

# COMPUTERIZED MAPPING, GIS DEVELOPMENT AND UTILITIES COMPUTERIZATION FOR BANGALORE WATER SUPPLY & SEWERAGE BOARD (BWSSB), BANGALORE, INDIA

<b>Implementing agency:</b>	Bangalore Water and sewerage board
<b>Place:</b>	Bangalore India
<b>Scope of work :</b>	Implementation of a complete GIS/MIS solution for water & sewerage management,
<b>Name of the Project</b>	Bangalore Information System on Networks
<b>Date :</b>	1999 - 2002

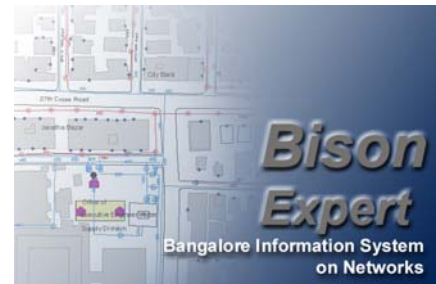
## BACKGROUND & OBJECTIVES

The Bangalore water supply and sewerage systems have grown enormously during the last 4 decades. In order to handle such a large system with large volumes of geographically related information, it was imperative to develop and give decision makers a powerful management and decision making tool.

The aim of the BWSSB GIS project consisted of setting up a Geographical Information System for Water Supply and Sewerage Systems using geographical and numerical data.

The key business objectives driving the need for a corporate GIS were as follows:

- to provide interactive access to up-to-date network and geographical information for Operations and Maintenance purposes;
- to provide a planning tool to enable the acquisition of new & replaced main;
- to provide accurate and comprehensive network information for monitoring, reporting, decision making and data consolidation;
- to allow the integration of geographical information from different sources and scales, both internal and external;
- to provide a widely available asset management system,
- to set up a pilot repository spatial dataset for the BWSSB.



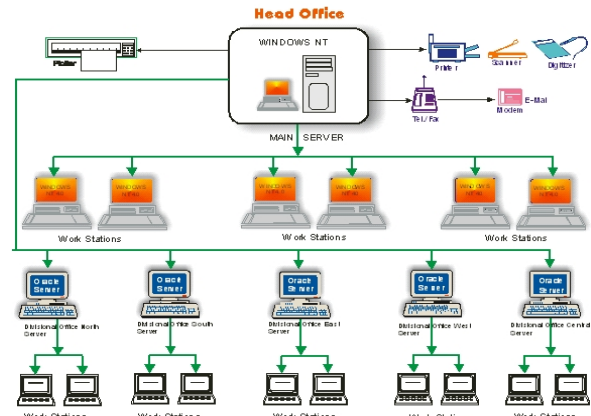
## SCOPE OF WORK

The scope of work was defined after a comprehensive User Needs Assessment, conducted by the Consultant during the first stage of the project implementation:

- Provide high-end equipment and computers to BWSSB Head Office and its Operational Divisions

- **Supply and Installation of Computers**, Networking Products and Peripherals for BWSSB head office and divisional offices

- Windows NT Server, Windows NT Workstations
    - Oracle 8i Server and Clients, Oracle Developer 2000
    - Spatial Database Engine (ArcSDE)
    - Microsoft Exchange Server
    - Visual Basic Pro 6.0, Visual C++ 6.0
    - Firewall CA Le Guardit
    - Map Objects Lite

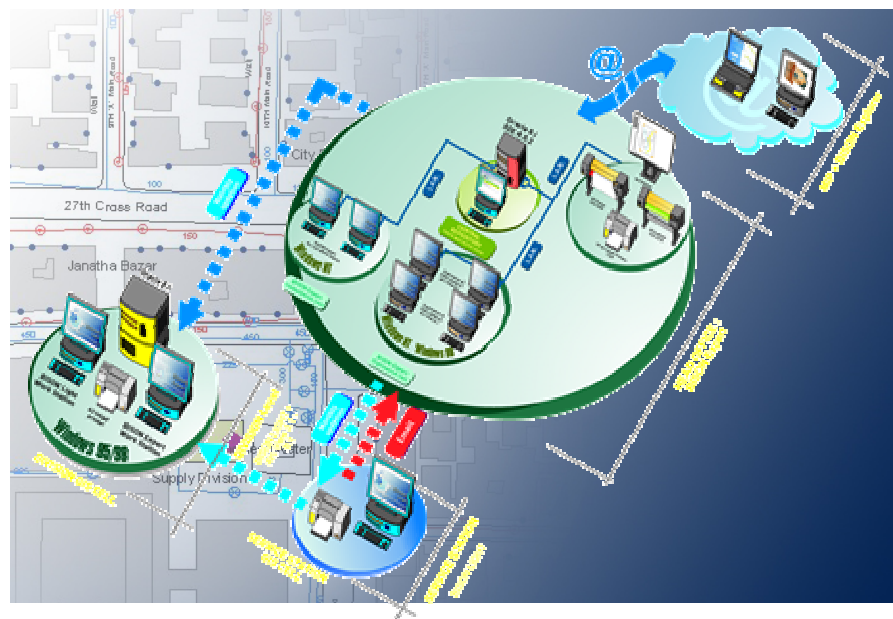


*Functional Architecture of Hardware & Software supplied*

- **Software** provided for Database and other Application Development

- ArcInfo Products: ArcInfo, ArcFM, ArcView, ArcEdit, ArcCOGO, ArcNetwork, ArcSCAN, ArcEXPLORER, ArcPRESS,
    - AutoCAD

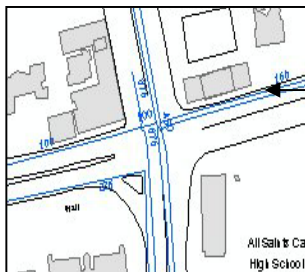
- Provide Services for Database and GIS design and development, field surveys for spatial and alphanumeric data collection & integration
- Capacity Building: Transfer of Technology, User Training



## KEY ASPECTS OF THE PROJECT

The key aspects of the project lie in the following elements:

- Data collection challenges:
  - 98% of data had to be collected on the field directly by the consultant in close collaboration with BWSSB for the 290 Sq.km representing the BWSSB jurisdiction,
  - In less than one year, the Consultant had to collect all the information, both graphical & alphanumerical concerning the BWSSB assets, the consumers, the BWSSB employees, etc. representing a tremendous challenge in a surface area twice the size as Paris.
  - Strong, efficient and relevant methods were thus implemented to fulfil the client's expectation in a very tight time frame and to ensure the delivery of an international data quality standard.



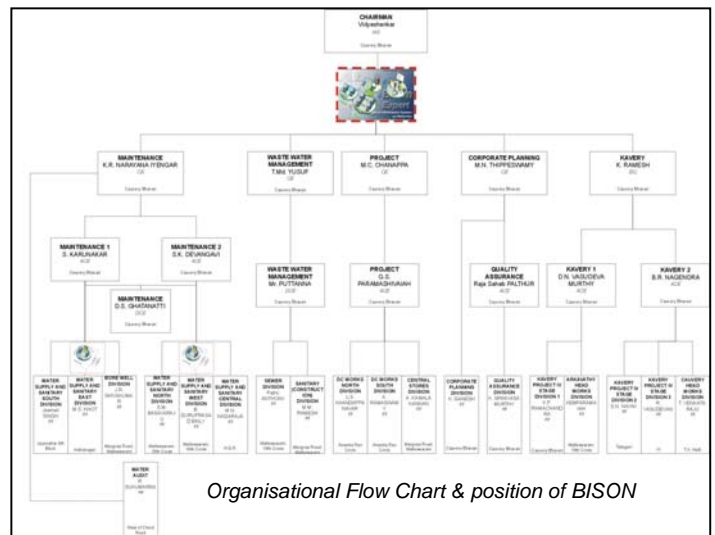
Water Pipeline Data collections in close collaboration with BWSSB field Staff



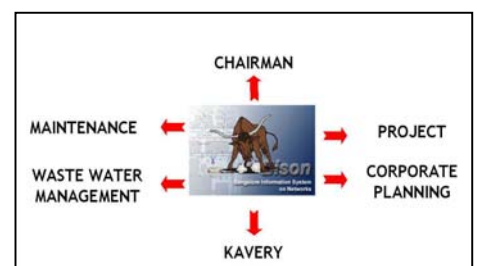
Excavation to verify the material used and measure the depth of the Manhole



- The organizational issues:
  - Among the 2886 employees, only 8% are engineers and their average age is between 45 and 50 with a strong segregation of functions. The departments communicate little and the BWSSB core dataset that should have constituted the repository didn't exist.
  - Moreover, the general attitude of people towards IT was reserved and one of suspicion. The fear of modifying ancient methods of working was quite prevalent.
  - Our project has managed to develop a positive attitude towards IT within the organization, by promoting decentralized approach, accountability and extremely user friendly tools
  - Furthermore, the GIS dissemination in 60 different and remote locations has established confidence. Today the system has around 400 daily users.



The large magnitude of users:



A Multi-User Corporate GIS oriented accessible in 60 different locations

- Key decisions Makers: Chairman and the 5 Chiefs engineers
- 5 Departments (Maintenance, Project, Corporate planning, Cauvery etc.)
- 6 divisions, 55 Service Stations.

● The development of a total GIS Solution:

- **Bison Expert** This is the repository whose updation depends on the maintenance of the data since the repository is by definition the data sharing tool which benefits all users.

- **BISON Light** is looked at as a combination of three tools in a user-friendly environment that doesn't require strong computer knowledge, but at the same time offers a wide range of capabilities.

- **BISON Visio** allows the user to display and to query all the different water supply and sewerage layers in a smooth and easy way. It will offer consultation of interactive maps dealing with SS concerns, and provide hard & soft copies of maps in all kinds of scale.

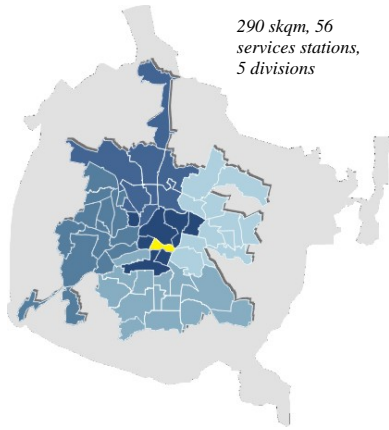
- **BISON Editor** constitutes the core tool for the updation process. It deals with point data at the Service Station level: consumers, complaints & repairs, water quality.

- **Management Indicator Panel (MIP):** This product was defined in order to provide a document that will give the key persons at the decision making level information at a glance of the entire assets of the BWSSB through a series of maps and important indicators. Its main targets are the Chief Engineers and the Chairman.



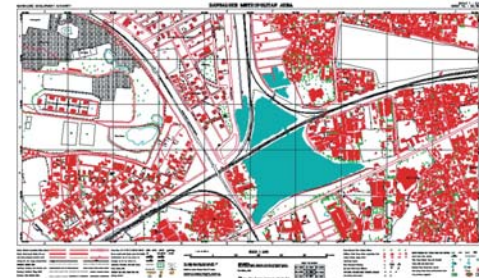
Customised Tools providing a comprehensive GIS solution for the BWSSB

## SERVICES RENDERED & METHODOLOGY



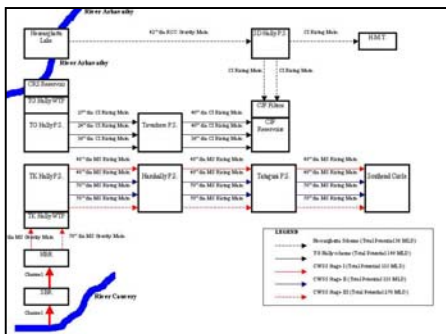
(NRSA), Hyderabad in 1:2000 scale.

- Area covered
  - A 290 Sq. Kms pilot area, covering the whole BWSSB jurisdictions area to implement the GIS system.
- Base Maps
  - The digital vector data and maps based on aerial photography for the pilot area were provided by National Remote Sensing Agency



1:2 000 scale NRSA maps delivered by NRSA

- Phase 2 - Equipment procurement and installation -
  - Hardware, software supplied and installed in three shipments



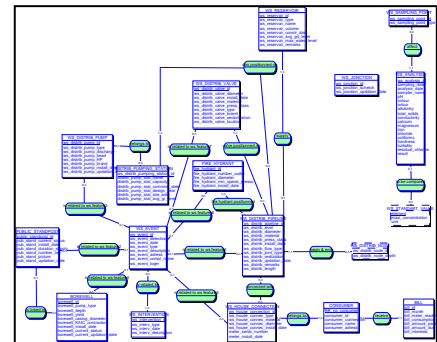
Water Distribution Scheme

- Phase 5 - Detailed water supply and sewerage systems analysis -
  - Compilation and synthesis of available information
  - Identification of information gaps
  - Acquisition of the basic knowledge to conduct the UNA
  - Study of BWSSB organization
  - Detailed description of procedures followed by BWSSB
  - Preliminary stage for GIS and Database design

- Phase 6 - User needs assessment -
 

This crucial step was undertaken to ascertain the requirements of BWSSB. The main objectives were:

  - To assess what BWSSB expects from the GIS
  - To assess how BWSSB will utilise the GIS in order to design a GIS that supplements these expectations
  - To carry out a detailed analysis of BWSSB's needs
  - To inform BWSSB what their expectations really mean in terms of data collection, data integration, data updation, required equipment, staff availability and training on a long term basis
  - To select the needs that can be fulfilled within the current project, the needs that can be fulfilled during a project extension and the needs that can only be fulfilled later



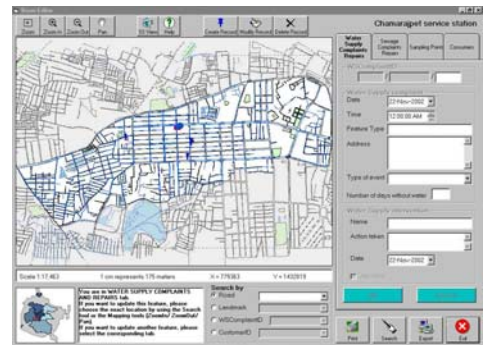
Conceptual data Model of BISON

- To arrive at a mutual consensus on the implementation of the selected user needs and to tailor a customised GIS
- Phase 7 - GIS Design and Phase 10 (Coding): implementation of the MERISE method-
  - Conceptual Data Model for definition and relations between all data required for the application
  - Conceptual Organisation and Process Model for elaboration of processes necessary to fulfill the selected needs
  - Logical Data Model for definition of logical links between tables designed in the Conceptual Data Model
  - Functional Architecture designs which sites have to be equipped according to the above organization and design
  - Physical Data Model, a collection of scripts building the entire structure of the Oracle database, that was designed according to the above requirements
  - Design of User Interfaces such as application menus, toolbars, popup and windows, as it will be seen by the users
  - Operational Process Model for details of procedures coded in phase 10 ("Development and testing of front-end application")



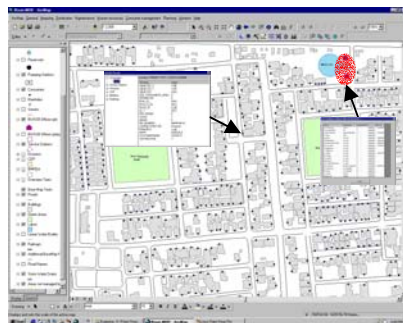
The Employee database along with the Billing system integration in the GIS improves the Bill collection and the transparency among the organization.

- Phase 8 - Graphical and Alphanumerical Data Collection -
  - 290 sq. kms spread over the five Divisions of BWSSB Maintenance Department
  - 55 Service Stations
  - Over 4000 kms of water pipelines
  - Over 3000 kms of sewage lines
  - Over 3.2 lakh consumer connections



Accessible from the 55 Service Stations, Bison Editor provide a powerful solution to track the complaints & repairs and to manage the water quality and the new consumer

- Phase 9 - Data Integration -
  - Data Entry of Alphanumerical Data using Excel sheets
  - Report of Graphical data collected on the field on reference base maps (A0 size – 1: 1200 scale)
  - Conversion of NRSA base maps into the ARC/INFO / ARCFM GIS
  - Digitisation of Graphical data
  - ARC/INFO conversion after Quality Control
  - Corrections and validation by BWSSB
  - Final Integration of Data after Topology Building



A comprehensive information collected all over the networks

- Phase 10 - Development and Testing of Front End Application -
  - Development of User Interfaces to fulfill BWSSB Needs and procedures of their Functioning
  - Coding in VB (Visual Basic) and VBA (Visual Basic for Applications) to implement the Application Modules for the Users

- Procedure Level as well as Global Testing to ensure strict Quality Controls



*Two months of training for 60 persons, extensively in the use of BISON and the benefit from the data standardization.*

- Phase 13 - Training of BWSSB Staff -
  - Identification and Selection of Trainees
  - On-the-job Training to BWSSB Service Station staff during Field Surveys
  - Categorized Training to various users according to proposed usage (updatation, viewing etc.)
  - Training to Decision Makers as well as the Operational Staff

## DURATION, STAFFING & BUDGET

- Duration of Project
  - 29 months: official project start was May 2000, end in November 2002
- Staffing:
  - 1 GIS Senior Expert as Team Leader with a Water management background,
  - 1 co-Team Leader, GIS and Database expert,
  - 1 GIS Design Engineer (expert),
  - 1 Hydraulic, Water Supply and Waste Water Expert,
  - 4 GIS developers (Control Data Collection - Data Integration - GIS Map Integration, ARCInfo, MAP Objects),
  - 1 Database manager + One Database expert (ORACLE + SDE),
  - 4 VB, VBA, Developers,
  - 4 digitizers,
  - 30 surveyors.
- Budget – the project finance under the Indo-French Protocol
  - Hardware & software : INR 1.5 Crores,
  - Services charges for GIS implementation & maintenance : INR 8.7 Crores

## BISON AT A GLANCE

- BISON is:
  - 477 446 Buildings,
  - 330 903 Consumer Connections,
  - 100 691 Manholes,
  - 13 970 Valves,
  - 3 000 Employees,
  - 4 008 Water Pipelines (Km),
  - 3 245 Sewage Lines (Km),
  - 315 Fire hydrants,
  - 195 NRSA A0 maps, covering 390 sqkm
  - 96 Reservoirs,
  - 72 Offices,
  - 29 pumping stations
- In term of hardware:
  - 6 Proserver Nt
  - 16 Workstation Winstation Ii Dual,
  - 1 A0 Size Scanner
  - 1 A0 size colour inkjet plotter,
  - 1 digitizer A0 table
  - 2 10 Channel Sub-Meter Gps