply Project included a public awareness campaign about saving water and improving the environment, and it will help develop adjacent cities in northern India.
- 100% of all households in Agra received automated water connection with meter installation.
- Employing Bentley technology improved productivity, design efficiency, and deliverables quality, and it reduced resource-hour costs and the overall project schedule.

A case study of Guwahati's hydraulic modeling to execute water supply

The water system for Guwahati, the largest city in the northeastern region of India, was originally built to harness the Brahmaputra





River with a gravity-based distribution system. Unregulated development led to water supply problems, as well as high water pressure in 60% of the system. To improve water distribution and the quality of life for residents, NJS Engineers India was tasked with constructing or upgrading water infrastructure throughout the city, including 36 kilometers of transmission mains, 1,155 kilometers of distribution pipes, 1.42 million service connections, a treatment plant, pumping stations and other infrastructure. Due to the size of the project, NJS needed to combine design, construction management and hydraulic models into a single platform.

Solution

NJS used BIM methodology and hydraulic modeling to design, organize, and execute the water supply project. The organization developed an online portal that integrated with a connected data environment, to help design teams collaborate and manage engineering data as well as 3D images of water infrastructure.

Within this portal, hundreds of designers from various disciplines collaborated on designs, determined which water zones needed to be reworked, iterated designs of new structures, and detected and resolved clashes. Working within 3D models, NJS developed construction, maintenance and environmental protection plans for the full lifecycle of the project.

Outcome

By using hydraulic models to determine where pressure-reducing valves or break pressure tanks were needed, the agency successfully reduced high pressure throughout the water system. Analyzing the existing water system allowed design teams to determine the condition of critical pipe segments, remediate any issues, and create proactive maintenance plans. Sharing data among teams and planning construction schedules during the design phase saved 175 resource days and reduced the overall cost of the project by 6%. The 3D model database created for the project can be used for proposed sewer work and the development of a digital city platform.

Software

ProjectWise provided an open, connected data environment to facilitate collaboration among designers in multiple locations and manage customer needs and feedback during construction. OpenFlows WaterGEMS allowed designers to produce hydraulic models, which helped determine the areas that were prone to high water pressure and where pressure-reducing valves were needed in major pipelines. OpenFlows WaterGEMS and OpenCities Map were integrated together to determine which specific customers needed pressure-reducing valves installed at the point of delivery, while OpenFlows HAMMER helped define operations and maintenance plans. STAAD assisted NJS with the design and review of structural engineering work for structures such as the water treatment plant.

Outcome/Facts

- The water infrastructure for Guwahati, the largest city in northeastern India, suffered from water supply problems, as well as high water pressure in 60% of the system.
- By using hydraulic models to determine where pressure-reducing valves were most needed, NJS successfully reduced high pressure in problem areas.
- Sharing data among teams and planning construction schedules during the design phase saved 175 resource days and reduced the overall cost of the project by 6%.
- The project's 3D visualization database can be used for proposed sewer work and the development of a digital city platform

About the Authors

Mr Rohit Dembi is result-oriented professional having more than 21 years of professional experience in application of Digital Engineering in Civil Engineering domain, specifically in Water, Wastewater & Urban Development Projects in India & South East Asia. He is Head – Digital Engineering Services at NJS Engineers India Pvt. Limited. He brings strong leadership and technical expertise in Digital Engineering, Project Engineering/ Management and GIS Based Asset Management that aligns to international best practices in environmental infrastructure sector. He has successfully deployed multi-million value projects externally funded by JICA, ADB, World Bank, GTZ, etc., that includes tasks like digital engineering planning & its Implementation with hydraulic designs, Construction review, monitor & control during designing, construction and operation and maintenance phases.