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Research Paper

Application of digital engineering in water and wastewater domain

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Abstract**—***it is claimed that Water & Wastewater engineers spend two thirds of their time validating basic data like pipeline & other assets with equipment information. It is estimated that over 80 percent of maintenance is done reactively and that more than half of construction projects are over budget. This sounds like an enormous drain on efficiency, but luckily there seems to be a relatively easy solution using the latest digital engineering like asset mapping developed during designing and finally validating during construction phases. Further conceptualizing the GIS based asset management system framework to be used during operation and maintenance phase.*

Key Words: *GIS, MIS, Asset Management System, Asset Management Policy, Plan & Strategy*

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I. INTRODUCTION

Asset Registry on uniform GIS platform is a scalable database, designed to bring together data from numerous devices and systems into a single, intuitive database. GIS based Asset Registry can help O&M engineers to visualize & analyze the assets on a system. Once the assets are connected to the real-time system using the internet of things, these can be monitored via the web, app, and other remote devices and systems. Localizing data in one place, adding real-time feeds and making information visual can help O&M Department do their work better, and organizations cut operational and energy costs that today are seen as unavoidable. **[5]**

GIS Based Asset management System involves achieving the least cost and least risk of owning and operating assets over their life cycle while meeting service standards for customers. Consequently, utility managers need to put in place policies, plans, and strategies. They must also develop and implement a suite of processes that cover asset acquisition, operation, maintenance, overhaul, and disposal. **[4]**

II. OBJECTIVE

The objectives of the research is

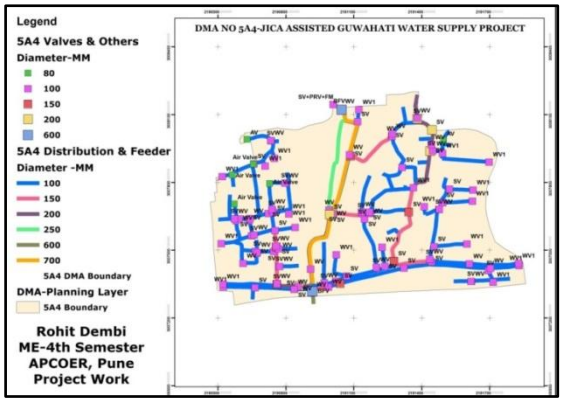
- Design & develop the asset registry on uniform GIS platform for brand new waterworks facilities at Guwahati Water Supply Project during designing and construction phases. (Specific 1 no. DMA). Pipeline network & appurtenances data with relevant attributes will be captured during construction phase on the pilot mode
- Conceptualize the GIS based Asset Management System Framework for water utilities
- Conceptualize the set-up for typical GIS based Asset Management System for water utilities

III. BACKGROUND

In order to provide affordable, reliable, safe, pressurized and continuous (24x7) supply of water to this fast developing Guwahati Metropolitan area, the Government of Assam has taken up three major water supply projects, with the funding from Government of India (JNNURM) for the South West region, Japan International Cooperation Agency (JICA) for the North and South Central regions and Asian Development Bank (ADB) for the South East region of Guwahati, at a total cost of about 2,166 Crores. The four regions of Guwahati Metropolitan Area will have independent water supply systems with individual intake arrangements from the River Brahmaputra. All the projects have been designed for 24X7 supply of water. **[1]**

This research project is part of "JICA Assisted Guwahati Water Supply Project" to design and develop the GIS based Asset Registry and Conceptualize the GIS based Asset Management System Framework within Guwahati Water Supply Project.

Further, it might help the (GMDW&SB) Planning and O/M teams during the implementation of house service connection implementation, billing & metering and operation & maintenance activities. The asset data that includes network, valves, washouts, flow meters etc., with all designing and construction details with relevant photographs will be uploaded on Web- GIS System to access collectively the spatial & non spatial data and conduct the analysis by GMDW&SBs planning, billing and o/m Engineers.



IV. PROBLEM STATEMENT

The actual service delivery of existing water supply at Guwahati is sub-optimal. The current service level in this sector suffers from serious deficiencies which have been being addressed below: **[1]**

- Inadequate coverage of network,
- Old network with full or partial leaks,
- Under-utilized treatment capacity,
- Interconnection of existing water lines with sewer & storm water drains
- Lack of infrastructure and operational records.
- Lack of performance orientation, and inadequate use of innovative and latest Digital Engineering System

V. NEED OF THE STUDY

This research paper describes the application of "latest Digital Engineering technologies that includes the Asset Mapping & Conceptualize the Asset Management System". It describes the major characteristics of Digital technologies, as well as water management system and the reasons for the application of GIS based Asset Registry & implementation of Asset Management System. It can be developed during planning, designing and construction phases, but used extensively during operation & maintenance phase to overcome the future water scarcity reducing the resource optimization.

VI. METHODOLOGY & APPROACH

GIS based Asset Registry of new water assets during designing and construction phases will help in development of accurate data with detailed attributes. The attributes includes the diameter, material, design parameters, hydraulics, date of construction, hydro-test & flushing details, RFI details, asset id etc. Also, it might include the asset, warranty & financial details for all critical assets.

Asset management shall involve achieving the least cost and least risk of owning and operating assets over their life cycle while meeting service standards for customers. **[4]**

Asset management implementation means applying tools that help make these processes effective, such as setting service levels, computing life-cycle asset costs, maintaining an asset register, monitoring asset condition and performance, and carrying out risk analysis of possible asset failure. Asset management for water utilities is more complex than for most other sectors because of the number, variety, age, condition, and location of assets; the magnitude of asset investment; and the difficulty of inspecting and maintaining buried assets. This complexity is often compounded by lack of finance, information, and skills that can impede acquiring, commissioning, maintaining, overhauling, and replacing assets at the optimum time.**[6]**&**[8]**

VII. NOVELTY IN THE TASK OF THE RESEARCH

A. ENHANCE ASSET MANAGEMENT WITH SPATIAL INTELLIGENCE.

GIS based Asset Management System integrated with SCADA & real time units enables a holistic approach with fresh insights about performance, risks, resources, and costs. Since assets are spatial, their exchange of influence is not only reciprocal but also determined by their criticality and location**. [10]**

B. OPERATIONAL INTELLIGENCE

Successful operations management for water utilities shall optimizes resources to increase productivity and reduce lost time. Implementation of GIS based Asset Registry and Asset Management System integrated with SCADA Systems (local & central) can transform operations with easy-to-use data/system at any Water Supply or Management Board that improve collaboration, coordination, and decision-making and offer real-time operational views to office and field staff. **[10]**

C. HELPING CUSTOMERS HELP THEMSELVES

Empowering customers to access the information they want, when they want it, increases customer satisfaction. Fast new house service connections, information on site feasibility, and outage restoration are on the top of customers' & Departmental minds. Location-based data plays an integral role in providing this information in a timely and efficient manner. **[10]**

VIII. BENEFITS & OUTCOME ENVISIONED

No	Enhancement	Benefits	Expected Outcome
1	Surveys & GIS Mapping	Maximize accuracy and availability of data using modern technology Minimize human errors in survey & high-quality map preparation.	Final output in quick, accurate and reliable digital form displayed & utilized on the Corporation's or Board's GIS Platform for easy visualization, retrieval, analysis & reporting.**[5]**
2	Asset Management Policy, Strategy & Plans	Engaging the staff at all levels for top-down cascading of key objectives and initiatives and directing the working level staff to work objectively in a systematic & sustainable manner.	Providing an opportunity for staff at all levels to work effectively and contribute towards achieving the strategic objectives throughout the life of assets (Reduced Capex/Opex, extending life, improve the operational efficiency and effectiveness of the assets)**[2]&[4]**
3	Software tools integrated with enterprise systems	Reduce delivery time and improve quality	Reduce O&M cost while improving operational efficiency through GIS-based AMS integrated with Corporations' or Board's existing systems. **[2]**
4	Create Model of all major facilities and update these on periodic basis	Leverage modern technology platforms such as digital twins & use related asset information for better Asset Life Cycle Management	Reliable asset tracking, monitoring and improved operational efficiency. **[9]**
5	Capacity Development through Trainings & Workshops	Systematic enforcement of the mission critical functional aspects to key personnel	Corporation or Board Sewerage Department will develops vision of ownership and sustainability after these trainings. **[6]**

No	Enhancement	Benefits	Expected Outcome
6	MIS reporting with key information on custom dashboards	Monitor & Control corporate & operational risk to meet customer's demands & service levels through realistic performance targets/ KPIs	Enhanced efficiency and collaboration with lot of transparency both internally & across departments on real-time basis. **[10]**

IX. FUTURE TECHNOLOGIES

Implementation of Automated Digital Twinswill be the core to manage the water & wastewater planning, construction, analysis and Operation & Maintenance activities. **[3]**

The analytical part of digital twins in water sector will be more accurate with integration of trending technologies i.e., artificial intelligence, hyper automation, robotics, and predictive analysis. **[10]**

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X. CONCLUSION

This research found that the best water utilities take three additional and clear actions.

- They invest in demonstrable leadership of the change initiative. Effective asset management is enabled by the active support of the most senior executives, and is in turn supported by a detailed bottom-up commitment to specific, targeted improvement initiatives.
- They regard asset management as an integrated whole and create initiatives that lead to improvement as part of a cohesive plan. Working in silos is avoided.
- They appreciate that building a strong asset management capability takes years—they see it as a journey, and no matter what other issues they confront, they stay focused on the core asset management improvement tasks.**[9]**

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REFERENCES

[1] JICA Assisted Guwahati Water & Sewerage Project, Guwahati
https://gmda.assam.gov.in/portlets/water-supply-projects-0
https://www.guwahatiplus.com/assam/zoo-road-water-supply-scheme-on-death-bed

[2] JICA Assisted Abatement of Pollution in River MulaMutha
https://www.pmc.gov.in/en/jica-project
https://nrcd.nic.in/writereaddata/FileUpload/86701329ongoing%20works.pdf

[3] JICA Assisted Ganga Action Plan-II Project, Varanasi
https://www.bentley.com/es/project-profiles/2019/njs-engineers_jica-assisted-water

[4] Water utility asset management: A guide for development practitioners.
https://www.adb.org/documents/water-utility

[5] A Practical Guide to GIS in Asset Management
https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/whitepapers/pdfs/a-practical-guide-to-gis-in-asset-management.pdf

[6] ADB Piloted GIS-based Asset Management System in Georgia – a "Mission Control Center" for Georgia's Major Public WSS Utility
https://www.adb.org/sites/default/files/project-document/177769/43531-012-dpta-01.pdf

[7] Asset Management: Integrating GIS as a Decision Support Tool in Meter Management in National Water and Sewerage Corporation
https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8895582&fileOId=8895583

[8] CPHEEO, New Delhi
http://cpheeo.gov.in/upload/uploadfiles/files/systems_chapter8.pdf

[9] How GIS helps Utilities streamlined Asset Management
https://www.tighebond.com/how-gis-helps-utilities-streamline-asset-management/

[10] ESRI INC.,
https://www.esri.com/en-us/industries/water-utilities/overview

[11] Map Reference
Map showing different zones of Guwahati Water Supply Project and DMA Map (5A4) displayed in this paper has beendeveloped by author for the "Research" purpose.