Corporate GIS: GIS Strategy

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1. Introduction

Geographic Information is at the heart of what eThekwini Municipality does. In recent years there have been significant changes and initiatives in Geographic Information Systems (GIS) technology which melds maps with data to see the world in a smart way. The biggest trends are centred on efficiency savings, making data more accessible and creating context to visualize this data.

GIS at eThekwini Municipality is in a decent state with room for improvement. A number of milestones in certain aspects have been reached. However technology is ever changing and we have to adapt. We need to put a strategy in place to enable us to plan; resource GIS in order to optimise its use across the municipality and to allow for improvement in our working procedures and in service delivery.

This strategy sets the priorities for the development and resourcing of GIS at eThekwini Municipality for the next five years (2018-2022). The overarching aims are to ensure the municipality gets value for money from the investment it has made in the current GIS infrastructure and to support the municipality's Integrated Development Plans (IDPs) and ICT Strategy.

2. What is Geographic Information?

Geographic Information is any information that contains a reference to a location, also known as 'spatial data'. Geographic information contains either an explicit geographic reference, such as a latitude and longitude or an implicit reference such as an address or road name (Esri, 1998). Research shows that 80% of local government data has a geographic component.

A GIS describes a large array of technology that is used to visualise, analyse and present geographic information. A GIS is used to overlay any number of data layers enabling the user to explore, determine and define relationships between these data layers (Hambleton Disrtict Council, 2016).

For example, address data can be overlaid with ward boundaries to distinguish which properties fall within a particular ward.

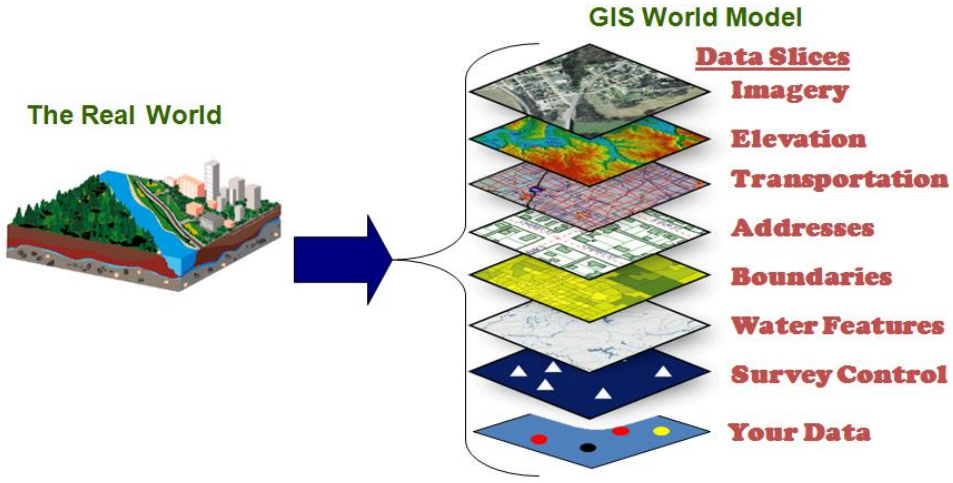


Figure 1. GIS World Model (GIS and Marine Conservation, Retrieved 2017)

3. Why does eThekwini Municipality need a GIS strategy?

eThekwini Municipality has had an operational Enterprise GIS (EGIS) system for a number of years now. This system has developed over that time, incorporating the technology of the day in order to package GIS capabilities together and provide an end-to-end solution. A strategic plan is necessary to direct the EGIS. An important element of a GIS strategy plan is the multiyear work plan containing vision, annual priorities and rough order estimates of resources required. The work plan provides this information for each of the components of EGIS: applications, database, infrastructure resources and organization/staffing.

There have been significant game changers in the Geographic Information Science (GISc) space both in the West Asia, Middle East and Africa (WAMEA) region and internationally. Additionally there are other drivers that highlight this as the right time to implement a GIS Strategy for eThekwini Municipality.

4. Context

In 2008, Esri president and founder, Jack Dangermond shared the following insight on the future of GIS:

> There's no question that the Web, Web services, and service-oriented architecture (SOA) provide a new pattern for implementing GIS systems -- just like desktop and multi-user server patterns. The central focus of the Web environment is a GIS server, such as ArcGIS Server. Increasingly this platform will be used to serve data, analytic models and maps for others to use on the Web. The server will also be the platform for supporting integration of GIS knowledge into enterprise systems.

5. Web GIS

In 2016 Dangermond made the following statements:

> Web GIS is at the forefront and are transforming the way GIS is used across many organizations. Moving away from a traditional desktop GIS to a server-based GIS to web services based GIS. Web GIS allows us to manage Big Data, including real-time sensor input, in ways that make it more useful to people. By combining Web GIS with the Internet of Things, in which everyday objects have network connectivity, cities are transforming into smart communities. Because people use platforms to connect to share information, we are seeing systems of intelligence come together that elevate geographic information.
>
> Web GIS is not making traditional GIS obsolete. Integrating traditional and Web GIS only makes the geographic platform more capable. Open access to open systems via Web GIS will hopefully compel agencies to readily share geographic information and encourage collaboration. The reason why open data is so important is because anyone and everyone can access it. They can use it to be more engaged in their businesses, their communities and society.

6. What added value does GIS bring to the municipality?

We cannot address problems that are being faced by local government in South Africa effectively (through the distribution of resources) if we do not know where the problems occur and how they are spatially distributed?

In recent years, the use of GIS in local government in South Africa has risen tremendously. However, many of the developments in GIS are taking place in a strategic and tactical vacuum because the implementation of the technology in many municipalities in South Africa, is failing.

The objective is to distribute GIS functions and data throughout an organization while leveraging and integrating the functions and data offered by other technologies. Accomplishing this requires adherence to standards and use of uniform methods to define the GIS data, service and information product components of business functions (Esri, 2007). These revised business processes and information products provide internal efficiencies as well as improved services for the public. Case studies have identified key areas where GIS is a force for transformation (Hambleton District Council, 2016):

- Channel shift - through the deployment of transactional web mapping system
- Improved transport efficiency - wide application of route optimisation and street works management
- Better decision making - using geographic enabled local information systems and shared intelligence networks provides easy access to quality information and reduces time to find it
- Reduced data duplication - using master datasets such as the Corporate GIS database warehouse

7. How can GIS help eThekwini Municipality deliver local priorities?

A GIS strategy will underpin the municipality's IDPs and ICT Strategy. It can also assist in the delivery of key systems and/or policies.

7.1. Integrated Development Plans

The Municipal Systems Act (No.32) of 2000 (MSA) requires that local municipal structures prepare Integrated Development Plans (IDPs). The IDP serves as a tool for transforming local governments towards facilitation and management of development within their areas of jurisdiction.

The Municipal Finance Management Act (Act no. 56 of 2003) secures sound and sustainable management of the financial affairs of the municipality and other institutions in the local spheres of government. It does this by ensuring that its developmental programmes are aligned to its budget, and in so doing eThekwini Municipality, through its integrated development planning process, therefore delivers in accordance with the community needs and priorities, whilst committing to the budgetary programmes as enacted by the Auditor-General.

GIS can support delivery against each of the local government priorities for achieving the municipality's vision of being Africa's most caring and liveable city. Whilst GIS has been predominantly used in the Built Environment Sectors of local government, its application can further lends itself to improved governance within the city. For example, spatial depiction of capital

budgets, crime mapping and community access modelling are but a few applications of its potential over and above current uses within the municipality.

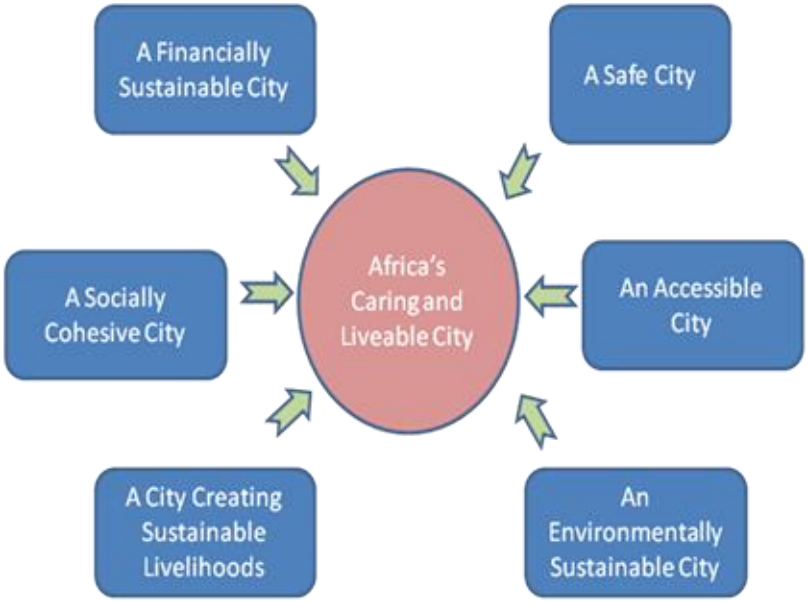


Figure 2. Africa's Caring and Liveable City

7.2. ICT Strategy

The ICT strategy highlights the need for a critical requirement to consolidate information across the municipality and to manage the integrity of the information on an ongoing basis. A consistent management approach to information and data will enable the city to plan more effectively, execute projects more efficiently and have visibility from an integrated service delivery perspective.

Data management within the municipality cannot be solely left to the people involved with a particular data set. The result of this is disparate sets of data of differing quality and integrity. There needs to be a consistent approach to data management within the municipality and enterprise standards and policies for data management need to be defined.

7.3. Property Management System (PMS)

The Property Management System (PMS) is a system used for the upkeep of the municipality's property base. This system serves the municipality for a wide range of purposes in the context of service delivery as well as revenue generation. Most of the data in the system concern the cadastre such as addresses, street names or sectional title units.

7.4. Road Naming Policy

The Council of the eThekwini Municipality established a uniform system for road naming and for numbering property and buildings on all roads, streets and public motorways within the municipality. All streets shall be named and all properties and buildings shall be numbered in accordance with the provisions set forth in the policy.

8. Existing GIS customer experiences

Although GIS is not currently exploited to its full potential by business units within the municipality, it is currently successfully supporting a number of business units and/or services to reach their strategic objectives and delivery plans.

Below are a couple of examples of where GIS is currently benefiting

"GIS is an important tool in decision making and trend analysis. The City has long identified this as a key component in our planning of the City and implementation thereof. Our GIS system is always improving and provides a strategic tool for both the public, Councillors and Officials. The data that has been collected from the various role players provides for a comprehensive infrastructure dataset that is used to compile maps and presentations to various audiences. Here at the Development Planning, Environment & Management Unit, we encourage all our staff to use GIS via our internal services. This has really enabled them to perform various spatial functions using this invaluable resource right from their own desktop computer. To the public, via the internet, our GIS Web Viewer is extremely user friendly and informative portal. A huge step-up from what we previously had and much credit and thanks must go to our Corporate GIS Office."

Buddy Govender

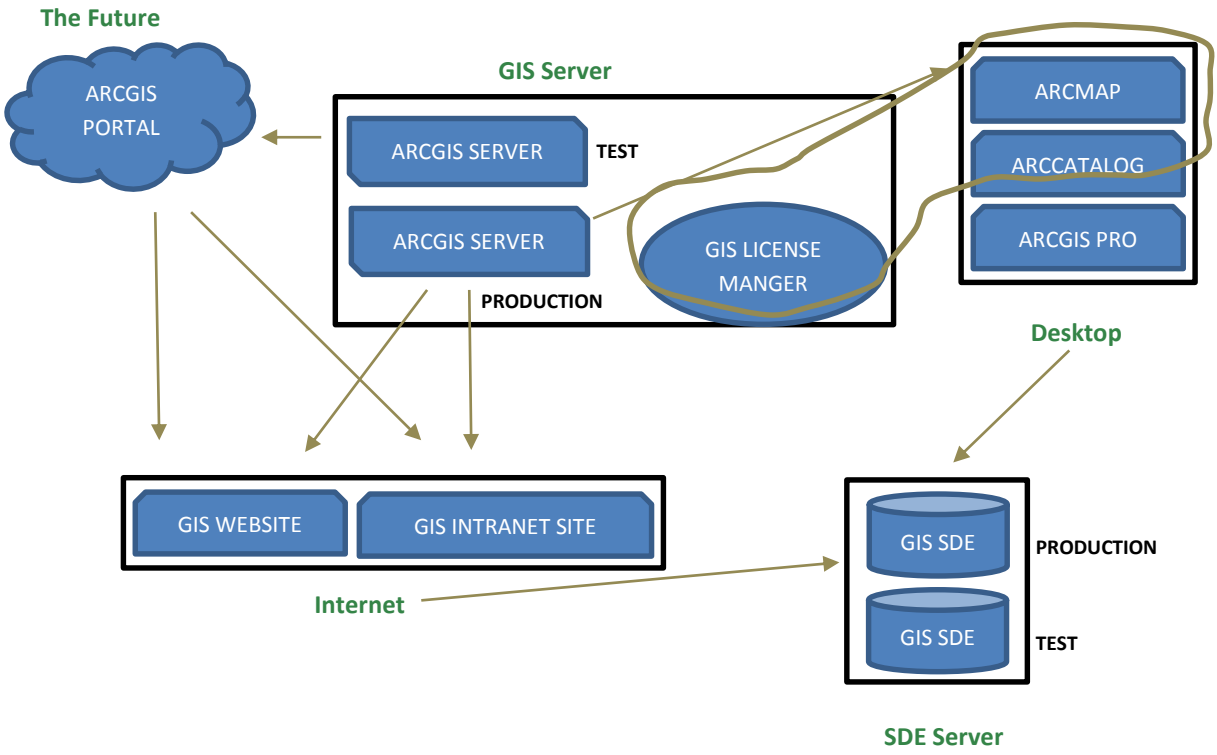
Senior Manager: Information Systems Development & Planning

"I would like to congratulate you on the fact that the GIS viewer on the eThekwini website has been working very well in recent times and provides an important and very informative tool. I have noticed that some modifications have been recently made to the GIS. **"**

Robert Littlefield

Town Planner

9. Technology



10. GIS Software

The municipality currently has Esri's ArcGIS Desktop 10.3.1 rolled out to 1 303 users. The latest version of ArcGIS Desktop is 10.5 (10.5.1). The municipality does an enterprise upgrade with every second full release of ArcGIS Desktop. We are currently working on a feasibility of ArcGIS Desktop 10.5 (10.5.1) upgrade, this will constitute of a feasibility report and a roll out plan.

The municipality has a centralised ArcSDE geodatabse on which all vector data is stored. Present-day Aerial Photography is available as an Image Service on the ArcGIS Server site and Historic Aerial Photography dating back to 1994 is available on a dedicated raster data server.

We make use of ArcGIS Server 10.3.1 to share our geographic information to others in the organization and the public with an Internet connection. This is accomplished through web services, which allow a powerful server computer to receive and process requests for information sent by other devices. ArcGIS Server opens our GIS to tablets, smartphones, laptops, desktop workstations, and any other devices that can connect to web services.

11. Web

The eThekwini Municipality Corporate GIS Website provides global access to the municipality's GIS web services and data. The website serves a large number of external users who predominantly access the municipality's GIS system through the internet. It hosts the following web services:

- Staff Web Viewer - This is an internal web viewer for staff which contains layers unavailable to the public

- Public Map Viewer - This is what the public see on the web, this viewer has restricted datasets
- Oblique Viewer - The viewer allows a user to pan around in the oblique mode, in a single viewing angle, or switch angles to view an area of interest from different angles
- Durban Solar Map Viewer (on behalf of the Durban Energy Office) - This viewer allows you to plan a Photovoltaic Installation on your roof and gather some information regarding possible costs and potential savings
- SG Diagram Searches
- Corporate GIS Data Downloads - This consists of flat files available to the public for download
- Corporate GIS Metadata

12. Metadata

Metadata is data that describes data. For example author, date created, date modified and file size are very basic document metadata. This provides effective data management, eliminates data duplication, enables easy access to resources for staff and facilitates for better data sharing with external role players.

Data owners or business units within the municipality are held responsible for keeping their datasets and metadata up to date. In some instances little updating of datasets has taken place and in other instances no metadata is in place.

There is a lack of metadata standards in the municipality. It is essential to develop metadata standards to enable the best possible description of a resource type for the municipality's needs. This shortcoming is acknowledged and has been identified as a key area of work for the future.

13. Functionality

The municipality's current GIS infrastructure delivers the following key corporate functions:

- Desktop GIS
- GIS Software Share
- Historic Aerial Photography Share
- Property Management System
- Spatial Database Warehouse
- Various GIS Web Services

14. Priorities for 2018-2022

Although the current GIS infrastructure meets the municipality's current needs, it is capable of doing much more. It is important to encourage staff, stakeholders and the public to use it as much as possible.

Over the next five years our priorities will be to:

- Seek for a systematic "GeoVision" strategy to promote smart government and digital transformation

- Continue to advance the adoption of GIS across business units in the municipality in order to improve service delivery
- Continue to maintain and where possible enhance the municipality's GIS service
- Get the best value for money out of the current GIS by expanding it to move away from traditional desktop GIS to a server-based GIS to web services based GIS
- Strive to produce products which business can make the most of to maximise their return on government services

We forecast the key areas of work for the future as being:

- Establish metadata standards in order to facilitate content and access management
- Develop and improve uniform methods to define the GIS data and information product components of business functions
- Continue to develop the eThekwini Municipality Corporate GIS Website
- Promote good communication channels with enterprise and external GIS users to facilitate information flow, data sharing and partnership working

These priorities and key areas of work will allow GIS to continue to support local government services and corporate functions into the future.

15. Delivery

15.1. Investment

The municipality has an Enterprise License Agreement (ELA) and a Service Level Agreement (SLA) with Esri South Africa to cover the supply of GIS technology and professional services for existing and/or new systems and solutions. The city has a vision of integrating Web GIS with traditional GIS in order to make the geographic platform more capable. For this, additional setup costs could be required and will need to be budgeted for. To support the delivery of the GIS strategy investment is needed in staff training, and additional GIS solutions.

15.2. Staffing

GIS requires experienced and costly people in order to use it. To effectively deploy GIS, companies need to hire an expert in programming; web development; database management and GIS. That individual also needs to understand the industry; the business it operates within; internal functions of the marketing; have web development expertise and a complete knowledge of the company. These "uberemployees" are very rare and require an extreme investment to create or train.

The municipality needs to rethink its GIS resource recruitment approach. The municipality is struggling to fill technical GIS positions required to deliver the current level of service. To achieve the priorities of this strategy whilst continuing to provide the current level of service additional resources are essential.

15.3. Monitoring and Implementation

The municipality has identified and continues to identify priorities. An action plan with a number of tasks that will need to be completed will be identified and incorporated as an appendix to this strategy.

16. Glossary

GIS	Geographic Information Systems
IDP	Integrated Development Plan
IMU	Information Management Unit
ICT	Information and Communications Technology
Esri	Environment Systems Research Institute
EGIS	Enterprise GIS
GISc	Geographic Information Science
WAMEA	West Asia, Middle East and Africa
SOA	Service-oriented architecture
MSA	Municipal Systems Act
PMS	Property Management System
SG	Surveyor General
ELA	Enterprise License Agreement
SLA	Service Level Agreement