A GUIDELINE TO INFRASTRUCTURE SECTOR

MASTER PLANNING

The blue print for sustainable development
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Service delivery is recognised as one of the key objectives of the South African government. Much energy has been ploughed into service delivery since the dawn of the new South Africa and impressive results have been achieved. National sector departments in particular have mounted major social infrastructure development campaigns and economic infrastructure has been expanded to ensure the growth and development of the economy.

To ensure that optimum solutions were developed, a new planning environment was created, calling for the preparation of Growth and Development Strategies at national, provincial and local level and Spatial Development Frameworks at all levels to guide development planning. At local level, the Integrated Development Plan (IDP) became a requirement, calling for the integration of strategic thinking and visionary planning with the provision of services, housing, amenities and facilities to ensure the development of sustainable human settlements.

While the IDP was intended to address short-, medium- and long-term planning, the introduction of the Service Delivery and Budget Implementation Plan (SDBIP), which generally looks at short-term project implementation, has had the effect of reducing the planning horizon in many municipalities. The IDP is now considered to be a five-year rolling plan at best, and is linked to political objectives associated with each five-year term. The concept of the Master Plan to accommodate long-term growth and look at long-term and phased developments has largely been lost, with the result that planning is focused on localised township development, rather than long-term, town- or city-wide sustainable development. This is having the effect of entrenching the spatial patterns of the past, rather than moving to mixed, equitable distribution of residential properties and employment opportunities.

The purpose of this document is to describe the need for long-term planning to unlock the full potential of each municipality and to offer guidelines on what to consider when carrying out both strategic and long-term planning per sector. The networked services of water, sanitation, roads, stormwater and electricity are considered, followed by considerations for housing and municipal amenities. The planning landscape is examined, weaknesses are identified and guidelines are offered in terms of asset management and drawing up long-, medium- and short-term plans for each service. A suggested Terms of Reference document is presented in Part IV for use when calling for the preparation of Master Plans.
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<td>SAMP</td>
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The imperative need for long-term planning and an outline of the scope and use of this guideline document for master planning are given in Chapter 1. The planning landscape is examined to gain an understanding of why limited long-term planning takes place in local government. Chapter 2 first describes the many types of plan, including Integrated Development Plans, Sector Plans, Spatial Development Frameworks, and Growth and Development Strategies. A discussion on what master planning is and the factors that should be considered follows. Chapter 3 explains the planning process, which is complex, requiring first a visionary, strategic plan to be developed considering municipal-wide parameters followed by infrastructure development plans to support the strategy.
The ‘new’ South Africa brought with it great excitement and many challenges. The emergence of a new municipal environment covering the entire country in a wall-to-wall model of local government meant that the infrastructure needs of the entire population would finally be addressed.

The Constitutional Commitment

Section 152 of the Constitution identifies the following objectives of municipalities:
- To provide democratic and accountable government for local communities
- To ensure the provision of services to communities in a sustainable manner
- To promote social and economic development
- To promote a safe and healthy environment
- To encourage the involvement of communities and community organisations in matters of local government

Section 153 continues to address the developmental duties of municipalities and calls for each municipality to:
- Structure and manage its administration, and budgeting and planning processes to give priority to the basic needs of the community, and promote the social and economic development of the community, and
- Participate in national and provincial development programmes

The objectives outlined would not seem that different from the philosophies of the past, but the approach to achieving them is significantly different. The top-down approach has been replaced by bottom-up community participation, which affects decisions at all levels.

The Millennium Development Goals

The Millennium Development Goals (MDGs) further addressed these imperatives by looking at health, education, equality and service delivery to ensure that all people live in dignity. Many of South Africa’s national targets with respect to these MDGs relate to engineering services, including:
- Bucket eradication by 2007
- Access to potable water for all by 2008
- Access to formal sanitation by 2010
- Access to electricity by 2012
- Access to basic roads, sports, recreation, waste disposal, public and community facilities by 2013
- Upgrading of all informal settlements by 2014
- Accelerated housing delivery by 2014

The energy ploughed into service delivery has produced impressive results. National sector departments in particular have mounted major social infrastructure development campaigns and economic infrastructure has been expanded to ensure the growth and development of the economy. Some MDGs have been achieved to a greater or lesser extent. However, backlogs and the rate of delivery are such that many citizens are still faced with a long wait for services.

Resolutions from the Earth Summit

In addition to the all-inclusive role that local government is expected to play, the resolutions emerging from the Earth Summit of 1992 (held in Rio de Janeiro) placed further demands on local government, which was considered to be at the coal face of sustainable development. Agenda 21 was developed at the Summit and outlined a global action plan for sustainable development. In South Africa, municipalities were tasked to:
- Integrate social, economic and environmental issues
- Work in partnership with civil society
- Consider the future by taking a longer-term view
- Adopt a multi-sectoral approach
- Recognise and operate within ecological limits
- Link local issues to global impacts

Why Plan for the Long Term?

In addressing development needs, long-term development plans must be considered to ensure that systematic
and sustainable development takes place. The guiding principles for sustainable development call for political and social stability through good governance and ensuring that existing and new human settlements are economically sustainable, by placing employment opportunities and economic development within reach of the employable component of the population. Furthermore, society must be empowered to join the economy through appropriate and adequate education and skills development.

This requires looking at long-term economic development and growth opportunities, demand, practical spatial distribution, economic development and bulk infrastructure requirements. To this end many sectors are setting new longer-term goals to take development to new heights. It is also of critical importance to recognise, and make provision for, ongoing efficient implementation, operation, management and maintenance of existing and new infrastructure generated via the planning process.

To ensure that adequate planning would be done, the Municipal Systems Act (MSA), 2000 (Act No. 32 of 2000), as amended by Act No. 44 of 2003, called for the development of Integrated Development Plans (IDPs) aimed at developing municipalities in a sustainable manner. Chapter 5, Part 2, Clause 26 of this Act calls for municipalities to develop a vision for their long-term development, looking initially at the existing levels of development and considering long-term economic development and transformation. The Act further calls for municipalities to align with national and provincial sector plans and strategies, as well as spatial development and appropriate land-use management.

To ensure that delivery was indeed taking place, the Municipal Finance Administration Act (MFMA), 2003 (Act No. 56 of 2003) also called for the preparation of Service Delivery and Budget Implementation Plans (SDBIPs) which require that municipalities produce monthly and quarterly reports outlining income, expenditure, adherence to milestones and the equitable distribution of projects acrosswards. This has had the effect of focusing development efforts on the present rather than the medium- and long-term. Coupled with their limited capacity, few municipalities have developed visionary IDPs but have rather concentrated on addressing short-term development plans. As a result, many sectors are setting new longer-term goals to take development to new heights. It is also of critical importance to recognise, and make provision for, ongoing efficient implementation, operation, management and maintenance of existing and new infrastructure generated via the planning process.

Table 1: The structure of the document

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<td>14. Terms of Reference</td>
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result only a few IDPs look beyond the current five-year political term to take their municipalities into a new paradigm.

The Need for Long-Term Planning

Overview of Planning

This document has been prepared to offer guidance on the key considerations and approaches to adopt in the specification, development and use of Master Plans. It is intended to guide politicians on the rationale, activities and benefits of preparing a Master Plan, as well as officials on what to call for in specifying the scope of a master planning exercise and service providers on what is expected of them. Guidance is provided for service providers and officials alike to check that planning has been both visionary and comprehensive, and a sample Terms of Reference is provided in Part IV for officials to edit as appropriate for the particular service under consideration. The aim of this process is to improve the strategic long-term planning of infrastructure, risk management, financial management, capacity building and long-term sustainability, and is aligned with existing statutory municipal processes.

Long-term planning requires a multi-disciplinary approach, drawing on knowledge from disciplines such as the management and social sciences, engineering and accounting. It is essential that communities, politicians, municipal officials and a range of engineering, social, financial and planning professionals collaborate to solve the complex long-term planning challenges facing local government. The document is structured into four parts:

- Part I: Overview of Planning
- Part II: General Planning Considerations
- Part III: Sector Planning Considerations
- Part IV: Terms of Reference

More detail is given in Table 1. Ideally, this document should be issued with each Master Plan tender document as a guideline to service providers. The guideline considers the development of infrastructure that is required, now and into the future, including upgrading, new construction, renewal of failing infrastructure, and the operation and maintenance of current and new infrastructure.
Introduction

To determine future development requirements and how to achieve sustainable solutions, it is important that the future needs be determined as accurately as possible. Planning methods must be tested from a variety of viewpoints to ensure the best possible development strategies. There appears to be an overabundance of planning processes in place, few of which talk to each other or consider long-term sustainability.

Figure 1 depicts the typical process followed in local government, the elements of which will be discussed in the following sections.

Growth and Development Strategies

Growth and Development Strategies (GDSs) are aimed at growing the economy to deal with developmental challenges confronting the country and regions. In South Africa much of the emphasis is placed on driving transformation to correct past imbalances and ensure access to economic and social opportunities for the historically disadvantaged. GDSs are long-term planning tools for the next 10 to 30 years. They are not governed by laws but serve as long-term guidelines. Without GDSs guiding development at various levels, development will be piecemeal and localised bottlenecks in development will be experienced. Each sector plan needs to take cognisance of all these long-term development plans and must be developed for the long term, to feed into successive IDPs.

GDSs are aimed at supporting government’s development agenda, including macro- and micro-economic objectives, and responding to the needs of key economic sectors, including manufacturing, tourism, mining and beneficiation, and agriculture, as well as promoting rural development. GDSs are also aimed at providing a spatially referenced framework for both public and private sector investment, and at promoting regional integration and growth in the Southern African Development Community (SADC) and ensuring implementation of New Partnership for Africa’s Development (NEPAD) resolutions.

In preparing a GDS for a municipality it is necessary to identify those factors that place the greatest constraints on the willingness of municipal-based businesses to invest. The most significant constraints on investment are currently lack of the skills required by a fast-modernising economy, the high cost of crime and ailing (or in some instances failing) infrastructure. Other constraints may include an inefficient urban form and therefore the relatively high cost of utilities, fragility of energy supply, poor public transport, increasingly overburdened road freight transport, high cost of telecommunications and weak supportive conditions for the development of small, medium and micro-enterprises (SMMEs). Institutional blockages, such as delays in the processing of development applications, Environmental Impact Assessments (EIAs) and delays in the awarding of tenders, also hamper development and growth. Addressing these constraints requires a range of dedicated municipal-led programmes.
The Planning Landscape

The Spatial Development Framework

A Spatial Development Framework (SDF) is an urban management tool that deals with a municipality’s planning strategy with regard to issues such as land use, transportation, engineering services, housing and open spaces. It is aimed at giving the municipality a vision of what will be involved in building and maintaining a thriving and sustainable city. It provides development direction, identifies key development areas for improvements and directs municipalities, developers and investors on the locations and forms that development should take.

The SDF is essentially physical in nature and deals with two important aspects of development, namely the potential supply of land available for various land uses, which is finite, and the demand for various land uses, which is based on population growth and appears to be infinite. The SDF should deal with the physical (including infrastructure), social (demographic), economic (socio-economic and local economic development strategy), historical and administrative (capacity) components.

The SDF follows a rational, comprehensive approach, meaning that it is cyclical in nature and allows for regular updates. SDFs should be updated every five years, with a moving horizon of at least 20 years for population demand. The preparation of an SDF begins with the analysis of available data, proceeds to the identification of problems and issues, develops goals and objectives and finally selects the best out of several alternative plans for solving the problems identified. These alternative plans should be informed by the substantive theories that the planners have studied. The selection of the most appropriate alternative is an iterative process in which public participation is required.

When the ‘best’ alternative has been selected, engineering Master Plans should be drawn up to match the land uses and priority areas. Where land-use changes are required to support the development of bulk infrastructure, these should be fed back into the SDF. They should be costed, phased and prioritised for implementation, so that they can be taken into account by the various services and so that budgeting can be undertaken by the municipality’s finance department.

Cognisance must be taken of spatial planning and development undertaken by the province in which the municipality falls. In Gauteng, two initiatives that have to be considered are the Spatial Development Initiatives (SDIs) and the Gauteng Spatial Development Framework (GSDF). Relevant SDIs are the Maputo Development Corridor, the Gauteng SDI and the Platinum SDI, among others. Objectives listed in the GSDF which affect planning include:

- Resource-based economic development identifying a high-intensity web of present and future economic development and activity
- Contained urban growth with a defined edge that can be implemented and managed
- Rural development beyond the urban edge, focusing on conserving natural resources, exploring, developing and marketing tourism, promoting agricultural activities and limiting urban sprawl
- Mobility and accessibility to improve access to transport systems, jobs, education, health, social facilities and general amenities, providing users with the opportunity to get to and from their destinations as quickly as possible
- Redirection and stimulation of urban growth by creating functional and sustainable urban environments into which housing and employment can be integrated. The provision of housing in proximity to the areas of employment must be addressed through:
  - densification of existing urban areas
  - stabilisation and limitation of growth in economically non-viable areas
  - unlocking the development of vacant land in proximity to economic core areas and transport corridors

The Integrated Development Plan

It was recognised at an early stage that there was inadequate planning to ensure the sustainable development of infrastructure and for this reason the concept of an Integrated Development Plan (IDP) arose. As the name suggests, the idea of preparing an IDP was to bring together the strategic development needs of all sectors of a municipality, based on community aspirations and economic growth. It was intended that the IDP should serve as a strategic development plan and management instrument for a municipality, bringing together short-, medium- and long-term objectives and strategies. It is legislated by the Municipal Systems Act (MSA), 2000 (Act No. 32 of 2000), as amended by Act No. 44 of 2003. The Act calls for municipalities to undertake an integrated planning process to cover planning from one local election to the next. It is intended that IDPs overcome the ‘silo effect’ of earlier departmental planning. (The ‘silo effect’ refers to a lack of communication and common goals between departments in an organisation. It is the opposite of systems thinking in an organisation. It gets its name from the farm storage silo: each silo is designated for one specific grain). Integrated development planning is a process by means of which the planning efforts of different spheres and sectors of government and other institutions are coordinated at local government level.

The IDP should:

- Consider the effective use of scarce resources
- Enhance service delivery
- Assist with attracting additional funds
- Strengthen democracy
- Overcome the legacy of apartheid
Promote coordination between all stakeholders
Encourage investment
Encourage partnerships

In doing so it contributes towards eradicating the development legacy of the past by:
- Considering spatial integration and development opportunities
- Formulating strategies focusing on the poor and poverty alleviation
- Supporting the second (or informal) economy
- Introducing mechanisms to promote social and economic equality and instruments to address sustainability in its three facets – ecological, economic and social.

Figure 2 shows the extent of input required to prepare a sound IDP. It must be specific enough to inform budgets, business plans and land-use management decisions while providing sustainable empowerment, growth and equity for the short, medium and long term. The IDP process is facilitated through the application of specific methodological tools and involves communities, municipal officials and politicians in an iterative process considering housing and associated sector needs within the constraints or opportunities associated with economic development and spatial development, as shown in Figure 3.

The ultimate purpose of developing IDPs is to be able to prepare a series of five-year development plans which will guide and inform planning, budgeting, management and decision making in a municipality. They are linked to the development of the Medium Term Expenditure Framework (MTEF) which is an annual, rolling three-year expenditure plan setting out medium-term expenditure priorities and budget constraints against which sector
plans can be developed and refined. The MTEF also contains outcome criteria for the purpose of performance monitoring. IDPs are reviewed annually with regard to priorities, budget constraints and development imperatives.

Since the IDP approach tends to be forward looking and applies to the short to medium term, the status quo and long-term needs are rarely considered in an IDP, which impacts negatively on maintenance and long-term growth respectively. The tendency is to base development planning on backlog information, such as housing shortages and urgent essential maintenance. However, this is only appropriate for dealing with current community needs and the need to address significant levels of poverty and unacceptable living conditions; it does not take local government forward in terms of accommodating long-term development and sustainability.

### The Service Delivery and Budget Implementation Plan

To ensure that quality spending and outcomes are achieved, the MFMA calls for municipalities to prepare annual Service Delivery and Budget Implementation Plans (SDBIPs). These plans must be approved by the mayor and focus on implementing the delivery of services and the annual budget. Elements which must be included in the plan are:

- Monthly projections of revenue to be collected, by source
- Quarterly service delivery targets and performance indicators
- Projections regarding capital projects and operations and maintenance (O&M) expenditure

Based on this plan, monthly and quarterly reports must be generated, indicating progress, giving explanations for deviations and providing motivations for revision of the plan where necessary. Given that this is an annual plan which drives performance against scorecards, much emphasis is placed on short-term delivery, often to the detriment of medium- and long-term considerations.

### Additional Frameworks and Plans

Although many of the above plans are expected to take the long term into account, much emphasis is placed on political and community aspirations, without considering the long-term viability and sustainability of service delivery. In *Guidelines for the Formulation of Spatial Development Frameworks* published by the Department of Rural Development and Land Reform in 2010, the writers lament the fact that current SDFs have not addressed the inequalities and inefficiencies of past spatial planning and that SDFs are not aligned with sector planning and vice versa. Furthermore, sector plans require sound technical input to ensure that infrastructure is adequately planned, operated, maintained, upgraded or expanded before increasing loads or demands have a detrimental effect on existing infrastructure. Therefore, to address current weaknesses, additional frameworks and plans have been developed as follows:

#### Medium Term Strategic Framework 2009–2014 (MTSF)

The Medium Term Strategic Framework 2009–2014 (MTSF) calls for all spheres of government to work together to:

- Speed up growth and transform the economy to create sustainable employment opportunities and livelihoods
- Mount a massive programme to build and maintain economic and social infrastructure
- Develop a comprehensive rural development strategy linked to land and agrarian reform and food security
- Strengthen the skills and human resources base
- Improve the health profile of all South Africans
- Intensify the fight against crime and corruption
- Build cohesive, caring and sustainable communities
- Pursue African advancement and enhanced international cooperation
- Ensure sustainable resource management and utilisation
• Build a developmental state, which should include improving public services and strengthening democratic institutions.

However, without such cooperation and collaboration and without consideration of long-term needs, the massive infrastructure called for may very well not be sustainable once installed and commissioned. Typical challenges relate to bulk services supply, mobility and economic sustainability.

**Action Plans**

Due to the slow rate of delivery, high unemployment and deteriorating infrastructure, similar lists have been drawn up in the five-year Local Government Strategic Agenda Implementation Plan and the Government Programme of Action (GPOA). The areas of focus include:

• The development and implementation of implementable integrated development plans informed by Master Sector Plans and inclusive Spatial Development Frameworks
• Developing infrastructure and Local Economic Development (LED) strategies
• Accelerating municipal infrastructure programmes to meet targets for water, sanitation and electricity
• Developing the anti-corruption capacity and focus of municipalities
• Enhancing public participation by means of ward committees, community development workers and partnerships between the public and private sectors
• Institutionalising performance management and strengthening the monitoring, reporting and evaluation capacity of municipalities in respect of local government service delivery

• Intensifying support to provinces with a specific focus on the Premiers’ Offices and Provincial Departments of Local Government
• Providing ongoing capacity building and technical support to municipalities

Once again, no attention is given to long-term planning.

### The Long-Term View

There is an urgent need to look beyond the short and medium term to ensure long-term sustainability of municipal infrastructure, the planning and implementation of which is the responsibility of local government. Municipalities are at the coal face and are in the best position to make decisions on how services should be provided, taking into account the needs of their constituencies, as well as social, economic and environmental aspects within their areas of jurisdiction. Thus, in looking at the longer term, plans should not only be based on community input, but planners (including town and regional planners and transport planners), economists and technical professionals should be called upon to apply their minds to growth and development strategies as a whole.

To identify nodes for retail outlets that will keep consumer spending within the municipality, or for new residential, industrial, farming, tourism and other

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opportunities to attract investment and create job opportunities in the area, a longer-term spatial plan such as the Spatial Development Framework is essential. It should be updated on an ongoing basis to ensure the financial viability and sustainability of the municipality, which will equip it better to address community needs. Such planning will also identify the need for improved through routes and transport corridors, amenities and increased bulk services to support growth, and will highlight opportunities for developers.

**National Planning Approaches**

In developing local government sector plans it is necessary to understand the national, provincial and local needs as shown in Table 2. Role players must undertake their planning responsibilities within the planning framework to ensure that they provide the necessary inputs for municipal infrastructure development.

**The National Planning Commission**

It has been the inadequacy of, and at times the lack of attention paid to, the National Spatial Development Perspective (NSDP) and sector macro-planning that has given rise to the National Planning Commission (NPC), whose purpose is to look beyond the five-year horizon with regard to planning for South Africa. The NPC is tasked with scenario planning and preparing a vision to 2025. It is expected to advise on key issues such as food security, water security, energy choices, economic development, job creation, poverty and inequality, the structure of the economy, human resources development, social cohesion, health, defence capabilities and scientific progress. It is also expected to assist with mobilising society around a national vision and other tasks related to strategic planning.

It is thus not inconceivable that the NPC may ultimately propose new towns or cities, development nodes and expansion of national bulk services to increase the opportunities for job creation and economic growth. Given that the major bulk supplies, such as dams, power stations and major corridors and transport networks, take years to plan and develop, a view even longer than 2025 is required when considering major infrastructure development. Growth and development strategies become important when looking at capacity at a national and provincial level.

**Master Plans**

It is evident from the above that adequate and appropriate sector plans are vital for the preparation of meaningful IDPs and there is a need to take a much longer view than the three-to-five-year life of an IDP. Hence when calling for the preparation of a sector plan, a long-term or ‘master’ plan is essential. Collins English Dictionary defines a master plan as “an overall or controlling document”. Forward planning exercises and the preparation of Master Plans were commonplace in local government in the apartheid era and many wise long-term developments were initiated which allowed cities to grow considerably, such as the motorways in many cities and the Diepsloot sewage pipeline in Johannesburg, among others. However, because the previous strategies generally planned for the segregation of communities and services, the concept of IDPs was adopted to ensure integrated and mixed-use spatial and infrastructure planning, addressing short-, medium- and long-term needs. The challenges associated with reducing the horizons of the IDP and SDBIP have been discussed. It is therefore necessary to entrench the culture of forward planning once and more and ensure that Master Plans are developed for all services. Sector departments and municipalities have a duty to ensure that comprehensive sector planning takes place so that that there is sufficient capacity at all times to deliver each service, in the face of growing or changing demand. The master planning process and its relationship with other municipal plans is shown in Figure 4.

Master planning refers to long-term sector plans, which are more detailed plans for each municipal service. Generally, the services under consideration are the network services, i.e. water, sanitation, roads, stormwater drainage and electricity. Although telecommunications, oil and rail are also network services, they are not the responsibility of local government but must be accommodated in spatial planning. The other services that are the responsibility of local government are the provision of housing, municipal facilities and amenities, and the removal of solid waste.

In developing Master Plans, it is necessary to gain a thorough understanding of the needs of communities and to determine infrastructure and capacity constraints to allow municipalities to prioritise the development or augmentation of services that would not be possible at a later stage, or would be too costly or difficult. Such developments depend to a large degree on the accessibility and availability of land and funds. The Master Plan also provides a time frame for development to suit and facilitate the funding process and a roadmap for taking the system from its current state to the desired long-term state. Furthermore, as much of the existing infrastructure is ageing, there will be increasing pressure to include the optimisation of operations, maintenance and refurbishment in the planning process. The Master Plan can be thought of as a phased planning approach, with Phase I considering the short-term needs, Phase II the medium-term capital-improvement programme (three to five years), and Phase III encompassing longer-term planning horizons.

While municipal sector plans may differ from sector to sector (e.g. the Water Services Development Plan may be structured differently from the Integrated Transport Plan), each sector plan needs to address the following:

- The vision of the municipality
- National, provincial and regional imperatives
The status quo
- A needs assessment to estimate future demand and localities for expanded infrastructure
- The consumer profile and demographics
- Service levels
- Bulk capacity
- Alternative solutions
- Infrastructure refurbishment, upgrades, development and disposal
- Operation and maintenance plans
- Financial and legal issues and constraints
- Institutional and management issues and constraints
- Resources, environmental issues and challenges
- Solutions, projects, programmes and processes
- Budgets
- Time frames for development

Developing a Master Plan also requires a thorough knowledge not only of the area itself, but also of the surroundings and of any development planning that impacts on the area under consideration. Hence there is a need to gather information both vertically and laterally.

A Master Plan must be considered to be a living document and be interrogated regularly, not with a view to making frequent amendments, in which case the term ‘Master Plan’ would be invalid, but to ensure that in a continually changing environment it is guiding the planned growth for sustainability.

Vertical information gathering would start at national level to determine national goals, provide a link to national spatial development perspectives and acquire knowledge of policy development, particularly in relation to economic growth. It would devolve down through provincial, regional and local government levels to local sector level.

Lateral information gathering is required to determine what effects planning in adjacent or neighbouring provinces, regions, municipalities or local areas will have on the area being master planned or vice versa. No structures, be they provincial, regional or local, can focus on their own area of jurisdiction only. For example, provincial, regional and local area boundaries might not coincide with watersheds or catchment areas, which

Since investment is required over the life of a service, long-term cash flow must be considered and investment plans put in place to ensure that services are maintained in working order. Figure 5 shows an example of a long-term cash flow relating to infrastructure maintenance and renewal. By considering the long term, extreme spikes in future spending can be identified and plans can be put in place to start investing earlier in maintenance, refurbishment or renewal to ensure that costs are contained.
could affect water supply and distribution, stormwater management and sewage disposal and treatment. Initially, boundaries may be remote from adjacent areas of planned development, but over a period of 20 years or more they can become a mere line on a drawing and have an effect on, for example, regional health and/or fire and disaster management services across boundaries. Continuous and adequate information gathering is a prerequisite for good master planning. Foresight, energy and commitment are indispensable components of the process.

Master planning involves more than just planning the expansion of each service. It is a complex process which requires scenario planning to take place with respect to future demand and opportunities. One of the primary drivers for this is economic development in the service area. It is therefore essential to have economists and statisticians on board during the process to get comprehensive and the most informed professional opinion and a realistic forecast on growth.

Where growth forecasts are underestimated, services will be placed under undue strain, leading to design parameters being exceeded and to burdens that may reduce the lifespan of the service or require overspending on operations and maintenance to compensate for design failures. Overestimation, on the other hand, will result in scarce capital being spent on infrastructure that will not provide a return on investment (ROI), leading to capital being diverted from other, more deserving projects, causing scepticism in the financial department and a reluctance to make capital available when needed in the future. Inadequate capacity will also result in revenue loss and dissatisfied consumers, due to performance failures and lack of service availability.

The process is not a linear one-time process, but involves several iterations to obtain a workable or preferably optimum solution within the constraints of budgets and available capital. The overall process and elements of the Master Plan are outlined in the next chapter.
Introduction

The planning process is complex in that it must consider and evaluate the finite needs and aspirations of the here and now against the unquantified demands and challenges of the future, and deliver solutions that will address both present and future needs. What separates master planning from any other form of planning is the need to develop a long-term vision for the organisation in order to weave together a final solution composed of short-, medium- and long-term plans superimposed on the current status quo.

Figure 6 depicts the planning process leading to the development of a Master Plan, namely:

Figure 6: The planning process
Strategic Planning

Strategic planning considers the long-term vision and mission of the municipality and the macro-drivers and inhibitors that must be understood, addressed and, where necessary, overcome to take the municipality forward. In this phase long-term demographic, economic and financial modelling is commissioned and scenarios are proposed, largely emerging from the Growth and Development Strategy and the Spatial Development Framework, and considering national and provincial imperatives. Analysis will include:

- Economic development
- Demographics
- Environmental realities, constraints, concerns and opportunities
- Socio-economic considerations
- Spatial distribution, growth directions and land availability
- Financial viability and income streams
- Legislation/by-laws/policies and guidelines

Each of the above is discussed in more detail in Chapter 4.

Sector Planning

The Status Quo

Developing a vision and defining strategies for the future without a clear knowledge and understanding of the present situation, as well as those factors that may influence development, is a futile exercise. Determining the status quo will require much research and interaction with role players in order to collect data and build a current model. It will be necessary to:

- Collect maps, GIS models, drawings, asset registers, previous studies and reports, and associated data covering municipal infrastructure
- Gather consumption or usage and financial data
- Identify existing capital and grant-funded projects
- Determine what budgets are available
- Locate reference material influencing inputs into the Master Plan, such as the Spatial Development Framework, Growth and Development Strategies and economic development plans, risk assessments, legislation, permit or licence conditions, environmental conditions and binding national and provincial plans
- Identify policies, processes and procedures, such as by-laws, supply chain management, risk management, indigent management, and maintenance management practice, which will influence development
- Gather sector plans
- Carry out desktop studies and field research where necessary, including household surveys
- Determine current demographics and usage, load or demand placed on services
- Determine available resources
- Identify role players and stakeholders
- Determine investor capacity
- Determine strengths, weaknesses, opportunities and threats (SWOT) and challenges to infrastructure development, and identify risks

The Asset Register

Once all the data have been gathered, it will be necessary to draw up an Asset Register of all services in the municipality for determining current and future capacity and the cost of maintaining, refurbishing, upgrading or expanding networks and services. The Asset Register will contain asset type, size or class, value, location, condition, long-term capacity, current usage and remaining useful life. These data are the cornerstone of service delivery planning and should preferably be captured in an electronic system designed for more than hosting status quo information but for purposes of ongoing asset management, as called for in GRAP 17 (guideline from the Accounting Standards Board – GRAP 17: Property, Plant and Equipment).

With a comprehensive model that quantifies current supply, demand and spare capacity available, if any, it will be possible to determine and superimpose the visionary long-term needs on the model.

Future Demand, Needs and Challenges

In developing Master Plans it will be necessary to understand the relationship between potential growth and associated demands for infrastructure. Future needs may include:

- Housing
- Human and community development, including the need for education, safety, security and access to health facilities
- Infrastructure and basic services
- Enhanced spatial form and urban management
- Transportation
- Financial sustainability
- Institutional capacity and viability
- Resources, including water, electricity and bulk services

To determine the extent of these demands it will be necessary to consider:

- Population demographics and trends
The Master Plan

Once the needs versus the current situation have been analysed, a Master Plan can be prepared which will include the Asset Register and operational and maintenance programmes in support of Infrastructure Asset Management Plans (IAMPs), IDE priorities, medium-term capital projects and long-term scenarios. The Master Plan will outline the impact on consumers/communities and industry, and will include an implementation plan which will be dependent on funding sources, such as own funds, grants and other external sources of funding, or other methods of delivery, such as public-private or public-public partnerships. The parameters to be defined will vary according to time frames and are considered below.

Long-Term Planning

For the development of major bulk supplies, transportation backbones, new industrial expansion zones or radical changes to the geographic, land-use or demographic profile of a municipality, a 20-to-30-year planning horizon should generally be considered. Twenty years constitutes a typical lifecycle or design life of a service, hence such a planning horizon is useful in comparing different timing and project costs for multi-component developments. Capital and operating costs and impacts are then determined in terms of Net Present Costs (NPC) to compare such alternative plans.

Factors considered in long-term planning will include the capital cost of projects at the time of implementation. Costs such as operations, maintenance, impact amelioration and environmental impact must be calculated, as well as the financial and economic benefits of the system over time. Both benefits and costs are considered either as ‘perceived costs’ or in terms of the real cost to society. It is preferable to evaluate both, as people react to and use services in terms of the direct cost to themselves. Levels of service must also be considered, as different levels will make different demands on resources, funds and planning in general. Provision should also be made for a gradual move from basic to higher levels of service.

Financial models and sources of funding need to be considered. Rates, tariff structuring, special taxes and levies, developer contributions and policies, indigent management, own capital, grants, loans and possible sources of external funding need to be explored in determining the viability of development scenarios. For more details see the section on Financial Planning in Chapter 4.

The provision of new bulk services, houses, amenities and facilities is inextricably linked to the availability of land. Long-term plans must consider the availability of land and make provision for acquiring land, zoning it accordingly and protecting it from land invasion, so that it will still be available when required. Where appropriate
land is not available, expropriation must be considered and commenced if necessary as this is a long process. Servitudes must be registered for major pipelines and other network services where required.

According to the CSIR document, *Guidelines for Human Settlement Planning and Design*, master planning predominantly concerns developing major systems. As these may very well have an effect on the environment, Environmental Impact Assessments must be started early, in case alternative development sites ultimately need to be found.

Long-term plans offer a sense of where development should go and ensure that leaders start debating and assessing the scenarios suggested against political, consumer, financial, economic and environmental criteria. Long-term plans will suggest milestones at which each of the planning phases should be initiated to ensure that detailed research on appropriateness, acceptability and viability will be completed in time for development to commence before capacity constraints impact negatively on the well-being of the municipality. Without long-term plans, augmentation or new services only being planned when needed may be costly or difficult, or in some cases impossible.

**Legislated Sector Plans**

Given the lack of long-term planning and the fact that current IDPs do not offer a holistic picture of the status quo, or of the maintenance, refurbishments, upgrading and long-term development required per discipline but rather focus on medium- and short-term needs, sector departments have called for the preparation of development plans associated with each discipline as follows:

- Water Services Development Plans
- Integrated Transport Plans
- Integrated Stormwater Management Plans
- Integrated Energy Plans
- Integrated Waste Management Plans
- Housing Development Plans
- Integrated Environmental Management Plans
- Land Use Management Plans
- Disaster Management Plans

The periods for each type of plan vary from five to 20 years, which means that longer-term sector plans are still needed to consider the scenarios for 20 years and beyond. Long-term plans developed in this way feed into the legislated plans as listed above.

**Infrastructure Asset and Consolidated Municipal Infrastructure Plans (CMIPs)**

Investment in maintenance and the associated condition of the infrastructure are also of critical importance. Figure 7 shows the typical decay that occurs when there is underinvestment in road maintenance. This will eventually impact on the municipality’s ability to offer its citizens access to employment, education and other opportunities. Such deterioration is not limited to roads, but applies to all infrastructure, which, if neglected, will offer reducing levels of service and in some instances will become a danger to the public.

Recognising that most planning initiatives cover the short to medium term and generally consider only capital expenditure, the Municipal Finance Management Act (MFMA) calls for the development of Infrastructure Asset Management Plans (IAMPs) per sector, which must be consolidated into a Consolidated Municipal Infrastructure Plan (CMIP). The guidelines issued for infrastructure asset management were based on best practice published in 2006 by the Institution of Municipal Engineering of Southern Africa (IMESA) in the *International Infrastructure Management Manual* and were intended to ensure that planning considered not only immediate needs, but life-cycle asset management for at least a ten-year horizon.

![Figure 7: Condition deterioration due to underinvestment in road maintenance](image-url)
The nature, extent, age, utilisation, condition, levels of service, performance, value and remaining useful life of the infrastructure must be determined and captured in an Asset Register (see section in Chapter 3). Strategies must be developed to maintain or enhance the levels of service which must be captured in the IAMP and managed through an Infrastructure Management System. The document *Guidelines for Infrastructure Asset Management in Local Government 2006–2009* published by the Department of Provincial and Local Government is an invaluable guide for all who are responsible for managing municipal infrastructure. The emphasis of this document, however, is on a ten-year horizon, which is inadequate for considering long-term needs as was demonstrated in Figure 5 in Chapter 2. The Asset Register and IAMP should be updated as capital development and maintenance takes place. It constitutes the basis for prioritising maintenance and upgrading activities to be carried out in the medium and short term, as illustrated in Figure 4 in Chapter 2.

Once the long-term plan has been developed, projects will need to be prioritised and implemented over the medium and short term as follows:

**Three-to-Five-Year Capital and Operational Plan**

This plan relates to the rolling strategic medium-term plan of the municipality and feeds into the Medium Term Expenditure Framework (MTEF) and the IDP. The plan will determine which long-term projects should be prioritised for development over the period and will outline the rationale for their selection. Development plans should thus be aligned with the Spatial Development Framework and land-use management plans, and must include provision for rezoning land for bulk services where required, and/or registering servitudes. To ensure that there are no delays, a process should be put in place to commence with Environmental Impact Assessments (EIAs) long before the project commencement date.

During this period, in addition to planning for anticipated growth, maintenance, upgrades and replacement plans must be prioritised, drawn from IAMPs, to ensure that all networks reach full life-cycle targets, and to address the possible premature failure of infrastructure that has not been adequately maintained.

The plan must also examine institutional and funding models, external sources of funding and partnerships to accelerate development and increase levels of service. Institutional support must also be considered to determine the capacity, systems and processes required to roll projects out. Such investigations may highlight the need to privatise or partner with the private or public sector to develop, operate or maintain one or more services.

The importance of the medium-term plan is often underestimated as it is simply seen as an answer to the question “What do we do next?” It is, however, much more important, as it is a rolling plan by means of which longer-term, integrated and strategic goals will be achieved. It must be robust, to ensure a logical and continuous implementation path, yet it needs to be able to accommodate and actively support changes due to unforeseen circumstances, such as unexpected demographic changes, changes in economic growth rates, national or provincial programme changes and so on. The plan will be compiled concurrently with the budget for the next financial year and not as a one-year budget plan followed by the medium-term plan.

The medium-term plan has access to relevant and recent data, and needs to be compiled with great care. If adequately developed, it can be used to inform the long-term plan and serve as a sound basis for extrapolation.

**One-Year Project and Budget Plan**

The One-Year Project and Budget Plan for the next municipal financial year is the best known and understood output of the planning process and covers the projects to be delivered in the immediate future. It is compiled annually and is the focus area of the project management team; in many municipalities it is the only ‘plan’ that receives any attention. This is because it deals directly with the municipality’s current responsibilities and allows Councillors to demonstrate to their constituencies that they contribute effectively to the preparation of service delivery processes. It is important that Councillors are able to carry out their duties related to infrastructure and services, as poorly prepared Councillors may not be able to contribute to their municipality’s obligations as defined in the South African Constitution. The plan must also indicate the municipality’s commitment to provincial and national policies, programmes and goals.

This plan should be built up from the priorities outlined in the Three-to-Five-Year Capital and Operational Plan (see previous section) and must be developed in such a way that it provides comprehensive motivation for all projects and processes proposed for inclusion in the municipal budget. The plan will include tender documentation, sources of funding, capacity requirements, implementation plans and community education programmes where necessary to educate communities on the use and care of infrastructure. Maintenance, refurbishment and upgrading should form part of the plan. Works linked to new private developments should either be undertaken by the developer through offsets against bulk contributions, or by the municipality, using funds raised through bulk contributions.

The One-Year Project and Budget Plan links with the overall integrated municipal service delivery responsibility and provides a focus for employees’ immediate duties. As many employees do not relate to longer-term planning, this plan provides daily direction, motivation and job satisfaction, all of which are essential ingredients in making municipalities effective, and also forms the basis of performance contracts. As infrastructure is developed, details should be added to the IAMP as shown in Figure 4 in Chapter 2.
Stakeholder Engagement and Reviews

With the suite of plans having been developed, they can only be considered and adopted once public comments have been invited and incorporated. Plans are finally approved and adopted through a resolution of Council. Ongoing monitoring and evaluation of the implementation of the plans is essential to determine the impact and relevance of solutions adopted and to take into account the ever-changing legislative and intergovernmental landscape, the municipal budget and the demands made on services.
Part II: General Planning Considerations

Developing a strategic plan requires consideration of demand trends and opportunities for development. Many elements that need to be considered for the municipality as a whole and for individual services are common to all municipalities. The range of strategic, yet generic parameters to be considered are outlined in Chapter 4, including economic growth, demographics, environmental, water and energy security, land use and availability, safety, health, security, financial planning, delivery mechanisms, legislation and inter-governmental influences.
Introduction

As outlined in the previous chapters, much development and energy have been focused on addressing backlogs and national imperatives, so that all too often only immediate needs have been considered. Short-term attempts to address backlogs and the haste to connect households to reticulation systems and other services have meant that the actual capacity of current bulk services has been overlooked. This problem is exacerbated by ignorance of and lack of attention to massive losses, inefficiency and wastage. Furthermore, the lack of maintenance and associated deterioration and decay in existing infrastructure, and the unprecedented pressure placed on infrastructure, which is often loaded or operated far beyond its design limits, has resulted in early failures and loss of capacity. The time has come to develop Master Plans which look closely at current conditions and capacity, consider refurbishment, upgrades and disposal where necessary, and to develop new infrastructure of sufficient capacity to cope with the growing demand and recent loss of capacity.

Strategic Planning Imperatives

Several parameters that have been ignored in many planning exercises must be considered. Although demand patterns, technologies and solutions are unique to each sector, there are a number of parameters that affect development in all sectors. These are generic or cross-cutting issues, many of which would have been considered when preparing strategic plans, and they apply to all master planning exercises. Strategic and generic factors relate to both physical conditions that must be considered (such as the impact on the environment and the need to consider, e.g., health, safety and security), and future considerations (such as long-term demographics, business imperatives and global trends that may impact on development). Although most of the strategic considerations should have been taken into account when Growth and Development Strategies and Spatial Development Frameworks were developed, it is imperative that each consideration be revisited when preparing sector plans to ensure that adequate provision has been made for the long term to support sustainable growth.

The issues to be considered for all master planning exercises are shown in Figure 8 and are discussed in more detail below.

Economic Growth

Sustained economic growth and, in turn, greater employment results from more economic investment, either from the establishment of new businesses or the expansion of existing businesses. To achieve its desired future, the municipality’s optimal course of action is therefore to facilitate greater economic investment. In the formulation of a strategic economic development plan aimed at identifying new opportunities and supporting local industries, emphasis will need to be placed on ensuring adequate resources, infrastructure, transport and community services to sustain job creation, which should be a major objective in addressing unemployment and the eradication of poverty.

It must be borne in mind that job creation must be compatible with the natural and cultural resources. Ecotourism must be given consideration and the types of attractions, activities and experiences that this sector of tourism offers must be assessed to determine how best to utilise natural assets within the municipality. Informal trade provides employment opportunities in demarcated areas, incorporating workshops and storage areas. The generation of alternative energy through the harnessing of solar energy, wind energy, or the generation of bio-energy from animal, human and plant waste should be considered in rural areas to allow industrial nodes to be set up, to stimulate growth. Business opportunities associated with biogas should, however, not be limited to rural areas but should be initiated in major centres where large volumes of waste from wastewater treatment works and landfill sites are available for the generation of electrical energy.

Spatial Development Initiatives (SDI), including Industrial Development Zones (IDZs), nodes or corridors, innovation and incubation hubs, should be considered where appropriate to stimulate economic and associated social development, supported by the growth of transport networks and hubs to ensure access to market and job opportunities. Infrastructure should be upgraded where necessary to support development, as many industries have identified the current condition of infrastructure, and in particular electricity blackouts and traffic congestion, as major constraints to future development.
Economists should be core members of the planning team, tasked with developing long-term growth scenarios. These will depend on population growth, the financial standing of the municipality, and the state of the regional, national and global economy. It must be recognised that the longer the planning horizon, the less exact the analysis will be, as conditions can change rapidly as a result of many factors beyond the control of the municipality.

When economic scenarios are being developed, consideration should also be given to innovative financing methods, robust and imaginative tariff modelling and debt collection, and involving developers and external investors in growing the area under consideration.

Items for investigation and consideration should include, but not be limited to:
- Mining and beneficiation processes
- Construction
- Availability of building materials, e.g. considering the location of quarries and clays for bricks
- Manufacturing, including heavy and light industry
- Finance, commercial, service and retail development
- Smart industries, e.g. ICT and Research and Development

Figure 8: Strategic considerations for service delivery planning
Agriculture, agri-processing and forestry
Tourism, ecotourism and heritage sites
Community, social and recreation opportunities
Informal trade and the development of entrepreneurs
Identification of areas needed for specific developments
Opportunities for investment

Demographics

Determining future demographics is a major challenge when developing long-term scenario plans. Overall population growth is not the only parameter associated with the demand for services, but household splitting, single-parent households, urbanisation, migration, HIV/AIDS and other diseases, natural disasters, immigration policies, conditions in neighbouring states and global trends can all influence population figures. The split between low-, medium- and high-income households will affect the level of service required, which will in turn impact on financial modelling. The slow but gradual migration of the previously disadvantaged into the middle class will increase the demand for higher levels of service and place an increasing load on infrastructure.

Policies to reduce the need to increase network capacity or geographical spread must be considered, such as densification, the ‘user pays’ principle, road tolling, prepaid meters and other techniques, to discourage excessive usage or wastage of resources.

Where funding precludes original modelling of long-term growth associated with the municipality in question, care should be taken to ensure that the model adopted takes all of the above parameters into consideration. Use must be made of reputable data compiled by demographic researchers. Items for investigation and consideration include, but should not be limited to:

- Demographic profiles
- Community needs assessments
- Healthcare and education
- Attitudes, opinions and usage
- Social impact
- Socio-economics
- Market segmentation
- Community aspirations
- Cultural practices

Environmental Impact and the Location of Services

The definition of ‘sustainability’ is important when discussing the environment as it implies the ability to meet present needs for land and resources without compromising the needs of future generations. In order to manage any resources in a sustainable manner, all development, especially engineering services development, must take cognisance of the environment to avoid long-term detrimental effects. The approaches employed should be embodied in the municipality’s Environmental Management Framework (EMF).

Chapter 2 of South Africa’s Constitution states that everyone has the right “to have the environment protected through reasonable legislative and other measures that promote conservation and secure ecologically sustainable development and the use of natural resources, while promoting justifiable economic and social development.”

The principles of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended by Act No. 56 of 2002, Act No. 46 of 2003 and Act No. 8 of 2004 (NEMA), state that:

- “Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (Clause 2.(4) (b)).
- “Sensitive, vulnerable, highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure” (Clause 2.(4) (r)).

The general principles of the Development Facilitation Act, 1995 (Act No. 67 of 1995) stipulate that:

- “Policy and administrative practices should promote efficient and integrated land development in that they encourage environmentally sustainable land development practices and processes (Clause 3 (1)(c)(viii)).
- “Each proposed land development area should be judged on its own merits and no particular use of land, such as residential, commercial, conservation, industrial, community facility, mining, agricultural and public use, should in advance or in general be regarded as being less important or desirable than any other use of land” Clause 3 (1)(j).

The natural carrying capacity of an area must be established to ensure a quality living environment. River courses and flood lines must be established, dolomite and other areas unsuitable for development must be determined, and development must be restricted where necessary to reduce the possibility of natural disasters. These and other areas can be earmarked for greening and public open spaces.

Cities ignore the risk of global environmental trends at their peril. Sadly, whenever cities fail to manage these risks, the worst affected are always the poor. Planning should aim at developing sustainable cities by anticipating and managing the effects of environmental change. This means trying to limit the impact of urban processes of production and consumption on the environment. It also means promoting ‘environmental justice’ by ensuring that poorer communities do not routinely suffer most the effects of urban-environmental risks and disasters. In addition, quality of life must be enhanced by extending open spaces and green areas in previously disadvantaged areas.

There is strong evidence that global warming and climate change threaten sustainability and could have severe implications for water resources, energy supply, environmental health and human settlements. Water
resources have been identified as being highly vulnerable to climate change. Water pollution has a negative impact on both the maintenance of healthy ecosystems and the quality of life. Planning measures must be in place to prevent pollution and its therefore negative impact.

The protection or conservation of natural resources is a non-negotiable key to maintaining an area’s future economic vitality and quality of life for its citizens. Conserving highly productive agricultural areas, forests and existing natural vegetation and wildlife, and, in particular, ensuring the survival of rare species must be considered when planning and selecting development sites. For example, the selection of a particular location as a borrow pit or quarry site may be harmful to a sensitive area. Public areas such as beaches, estuaries, nature reserves, wetlands, etc. must be conserved, including the natural vegetation which ensures stability and limits the damaging effects of stormwater or high seas on river courses and the coastline respectively.

Items for investigation or consideration should include, but not be limited to:

- A Strategic Environmental Impact Assessment of the Spatial Development Framework
- Climatic implications, including wind, temperature inversion, climate change, and protracted wet and dry periods
- The proximity of residential areas to major threats to health, such as landfill sites, wastewater treatment works, abattoirs, industries producing hazardous waste, cemeteries and crematoria
- The placing of cemeteries and landfill sites so as to prevent pollution of groundwater
- The distribution of natural vegetation, wildlife and ecosystems, ensuring that their protection is designed into developments in the area
- Fertile agricultural land and areas of scenic beauty which support tourism
- Topography, particularly the possibility of instability or erosion when developing on steep land
- Dolomitic rock and other potentially problematic geotechnical conditions
- Flood lines
- Protection of wetlands
- The possibility of flooding in industrial areas known to produce hazardous waste
- Forestation and greening
- River systems, dams and water supply catchment areas
- Alternative land uses

The Gauteng State of the Environment and Environmental Implementation Plan should be consulted for further guidelines.

Land Use and Availability

Land is an important resource in Gauteng but land use is inefficiently and inequitably structured. The distribution of communities with respect to job opportunities continues to present a problem, while in other instances valuable land remains farmland or highly arable land has been used less effectively for domestic or commercial development. Although these challenges should be dealt with largely when developing and refining the Spatial Development Framework and Land Use Management System, many engineering and logistical challenges must be considered when developing Master Plans since they may impact on or necessitate a revision of these plans.

Where land is required for specific developments such as housing and amenities, land availability will become an issue. Similarly, where major transportation corridors, through-routes, service corridors and pipelines are needed for future expansion, land availability must once again be considered. There are many options for acquiring land, including the use of municipal, provincial, national, tribal or private land. Huge tracts of land are in the hands of the public sector, particularly in those of national departments such as Public Works, the Department of Water Affairs, the Defence Force, the Department of Land Affairs and the Department of Agriculture. Information on ownership can be obtained from the Deeds Office.

In each instance, the land required needs to be acquired and transferred to the final user. Once earmarked, such land must be protected from land invasion, or from developers approaching municipalities to change the land use to suit their requirements, as such changes may thwart long-term development. In the case of services crossing private land, wayleaves and servitudes such as pipeline routes, rights of way, power-line easements, tunnel routes, etc. should be registered which are adequately sized for long-term growth.

Geotechnical and current land use considerations are also important when selecting land. As outlined in the section on Environmental Impact and the Location of Services above, cognisance must be taken of other land uses that contribute to economic growth and well-being, such as fertile agricultural land, scenic areas, ecologically sensitive areas, etc. If such areas were to be developed, this would disrupt the economic well-being of those living off the land and may reduce national production of critical crops. The remains of past mining activities, such as slimes dams, mine dumps, shallow undermining (which is subject to subsidence), unrehabilitated mining land and shaft areas, and radon emissions, may also constrain development.

Geotechnical suitability is another key consideration. To ensure stability, construction in dolomitic areas, heaving clays and other unstable foundation materials is not always practical, and where it is possible, the land is more expensive to develop. Similarly, development in rocky areas is expensive and also poses a challenge to property owners in that excavation is difficult, which limits their opportunities to landscape and further develop their properties once construction is complete.

In selecting land, many engineering and logistical issues need to be considered. These should include, but are not limited to:

- Land requirements
- Land availability and current ownership
- Access to transport
- Current usage, e.g. vacant, derelict or underutilised land
Strategic Planning andGeneric Considerations

Current productivity of the land, including agricultural use and ecological considerations
Urban development and growth directions
Access to services
Adequate water and electricity supplies and sewage and stormwater discharge capacity
Topography, particularly the possibility of instability or erosion when developing on steep land, or difficulty in handling drainage when developing on flat land
Geology, paying particular attention to difficult geotechnical conditions such as dolomitic areas, heaving clays and solid rock
Flooding and wetlands
Environmental issues as outlined in the previous section

Strategic Sector Considerations

Although the bulk of this document is aimed at sector planning, several strategic issues must be considered in terms of sector management, as follows:

Water and Energy Security

Municipalities are generally able to ensure, within financial constraints, that they develop adequate services for the removal, treatment and management of solid waste, and provide the roads and transport networks required. They are, however, generally dependent on many spheres of government for access to bulk supplies of water and energy. The national Department of Water Affairs is generally responsible for the development of dams and international water supply schemes to provide water for South Africa, and Eskom for the generation and supply of electricity.

Given the arid nature of most of South Africa and the capacity limitations with respect to electricity, major long-term developments of township, commercial or industrial areas cannot be considered unless sustained water supply and energy security are assured. This could mean negotiating with neighbouring municipalities or water boards who have excess capacity to pipe supplies into the municipality, starting an aggressive campaign to set up a network of Independent Power Producers in the case of electricity, or expanding alternative supplies such as gasworks. At the strategic planning stage the exact constraints may not be known, but the investigation of various scenarios should be called for before ambitious development plans are made which cannot be achieved.

Safety, Health and Security

One of the planning objectives must be to provide a safe, healthy, sustainable and secure environment for citizens. Security is critical for promoting economic growth and enhancing the quality of life. Safe, healthy and well-educated citizens and workers are the basis of a prosperous and high-quality city or town. Residents must feel safe while travelling, as drivers, pedestrians, and passengers. They must be protected from the consequences of fires and be safe from disasters and their effects. In addition, citizens must be trained and prepared to deal with extraordinary events. Adequate police, fire protection and emergency medical services must be provided. The correct location of police facilities will decrease response times, increase patrol availability and enhance community-oriented policing.

Security measures should include electronic surveillance systems and covering the key areas of central business districts, transport nodes, retail precincts, tourist destinations, schools and sports venues, integrated with traffic management information and systems. Correctly locating fire stations will provide safe, efficient and equitable fire protection, and emergency medical services must be in place for emergency treatment. Means to prevent fires and reduce response times are, for example, ensuring that clear road names, house numbers, fire hydrants, street lighting and telecommunications are in place. GPS systems, based on GIS, will become increasingly important for municipality police and protection services in order to store and locate data, as well as to enhance response times to emergencies and find the exact locations of incidents. Public health and health care services must be located in areas easily accessible to the population.

Items for investigation and consideration should go hand in hand with the demographic study and should include, but not be limited to:
Strategic Planning and Generic Considerations

General Planning Considerations

- Population needs and vulnerability
- Positioning of clinics and hospitals
- Fire prevention services
- Adequate access to emergency services and treatment
- Disaster management and training
- Traffic security
- Availability of police and security services
- Needs of special groups, including the disabled, the aged and those suffering from HIV/AIDS

Disaster Management

In terms of legislation, every municipality should have an operational Disaster Management Plan in place. However, attention to disasters needs to go further than planning and must be supported by physical resources, including staffing. Ongoing training and updating of resource databases is critical.

Disaster resilience measures should be researched and specific plans of action should be put in place to develop, build and sustain a culture in which risks and possible disasters are identified and proactively addressed. This requires:

- Identification of potential disasters
- Identification of areas, communities and households at risk
- Measures to reduce the vulnerability of risk areas
- Prevention and mitigation strategies
- Contingency plans and emergency procedures in case of disasters

Disaster resilience measures aimed at preventing disasters and guiding processes should include communication at all levels during and after incidents. Typically, Disaster Management Plans should address natural and human-initiated disasters, such as droughts, flooding, fires, power failures for mission-critical activities, structural failures, chemical spills, gas leakages and explosions, earthquakes, mining-related collapses, sinkholes, failure of dams and slimes dams, contagious or pollution-related diseases and major accidents, such as multiple vehicle or aircraft accidents.

Although district municipalities are responsible for developing Disaster Management Plans, much of the infrastructure required to respond to disasters, or which may contribute towards disasters, is the responsibility of local municipalities and metropolitan municipalities. It is therefore important to consider disaster prevention and management when developing sector plans.

Since climatic conditions change from year to year, specific attention should be given to mitigation. Typically, a new urban development in a stormwater drainage basin may influence the flood levels downstream. Buildings and structures that are not inspected regularly may cause disasters due to a lack of maintenance or changes of use. In the case of bridges, new load allowances for vehicles may be introduced which exceed the design loads.

In mining areas the maintenance of slimes dams or slurry dams must be closely monitored. A potential disaster could build up over a number of years. In the case of mine dumps, sand blowing off poorly maintained dumps could cause illnesses for those in close proximity, including lung ailments. Acid mine water drainage will also cause disasters in the long run if it remains unchecked and untreated.

Fire hazards in urban environments are particularly important since uncontrolled so-called ‘informal settlements’ where buildings and town planning layouts do not conform to fire regulations are regular causes of disasters. Water networks must be planned to include such areas and network design should ensure that adequate water pressure is available at peak demand times so that the draw-off volumes associated with fire fighting can also be coped with.

Sector Departments

Sector departments are departments and structures that are directly involved in planning, policy making, coordination, development, implementation, monitoring or reporting on matters relating to service delivery. Cooperative governance is vital to ensure that the different departments and spheres of government work towards common goals and objectives when planning. Integration, harmonisation, alignment and collaboration with and between sectors is essential to ensure that overlapping and duplication are minimised and that mandates are clearly understood and acknowledged.

Legislation, plans, directives and infrastructure provided by the following national departments should be considered when developing Master Plans:

- Department of Cooperative Governance and Traditional Affairs (COGTA)
With regard to networks and supply, integration with parastatals is necessary. These organisations include:
- Telkom and other telecommunications entities
- Water boards, e.g. Rand Water and Magalies Water
- Eskom
- Transnet
- The South African National Roads Agency Limited (SANRAL)
- Petronet and gas pipeline-related institutions

To determine provincial imperatives, the work of all provincial sector departments should be considered. These include:
- Gauteng Department of Local Government and Housing
- Gauteng Department of Environment and Tourism
- Gauteng Department of Agriculture and Rural Developments
- Gauteng Department of Economic Development and Planning
- Gauteng Department of Roads and Public Transport
- Gauteng Department of Infrastructure Development
- Gauteng Department of Health and Social Development
- Gauteng Department of Education
- Gauteng Department of Sports, Arts, Culture and Recreation
- Gauteng Department of Finance
- Gauteng Department of Community Safety

**National and Provincial Imperatives and Prioritisation**

In considering the long-term needs, all national goals and targets must be taken into account, including the Millennium Development Goals listed in Chapter 1 and more recent plans and goals that look further ahead, such as:
- Human Settlements Vision 2030
- Transport 2050
- Integrated Waste Management Targets 2015
- Gauteng Vision 2055
- Gauteng 2034 Energy Strategy

Where national targets demand that imminent deadlines be met, it will be necessary to prioritise spending to comply with these demands. The most pressing of these deadlines affecting current spending are the 2012 to 2014 deadlines as follows:
- Access for all to electricity by 2012
- Access for all to basic roads, sports, recreation, waste disposal, public and community facilities by 2013
- Upgrading of all informal settlements by 2014
- Accelerated housing delivery by 2014

**Financial Planning**

In planning developments, attention must be given to the sources of funding available as such funding may be critical for large-scale bulk supplies, plants or networks. Funding that has been successfully accessed should be factored into short-, medium- and long-term plans.

**National Grants**
The range of national grants should be considered, such as the Provincial Infrastructure Grant, the Restructuring Grant, the Municipal Infrastructure Grant, the Neighbourhood Development Partnership Grant, the Regional Bulk Infrastructure Grant, the Operations and Maintenance (O&M) Grant and others which are made available to address the various targets or challenges that arise from time to time.

**Additional Sources of Funding**
Additional sources of funding include:
- The municipality’s own annual budget
- Special levies
- Housing subsidies
- Bulk service contributions
- Commercial loans
- Loans from Development Fund Institutions
- International finance
- Special-purpose international grants, such as the GTZ Energy Efficiency Grant
- Donor funding, e.g. from German Technical Aid (GTZ), UK Department for International Development (UKDFID), United States Agency for International Development (USAID), the European Union (EU), Myula Trust, etc.
- Sale of carbon credits
- The private sector through the formation of public-private partnerships to tackle major initiatives
- The public sector where large projects would be more cost-effective if developed for more than one municipality or in conjunction with national or provincial departments or State-Owned Enterprises (SOEs)

**Delivery Mechanisms**

There are a number of mechanisms for delivering services:
- Specifying, managing, operating and maintaining infrastructure carried out by the municipality itself
• Engaging the private sector to deliver, train and/or operate and maintain
• Completely outsourcing
• Entering into partnerships, public-private or public-public

The choice will depend on variables such as the availability of technical, administrative and managerial capacity in the municipality and whether there are adequate capital and operating funds for critical large-scale developments.

**Internal Delivery**

This is the normal model in which the municipality is the developer, owner and provider of services. Projects are planned, designed either in-house or by the private sector, and constructed either by in-house teams or by contractors, but are owned, operated and maintained by the municipality. Consumer or user charges are levied to consumers or users for services rendered. There is a range of models that can be entered into with the private sector or communities with regard to design, construction, operations and maintenance, which a municipality may consider where capacity or time constraints arise.

**Engaging the Private Sector to Deliver, Train and/or Operate and Maintain**

• **Build, Operate, Train and Transfer (BOTT)**
  Where a municipality does not have the capacity to set up operations and develop and maintain the skills base necessary to operate infrastructure, tenderers may be called upon not only to build, but also to appoint and train people to operate and maintain the new infrastructure for a period, ultimately handing the fully operational infrastructure back to the municipality, together with a full complement of operations and maintenance staff.

• **Community Projects**
  In a bid to create jobs, the government devised the Expanded Public Works Programme (EPWP) to roll out capital works that can be carried out using labour-intensive methods. Although it is necessary to consider the possibility of using EPWP methods of construction when designing new projects, greater long-term employment opportunities can be created by using local communities to operate and maintain services. This contributes to sustained employment opportunities and must be factored in when selecting the type of service and associated operations and maintenance for poor communities or remote areas.

  To ensure that comprehensive scopes of work are developed and that projects are adequately designed and constructed, municipalities require qualified and experienced engineering staff to scope and quality assure service delivery. In addition, a sufficiently skilled management team is required to oversee operations and maintenance of infrastructure.

**Outsourcing and Partnerships**

With regard to major projects, it must be remembered that many municipalities have inadequate resources, expertise, experienced personnel, or cash flow to operate and maintain mission-critical infrastructure such as water and sewage treatment works. Hence it is necessary to consider external or partnership arrangements, as will be discussed in the following sections.

• **Completely Outsourcing – Privatisation**
  Privatisation is the most radical approach to providing municipal services. In this case the entire asset, its operation and maintenance and the opportunity to generate income are ‘sold’ to the private sector. Such deals often meet with resistance since the whole responsibility is transferred to the new owner, which makes it difficult to hold the owner accountable for the long term and renders the public helpless when things go wrong. Limiting tariff increases becomes more difficult and loss of jobs is a concern of the unions. Research data, however, show that in most instances privatisation does invariably lead to cost savings and improvements in service levels over time. Of benefit to municipalities is the fact that privatisation transfers all the risks to the new owner.

• **Public-Private Partnerships**
  Public-Private Partnerships (PPPs) can be successful in instances where municipalities are unable to raise sufficient capital for development or to provide the capacity and resources cost-effectively to operate and maintain infrastructure. PPPs represent a collaborative arrangement, over one or more phases of the lifecycle of a project, between a municipality and one or more private sector parties. Rights and responsibilities are specified along with the element of sharing risks and rewards in a long-term contractual relationship. In effect, the private sector partner raises sufficient capital to construct the project and raises income through, for example, the sale of treated water in the case of a water supply project. There currently appear to be substantial opportunities to mobilise the private sector in the provision of alternative energy and recycling, for example in the development or operation of landfill sites and wastewater treatment works.

  At some stage the funded capital must be repaid. Due to the large indigent population in many municipal areas, the private sector finds providing municipal services unattractive. It has been found internationally that formal privatisation has not benefited lower-income communities. Hence only certain ring-fenced income-earning activities lend themselves to PPPs.

• **Public-Public Partnerships**
  Public-public partnerships can be successful where more than one municipality or organ of state requires the same service and can develop or operate in partnership to achieve economies of scale. Regional solutions, such as water supply and treatment works, can often be more effective than each entity developing
its own facility. Partnerships with water boards and provincial and national road authorities, among others, may also be considered to avoid having to develop, duplicate or augment internal water supplies, or to develop and maintain transportation corridors respectively.

Comprehensive guidelines were developed by the former Department of Provincial and Local Government (DPLG), now the Department of Cooperative Governance and Traditional Affairs (COGTA), on the selection and implementation of municipal service partnerships. These guidelines require astute technical staff in local government to identify, develop and manage the partnerships that will serve their municipalities. They also require careful crafting of agreements, which should include the duration of the agreement and the value of the infrastructure at the end of the agreement.

**Legislation**

There is a great deal of legislation that addresses how infrastructure and associated finances and resources must be developed and managed, and that addresses public safety and well-being, and the protection of the environment. Specific Acts and guidelines will be discussed per sector in Part IV, but cognisance must be taken of the cross-cutting influence that many Acts and guidelines have on infrastructure development. A comprehensive list of relevant legislation is given at the end of the bibliography for this document.

**Local Knowledge and Experience**

It should be clear from this chapter that the service providers selected to handle master planning should have a thorough knowledge of local conditions, trends and challenges. Master planning exercises are often found to be inadequate or expensive when service providers are appointed who have little knowledge or experience of the local area and simply apply national norms and standards, or spend an inordinate number of hours interviewing municipality staff and communities to try and develop an understanding of the status quo and needs. Furthermore, the latter approach rarely offers a sufficiently broad perspective to plan adequately.
In this part the sector planning considerations associated with master planning are outlined per service (Chapters 5 to 11), covering the status quo, future demand and parameters to consider when analysing the data and preparing the final plan. These include demand management, levels of service, alternative technologies, delivery methods and risks. The final elements to be included in the Master Plan are discussed. The services considered are water, sanitation, stormwater, roads and transportation, electricity, solid waste, housing and municipal buildings and facilities.
Introduction

Infrastructure plans must match the social and economic development needs of the area. Economic development in particular requires the provision of a reliable set of municipal services which are necessary to facilitate growth and maintain safe, healthy and sustainable environments for human activity and the environment in general. Plans must provide for adequate shelter, water and energy supplies, and the removal of all forms of waste, including the separation of communities from the waste, hazardous materials, potential pollution, protection from flooding and so forth. Plans must accommodate and give preference to integrated transport modes that will increase access to employment, community services, health, cultural, recreational, educational and commercial facilities, and must decrease reliance on single-occupancy vehicles.

Drivers and Inhibitors

The two main drivers or inhibitors of service delivery are financial and physical. The interaction of the two will determine the success and, ultimately, the sustainability of the service or infrastructure. If insufficient service charges are levied to replace assets and expand and maintain the service, it will not survive. Likewise, if the service is not operated and maintained properly, the physical components will deteriorate prematurely, resulting in a reduced lifespan.

To be sustainable, a service must have both a capital and an operating and maintenance budget. The capital budget is aimed at replacing ageing infrastructure and establishing new infrastructure to service the expanding client base. Funds for operations and maintenance are required to generate or purchase bulk supplies and operational items, including staff, materials and machinery. Likewise, infrastructure must be physically developed, replaced, repaired or serviced and must be efficiently managed with respect to load, demand and supply constraints.

The Asset Register and Infrastructure Asset Management Plans

The first consideration for all sectors is to establish the status quo (current situation) and evaluate the viability of existing infrastructure, including primary and secondary networks, routes and equipment, to provide reliable and affordable services to all current and future consumers and users. Without the setting up of a comprehensive Asset Register, detailing and locating all infrastructure, its condition and value, current usage, long-term capacity and remaining useful life, it is difficult to determine long-term development needs. Asset registers form the foundation for all planning and must be kept up to date.

In addition, Infrastructure Asset Management Plans (IAMPs) and supporting systems must be in place. These are essential tools for the planning, development or acquisition, utilising, operating, monitoring, maintaining and decommissioning of infrastructure, taking into consideration total lifecycle cost, service level and risk exposure, and are a requirement of the Municipal Systems Act, 2000 (Act No. 32 of 2000). Such systems require trained staff for using, managing and interpreting data, and require funds for updates and software upgrades.

The key to successful infrastructure asset management is to change the way departments think and operate. Figure 9 shows the change elements required to institutionalise infrastructure asset management.

‘Asset management’ can be considered as a body of integrated management practices applied to the entire portfolio of infrastructure assets. It seeks to minimise the total investment in acquiring, maintaining, operating and renewing the assets within an environment of limited resources, while continuously delivering the service levels that consumers/stakeholders desire and regulators require. The development and maintenance of asset management systems should be included as an output of all master planning proposals. Phasing and prioritisation are made considerably easier and more reliable when such systems exist.

Developing Master Plans based on infrastructure asset management plans integrates strategic-level management and operation-level management into a single focus.
In preparing short-, medium- and long-term plans for service delivery, attention must be given to institutional capacity and the municipality’s ability to plan, deliver, operate and maintain infrastructure. Although a detailed implementation plan in terms of resources and support is not required as part of a master planning exercise, recommendations should be made about the staffing levels and competence requirements, systems, policies, procedures, tools and equipment that should be in place to achieve the final goals. Adequate leadership, direction and capacity, whether in-house or outsourced or a hybrid model, must be in place to ensure the successful implementation of Master Plans.

The following chapters look at the specific parameters that must be considered per sector when preparing a Master Plan.

1 Source: RICS Public Sector Asset Management Guidelines – A Guide to Best Practice
Introduction

The importance of this limited resource is well recognised and subject to extensive legislation as there can be no development without water. The provision, distribution and management of water require many levels of organisation to provide for the needs of communities – be they domestic, commercial or industrial users. The provision of water infrastructure is by nature invasive since it involves underground reticulation which is costly to install and difficult to change at a later stage. For this reason water reticulation requires a long design life and must be planned for the long term.

Providing bulk water infrastructure is not only costly, but time-consuming with regard to both planning and construction, with lead times of two to five years for reticulation, five to ten years for purification works and 15 to 20 years and more for dams. It is imperative that the long-term planning is properly funded and researched and is recognised as part of an integrated scheme. It is for this reason that the long-term vision and mission of the municipality, i.e. the Growth and Development Plan, must be known and understood. Planning therefore needs to follow the process outlined in Chapter 3, all elements of which are discussed in the sections below.

Status Quo

Legislated Reports

The Water Services Development Plan (WSDP) as required in the Water Services Act, 1997 (Act No. 108 of 1997) provides comprehensive information on a complete municipal water scheme, including short-term planning. This WSDP should provide the status quo, the present capacity and the capabilities of the system, and the requirements to meet the immediate needs related to a five-year plan. However, this document may not be reliable, must be checked regularly and, if it is found to be outdated, current information must be gathered.

In this instance it will be necessary to review bulk supplies and treatment works, distribution systems and associated efficiencies to determine the current capacity.

Bulk Supply

The bulk supply system is a strategic service that is subject to long-term planning initiatives and forms the basis for continuing development. It is necessary to assess the existing system and determine the delivery capacity in terms of the growth of the consumer base, purchase agreements, storage facilities in the form of dams and reservoirs, trunk mains, purification works and, where applicable, groundwater. Any limitations or restrictions affecting normal operation need to be identified and quantified, and the current level of delivery into the distribution system must be determined. Bulk water supply is a primary asset of high cost and long design life. Therefore efficient operation and maintenance are vital and to this end effective asset management is imperative.

Distribution System

The distribution network must be assessed to determine delivery capacity in terms of storage reservoirs, pump stations and distribution pipework. Any shortcomings in the service due to flow, pressure, continuity or quality of supply need to be identified. Many of the problems with distribution systems relate to operations such as closed, broken or lost valves resulting from burst pipes or leak repair work. It is necessary to determine to what extent poor service delivery is a function of design limitations or operational failure. In rural areas, borehole schemes are particularly problematic as pumps are rarely maintained, or fuel may not be available in the case of diesel pumps, and alternatives such as hand-pumps or alternative access methods should be considered.

Current Demand

Various levels of water usage must be determined by conducting a water balance exercise based on the bulk supply (as required by legislation) and evaluating the unit demands of the consumer profile. This is particularly important in the case of unmetered water supply to end users as it relates to the ’deemed consumption’ group which is frequently subject to controversy. Where insufficient information is available, it will be necessary to undertake field investigations for an accurate determination of the water supplied. To this end bulk water meters, which function correctly and are maintained regularly, must be installed.
Backlogs

Backlogs relating to the Millennium Development Goals and the enhanced levels of service promised to various communities need to be determined and factored into future planning. Recommendations for upgrading, improvements and refurbishments that have not been executed need to be reviewed to determine whether these are still relevant or in need of reassessment. The current IAMP also needs to be reviewed to identify unfulfilled maintenance requirements. If an IAMP does not exist, it should be prepared to guide planning.

Efficiency Levels and Losses

The performance of service delivery, judged from consumer complaints, must be assessed to determine the underlying causes of complaints. Furthermore, the effectiveness of operations and maintenance, judged from evaluation of the Service Delivery and Budget Implementation Plan (SDBIP) against unplanned repair/replacements, must be determined and assessed.

The various components of Non-Revenue Water (NRW) must be assessed and problem areas such as physical loss, wastage, billing errors and deemed consumption calculations must be determined. Legislation stipulates that a municipality must draw up a water balance across its supply and demand system each month in order to determine where problem areas exist. This assessment must be made using the modified International Water Association (IWA) water balance approach as per the guidelines developed by the Water Research Commission (WRC).

Future Demand, Needs and Challenges

Spatial Development and Land Use

Regional development in terms of national initiatives and recognised target areas for growth and development must be considered. With regard to land use, the anticipated water demand and critical factors that would affect service provision must be identified. This will typically involve the regional Water Board which may need to extend its system to deliver water to the area. These trends and probable future demands need to be jointly agreed with the Water Service Authority.

The planning area must be divided into supply and pressure zones which are dependent mainly on the topography, and the potential of the area must be evaluated in terms of the numbers of present and future consumers. This will determine the potential water demand. The demand forecast will vary in accordance with the zoning, for example industrial, commercial or residential, and with the development rate or changes in land use. Forecasts of the rate of development of the area and of the growth patterns must be made to determine the lifespan of existing infrastructure and to what extent and when it will need to be upgraded and augmented.

Bearing in mind the length of the lead times required to plan, design, construct and commission infrastructure and the availability of funds, growth forecasts and predictions need to be made on a regular basis.

The effects of the densification initiatives of existing developments, changes in land use or rezoning of large tracts of land must be assessed and taken into account. This may require upgrading of reticulation, mains and reservoirs.

Demographics and Possible Growth Patterns

Based on planning reports and established land use, the various development scenarios need to be recognised and strategic requirements with regard to bulk supply and service delivery determined. This will include determination of the bulk supply point, trunk mains routes and storage reservoirs. Care must be taken that servitudes are timeously registered and that these servitudes are policed so that encroachment does not take place.

The actual water demand as determined by the levels of service and the number and type of consumers will depend on the growth rate. The growth trend is not a water-related factor and must be agreed with regional and local planners.

Economic Development

Successful economic development requires that all stakeholders are treated equitably such that no sector of the community is neglected in favour of another. To this end industrial, commercial and institutional users must be properly included in the planning process. Where a Local Economic Development strategy is in place, it will form an integral part of the planning and approval process.

By means of close cooperation and liaison with the supply authority and with the knowledge of the predicted future demand, the positions of future supply points need to be established. This should be followed by the design of bulk supply mains and, where necessary, reservoirs that feed into determined supply zones. The system design will establish the necessity for pump stations and water-pressure towers.

Levels of Service

Levels of service for water as published in the COGTA, 2010 Municipal Infrastructure Industry Guide, are defined as follows:

- Minimum service – 6 kl of drinking water per month, delivered to within 200 m of each household
- Basic service – communal standpipes or yard taps
- Intermediate level – roof tanks
- Full service – in-house reticulation

Service provision is dependent on the needs of the consumer and the level of development in the service area. The standards will be the national guideline, unless amended by local by-laws. This will generally be a metered connection sized to suit the demand and paid for according
to tariffs. In low-income developments with indigent users, the level of service is usually unmetered and ‘deemed consumption’ is allowed for. In these areas bulk metering should be in place for loss-management purposes.

Levels of service should be negotiated and agreed with communities, and provision should be made in long-term planning for these levels to be finally upgraded to a full in-house reticulation service. Levels of service will also be determined by the availability of resources and local conditions, for example in remote, hilly areas, full in-house supply may be too costly both to construct and maintain for a small number of households.

Legislation and Guidelines

Numerous pieces of legislation and documents guide and/or dictate aspects of water supply, its use and the quality of effluent. The most significant of these are:
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
- Water Services Act, 1997 (Act No. 108 of 1997), as amended by Act No. 30 of 2004
- Department of Water Affairs’ Water Quality Management Policy

Analysis and Modelling

The provision of a hydraulic model of the water supply scheme, based on the latest cadastral and topographical information and derived from current aerial photography, is essential to:
- Determine present and future system pressures and flows during various demand situations, including fire fighting and periods of drought
- Identify problem areas
- Quantify upgrading and augmentation requirements to accommodate present and future demands
- Provide a tool to enable the implementation of water demand management
- Develop, manage and monitor a maintenance programme
- Identify pressure and supply zones

Water Demand Management

If a water balance calculation is done as required by legislation, it ought to show the physical losses in the system. However, when the adapted IWA water balance is done according to acceptable standards, it will show that the actual NRW far exceeds the losses calculated as there are many other elements associated with NRW, such as water used but not paid for, illegal use, own use by the municipality, wastage, etc.

The NRW can be derived technically but can also be established through an audit of the financial statements of the municipality. The NRW is a large ‘new source’ of water to produce or generate revenue for the municipality if it is addressed correctly. Reducing the NRW to the practical minimum should be the first priority. Metered or uncontrolled services are known to be a major issue and must be addressed since doing so could delay the immediate need for upgrading a bulk supply.

Bulk Supplies

Hydraulic modelling and network analysis will identify shortcomings in the system, but attention must be given to ensuring that the existing components perform to design criteria and that these are properly operated and maintained. Consideration should be given to cooperation agreements with adjacent municipalities for joint schemes in boundary areas.

Upgrades and Refurbishments

The municipality should establish an infrastructure asset management system which will provide for lifecycle costing, maintenance programming and budgeting for operations and maintenance. Proactive maintenance, upgrading or refurbishment of existing infrastructure may be more cost-effective than replacing or developing a new service.

Expansion of Networks

When future areas of expansion have been identified and all town planning criteria have been addressed, provision must be made for the timeous expansion of networks to cover the new area. Care must be taken that the bulk supply network is able to cope with the expansion of the reticulation network serving any new development.

Alternative Technologies and Solutions

Where the terrain, budget or a lack of capacity to maintain adequately a sophisticated collection, supply and reticulation system constitute challenges, alternative solutions such as rainwater or fog harvesting, yard tanks and rural water schemes should be considered. More expensive methods, such as desalination or treating effluent and mine water, may be necessary where natural water supplies are limited. The possibility of recharging underground aquifers by artificial means, such as channelling stormwater runoff to aquifers, must be investigated. This can be fruitfully done depending on the area.

In all schemes that intercept rainwater runoff there is the added benefit that the ever-increasing percentage of runoff due to development is reduced and consequential flood damage may be reduced as well. Typically, the application of permeable paving can also assist in this regard.

Delivery Methods

Where bulk supplies require augmentation, it is generally advantageous to partner with neighbouring municipalities,
Water Boards and, where appropriate, with the DWA to consider long-term supply. In most cases, bulk supplies would be provided through Public-Public Partnerships.

It may be best for rural water schemes to be operated by the communities that receive the service and for this purpose a Community-Based Organisation may be set up with responsibility for operating and maintaining local boreholes, pumps, reticulation systems and storage components. Water Service Committees as provided for in the Water Services Act, 1997 (Act No. 108 of 1997) will govern these models of supply.

Risk Assessment

Once the demands and requirements have been fully determined and the present capacity and operational ability assessed in detail, the necessity for augmentation, upgrading and additional infrastructure can be evaluated. To establish priorities for implementation, a risk assessment must be carried out to determine the consequences of delayed implementation and to assist in planning the necessary schemes. In particular, the risk to long-term growth of delaying the development of critical infrastructure such as bulk supplies needs to be determined. Until water demand management is effective in areas with uncontrolled and deemed consumption, the high risk of ‘unexpected’ water shortages impacting on new schemes and commercial investments must be considered.

Fire-fighting represents a further challenge to water supply. Pressures should be adequate to deal with emergencies, even during the daily peak demand times. Where this is not possible, the level of risk should be determined.

Lack of expenditure on water quality management and the risk to health is a further consideration. Assessment of water quality challenges should also be factored into the analysis as water-related diseases can pose a severe threat to health if the quality is not adequately managed.

The Master Plan

Once an Asset Register has been developed and the current supply and long-term demands have been determined, the Master Plan can be compiled. It will be composed of long-term plans, which will determine the infrastructure development backbone, and medium- and short-term plans, which will address priority developments. These will be phased in the Master Plan as follows:

Long-Term Plan

Based on the Spatial Development Framework and the Town Planning Scheme for the area developed in terms of the Growth and Development Strategy, long-term plans are designed for the next 20 to 30 years, taking into account the anticipated economic and population growth. Long-term development forecasts must be made, including development priorities. These must be monitored and updated each year during the IDP process, based on the direction and type of growth taking place. The long-term forecast must be accompanied by present-day cost and operational cost estimates. These are adjusted annually so that the Water Department can prepare budgets for the Medium Term Financial Plan (MTFP), for the anticipated capital and for the O&M costs, and the municipality can make decisions on the levels of service to be provided.

The long-term plan will set milestones for selecting the most suitable sites for the provision or expansion of dams, reservoirs, purification works, distribution networks and pump station locations, and needs to look at land acquisition or the registration of servitudes.

The long-term plan will also set milestones for identifying delivery methods, and alternative sources of funding and external investment.

Three-to-Five-Year Capital and Operational Plan

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3.

One-Year Project and Budget Plan

The short-term plan will cover projects to be delivered in the immediate future in accordance with the guidelines outlined in Chapter 3. The plan should focus on areas of stress being experienced by municipalities and make recommendations to address them. Maintenance, refurbishment, upgrading and shortcomings should receive priority.
Introduction

The supply, operation and maintenance of sanitation systems is well covered by legislation. The provision of adequate sanitation is in many ways just as important as that of water supply in that when sanitation is not properly managed, the water resources become polluted and waterborne or sewage illnesses will cause secondary problems, resulting in an increased burden on health services. Sanitation has many levels of organisation to provide for the needs of communities, be they domestic, commercial or industrial. The provision of sanitation infrastructure is invasive and its installation is costly, but generally it has a longer design life than that of water reticulation infrastructure.

Building bulk infrastructure is complex since relying on gravity to convey the sewage means increasing the depth at which the pipes have to be laid, in contrast to water pipes which operate under pressure. This involves routes that generally follow ground contours and cannot easily go under or over obstacles. Planning and construction are time-consuming as in some places sewers are very deep and in other places they may have to cross low points such as valleys or bridges.

Where gravity flow is not practical or possible, pump stations have to be built, operated and maintained at substantial cost. Sanitation waste is handled at treatment works. The necessity to acquire land and to arrange servitudes for large pipes can mean lead times of 10 to 15 years. It is imperative that long-term plans are properly researched and form part of an integrated scheme. It is for this reason that the long-term vision and mission of the municipality must be known and understood. Planning therefore needs to follow the process outlined in Chapter 3, all elements of which pertaining to sanitation are discussed in the sections below.

Status Quo

Legislated Reports

The Water Services Development Plan (WSDP) as required in the Water Services Act, 1997 (Act No. 108 of 1997) provides comprehensive information on a complete municipal sanitation scheme, including short-term planning. This WSDP should provide details of the status quo, the present capacity and the capabilities of the system, and the requirements to meet the immediate future needs related to a five-year plan. However, this document must be checked regularly and if it is found to be outdated, current information must be added.

In this instance it will be necessary to look at the collection, conveyance and treatment systems and associated efficiencies to determine the current capacity.

Bulk Capacity

Inadequate bulk collection and/or outfall sewers and processing facilities at treatment plants may limit long-term development. It is necessary to assess disposal and treatment capacity, including conservancy capacity, package plants and wastewater treatment works. Reduced capacity due to poor operations and/or maintenance needs to be considered. Many of the problems associated with treatment are related to poor operations or maintenance, including:

- Understaffing
- Unqualified staff
- Lack of capacity
- Overload due to ingress of groundwater and stormwater into sewer lines
- Wastage of potable water entering the system through leaking taps and toilets
- Treatment of diluted sewage and industrial effluent

It is necessary to determine to what extent poor service delivery is due to a design limitation or to an operational failing. Sewerage facilities are high-cost primary assets and long design life and efficient operation are vital. Effective asset management is imperative.

Collection Systems

Collection systems must be assessed, including the adequacy of sewage-collection networks, dry sanitation solutions and vacuum-pump tankers and chemical toilets. It is necessary to determine to what extent poor service delivery is a design limitation or an operational failing. Any design shortcomings in the service, including inadequate pipe or pump capacity and insufficient sewer grade, should be quantified. Many of the problems in networks are related to operations and maintenance, such as broken or blocked pipes, or ingress of stormwater.
**Current Load**

The municipality must determine the quality and composition of inflow into the treatment works in order to implement appropriate treatment and to adapt the treatment process if necessary. This will also involve determining whether ‘illegal’ substances are being dumped into the system. Such substances must then be analysed and their source must be established. Industries and commercial enterprises must be monitored regarding their effluent and the ‘polluter pays’ principle must be adopted. Pretreatment by industry is advisable.

**Backlogs**

Backlogs relating to the Millennium Development Goals and the enhanced levels of service promised to various communities need to be determined and factored into future planning. Recommendations for upgrading, improvements and refurbishment that have been delayed must be reviewed to determine whether they are still relevant or in need of reassessment. The current IAMP must be reviewed and unfulfilled maintenance requirements, staffing levels and availability of tools and materials must be identified. If an IAMP does not exist, it should be prepared to guide planning.

**Efficiency Levels and Losses**

The performance of service delivery, judged from consumer complaints, must be assessed to determine the underlying causes of complaints. Furthermore, the effectiveness of operations and maintenance, judged from evaluation of the Service Delivery and Budget Implementation Plan (SDBIP) against unplanned repair/replacements must be determined and assessed.

**Future Demand, Needs and Challenges**

**Spatial Development and Land Use**

Regional development in terms of national initiatives and recognised target areas for growth and development must be considered. With regard to land use, it is necessary to determine the volume and type of inflow expected and to identify critical factors that would affect service provision, including the extent of the area to which the municipality can viably supply waterborne sanitation.

Waterborne sanitation will normally be limited to the urban edge, i.e. that boundary fixed by Town Planning in consultation with Engineering Services within which a high level of service can be provided. This approach, known as ‘containment’, is adopted to contain urban expansion/sprawl and encourage densification in areas where bulk capacity is available. Sanitation planners must be aware of this spatial boundary but must not limit planning to within the urban edge. The provision of waterborne sanitation is a long-term (25 years plus) vision and this must be borne in mind in order to secure the optimal location for future treatment works.

Outside the urban edge, alternative sanitation options would be the norm. Developers must be informed accordingly so that they do not put pressure on orderly development by creating an artificial demand for high-level sanitation that cannot reasonably be met. Alternatives must also be communicated to the Water Service Authority to ensure common levels of service.

The service area must be divided into catchment zones and the number of present and future households must be evaluated to determine the potential sewage discharge. Loading forecasts will vary in accordance with the zoning, for example industrial, commercial and residential. These forecasts in turn affect the routes and capacity, design and choice of material for outfall sewers, pump stations, rising mains and, ultimately, the design parameters and technology to be used for the wastewater treatment works. Investigations must include community sewage-disposal schemes and treatment works, as well as sewage-conveyance infrastructure and treatment works owned/formerly owned by others which have to be incorporated into the holistic future planning scenario, for example where municipalities need to take over mining or rural communities. Potential changes in zoning or land use should be considered.

When prescribing dry sanitation, the geological conditions, groundwater levels and proximity to water sources will influence which type should be used.

**Demographics and Possible Growth Patterns**

Based on planning reports and established land uses, various development scenarios in terms of collectors, outfalls and treatment works capacity must be determined. Care must be taken that servitudes are timeously registered and that these servitudes are policed so that encroachment does not take place.

The actual demand for sanitation as determined by the levels of service and the number and type of consumers will depend on the growth rate.

**Economic Development**

Successful economic development requires that all stakeholders and affected parties are treated equitably such that no sector of the community is neglected in favour of another. To this end domestic, industrial, commercial and institutional users must be properly included in the planning process. Where a Local Economic Development Strategy is in place, it will form an integral part of the planning and approval process.
Levels of Service

Levels of service for sanitation as published in the COGTA, 2010 Municipal Infrastructure Industry Guide, are defined as follows:

- Minimum service – VIP latrine or better
- Basic service – VIP latrine
- Intermediate level – Loflos or septic tank
- Full service – waterborne system

Service provision is dependent on the needs of the consumer and the level of development in the service area. The level of service must be determined in consultation with communities and on the basis of the cost of such service. The advantages and disadvantages of different solutions must also be discussed. In preparing long-term plans, consideration must be given to moving consumers to higher levels of service as their income improves or as they move to areas in which a higher level of service is feasible.

Levels of service will also be determined by the availability of resources and by local conditions, for example where inadequate water is available, a waterborne sewer system cannot be contemplated, and where water supply is available but there is no possibility of waterborne sewerage because of the topology or the presence of solid rock, a full water service may not be an option.

Legislation

Numerous pieces of legislation and documents guide or dictate with respect to sanitation. The most significant of these are:

- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
- Water Services Act, 1997 (Act No. 108 of 1997), as amended by Act No. 30 of 2004
- Department of Water Affairs’ Water Quality Management Policy

Analysis and Modelling

The provision of a hydraulic model of the sewerage scheme based on the latest topographic and cadastral information and derived from current aerial photography is essential to:

- Determine current and future system flows and sewer diameters
- Identify current problem areas
- Identify and quantify upgrading and extension requirements to accommodate current and future effluent discharges
- Provide a tool for demand management and the control of sewer flows

- Manage sewer outflow quality
- Record all manholes, pump stations and related structures for operation and maintenance purposes
- Provide management with a workable visual document for management planning
- Develop, manage and monitor a maintenance programme

Load Reduction

If water demand management is successful, it could have a marked effect on the volume received at wastewater treatment plants since these plants will not be inundated with potable water, thus pushing them over their design limits. This will make the treatment process less costly and less complex.

There are innovative ways in which effluent of acceptable quality can be reused by a municipality. These include the irrigation of public facilities such as municipal grounds, parks, cemeteries, sports fields and, in strictly controlled circumstances, community gardens. There is also the opportunity to provide industry and commerce with non-potable process water at reduced cost. Strict measures must, however, be put in place to safeguard the public and prevent secondary infections. Further, the collection of ‘grey’ water by consumers for irrigating gardens should be encouraged. This will reduce their consumption of potable water and effect a saving in terms of service fees. As a note of caution, however, the risk to underground water resources must be evaluated and it must be kept in mind that over the medium or long term, some plants could be negatively affected.

The water balance analysis already conducted will quantify the level of non-revenue water. Reducing this to the practical minimum should be the first priority. This could delay the need to upgrade the waste treatment works for several years.

Bulk Collection and Processing

Ensuring adequate capacity to process sewage effluent is critical to reduce the risk of pollution. Consideration should be given to cooperation agreements with adjacent municipalities for joint schemes in boundary areas. Where a regional treatment works exists or is envisaged, close cooperation and liaison with the regional authority is required. Jointly determining the potential discharge from an area will assist with planting a future works or augmenting an existing works. Bearing in mind the lead time required for designing, constructing and commissioning a works and the limited availability of funds, it is necessary to make growth forecasts and predictions on a regular basis to ensure that an accurate model is used when such a development finally goes ahead.

Upgrades and Refurbishments

It will be to the advantage of municipalities to investigate the upgrading of existing wastewater treatment facilities by modernising existing processes and utilising the most recent technology advances. This could be done by, for example:
Engaging expert consultants to evaluate configurations

Introducing water demand management to lessen the load on treatment plants

Replacing stone in biological filters with new plastic-type filter media

Engaging expert consultants to evaluate configurations and adapt or add elements

Expansion of Conveyance Networks

When future areas of expansion have been identified and all town planning criteria have been addressed, provision must be made for the timely expansion of conveyance networks to cover the new area. The treatment capacity must be taken into account when these networks are planned.

Alternative Technologies

The full range of dry and wet sanitation solutions, including condominial systems, need to be considered for collection. With regard to disposal, reed beds and stabilisation ponds should be considered in areas with limited water or ability to maintain sophisticated networks or disposal processes.

Economic limitations may restrict the installation of a reticulated sewage-disposal system in the short to medium term in a catchment or subcatchment. There are several suitable dry disposal systems available which have been designed and developed locally and used both locally and internationally. These and other systems should be investigated in preference to wet (waterborne) disposal systems. French drain and septic tank systems offer an alternative, provided that the geotechnical conditions are suitable.

In selecting equipment and treatment processes, consideration should also be given to their energy rating since using efficient equipment can greatly reduce operating costs.

Delivery Methods

There are substantial opportunities for the private sector to get involved in wastewater treatment. The development, operation and maintenance of large regional schemes may lend themselves to Public-Private Partnerships over a long period such as 10 or 15 years. For smaller and even existing plants, the opportunity exists for the private sector to take over and sell treated effluent to mining and industrial consumers. Producing biogas from the sludge and generating electricity with it offers other opportunities for either the municipality or the private sector to contribute to the reduction of waste and at the same time to the generation of renewable energy. All these possibilities and emerging opportunities for alternative funding sources and delivery methods should be considered.

Risk Assessment

Once the demands and requirements have been fully determined and the present capacity and operational ability assessed in detail, the necessary augmentation, upgrading and additional infrastructure can be evaluated. To establish priorities for implementation, a risk assessment must be carried out to determine the consequences of delayed implementation and to assist in planning the necessary schemes. Until water demand management is effective in areas with unmetered consumption, the risk of overload caused by potable water must still be considered. Where expansions or upgrades are considered to be beyond the budget, the risk to the environment in terms of spillages and public health must be considered and if found to be unacceptably high, budgets need to be reprioritised or funding sought elsewhere. Furthermore, spillages may affect the economic livelihood in the area with regard to agriculture, tourism and sports and recreation. Non-compliance with national quality standards is now a punishable offence and should be factored into the risk analysis.

The Master Plan

Once an Asset Register has been developed and the current supply and long-term demands have been determined, the Master Plan can be compiled. It will be composed of long-term plans, which will determine the infrastructure development backbone, and medium- and short-term plans, which will address priority developments. These will be phased in the Master Plan as follows:

Long-Term Plan

Based on the Spatial Development Framework and the Town Planning Scheme for the area developed in terms of the Growth and Development Strategy, long-term plans are designed for the next 20 to 30 years, taking into account the anticipated economic and population growth. Long-term development forecasts must be made, including development priorities. These must be monitored and updated each year during the IDP process, based on the direction and type of growth taking place. The long-term forecast must be accompanied by present-day cost and operational cost estimates which are adjusted annually so that the Sanitation Department can prepare budgets for the Medium Term Financial Plan (MTFP), for the anticipated capital and O&M costs, and the municipality can make decisions on the levels of service to be provided. The long-term plan will set milestones for selecting the most suitable sites for the provision and expansion of treatment works, sewer routes and pump station locations, and needs to look at land acquisition or registration of servitudes. Since treatment works and pump stations can be hazardous, there is a requirement for restricted land use to be prescribed around each treatment works and pump station. Rezoning around the area will be necessary to ensure that housing developments, schools, hospitals and industries associated with the preparation of foodstuffs, etc. are not located within the restricted zone.

Sanitation Sector Planning Considerations
The long-term plan will also set milestones for identifying delivery methods, and alternative sources of funding and external investment.

**Three-to-Five-Year Capital and Operational Plan**

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3.

**One-Year Project and Budget Plan**

This short-term plan will cover projects to be delivered in the immediate future in accordance with the guidelines outlined in Chapter 3. The plan should focus on areas of stress being experienced by municipalities and make recommendations to address them. Maintenance, refurbishment, upgrading and shortcomings should receive priority.
Introduction

Of all municipal engineering disciplines, stormwater drainage has in the past enjoyed the least attention. Runoff was mostly channelled and piped with the purpose of discharging it into the nearest waterway as quickly as possible, with unabated velocity or energy, to the detriment of streams and rivers and ultimately dams due to the destructive energy and the transmission of pollutants of all kinds, including silt. This has led to the destruction and demise of wetlands and the degradation of ecological systems, with consequent deterioration of natural assets.

With accelerating urbanisation it is imperative to practise stormwater management to prevent further decreases in biological diversity, the destruction of habitat and the degradation of water quality, to the benefit of all residents living in the planned area. The recent concern about global warming has had a marked effect on the management of stormwater as storms are now fewer and of greater intensity, requiring capacity to be built into new systems and requiring existing systems to be checked for possible bottlenecks. Local communities have become aware of the dangers inherent in open culverts and streams, and are voicing their need for safer waterways, closed systems and pedestrian bridges to cross rivers and streams that have historically claimed lives. Modern integrated planning now includes social, environmental and storm-forecasting aspects.

There are numbers of ways to reduce runoff to manageable levels, such as:

- Landscaping, using and introducing indigenous plants that can slow the rate of runoff and improve the quality of water
- Reducing paved areas to a minimum and using alternatives such as grass or other landscaping materials
- Saving and protecting existing indigenous vegetation
- Using natural rock as an energy breaker
- Encouraging landowners to endeavour to keep stormwater runoff on their properties, even if for a short time
- Introducing retention ponds

An Integrated Stormwater Management Master Plan (ISWMMP) based on a scientific study must be compiled and its use enforced in the stormwater master planning of an area. This document can best be defined, as covering “everything done within a catchment to remedy existing stormwater problems and to prevent the occurrence of new problems. It involves the development and implementation of a combination of structural and non-structural measures to reconcile the conveyance and storage function of stormwater systems within the space and related needs of an expanding population. It also involves the development and implementation of a range of measures or best management practices to improve the quality of stormwater runoff prior to its discharge to receiving waters.”

The ISWMMP is a tool designed by an expert in the field and is used by municipalities in the region. It provides a mechanism for them to plan for and manage increasing runoff associated with future development and land-use changes. The management plan will assist municipal officials, urban planners, developers and contractors to understand urban and regional runoff and control non-point sources of water pollution. Management of the stormwater will protect the welfare and safety of the public and protect property from flood hazards, improve the quality of life of affected communities, conserve water by, for example, channelling rain water to replenish groundwater resources and provide optimum methods of controlling runoff.

Factors that must be taken into account include:

- Definition of major watersheds
- Definition of catchments and subcatchment areas based on actual topography arrived at through up-to-date aerial photography and cadastral overlays
- Identification and referencing of major watercourses and tributaries, and determining profiles, roughness, etc.
- Development levels, and topographic, geological and geotechnical features, for example shales, sandstones, dolomite, and soil conditions, affecting runoff coefficients and infiltration
- Climatic conditions, including annual rainfall patterns to determine flood return intervals and flood lines per interval
- Availability and location of regional attenuation ponds based on topography and utilising public open spaces and amenities
- Land use, varying from agriculture, mining, industrial, commercial and residential – from low to high-density developments, based on population distribution and economic growth
- Location of water and wastewater treatment works
- Location of landfill sites
- Sources of pollution, especially from industry
- Measures to monitor, control and prevent pollution
- Restrictions caused by Spoornet and other bridges crossing vlei areas and rivers
Stormwater models must be used to determine stormwater runoff for the entire municipal area and to design mitigating measures. The analysis includes critical storm duration, frequencies and peak flow, with hydrographs for specific problem areas within each stormwater system. Stormwater models for both the current situation, i.e. before any proposed development, and for the future implications of the anticipated developments must be generated. The model must cover upstream and downstream effects, and will therefore need to extend past the municipal boundary.

Stormwater modelling must take into account both the major stormwater system (rivers, streams, large culverts) and the minor stormwater system (gutters, kerb inlets, kerb outlets, pipes, intermediate culverts). The ISWMMP must very clearly interact with related environmental plans, viz:

- The municipality’s strategic plans
- The Catchment Management Plan for the area (National Water Resource Strategy)
- The Emergency Management Plan
- The Disaster Management Plan
- The Environmental Management Plan
- The stormwater by-laws

There is a clear overlap between all these plans and municipal departments must work together to ensure that their plans align – see Figure 10.

Where catchments overlap with those of neighbouring districts or local municipalities, ongoing liaison and integrated development are critical. Figure 11 shows the typical challenge faced by many Gauteng municipalities. Stormwater collected in the Johannesburg Metro leaves the municipal boundaries and becomes the problem of several surrounding municipalities.

**Status Quo**

Once the ISWMMP process has been started, information regarding the existing stormwater reticulation network must be gathered as a basis for future planning, including consideration of current inadequacies.

**Current Capacity and Maintenance Backlogs**

Using the above list of factors, the design capacity and condition of the existing drainage network, watercourses and roads, the functionality of inlets and the capacity and condition of attenuation ponds, if any, must be determined. Any design shortcomings should be quantified, although many of the problems in drainage networks are related to operations and maintenance. Blockages, rather than inadequate capacity, often result in overflows and flooding, so that the solution is very often not simply to expand the service. The condition of inlets, drains, road verges, etc. needs to be evaluated since improved operations and maintenance may be all that is required to reduce flooding.

**Current Flows and Flood Patterns**

A hydrological analysis must be carried out to determine flow levels and flooding patterns for various return interval floods, based on the current surface model and rainfall.

**Future Runoff and Challenges**

**Spatial Development and Land Use**

A Stormwater Master Plan must take into consideration the various proposed land uses, for example mining, industrial, commercial, high- to low-density residential developments and public open spaces. Proposed or anticipated changes in land use, for example from farming to mining, mining to industrial or residential to commercial, can have a significant effect on runoff. Other aspects that may affect runoff and drainage paths include the size of individual land parcels and the extent of the physical development of land parcels. Policy decisions need to be made regarding the selection of design storm frequencies for different types of development. Appropriate Return Intervals (RIs) must be determined for various land uses, for example 1 in 5 or 1 in 10 year RIs for residential areas, and 1 in 10 or 1 in 20 year RIs for commercial areas. Areas of high value and high risk, such as hospital precincts, must be identified and rated accordingly.

**Possible Growth Patterns**

Anticipated growth patterns must be determined on a regular basis and proposed phase development adjusted accordingly.
Economic Development

As for growth patterns, economic development trends must be noted and recorded on a regular basis and forecasts must be made as to when planned drainage systems need to be budgeted for and developed or upgraded as new developments will influence runoff downstream. Where a Local Economic Development Strategy is in place, it will form an integral part of the planning and approval process.

Levels of Service

Levels of service for stormwater as published in the COGTA, 2010 Municipal Infrastructure Industry Guide, are defined as follows:

- Basic service – open earth-lined channels
- Intermediate level – open lined channels
- Full service – pipe systems

Service provision is dependent on the needs of the consumer and the level of development in the service area. The level of service must be determined in consultation with the communities and on the basis of the cost of such service. The advantages and disadvantages of different solutions must be explained to the communities. In preparing long-term plans, consideration must be given to moving consumers to higher levels of service as their income improves or as they move to areas in which a higher level of service is feasible. Communities, especially the previously and currently disadvantaged, have become aware of the dangers inherent in any stormwater system when it rains. Some are demanding an end to old ‘apartheid’ open earth-lined channels which are dangerous in storms, while others have lost children who played in the streams and culverts or fell into open manholes. The need to identify these problems and incorporate them into Master Plans has become non-negotiable.

Legislation

Designers and managers must be aware of all the relevant legislation such as:

- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
- National Environmental Management Act, 1988 (Act No. 107 of 1988) and 2010 Framework Regulations
- Water Services Act, 1997 (Act No. 108 of 1997), as amended by Act No. 30 of 2004
- Municipal by-laws:
  - Stormwater by-laws
  - Public Health by-laws
  - Public Roads and miscellaneous by-laws
- SANS 10400-R: The application of the National Building Regulations – Part R: Stormwater Disposal

At this stage a detailed analysis of future scenarios should be carried out. Considerations would include:
- Detailed flood line studies encompassing all current infrastructure represented on the various models and future models, as determined from the parameters outlined under the section on Future Runoff and Challenges
- Hazard assessment
- Detailed planning of critical areas and prioritisation of watersheds
Compliance with the relevant environmental plans and legislation
IDP planning
Risk management

The next step will be to use the data obtained to develop a Regional River and Flood Management System, together with the neighbouring municipalities. This stage inevitably results in requirements to replace outdated infrastructure, upgrade infrastructure or extend the system. Since the needs will quickly exceed the budget limits, prioritisation becomes very important. Because an integrated system will include cross-boundary requirements, there is an opportunity to obtain provincial funding or even national funding.

Runoff Management

Municipal stormwater and building by-laws require that all development applications must be accompanied by appropriate approved stormwater management plans which ensure that the volumes of post-development stormwater runoff are limited to those of predevelopment runoff. These infill plans must be dovetailed into the minor systems, and the major systems must be tested for capacity.

Bulk Discharge (All Major Systems)

Management of the discharge from attenuation ponds is the responsibility of the municipality and this runoff must be channelled to appropriate local or regional attenuation facilities situated above the 100 year return period flood lines or another appropriate channel before being discharged into a stream or river. Management of the attenuation ponds on private land remains the responsibility of the landowner.

Upgrades and Refurbishments

All existing pipelines, inlets, attenuation ponds, etc. that have been identified as lacking in maintenance, in need of refurbishment or requiring improved capacity should be placed on the municipality’s priority list, except where imminent upgrading or replacement of a system is about to take place. Where the system is to be augmented, the necessary maintenance and refurbishment must be prioritised – see example in Figure 21. The system and its components must be made compatible with the designed RI storm.

Expansion of Networks

Networks must be designed for the appropriate RI storm, depending on the zoning of the area. If development proceeds first in the upper reaches of the catchment, spare capacity may be available in the system where it traverses areas of lower design standards, for example designs for 5 year RI instead of 20 year RI. Designers must consider the potential load of upstream developments that may occur at a later stage.

Alternative Technologies, Solutions and Standards

Where possible, in areas away from formal dwellings and where the volume of runoff conveyed is limited, open landscaped drains are preferable to a buried piped system and can be developed into natural features in public open spaces. Similarly, where there is a continuous low flow, the system can discharge into a wet pond designed to cater for attenuation by means of spare capacity for the required storm discharge, or by means of a system of weirs designed to bypass the wet pond into a dry pond to receive the major flows. Ponds should be effectively landscaped with indigenous plants; rocks and vegetation could be designed as a feature to be enjoyed by the community.

Other attenuation facilities, comprising park areas, sports fields, dams, etc., should be considered in catchments that have already been developed. The sizing and viability of attenuation facilities must be based on cost-benefit analyses.

Consideration should be given to diverting a portion of water from perennial streams to irrigate vegetable gardens and fruit trees where land for community gardening exists. Reduced velocities and hence energy can be achieved through lesser grades and steps, with the advantage of lower discharge/entry velocities and damage at the discharge point.

Investigative Methods for Developing the Skills of Junior Staff

Establishing the condition of major or minor systems, checking vegetation build-up in water channels and post-storm damage, and classifying the status of stormwater infrastructure and waterways can be easily done using GPS and GIS technology. Training young engineers and technicians to do these surveys using easy-to-follow templates offers good experience, allows them to gain an understanding of stormwater management and will provide regular high-standard data for any stormwater system.

Delivery Methods

There are a number of mechanisms for delivering services to the communities which will depend on variables such as:
- Type of project or service to be delivered, be it Capex or O&M
- Value of service to be delivered
- Resources available within the municipality

The Expanded Public Works programme (EPWP) provides opportunities to upgrade services and to put routine maintenance programmes in place. It lends itself to unblocking drains, and clearing vergeside vegetation and inlet covers. It does, however, require adequate management from the municipality to ensure quality.

Risk Assessment

Where growth cycles exceed available funds, which limits the immediate installation of required drainage
systems, a risk assessment regarding possible flooding and potential damage accompanied by damage claims must be undertaken and systems must be prioritised to optimise available funds.

**Disaster Management**

The end product of an ISWMMP should be a direct link between the Irene Weather Information System or other similar weather forecasting systems or the stormwater engineers and the Emergency Management Services (EMS). This will enable engineers to interpret dangerous flood warnings and inform the EMS where they must concentrate efforts to evacuate or assist communities. Monitoring instruments should be installed in watercourses and other areas known for flash flooding to allow access to these areas to be closed off timeously.

**The Master Plan**

Once an Asset Register has been developed and the current long-term threats and requirements have been determined, the ISWMMP can be compiled. The long-term plan will determine the infrastructure development backbone and the medium- and short-term plans will address priority developments. These will be phased in the Master Plan as follows:

**Long-Term Plan**

Based on the Spatial Development Framework and the Town Planning Scheme for the area, developed in terms of the Growth and Development Strategy, a complete ISWMMP is designed for the next 20 to 30 years, taking into account the runoff factors for the various planned zones and the anticipated economic and population growth. Long-term development forecasts must be made, including development priorities. These must be monitored and updated each year during the IDP process, based on the direction and type of growth taking place. The long-term forecast must be accompanied by present-day cost and operational cost estimates which are adjusted annually so that the Stormwater Department can prepare budgets for the Medium Term Financial Plan (MTFP) for the anticipated capital and O&M costs and the municipality can make decisions on the levels of service to be provided. The long-term plan will set milestones for acquiring land and/or registering servitudes as necessary for major drainage conduits and attenuation dams required in the future.

The long-term plan will also set milestones for identifying delivery methods, and alternative sources of funding and external investment.

**Three-to-Five-Year Capital and Operational Plan**

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3. The plan should include refurbishment of inlets, manholes, headwalls and inlets/outlets, ensuring that the systems are functional, attenuation ponds are properly maintained and in good working order, and pipelines are cleared of silt and debris. This should be planned on a catchment rotational basis with regular inspections taking place to prevent unintended storm damage.

**One-Year Project and Budget Plan**

This short-term plan will cover projects to be delivered in the immediate future in accordance with the guidelines outlined in Chapter 3. Hazard areas identified by the ISWMMP must also receive priority.
Introduction

The expansion of the road network is dependent on transport planning which must address existing and emerging transport needs and safety. Transportation networks are the backbone for development as they offer communities access to job opportunities, education, health services and mobility for their daily lives. In reviewing the need for future road development, consideration should be given to reducing the use of private motorised transport, expanding multi-modal transport feeder systems and making public transport available and affordable. Public transport routes need to be located within easy reach of residents to encourage their use as the preferred mode of transport. All transport planning must be in accordance with the Provincial Land Transport Framework (PLTF).

In general, transportation issues can be separated into two distinct areas:
- Facilities, in the form of roads, streets, bicycle paths, pedestrian walkways, taxi ranks, railways lines and stations, airports and other physical infrastructure
- Modes of transport, including buses, minibus-taxis, cars, bicycles, trains, aeroplanes, etc.

Municipalities carry a significant responsibility in the transportation field. A range of plans is called for to ensure that transport at municipal level is provided in an orderly and sustainable way, as follows:
- Comprehensive Integrated Transport Plans (CITPs)
- District Integrated Transport Plans (DITPs)
- Local Integrated Transport Plans (LITPs)
- Current Public Transport Records (CPTRs)
- Operating Licence Strategies (OLs)
- Rationalisation Plans (Rat Plans)

Local Authority Transport Planning is prescribed by the National Land Transport Act, 2009 (Act No. 5 of 2009) in which three types of planning authority are defined. The type of authority dictates the types of integrated transport plan to be developed, as follows:
- **Type 1.** As part of the Integrated Public Transport Network Initiative (IPTNI), 12 cities identified by the national Department of Transport (nDoT), as well as any other planning authority designated by the MEC or Minister, are required to prepare a Comprehensive Integrated Transport Plan (CITP)
- **Type 2.** All district municipalities are required to prepare a District Integrated Transport Plan (DITP), which must incorporate the transport plans of local municipalities under their jurisdiction
- **Type 3.** All other local municipalities are required to prepare a Local Integrated Transport Plan (LITP)

Planning required of Category 3 municipalities is expected to focus on operational planning and budgets. However, they need to coordinate closely with the planning of the Category 1 and 2 municipalities. All of the above plans ultimately feed into the National Land Transport Strategic Framework (NLTSF) which is submitted to the Minister to guide land transport planning for the country and should be consulted when drawing up Master Plans for the development of the road network. Figure 13 shows the minimum requirements of a CITP.

**Status Quo**

In preparing a report on the Transportation Status Quo, which offers a picture of the current transport system, it is necessary to consider:
- The Current Public Transport Record (CPTR)
- The current traffic patterns of the area (typically during peak hours)
- The transport infrastructure system and conditions (roads, rail, public transport, priority lanes, public transport facilities, traffic management systems and infrastructure, travel demand, etc.)
- The land-use patterns in the municipal area

In addition, the current road network as captured in the Pavement Management System (PMS), the Bridge Management System (BMS) and the Rail Status Quo report are essential components of the Transport Status Quo report. Roads are classified from Class 1 to Class 6 based on spatial planning and functionality as defined in RISFSA (Roads Infrastructure Strategic Framework for South Africa), published by the nDoT as follows:
- **Class 1.** Trunk roads – freeways, national, provincial and inter-regional roads
- **Class 2.** Primary distributors – urban freeways, expressways and major arterials
- **Class 3.** District distributors – minor arterials and major collector roads
- **Class 4.** Local distributors – minor collectors and collector streets
Figure 13: Minimum contents of a Comprehensive Integrated Transport Plan (CITP)²

- Class 5. Residential access roads – lightly trafficked roads and local streets
- Class 6. Pedestrian walkways

**Current Carrying Capacity**

To determine current load on the transportation network, traffic and transport surveys must be conducted to develop a transport database.

To establish the carrying capacity of the road network, traffic patterns, modes of transport (including bicycles and pedestrians) and the adequacy of infrastructure must be determined. This will enable the determination of the current levels of service being provided and indicate key aspects for improvement.

² Source: Department of Transport - Minimum Requirements for the Preparation of Integrated Transport Plans

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**Traffic Surveys**

Public, private and freight traffic volumes and patterns are obtained by means of physical counts and surveys. Surveys are usually undertaken during peak periods to establish worst-case scenarios. In certain cases surveys are undertaken to establish longer-term patterns that could influence the eventual planning and choices to be made. Surveys should be conducted on a regular basis as they provide information about areas experiencing traffic capacity problems that could possibly be addressed via traffic management and infrastructure upgrade measures.

Traffic management systems typically encompass the intersection priority and accident management system subsystems. In towns and cities experiencing high...
volumes of vehicle traffic, the priority system is essential for through flow of traffic in high-risk areas.

**Understanding Trip Generation and Travel Patterns**

Knowledge and information about travel patterns and origin-destination characteristics are essential for improving transport systems. In areas where the road and street networks are extensive, critical traffic problems may be masked by the fact that there are a number of alternative travel routes. An in-depth assessment of the efficiencies of all modes is therefore required to optimise existing infrastructure and systems.

It is only possible to manage transport demand by mode category and by using existing or innovative means if one possesses in-depth knowledge of the reasons for all aspects of trip generation and of available opportunities. This knowledge can then be used to encourage the use of different kinds of motorised and/or non-motorised transport. The preferred method of obtaining such information is by using statistically reliable interview surveys. These can include house-to-house surveys, workplace or business-based surveys, or ‘stop and ask’ surveys. Businesses should be surveyed to obtain information about commercial goods and freight.

**Backlogs**

Information about transport backlogs is obtained by using traffic surveys and interview surveys. The social services, health and other departments of a municipality can provide essential information relevant to backlogs. Integrated Transport System Plans should include information on backlogs so that a reliable and comprehensive transport demand model can be created which will contribute to sustainability in the broader sense of the word.

**Efficiency Levels**

Congestion caused by road and street network designs and poorly coordinated intersection traffic controls cumulatively contributes significantly to inefficient vehicle traffic flow and the production of exhaust emissions. Appropriate geometric design and routing options can limit delays or standing time considerably and reduce congestion. In addition to congestion and inadequate geometric design, lack of maintenance of road surfaces and inadequate drainage during storms contribute to unacceptably high levels of collisions. These are hidden costs borne by road users and should be taken into account due to their impact on the fiscus of the country as a whole.

The promotion of public transport as a mode of choice both for commuters and for the movement of goods is one of the most effective ways of reducing transport-generated pollution. Since public transport improves traffic flow, it leads to a lower demand for transport infrastructure related to streets and roads. Appropriate and efficient public transport systems must therefore be afforded a high priority level. It is essential that public transport services, i.e. buses, minibus-taxis and rail, are integrated optimally with regard to location and timetables, in order to maintain a suitable, optimised public system. Poor service intervals, quality and safety of public transport and poorly maintained facilities are among the issues that are often cited as reasons why the public does not want to use public transport.

**Environmental Impact of Transport**

The opportunities offered during transport system studies must be used to obtain essential information on negative environmental impacts caused within the current transport system. Possible system improvements, such as non-motorised travel, environmentally friendly vehicles, alternative materials for paving and other possible measures, must be identified as a means to reduce environmental impacts. Aspects such as minimising noise pollution and visual degradation, limiting the physical footprint of infrastructure and utilising transportation corridors for the greening of towns and cities can contribute to an improved environment. The use of plants and trees along routes can counter harmful effects by, for example, reducing noise levels and absorbing some of the exhaust emissions.

**Future Demand, Needs and Challenges**

**Spatial Development, Land Use and Growth**

Transport offers access to land and is therefore an essential element of service delivery. Land use and transport are thus interdependent. Spatial planning is not possible if a transport system is not in place. The type of intended or desired land use will determine its size and position, as well as the services required. The value of good transport and land-use planning (and planning information) is clearly very important to achieve desired levels of development.

Existing roads and streets in the area must be reviewed in close collaboration with the town planner to consider their compatibility with proposed future land use and the effect that land use will have on transportation corridors and carrying capacity. This review may highlight the need to vary the classification of roads and streets. In addition, the national and provincial road authorities (SANRAL and Gautrans) must be consulted to determine SANRAL and Gautrans future planning requirements and ensure that such requirements are incorporated into the Roads and Transportation Master Plan. It will also be necessary to determine the effect their requirements will have on the area being planned, for example land requirements, points of access, lateral movement in the area, and
traffic and transportation corridors being planned, and similarly, what effect proposed planning will have on neighbouring areas, for example the introduction of heavy vehicle haulage routes.

Constant liaison with structures at all levels, including with neighbouring municipalities, is essential to ensure coordination of future planning. In addition, liaison with various authorities responsible for rail-based transport is essential to ensure the integration of all modes of transport within the area of jurisdiction, as well as to make provision for future needs which could, for example, include commuter stations and private sidings.

A computerised planning system should be used along with up-to-date traffic counts to identify problem points and traffic volume trends, and to determine the appropriate intersection control (e.g. signalised, stop or yield) or the need to alter existing controls, and planning required for new intersections. A standardised traffic signal database of all installations should be compiled. Since traffic volumes change over time, settings of traffic signals require continuous updating and/or modification of timing plans. The software system will be an aid to all these decisions and to reassessing speed restrictions on Class 3 and 4 roads.

The condition and adequacy of road signage must also be considered. Route numbers need to be assigned and route number signs and direction signs, including heritage sites and tourism signs, must be planned, recorded, erected and maintained. Route signs and route numbers must be planned and implemented in liaison with neighbouring areas and taking cognisance of national and provincial route numbers.

**Economic Development**

Municipalities are required to deal specifically with Local Economic Development in order to have the means with which to achieve desired future levels of production and development. Economic development is subject to a wide range of variables, many of which are external and cannot be influenced by the municipality itself. It is therefore essential that development planning be robust and flexible, while at the same time adequately detailed to enable practical implementation in terms of funding, project development, availability of staff and training, etc.

Economic modelling is usually undertaking in conjunction with, and iteratively with, land-use and transportation modelling. For each parameter, the most probable development options are used and allowed to interact with each other. This ensures mutual support of these aspects, enabling a robust development route.

**Levels of Service**

In terms of the road network, levels of service as published in the COGTA, 2010 Municipal Infrastructure Industry Guide, and earlier guides, are defined as follows:

- Basic service – graded or gravel roads
- Intermediate level – narrow paved roads
- Full service – paved streets and kerbs

When unsurfaced or badly maintained all-weather roads are being upgraded, usually in underdeveloped areas, attention should be paid to the current usage of the road reserve. Such roads rarely have dedicated pedestrian sidewalks and therefore double as pedestrian walkways, and as playing and sports ‘fields’ for local children. When these roads are upgraded, they are likely to attract a higher volume of traffic, travelling at higher speeds. Provision should therefore be made for sidewalks and playing and sports fields within the community.

Where budgets are limited, upgrading should be aimed at heavily trafficked areas leading to education institutions, health facilities, business centres and work opportunities. Long-term planning should also take into account the need to increase the level of service as communities’ prosperity improves. A change in surface type, width or geometry may be required where road usage has changed substantially and needs to support higher volumes of traffic, public transport or freight.

In terms of the provision of public transport, levels of service cover a wide field of considerations and definitions. Service levels are differentiated between personal comfort/convenience and the effectiveness and efficiency with which the system is operated.

For passengers, high levels of service are typically determined by factors such as availability, service coverage, scheduling, predictability, capacity (passengers per square metre), information, convenience factors, passenger loads, reliability in travel, traffic and personal safety, cost, appearance and comfort.

Measuring service levels for public transport involves both qualitative and quantitative measures. This requires specific research in the areas being serviced and is critical in prioritising public transport improvements. The formalisation of public transport, particularly minibus-taxis, coupled with the upgrading of vehicle quality and safety measures, is required.

This strategy, when optimally integrated with larger and more effective forms of public transport, will offer great benefits in providing improved levels of personal mobility and accessibility and will, in turn, reduce the volume of road traffic.

**Legislation**

Designers and managers must be aware of all the relevant legislation such as:

- National Roads Act, 1971 (Act No. 54 of 1971)
- Urban Transport Act, 1977 (Act No. 78 of 1977)
Analysis and Modelling

Demographics and Forecasting Traffic Demand

Practical and suitable transport systems are long-term initiatives that require investor confidence. Accurate planning is difficult but by employing appropriate tools, such as capacity restraint simulation models, scenarios can be developed in accordance with transport demands and characteristics. Urban transport network development is capital intensive and can be severely disruptive during construction. With good traffic forecasting, it is possible to reduce the gap between transport system demand and supply to a minimum.

Current transport data collection surveys in district and metropolitan municipalities are usually structured in such a way that they include as many factors as possible that affect trip generation, and data are collected from various sources, including places of employment, education and other institutions, and households. Related data, such as income, affordability and typical business and social activities, are also collected.

Trip generation methods making use of this information are used to simulate actual traffic patterns and usage, similar to that surveyed in a mathematical model of the transport system. The model is developed to a point where it accurately reflects observed transport patterns and the correct information regarding traffic numbers and trip paths. At this point the model is considered accurate enough to be used for forecasting of expected future traffic scenarios. With this tool, various likely growth patterns and assignments can be developed, based on probable demographic, spatial, economic and social development growth and/or change rates.

Although this method requires a high level of training and application experience, it makes accurate and flexible planning possible. Capital costs, infrastructure lifecycle design, development programmes, social variables and economic growth rates can be used to determine the transport conditions to be expected. For an optimum or most desirable development path, the network should be planned to utilise an agreed percentage (e.g. 90%) of the available capacity during the commuter peak hour. This service target must be balanced against performance measures of competing modes and traffic safety.

Traffic congestion affects all vehicles, unless specific provision is made for them, such as priority lanes. Priority lanes are more restrictive to private vehicles and usually favour public and or multi-passenger vehicles. They are, however, difficult to manage and generally require more comprehensive law enforcement. A policy and method of promoting and facilitating public transport, giving it preference over private individual vehicles, is recommended and provides a wide range of benefits.

Alternative Technologies or Solutions

Sound master planning must enable the testing and utilisation of various alternative options for addressing transport service and infrastructure developments. It should allow viability testing of the upgrading of services versus the development of new services. This can be, for example, the choice of providing formalised, scheduled bus services for a specific residential area or, alternatively, demand-responsive services using smaller vehicles optimised to deliver services on a financially viable basis.

Development alternatives can also involve reassessing the required standards or specifications in cases where these have proved to be too high.

The use of alternative materials for road surfaces should be considered as they may be more cost-effective, easier or quicker to lay, more environmentally friendly, etc. By identifying lower-cost solutions, more expansive development may be possible within the budget and time frame considered.

Delivery Methods

The provision of transportation networks and services lends itself to Public-Private Partnerships (PPPs). These have been successfully used in South Africa over the past two decades and have enabled major transport projects to be developed for the mutual benefit of both private developers and the South African public and business sectors.

Projects with the greatest likelihood of success are those high-priority projects that are clearly defined and have a demonstrated public sector commitment. Projects delivered through a PPP must allocate the risks fairly between the parties, with each sector assuming the risks it is best able to manage. The public agency usually assumes the project definition risk by undertaking the environmental clearance effort, assessing financial feasibility and obtaining stakeholder and political commitment. The private sector can best assume the financial risk, such as project financing, construction and perhaps facility management.

Financial Viability – Cost-Benefit Assessment

The financial and functional feasibility of proposed service development options can only be effectively determined by assuming realistic lifespans. Master planning should allow incremental assessments within networks (e.g. maintaining a traffic model to assess the impact that an unexpected network closure will have on the rest of the system and selecting alternative solutions).

Risk Assessment

Mitigation against risk and gap analyses are important for managing service delivery. Municipalities must address risks as they are sensitive and are usually high on lobbying lists. Risks are often identified and reported on through direct community participation and are monitored using scorecard principles.
The Master Plan

Once an Asset Register has been developed, and the current supply and long-term demands have been determined, the Master Plan can be compiled. It will be composed of long-term plans, which will determine the transport network, and medium- and short-term plans which will address priority developments, which will be phased in the Master Plan as follows:

Long-Term Plan

Based on the Spatial Development Framework and the Town Planning Scheme for the area, developed in terms of the Growth and Development Strategy, an Integrated Transport Plan is designed for the next 20 to 30 years based on the anticipated economic and population growth and development. Long-term forecasts covering future road projects and associated design standards must be made and the direction and type of growth regularly monitored against the list of priorities which is continually updated. For transportation planning a 20-year planning horizon is generally used as 20 years is a commonly assumed transport project lifecycle and is thus useful in comparing different timing (scheduling) and project costs for multi-component transport system developments. Capital and operational costs and impacts are subsequently determined in terms of Net Present Costs (NPC) to allow comparison of alternative plans.

Factors considered in long-term planning need to include the capital cost of projects at the time of implementation. Operational costs, such as road maintenance, impact amelioration and environmental impact costs, must be calculated, as well as the financial and economic benefits of the transport system over time.

Three-to-Five-Year Capital and Operational Plan

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3.

One-Year Project and Budget Plan

This short-term plan will cover projects to be delivered in the immediate future in accordance with the guidelines outlined in Chapter 3. It must indicate an understanding of the road networks and transport and their place within the overall obligations of the municipality.
Introduction

The importance of this limited resource is well recognised and subject to extensive legislation as there can be no development without energy, of which electricity is one source. The provision, distribution and management of electricity supply require many levels of organisation to provide for the needs of communities – be they domestic, commercial or industrial consumers. For the provision of electricity infrastructure an Environmental Impact Assessment (EIA) must first be carried out and approved, and servitudes must be registered to provide corridors for distribution. Electricity distribution networks therefore require a long design life and must be planned for the long term.

It is for this reason that the long-term vision and mission of the municipality, i.e. the Growth and Development Plan, must be known and understood. Electrical master planning is a complex process. Understanding the underlying principles and goals is crucial to ensure that the service will be sustainable. If planning is not done correctly, the services will deteriorate and the reliability of the network will suffer.

Status Quo

The electrical master plan should incorporate the status quo, the present capacity and capabilities of the system, and the requirements to meet the immediate needs. Determining the status quo is an exercise in information gathering. The information needed in the case of electricity provision includes:

- Geographic information
- Network assets including bulk supply and feed-in points, distribution and associated reticulation systems
- Standards, criteria for design, etc.
- Investments in the network and refurbishments done
- Network models applicable to the type and design of the distribution network
- Present load data

Bulk Supply

The bulk supply system is a strategic service that is subject to long-term planning initiatives and forms the basis for continuing development. It is necessary to assess the existing system and determine the delivery capacity in terms of growth of consumer base, purchase agreements, distribution networks and, where applicable, internal (municipal) generation capacity. Any limitations or restrictions affecting normal operation need to be identified and quantified, and the current level of delivery into the distribution system must be determined. Therefore efficient operation and maintenance are vital and to this end effective asset management is imperative.

Distribution System

The distribution network must be assessed to determine overall delivery capacity in terms of feed-in points, distribution and reticulation systems at the various high-voltage levels. Any shortcomings in the level of service due to current, voltage, continuity or quality of supply need to be identified. Many of the problems with distribution systems relate to operations such as switching, transformers and cable loads. It is necessary to determine to what extent poor service delivery is a function of design limitations or operational failure. In rural areas, long transmission lines and factors in the external operating environment, such as lightning strikes and plant growth, that will compromise high-voltage insulation play a major role.

Current Capacity

The current capacity is a function of the design of the system, the age and condition of the infrastructure and other factors, such as the environmental conditions (ambient temperature versus a transformer’s temperature at the load at which it is running). The system is limited in its ability to meet demand by the maximum demand allowed by Eskom as the bulk supplier. Where the municipality has internal generation facilities, this additional capacity and the possibility of expanding this capacity must be weighed against the cost of the capital layout required to do so, i.e. the cost of generation must be weighed against the cost of buying in bulk from Eskom.

The capacity of the distribution and reticulation systems also needs to be assessed. As the geographical boundaries of the municipality expand as defined by the
urban edge and the demand rises, distribution networks closer to the feed-in point need to be upgraded to a higher load-carrying capacity to ensure that delivery at the boundaries does not suffer from supply quality problems.

Current Demand

The current load on the network must be determined and verified for accuracy. The demands and associated loads vary with the time of day. Networks are often utilised beyond their normal or design capability. Another factor that should be considered is the demand for electricity in areas where there is no distribution at present. Once electricity connections are available, this dormant demand will take up some of the new capacity, reducing the capacity available to meet future demand.

Backlogs

Backlogs relating to the Millennium Development Goals (MDGs) and the enhanced levels of service promised to various communities need to be determined and factored into future planning. Recommendations for upgrades, improvements and refurbishments that have not been acted on need to be reviewed to determine whether they are still relevant or should be reassessed.

Growth in demand will manifest itself as a deficit in network capacity to meet the demand. There are situations in which the absence of infrastructure has inhibited consumption but once infrastructure is available, part of the capacity will be taken up by consumers.

Efficiency Levels and Losses

The performance of service delivery, judged from consumer complaints, must be assessed to determine the underlying causes of these complaints. Furthermore, the effectiveness of operations and maintenance, judged from evaluation of the Service Delivery and Budget Implementation Plan (SDBIP) against unplanned repair/replacements, must be determined and assessed. Some equipment may be utilised beyond its design capacity, resulting in losses in the present system. Once the network has been upgraded, these losses may be reduced. As all systems have losses, the design criteria should include a clear statement of what level of losses the system is designed for.

Electrical losses can be determined in the same way as water losses are determined through the use of the International Water Association (IWA) water balance approach. Technical electricity losses are due to inefficiencies of electrical equipment; there are no other physical sources of loss. Non-technical losses can be attributed to ‘theft’ and fraud. Municipalities should do an electrical balance exercise to determine how large these losses are and investigate the causes of the losses, especially in the case of large consumers.

Future Demand, Needs and Challenges

Spatial Development and Land Use

Regional development in terms of national initiatives and target areas for growth and development must be considered. With regard to land use, the anticipated energy demand and critical factors that would affect service provision must be identified.

The planning area must be divided into supply zones and the potential of the area must be evaluated in terms of the numbers of current and future consumers and the diversity of these consumers (residential, commercial and industrial). The types of industry will also influence the consumption, e.g., a metal smelting industry will have a much higher consumption than a light industry producing furniture and warehouses may have an even lower consumption of electricity. All these factors will determine the potential energy demand.

Forecasts of the rate of development of the area and of the growth patterns must be made to determine the lifespan of existing infrastructure and to what extent and when it will need to be upgraded and augmented. Bearing in mind the length of the lead times required to plan, design, construct and commission infrastructure and the availability of funds, growth forecasts and predictions need to be made on a regular basis.

The effects of the initiatives to densify existing developments, changes in land use or the rezoning of large tracts of land must be assessed and taken into account. This may require upgrading of reticulation, substations and distribution networks.

Demographics and Possible Growth Patterns

Based on planning reports and established land use, the various development scenarios need to be recognised and strategic requirements with regard to bulk supply and service delivery determined. This will include determination of the feed-in point (or in some cases more than one feed-in point), the distribution networks and finally the reticulation networks. Care must be taken that servitudes are timeously registered and that these servitudes are policed so that encroachment does not take place.

The actual electricity demand, as determined by the levels of service and the number and type of consumers, will depend on the growth rate. The growth trend is not an electricity-related factor and must be agreed with regional and local planners.

The demographics of the consumers and the growth trends observed over time will give some indication of possible future growth patterns and thus demand, provided the trends persist. The converse may also be true: a migration trend may reduce the demand in one demographic area while increasing the demand in another area.

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The demographics of the consumers and the growth trends observed over time will give some indication of possible future growth patterns and thus demand, provided the trends persist. The converse may also be true: a migration trend may reduce the demand in one demographic area while increasing the demand in another area.
Successful economic development requires that all stakeholders are treated equitably such that no section of the community is neglected in favour of another. To this end residential, industrial, commercial and institutional consumers must all be properly included in the planning process. Where a Local Economic Development Strategy is in place, it will be an integral part of the planning and approval process.

By means of close cooperation and liaison with the supply authority and with knowledge of the predicted future demand, the positions of future distribution points can be established. This should be followed by the design of distribution networks and, where necessary, substations to feed into determined supply zones. The system design will establish the necessity for switching stations and substations.

A strategy aimed at stimulating the economic growth in an area will result in a much faster growth in the demand for energy. Such a strategy should be evaluated by economists so that an expected growth trend can be determined. Another way of dealing with such a scenario is to adopt a ‘wait and see’ approach by which expansion of the network will be paced with the growth in demand. Planning for such a scenario will ensure that with growth in demand, the distributor will be able to keep pace with its capacity.

**Levels of Service**

Levels of service for electricity supply to households as published in the DPLG, 2007 MIG Industry Guide, are defined as follows:

- **Minimum service** – 50 kWh per month, or equivalent, delivered to each household; street lights at a rate of one for every four stands or high-mast lighting for dense settlements
- **Basic service** – 5–8 A or off-grid electricity
- **Intermediate level** – 20 A
- **Full service** – 60 A

In an environment where energy is becoming a scarce and expensive resource, the emphasis on energy conservation and efficiency becomes ever more critical. The level of service may become a hybrid solution combining electricity and alternative energy sources. This could be achieved by, for example, restricting households to 40 A instead of the traditional 60 A maximum current demand, which will force them to reduce their consumption or invest in solar energy or use gas, etc. to be able to operate within this constraint. Other forms of demand management, such as load shedding, will also have an effect on the maximum demand and the level of investment required in the capacity of the network.

In planning new services, the levels of service should be negotiated and agreed with communities. In minimum service areas, provision should be made in long-term planning for the level of service to be improved with time.

**Legislation**

There are many pieces of legislation that may have an impact on the network design and operations. The most important are:

- **Labour Relations Act, 1995** (Act No. 6 of 1995)
- **National Energy Regulator Act, 2004** (Act No. 40 of 2004)
- **Electricity Regulation Act, 2006** (Act No. 4 of 2006)
- **National Energy Act, 2008** (Act No. 34 of 2008)
- **Quality of Service: NRS* 047 Parts 1 and 2**
- **Quality of Supply: NRS* 048 Parts 1 to 5**
- **Maintenance of Electricity Networks: NRS* 089 Parts 0 to 5**
- **Maintenance Work Execution: NRS* 090 (being developed)**
- **Electricity Network Asset Management: NRS* 093 (being developed)**

*NRS = National Regulatory Services

**Analysis and Modelling**

**Demand Management**

As part of the deliverables, a geographic electrical load forecast should be compiled. This would clearly show when the municipality is going to run out of capacity, but, more importantly, would show when a request for increased capacity should be submitted to Eskom. Since such infrastructure takes considerable time to install, an early warning is crucial for the municipality. The request must be accompanied by an application for a distribution licence.

Demand management is used to monitor and control the demand on the network. When the demand exceeds the capacity of the network, action must be taken. This would include the remote switching-off of non-essential items such as geysers and swimming pool pumps. When the demand has dropped to manageable levels, these items can be switched on again. This could have a dramatic effect on the cost of electricity to both the distributor and consumers. Most important is the reduction in the required peak capacity of the network. This would reduce the capital investment that would be needed to increase the capacity of the network, while still allowing demand to be met most of the time. The use of smart meters and other demand management approaches should be considered.

**Bulk Supply**

Bulk energy (electricity or even natural and LPG gas) is received through primary substations. The placement and capacity of these primary substations has to be chosen...
Electricity Sector Planning Considerations

Carefully, taking into account the demand closest to the substation, to ensure minimum distribution distance and cost of networks to distribute to the point of demand. This is done in Geographical Load Factor layers – see Figure 14. Geographical Load Factor (GLF) mapping should be undertaken, coupled with an environmental assessment. The formulation of alternatives is important.

Upgrades and Refurbishments

Before new infrastructure is developed, it may be possible to refurbish or upgrade existing networks. In the case of refurbishment, the network would be restored to its original condition and in the case of upgrading, the network would be enhanced. Upgrading would typically involve equipment and components that will have a higher capacity and will be able to deliver at a higher performance level than at present.

Expansion of Networks

Network expansion involves adding distribution networks to the existing network to deliver energy further away from the primary substations. In expanding networks, supply lines must be upgraded to have a larger capacity. If this is not done, the supply lines will be unable to deliver to the new network.

Alternative Technologies, Solutions and Standards

In the design of an upgraded network, one of the most pressing problems will be to ensure sufficient capacity. With the present generation constraints in the Eskom network, it may be necessary to look at alternative generation sources. In the case of the Tshwane Metro and Johannesburg’s City Power, their power stations have been refurbished and upgraded to supplement their electricity supply.

Alternative sources of energy, such as natural gas and LPG gas distribution networks, energy from biogas (including from landfill sites and waste treatment works), wind farms, hydro generation and other sources must also be considered. Alternative distribution networks, such as gas, could become a viable solution if electricity demand is constrained by what Eskom is able to deliver. Supplies from Independent Power Producers (IPPs) should also be considered. Another innovative solution would be to amend the by-laws to make the installation of solar water heaters mandatory. Since heating is one of the largest energy consumers in almost all spheres (commercial, business and residential), this could reduce the load on the existing system substantially. For a Master Plan all alternatives should be considered and weighed up against each other until the lowest-cost solution capable of meeting or delivering the required demand is found.

Delivery Methods

Traditionally, municipalities have generated their own electricity or purchased it from Eskom. Alternative sources of energy lend themselves to Public-Private Partnerships in which IPPs may also supply electricity to the municipality.

Financial Analysis and Cost-Benefits

Figure 15 shows the various factors involved in providing reliable power to consumers. If the consumer’s activities
and therefore income are dependent on power supply, blackouts will reduce income, incurring so-called damage costs. Damage costs will increase with reducing reliability. Increasing the reliability of the network on the other hand will increase the cost of operations and maintenance and therefore the cost of the utility. The total cost at any point is the sum of the consumer and the utility cost, with the optimum being at the turning point of the total cost parabola. The Master Plan task team must ensure that the balance between damage cost and utility is carefully and reliably determined in order to find the minimum-cost solution.

It is at this stage that ‘feed-in’ tariff structures as the basis for the capital costs come into play. No master planning is complete without a tariff structure analysis to determine the effects of the tariffs on the sustainability of the network. Capital layout and earnings or Return on Investment (ROI) must be clearly shown.

An analysis of the network, both technical and financial, should be made. Load flow and fault-level calculations should be carried out and reliability and stability analyses included, validating the decisions made. Costing alternatives should be explored and should include Interest on Income Return (IIR) and Net Present Value (NPV).

If the planned expansion phases show that the network expansion requirements will be beyond the municipality’s financial capacity during each of the phases, planning will have to be modified to suit the financial resources available. If the network development requirements exceed the resources, constraints will need to be determined and gaps addressed.

**Figure 15: Reliability modelling**

**Risk Assessment**

The risk of being unable to meet the future demand or eradicate the backlog in delivery must be considered. If the demand for energy in a residential area cannot be met, the consequences will be completely different from not meeting the demand in an industrial area. The first may have a nuisance value, whereas the second could seriously curtail economic growth and job creation, although, the economic consequences for home-based businesses and local office buildings should also be recognised. There may also be risks to the network if the network is overloaded even for short periods of time to meet peak demand.

**The Master Plan**

Once the status quo has been captured in the Asset Register, short-, medium- and long-term strategies to satisfy the future requirements for energy delivery can be considered. These will include the use of various alternative generation options, alternative energy sources and the use of technology to reduce consumption and manage demand. In the analysis and modelling phase, these alternatives must have been considered and the appropriate combination decided on that will deliver the optimum cost-effective strategy for energy delivery.

Deciding on possible strategies and which ones to implement is not a one-off process – an iterative process.
Electricity Sector Planning Considerations

is necessary to optimise strategies and arrive at the most cost-effective solution. The end result will be an implementation plan which will identify the need, the strategy to satisfy that need and the most probable solution to the problem. The decisions laid out in an implementation plan also involve the next step: project identification. A sensitivity analysis of the scenarios that the alternatives provide forms part of this iterative process. The Service Provider must deliver the results of his/her sensitivity analysis showing what solutions were chosen and why. The final submission will be structured as follows:

**Long-Term Plan**

Based on the Spatial Development Framework and the Town Planning Scheme for the area, developed in terms of the Growth and Development Strategy, an Integrated Energy Plan is designed for the next 20 to 30 years taking into account the anticipated economic and population growth. Long-term development forecasts must be made, including development priorities. These must be monitored and updated each year during the IDP process, based on the direction and type of growth taking place. The long-term forecast must be accompanied by present-day cost and operational cost estimates which are adjusted annually so that the Electricity Department can prepare budgets for the Medium Term Financial Plan (MTFP) for the anticipated capital and O&M costs, and the municipality can make decisions on the levels of service to be provided.

Milestones should be set for a gradual move away from coal-fired energy to alternative sources of energy. The provision of alternative energy lends itself to harnessing Public-Private Partnerships (PPPs), and negotiations should start at an early stage as negotiating development, financial and concession conditions is a lengthy process.

When considering the augmentation of supplies, the need for land acquisition or servitudes should also be considered at an early stage.

The long-term plan will also set milestones for identifying delivery methods, and alternative sources of funding and external investment.

**Three-to-Five-Year Capital and Operational Plan**

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3.

Where projects to implement alternative energy sources and Independent Power Producers (IPPs) form part of the Master Plan, these should also be carefully monitored since their failure or delayed implementation may have negative impacts on the overall performance of the network or planned networks. Once again, the risk analysis should also include these projects. The impact of such risks on the overall project execution should be evaluated and contingency plans put in place.

**One-Year Project and Budget Plan**

This short-term plan will cover projects to be delivered in the immediate future in accordance with the guidelines outlined in Chapter 3.

Given the poor condition of much of the electricity network, maintenance, refurbishment, upgrading and shortcomings should receive priority. The reliability of the network is dependent on reliable equipment. Equipment that is in dire need of maintenance or refurbishment is a liability and failure can lead to a chain reaction of other equipment being damaged or even destroyed unnecessarily. Unexpected failures of equipment or the need for unscheduled maintenance and refurbishment may require additional budgeting and planning.
Introduction

Environmental sustainability must be seen as the ultimate goal for all development and, if defined and managed correctly, should result in long-term benefits for society as a whole. This is true of all services, including waste management which refers to the collection, removal, disposal and/or recycling of solid waste.


Waste is divided into two classes in the National Environmental Management: Waste Act, 2008 based on the risk it poses, namely general waste and hazardous waste, as follows:

- **General waste** means waste that does not pose an immediate hazard or threat to health or to the environment, and includes domestic waste, building and demolition waste, business waste and inert waste.
- **Hazardous waste** means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

In Gauteng, waste generated per capita varies from 1.7 to 2.2 kilograms per capita day (kg/c/d), averaging 2 kg/c/d, whereas in Taiwan where land is scarce, the average is 0.91 kg/c/d. In controlled and managed landfill sites, volumes can be reduced by a ratio of 10:1 through the proper use of compaction equipment. The Polokwane Declaration (2001) committed South Africa to reduce waste generation by 50% and disposal by 25% by 2012. This target has subsequently been amended to more realistic levels. The overriding imperative that is driving the national approach to waste management is the ‘deviation’ of waste from landfill sites, i.e. finding other uses for the waste as in recycling.

The waste management hierarchy dictates the implementation of interventions such as separating waste at source, establishing materials recycling facilities, building rubble crusher plants, organic composting facilities, incineration plants and waste-to-energy plants. The disposal of general waste at landfill sites is seen as the last resort.

A further imperative is to minimise waste as a by-product of production to preserve resources and prevent pollution. Where waste still occurs, collection, treatment and safe disposal is necessary, hence a Waste Management Master Plan would look not only at the civil engineering element, i.e. a landfill site, but also at all possible strategies to minimise, recycle and treat waste effectively to minimise the effect on the environment.

**Status Quo**

A survey must be undertaken to determine all collection and disposal capacity and facilities. To determine the ongoing demand for waste facilities, an estimate of current deposits based on daily collections and intake must be made for each area/district. Collection would include street cleaning, litter picking, routine waste collection and specific collection and disposal of putrescible waste, carcasses, e-waste, oil, building rubble, garden refuse, hazardous and medical waste. Current practices need to be identified. The number of collection and disposal vehicles and their state of repair need to be determined to plan for replacements or a change of system or process if more appropriate or efficient.

An overview is required to determine the extent to which the municipality is moving towards compliance with the prescripts of the National Environmental Management: Waste Act, 2008. More specifically, the status quo with regard to the disposal of general and hazardous waste is required, including the roles of private waste management companies which dispose of the latter category of waste.

**Current Capacity**

With regard to the disposal of general waste, an overview is required of the waste management plans to determine what facilities have been implemented or are being planned to deviate waste from landfills. This must include the interventions mentioned above.

In terms of disposal, a record of all disposal facilities, including the number of solid landfill waste sites,
incineration units, biogas plants, etc., must be drawn up. In the case of landfill sites, current status must be determined, i.e. closed, in operation (including the available airspace), or nearing capacity and closure. The current capacity of other types of disposal unit must also be determined, as well as the capacity of the fleet.

A detailed checklist of what needs to be assessed to determine whether municipalities have adequate capacity, and what should be put in place, was included as Annexure 1 in the Gauteng Waste Management Survey carried out in 2009 and is available at www.civilsmusikheni.co.za

**Backlogs**

Where waste has been deposited and not placed on a landfill or treated in an acceptable manner, future capacity must be developed. For example, where containers such as skips are difficult to get to, or cannot be reached due to their height, refuse is not concentrated at a disposal point, but is abandoned or burnt within the community. A programme for its removal to suitable disposal sites and the rehabilitation of the land must be drawn up. In determining future disposal patterns and capacity required, attention needs to be paid to this ‘unaccounted-for waste’ which will become part of the equation if disposal facilities become more accessible.

Other areas of stress that may require immediate intervention include facilities for the safe disposal of medical waste, carcasses and other hazardous waste that is not being adequately handled.

**Future Load, Needs and Challenges**

**Possible Growth Patterns**

Growth patterns, both industrial and residential, must be closely and regularly monitored and forecasts for the necessary development of disposal facilities adjusted accordingly. The Maximum Rate of Deposition (MRD) is a measure of the projected maximum average annual rate of waste deposition, expressed in tons per day, during the expected life of a landfill. The MRD is calculated by establishing the Initial Rate of Deposition (IRD), which is a measure of the existing rate in tons per day, and escalating it in relation to population growth projections over the life of the landfill. Clearly, the rate of growth will influence the life of such facilities. Financial models must also be continually updated to allow adequate budgeting and planning.

**Development of Landfill Sites**

Landfill sites are classified in terms of waste class, size of operation, and potential for significant leachate, all of which influence the risk it poses to the environment. The Department of Water Affairs has compiled a document listing the Minimum Requirements for Waste Disposal by Landfill. These requirements must be met before a licence will be issued. They cover careful selection of the site including investigation of geotechnical conditions, hydrology, access, the possible impact of air pollution etc and they require an Environmental Impact Assessment, all of which take time and must be factored into planning.

**Economic Development**

The recycling and recovery of materials may not currently be viable in that the costs are not recovered from the resale of the material to commerce. Efficient means of recovery, including sorting at source, must be brought about. Furthermore, the cost of recycling should be offset against the reduction in the land required for and the operation of landfill sites over the long term. Recycling also adds a much-needed benefit in terms of employment opportunities. Where a Local Economic Development Strategy is in place, it will form an integral part of the planning and approval process.

**Levels of Service**

Levels of service for waste disposal as published in the COGTA, 2010 Municipal Infrastructure Industry Guide, are defined as follows:

- Minimum service – the disposal of waste into a container within 200 m per household, collected weekly
- Basic service – communal collection by the residents
- Intermediate level – communal collection by contractors
- Full service – kerbside collection from individual residences

The minimum service generally applies to poor, rural or informal areas, which by their very nature will generate a lower volume of waste than affluent consumers living in areas that receive a kerbside service. The level of service must be determined in consultation with communities and on the basis of the cost of such service. The advantages and disadvantages of different solutions must also be discussed. Consideration must be given to the movement from minimum to higher levels of service, and the rapidly developing middle class whose disposal income is on the rise, with an associated increase in waste disposal. Typically 0,5kg per capita per day is disposed of in poor areas, while as much as 3,5kg per capita per day is deposited in affluent areas.

**Legislation**

Specific pieces of legislation and guidelines to consider are:

Analysis and Modelling

Demand Management

Where it is necessary to expand capacity to deal with waste, community awareness and education should form part of the planning process to educate the public on waste separation and the commercial benefits of many waste products. The ‘Collect-a-can’ scheme, the sale of used bottles, waste paper and cardboard, tyres for reprocessing into road surfacing material or for use as the formwork for foundations or urban gardens, and the recycling of building rubble all reduce the demand on resources and the environment and will reduce the volume of material that must be disposed of. Furthermore, the cost-effectiveness of compaction equipment to reduce the volume of material being disposed of must be considered. Implementing such measures will reduce the long-term capacity required when planning landfill sites and other disposal facilities.

Upgrades and Refurbishments

Where sites no longer comply with regulations, it may be more cost-effective to refurbish or upgrade such sites rather than close them and develop new ones. Investigations into the current reasons for non-compliance must be carried out. Furthermore, it may be possible to reduce the growth rate of the air space by introducing waste separation.

Expanding Collection and Disposal Capacity

Once the daily deposit has been determined, it will be necessary to establish future volumes of hazardous or general waste based on the anticipated growth, decline or change of land use over a period of 20 to 30 years. This will indicate the disposal capacity required over that period. A needs analysis will determine volumes, types and optimum positions of disposal facilities relative to collection routes and anticipated growth patterns.

Expanded collection will make demands not only on disposal facilities, but on the need for vehicles, bins, skips, etc. The levels of service and method of collection in the case of kerbside collections will dictate the type of vehicle required, and it will be necessary to factor lifecycle costing and fleet management into long-term plans.

The selection and finalisation of disposal sites is a lengthy process as suitable land must be identified, cost-effective routes determined, Environmental Impact Assessments carried out and, finally, a licence must be granted to operate a waste disposal site or unit.

Alternative Technologies, Solutions and Standards

There are numerous methods of disposal, including mass burn, pyrolysis, gasification, and biological processing technologies such as composting and anaerobic digestion (biomethanation) and bioreactor landfills, including the use of sludge from sewage treatment, many of which have the added benefit of generating electricity or biogas. Each process has advantages and disadvantages and must be carefully researched with respect to the municipal waste in the area, which must be thoroughly analysed.

Incinerators should be sited next to industries that will be able to reuse the fly ash produced as a by-product of the process, such as in the production of aerated autoclaved concrete bricks. The range of recycling options, including the removal of potentially valuable items, must be considered and arrangements put in place to promote such recycling.

Delivery Methods

Waste collection lends itself to outsourcing and use of the private sector, to privatisation, Private-Public Partnerships, and to using communities and local labour to participate in activities such as street cleaning, litter picking and recycling. Many small businesses can be spawned through the use of waste material to create new products. The methods selected selection must be cost-effective and ensure maximum job creation, at the same time ensuring an efficient service and the long-term reduction of waste.

Risk Assessment

With waste management, risk mitigation is critical, given that inadequately managed waste may put lives in danger, particularly in cases where medical waste, hazardous waste and carcasses are not correctly disposed of. The risk of anthrax and other diseases must be factored into planning and sound solutions must be invested in. Furthermore, gases from landfill sites must be managed and closed sites must be monitored. The risks of not attending to these challenges must be considered where there is inadequate funding or capacity to deal with such issues.

The Master Plan

Once an Asset Register has been developed and the status quo of waste management has been determined, the Master Plan can be compiled. It will be composed of a long-term plan, which will determine the infrastructure development backbone, and medium- and short-term plans which will address priority developments. These will be phased in the Master Plan as follows:

Long-Term Plan

Based on the Spatial Development Framework and the Town Planning Scheme for the area, developed in terms of the Growth and Development Strategy, the long-term plan is designed for the next 20 to 30 years, taking into account...
the anticipated economic and population growth. Long-term development forecasts must be made which indicate the interventions that are required to meet the Polokwane Declaration targets. These must include specific targets for each of the interventions with an indication of time lines and the funding that will be required. Despite the fact that disposal of waste at landfills is seen as a last resort, international experience has shown that there will always be a residual element of waste that must be disposed of at landfill sites.

The long-term forecast must be accompanied by present-day cost and operational cost estimates which are adjusted annually so that the Waste Department can prepare budgets for the Medium Term Financial Plan (MTFP), for the anticipated capital and O&M costs, and the municipality can make decisions on the levels of service to be provided.

The long-term plan will also set milestones for selecting the most suitable locations for the development of landfill sites and other methods of disposal. Since such sites are hazardous, there is a requirement for a ‘buffer zone’ to be designated around each site. Rezoning around the area will be necessary to ensure that housing developments, schools, hospitals and industries associated with the preparation of foodstuffs, etc. are not developed within the buffer zone. Land must be allocated, rezoned and protected from land invasion or further rezoning until required. In planning for landfill sites, consideration should also be given to the needs of neighbouring municipalities as developing a regional landfill site may be more cost-effective.

Since funding requirements for new waste-minimisation facilities are onerous, municipal budgets may not be sufficient to ensure their establishment. The role that private sector organisations can play must be examined and if it is decided that PPPs should be entered into, negotiations should commence at an early stage as finalising these agreements is a lengthy process.

Three-to-Five-Year Capital and Operational Plan

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3. The plan must focus on interventions that will reduce the amount of waste disposed of at landfill sites and that can be realistically achieved within this time frame and within existing budget constraints. The emphasis must be primarily on lower-cost initiatives such as separation-at-source interventions, building rubble crusher plants and organic composting facilities.

The plan must examine institutional and funding models that can be made use of to finance the establishment of higher-cost solutions such as incineration, materials recycling facilities and waste-to-energy plants. Specific emphasis should be placed on private sector companies that could be enticed to join forces with municipalities to deliver the required facilities and services in an economically viable manner.

One-Year Project and Budget Plan

This short-term plan will cover projects to be delivered in the immediate future in accordance with the guidelines outlined in Chapter 3. The plan should focus on areas of stress being experienced by municipalities and make recommendations to address them. Maintenance, refurbishment, upgrading and shortcomings should receive priority.
Introduction

A core outcome of master planning must be to provide fully serviced, well-maintained, quality living environments for the citizens of an area and to ensure the provision of sound and affordable housing for all. In keeping with the Housing Act, 1997 (Act No. 107 of 1997), as amended by Act No. 28 of 1999 and Act No. 4 of 2001, “every municipality must take all reasonable and necessary steps to initiate, plan, coordinate, facilitate ...” the development of housing. Thus before embarking on housing development, the municipality must ensure that bulk services planned in Engineering Master Plans have been installed or at least that they have been budgeted for and will be installed during the housing construction phase and prior to occupation. Ongoing operations and maintenance, with the associated annual budgets, must also be factored into the planning and development of housing. It is essential to ensure that residential areas enable residents to live, play and work in their own localities. Therefore this also requires the provision of adequately serviced land for commercial and industrial activities – the financial backbone of any municipality and the key to job creation. A Land Use Management System must be adopted to ensure adequate siting and servicing of all land uses. To preserve, protect and enhance the integrity, economic viability and liveability of areas, vacant or underutilised property should be rezoned to encourage redevelopment that is compatible in use and intensity with the existing area. Conversion or adaptive reuse of vacant or underutilised commercial buildings to provide affordable infill housing should be promoted. The planning and development of public open spaces, recreational areas and sports facilities should go hand-in-hand with the development of housing units and must be budgeted for in the overall planning. It has been all too evident in the past that where this has not occurred, open spaces have become dumping grounds. Residents should be able to enjoy and ‘take ownership’ of their open spaces. The character and quality of housing is a primary determinant of the quality of the urban living environment. A house meets basic needs, provides the family living context and represents values and aspirations, becoming a home that may accommodate many generations. Integration and sustainability should inform the sustainable communities approach to housing in terms of qualitative and structural characteristics, layouts and the relationship between different functions, uses and spaces, and must move away from the mono-functional design of residential areas of the past and offer a range of typologies and tenure. These principles apply to greenfield, upgrade, infill and new projects. Sustainable development, efficient use of infrastructure and functional integration require more efficient land use and higher densities, based on new approaches in planning and new attitudes to housing, urban living and design.

Status Quo

Existing Housing Stock and Development

Before new housing developments are embarked on, it will be necessary to determine the scope of current developments and assess existing housing stock with a view to ensuring that all developments to date have been completed and handed over to beneficiaries. A complete inventory of housing developments should be drawn up and assessed to determine whether there are existing developments that are still to be completed or require remedial work before being handed over.

Infrastructure Services

The capacity of all bulk and network services needs to be assessed to ensure that adequate water and energy supply, waste and solid waste collection, and road and transport capacity are available for developments, failing which housing developments need also to trigger the development of new service networks and facilities, and expanded bulk capacity.

Current Demand

Information on housing demand, including high-, medium- and low-income housing and patterns of behaviour, particularly in informal settlements, must be obtained from ongoing surveys. Such surveys are carried out by the Gauteng Department of Local Government and Housing and should be accessed as a basis for detailed research to determine local demand. Coupled with the demand for housing, the demand for suitable land should also be determined and investigations initiated to identify
Backlogs

Backlog figures need to be interrogated for reliability in relation to data gathered when researching the supply and demand needs discussed above. There is a need to eradicate informal settlements and curb further growth of these through upgrading and formalisation. Strategies need to be incorporated into the master planning proposal to monitor current settlements and discourage the erection of new informal units, and to ensure that informal units are dismantled once new units replacing them are complete. Additional housing capacity is also required to accommodate backyard dwellers and address overcrowding in existing developments.

Efficiency of Application, the Allocation Process and Resale

The criteria for eligibility or access to housing need to be reviewed to ensure that members of one household cannot qualify for several houses and generate rental income from the balance. This trend may be inflating the demand figures. There is, however, also a need to normalise trading in terms of housing stock and allow owners to buy and sell RDP houses and move around as employment or other opportunities arise elsewhere. Currently, many RDP houses far from the owners’ workplaces stand empty while they rent accommodation nearer to work, thus placing further pressure on the demand for accommodation.

Future Demand, Needs and Challenges

Spatial Development and Land Use

Cognisance may be taken of the Spatial Development Framework and the Town Planning Scheme. Where insufficient land is zoned to meet the demand for housing, rezoning should be trigged. Practically speaking, the provision of services should be such that 50% of urban activities, such as employment, shopping, employment, education and social and recreational, should be within walking distance of residences, which requires comprehensive spatial planning and the provision of supporting infrastructure. If the Spatial Development Framework or Town Planning Scheme does not consider more appropriate configurations for development, such challenges should be highlighted in the master planning report.

The development of the Gautrain will in time dictate ‘nodal’ living as commerce, industry and communities are likely to position themselves around stations to ensure access to high-speed transport. Town planning schemes should be revisited in the light of the much-transformed transport backbone in the province.

Demographics and Possible Growth Patterns

Understanding the demographics and the socio-economic status of communities is essential when planning housing. Population growth or decline are not the only considerations – gender, age, disability, HIV/AIDS, employment and associated income are important. It is necessary to determine the percentage of women- and child-headed homes, as such families will require subsidies, as will the aged and other indigent families. Provision for those with disabilities must be factored into development costs, to ensure ease of access to dry sanitation options, where applicable, and transport.

HIV/AIDS trends need to be well researched. Although population decline may be indicated, the prevalence of HIV/AIDS may impact negatively on household consolidation. Understanding the economic sectors in which the population is engaged is essential as the level of income will dictate housing options, subsidies required and opportunities to access other types of funding. When determining growth, it must be borne in mind that, on average, the household growth rate is more than double that of the population growth rate.

Based on planning reports and established land use, various development scenarios should be considered to determine requirements in terms of bulk supply, service delivery, land availability, access to job opportunities, education, health, and other facilities. The development of commercial and industrial areas will trigger increasing demand for housing in and around such areas. Densification, mixed land use and social and economic integration should also be factored into the plans.

Economic Development

Successful economic development requires that all stakeholders are treated equitably such that no sector of the community is neglected in favour of another. To this end industrial, commercial and institutional consumers must be properly included in the planning process to create adequate job opportunities for communities. Where a Local Economic Development Strategy is in place, it will be an integral part of the planning and approval process.

Levels of Service

A detailed analysis of housing demand is required, considering the need to eradicate informal settlements, while also catering for household splitting and upward mobility in lifestyle. It is likely that a range of housing units will be required –from simply upgrading and formalising informal settlements, to providing RDP houses and working with the private sector to provide bonded houses ranging from affordable to middle and high income.
Legislation and Guidelines

Attention should be paid to the provisions of various Acts and guidelines which address the protection of homeowners, and home building methods and practices, as follows:
- Housing Act, 1997 (Act No. 107 of 1997), as amended by Act No. 28 of 1999 and Act No. 4 of 2001
- Rental Housing Act, 1999 (Act No. 50 of 1999), as amended by Act No. 43 of 2007
- The National Home Builders Registration Council Bill
- SANS 10400: The application of National Building Regulations
- National Department of Housing: Design and Construction of Engineering Services
- NHBRC Technical Standards contained in Government Gazette R1406 (NHBRC Home Building Manual)

Analysis and Modelling

Demand

Three national initiatives deal with the need for housing development and dictate the demand. They are:
- The Integrated Residential Development Programme (IRDP), which provides for the acquisition of land and servicing of stands for mixed land uses to ensure that residents are well located in terms of urban amenities and places of employment. This programme addresses development for low-, middle- and high-income groups
- The Upgrading of Informal Settlements Programme, which seeks to provide secure tenure and access to basic and emergency services and housing, where possible in situ. This requires a comprehensive process of determining beneficiaries, acquiring the land, surveying and formalising stands, and ultimately developing services; housing development will be carried out by the beneficiaries, who may seek construction assistance through other National Housing Programmes
- The Rural Housing Subsidy Communal Land Rights Programme, which allows those living in areas with communal tenure to access housing subsidies

In determining demand, waiting lists offer an indication of the extent of development required. However, as those on waiting lists could currently reside in:
- informal housing units on existing planned stands
- informal housing units on unplanned stands
- informal backyard dwellings
- formal dwellings, but with another family

these could result in double counting when surveys are also used to determine the demand. Furthermore, as outlined above, it has been established that waiting lists are skewed due to multiple applications being lodged. A thorough understanding of the actual need must be developed to limit what may become an oversupply of housing stock. Furthermore, the need for rented houses must be determined and factored into the demand determination.

Rectification and Transferring of Incomplete Developments

There have been many reports of poor-quality housing developments, as well as of contractors going into liquidation and not completing developments. In other instances developments have been completed but ownership of the land has not been resolved, which has meant that the houses have not been handed over, and in some instances houses have been abandoned. A register of all incomplete developments should be compiled to determine the number of houses that could be completed and handed over after minor repairs or after dealing with land issues.

Alternative Technologies and Approaches

There are many approved methods of constructing housing, ranging from traditional bricks and mortar, through precast concrete panels to cement-plastered polystyrene blocks and others. All have their merits and may have certification from the Agrément Board, which is part of the Council for Scientific and Industrial Research (CSIR). However, the intended community must be fully counselled on the pros and cons of the various methods before embarking on wholesale construction without which the housing scheme could turn into a financial disaster for the municipality.

Although single-storey detached units have been the norm for a long time, it is realised that densification is necessary to limit the extension of infrastructure networks, to utilise the land most suitable for development and to limit the opportunity for constructing further infill shacks and informal units. Double-storey to four-storey ‘walk-ups’ have become acceptable, many of which are being constructed with one or two external rooms for rental as part of the main structure, once again to limit the temptation to develop more informal accommodation. These recent approaches to housing development should also be considered. Furthermore, urban renewal, inner city regeneration (including the conversion of disused high-rise offices blocks into flats) and revisiting the social acceptability and cost-effectiveness of new medium- and high-rise developments are some of the many alternative approaches that should be considered.

Sources of Funding

Although funding is regarded as a generic consideration across all master planning exercises, identifying funding
for housing development requires special mention as there are many sources that could be tapped, including municipal resources, national and provincial grants and subsidies, as well as banks, mining houses and other institutions committed to social and housing development as part of the various Charters that govern the way they do business. PPPs may also be considered when working with developers on mixed housing projects.

**Delivery Methods**

Contracts of varying sizes can be awarded to SMMEs depending on their experience and ability, as opposed to using established contractors who require substantial developments to make their appointments viable. SMMEs can be graded according to their proven ability, starting initially with one or two houses and moving up the scale to the allocation of a greater number of units as they prove competent in housing development. Using SMMEs requires considerable involvement by the municipality not only regarding quality control and the grading process, but also regarding payment certification which is generally required twice a month. Some SMMEs may first require coaching when entering into a contract, followed by material acquisition and financial management to ensure that material suppliers and labourers are paid regularly and on time. Although the use of SMMEs addresses job creation, the construction process is generally slower than when using big contractors and this must be factored into long-term planning.

**Support and Consumer Education**

It is important to have personnel available to handle the process of allocation and transfer to the final owners shortly after handover from the contractor, without which rates accounts and service bills cannot be rendered. Community education on care of urban infrastructure and household responsibilities, including the use of prepayment metering and payment of rates, is essential for a harmonious relationship with the municipality. Handover and occupation by the owner must be seamless to avoid vandalism and illegal occupation which lead to further delays, frustration and fruitless expenditure due to the municipality having to rectify defects.

**Risk Assessment**

When the demands and requirements have been fully determined and the present capacity assessed, a risk assessment must be carried out to determine the consequences of delayed implementation or the unacceptability to communities of the various levels of service and construction materials selected for development.

**Disaster Management**

Housing must be located within prescribed distances from fire stations, other emergency services and possible shelters to ensure timeous response and evacuation in case of disasters. Housing should not be located in flood zones, unstable soil conditions or areas that present dangers to health, such as near wastewater treatment works or landfill sites.

**The Master Plan**

The provision of housing is inextricably linked to the availability of land and the provision of services. Short-, medium- and long-term plans will identify land that:

- Is immediately available for short-term development, i.e. already municipal property or in the hands of developers and can be used immediately
- Could be developed in the medium term, i.e. land available but not yet transferred
- Has not been previously suggested but is eminently suitable for the development, and will suggest the process to follow to acquire the land and proclaim and develop the appropriate townships

A detailed description of the process is given in Sustainable Human Settlement Planning, published by the National Department of Housing and The Housing Project Process Guide, published more recently by the Department of Human Settlements. The planning phases and related activities are detailed below:

**The Housing Register**

A Housing Register needs to be drawn up to determine which houses are already occupied and which still need to be completed or handed over. In this way the additional capacity required can be determined.

**Long-Term Plan**

The long-term plan will outline possible housing development scenarios linked to both demographic and economic trends and will require the acquisition of land and the proclamation of townships, which is a lengthy process. The long-term plan will thus set milestones for selecting the most suitable sites based on the availability of land, job opportunities and access to health services, education services, and retail and recreation facilities. Updating the Spatial Land Development Framework, land acquisition, rezoning and determining the need for increased bulk capacity are essential steps to allow long-term development to take place. Land must be allocated, rezoned and protected from land invasion or further rezoning until required.

The long-term forecast must be accompanied by present-day cost estimates which are adjusted annually so that the Housing Department can prepare budgets for the Medium Term Financial Plan (MTFP) and estimate the anticipated costs, and the municipality can make decisions on the levels of service to be provided.
The long-term plan will also set milestones for selecting the most suitable sites for housing developments, identifying delivery methods, and identifying alternative sources of funding and external investment.

**Three-to-Five-Year Capital and Operational Plan**

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3. It will address land acquisition, the provision of services and sources of funding. This plan must be in line with the Spatial Development Framework and Land Use Management Plans or include provision for rezoning where required.

**One-Year Project and Budget Plan**

This short-term plan will cover projects to be delivered in the immediate future, for which the land allocation and most of the services have been provided. In deciding whether development may commence, it must confirmed that all services will be available by the end of the development, including water supplies to feed both the water and sanitation networks, treatment works, electricity supplies, waste disposal capacity and adequate access to and from the development. The plan should also indicate funding sources and the support to be put in place for handover and community education. See Chapter 3 for more guidelines on the planning process.
Introduction

The Constitution assigns powers and functions to municipalities which entail significantly more responsibility than the delivery of network and individual services to households and industry. Schedule 4B of the Constitution calls on municipalities to provide various facilities, such as child care facilities, fire-fighting services, support for tourism, health facilities, airports, pontoons, ferries and jetties, over and above services such as electricity, public works, transport (including taxi ranks and pedestrian facilities), water and sanitation. Schedule 5B calls for the support of many more facilities, including public places, sports facilities, stadia, clubhouses, caravan parks, public ablution facilities, swimming pools, libraries, cemeteries and kennels. Other facilities are municipal offices, workshops, stores, vehicle testing stations, landfill sites, markets, abattoirs, community halls and centres, theatres, parking facilities, emergency services and stalls for informal traders.

It is unusual to develop a Master Plan for municipal buildings and facilities as the provision of most facilities is dictated largely by the Town Planning Scheme and guidelines relating to the number of households per facility. Unfortunately, many individual developments are of a size that does not warrant specific amenities but when several adjacent developments are considered, the overall facilities are found to be lacking or inadequate. It is essential that developer contributions be determined for all sizes of developments and that the full range of facilities be considered for quality living.

In determining which services to develop, community interests, location and need are of paramount importance and adequate and proper consultation is required. Sports facilities are particularly population-specific. For example, a soccer field would be utilised far more by a black rural community than a rugby field. Section 8.3 of Municipal Infrastructure: An Industry Guide to Infrastructure Service Delivery Levels and Unit Costs, published by COGTA, offers substantial detail on the planning and development of the range of facilities for sports, such as archery, athletics, baseball, basketball, cricket, hockey, netball, soccer, squash, swimming and tennis.

When a field, swimming pool or other facility is developed, usage should be maximised by placing it close to active populations, for example by placing it adjacent to a school. This would mean that these facilities could be used by the school during the week and by other sectors of the community in the evenings and over weekends.

Likewise, the hall in a multi-purpose community centre has the potential to be used as a school hall during the week, for after-school programmes, as a church on Sunday, and as an education and training facility for adult education and skills training after hours. Incorporated into educational facilities must be a public library system which provides opportunities and resources for continuing education and learning, and will be a source of information. Section 8.3.5 of the Municipal Infrastructure Guide, mentioned above, outlines all elements that should be considered when developing a multi-purpose community centre.

Of major importance at present is the expansion and positioning of cemeteries. All too often they are located far from the communities they serve, have limited or no security and are unsafe for visits by families and friends on anniversaries and other special occasions. The selection of land and access routes for cemeteries is important and this may take a long time to acquire and develop. Section 8.3 of the Municipal Infrastructure Guide, mentioned above, outlines all the parameters that should be considered when developing mortuaries, crematoria and cemeteries, from local cemeteries to regional cemeteries and memorial parks. Although physical conditions such as topography, soil, geotechnical conditions and hydrology, including flood lines, are important, an understanding of the demographics and the impact of religious beliefs and social attitudes will to a large extent determine the configuration required.

In the metros, the need for centralised administration, but localised consumer services, requires the development of centralised municipal precincts, coupled with local decentralised community centres, connected with adequate electronic bandwidth for efficient communication.

Many of the above facilities take years to develop, given the size, costs and need for land and agreement on localities to suit all users or consumers. Unless the facilities are planned timeously with adequate provision of infrastructure, municipalities will not be able to offer the numerous additional services now expected of local government.

Although many of the developments will be triggered by the Planning, Corporate Services, Sports and Recreation, Finance and Administration Departments, it is up to the Engineering Department to include the need for these services in its Master Plan to facilitate development in the long term.
Status Quo

Existing Amenities
Before embarking on new developments it will be necessary to assess existing amenities and determine whether these are fit for purpose. Where facilities have not been adequately maintained, it may be necessary to involve structural engineers to determine the stability and long-term safety of these structures. Likewise, the geology at existing locations needs to be investigated as many developments are situated on dolomites and are at risk.

Infrastructure Services
The capacity of all bulk and network services must be assessed to ensure that water and energy supplies, waste and solid waste collection, and road and transport capacity are adequate for current uses, failing which the development of new amenities should trigger improved services and accessibility.

Current Usage
The current utilisation of offices and facilities must be investigated to determine capacity and whether there is spare capacity. Many municipalities still do not have adequate records of their facilities and little or no space planning has been done recently, with the result that many facilities are underutilised and could be earning a substantial income for the municipality if properly managed. Furthermore, many offices and facilities are rented out or have been outsourced and need to be assessed in terms of Return on Investment (ROI) or a change of use. A register of all municipal properties needs to be drawn up and a facilities management system implemented to manage utilisation and ensure an ROI.

Suitability
As lifestyles and business practices change, usage patterns also change. It is therefore also necessary to determine the current suitability and appropriateness of facilities.

Future Demand, Needs and Challenges

Spatial Development and Land Use
Cognisance may be taken of the Spatial Development Framework and the Town Planning Scheme. They will largely dictate the location and type of amenities required, based on town planning norms. The guidelines on the number of erven, or population per amenity type, and appropriate sizes of amenities, and maximum distances from the populations they serve are defined in the Guidelines for Human Settlement Planning and Design published by the CSIR. These guidelines consider the parameters governing the planning and design of educational, health, recreational, cultural and administrative facilities. More detailed norms and standards can still be sourced from the old provincial guidelines of the apartheid era, such as the Transvaal Provinsie Riglyne. Where insufficient land is zoned to meet community needs, rezoning should be considered.

Demographics and Possible Growth Patterns
Based on planning reports and established land use, various development scenarios should be considered to determine whether communities are likely to grow and make increasing use of the amenities, or whether the area is in decline and utilisation of specific amenities will be short lived. Community demographics and interests must be determined, as needs will vary from population to population. The range of amenities that should be considered is outlined in detail in Sections 8.2 and 8.3 of the Municipal Infrastructure Guide, mentioned above.

Economic Development
Economic development will dictate to some extent the development of townships and thus the need for facilities. The need for major landfills, cemeteries and sports facilities will be dictated when major industrial developments spawn substantial mixed greenfield housing developments. Where a Local Economic Development Strategy is in place, it will be an integral part of the planning and approval process.

Levels of Service
Demographic composition and norms and standards applicable to the number of households per school, or distance from clinics, police stations, libraries, etc. should be considered to ensure that adequate facilities are being developed. Developers also need to comply with these standards and provide the appropriate facilities for greenfield developments. Levels of service for most types of facility are outlined in Sections 8.2 and 8.3 of the Municipal Infrastructure Guide, mentioned above, ranging from basic levels of service, through intermediate, to the highest levels of service.

Analysis and Modelling

Demand Management
Space planning and facility management are essential to ensure optimum usage and management of municipal
facilities and to ensure that new developments are fully warranted.

**Upgrades and Refurbishments**

Many municipal facilities have been neglected or have fallen into disuse. Upgrades and/or refurbishments may be more cost-effective than new developments and should be investigated.

**Alternative Technologies**

Municipal facilities such as sports fields and swimming pools present challenges in terms of ongoing maintenance and management, and can soon become unusable without adequate attention. Lower-cost maintenance solutions should be considered, such as placing Astro turf or developing closed swimming pools which require fewer chemicals and cleaning, etc.

**Delivery Methods**

Many facilities lend themselves to privatisation or outsourcing on medium-term contracts, including markets, landfill sites, and conference and sports facilities, and such agreements should be considered to ensure ongoing operations and maintenance and appeal to the public.

**Risk Assessment**

When the demands and requirements have been fully determined and the present capacity and operational ability assessed in detail, the necessity for augmentation, upgrading and additional infrastructure can be evaluated. To determine priorities for implementation, a risk assessment must be carried out to determine the consequences of delayed implementation.

**Disaster Management**

Fire stations and other emergency services should be located within the prescribed distances from amenities to ensure timeous response and evacuation in case of disasters. Amenities should not be located in flood zones, unstable soil conditions or areas that present dangers to health, such as near wastewater treatment works or landfill sites. Provision should also be made for a Disaster Management Centre. Guidelines on the development of emergency service facilities are outlined in Section 8.2 of the Municipal Infrastructure Guide, mentioned above.

**The Master Plan**

The provision of amenities is inextricably linked to the availability of land and the provision of services. Short-, medium- and long-term plans will identify land which:
- Is immediately available for short-term development, i.e. already municipal property or in the hands of the developer and can be used immediately
- Could be developed in the medium term, i.e. land available but not yet transferred
- Has not been previously suggested but is eminently suitable for the development and will suggest the process to follow to acquire the land.

The planning phases and related activities are detailed below:

**Long-Term Plan**

The long-term plan will outline possible facility development scenarios linked to both demographic and economic trends. It will set milestones for selecting the most suitable sites based on the availability of land, labour and community users. The long-term plan needs to outline the demand and services required in order to feed into long-term sector plans.

The long-term forecast must be accompanied by present-day cost estimates which are adjusted annually so that the relevant departments can prepare budgets for the Medium Term Financial Plan (MTFP), for the anticipated capital and O&M costs, and the municipality can make decisions on the levels of service to be provided.

The long-term plan will also set milestones for determining the most suitable selection of sites, identifying delivery methods, and alternative sources of funding and external investment.

**Three-to-Five-Year Capital and Operational Plan**

This medium-term plan will itemise projects to be developed over the period in accordance with the guidelines outlined in Chapter 3. It will address land acquisition, the provision of services and sources of funding. This plan must be in line with the Spatial Development Framework and Land Use Management Plans or include provision for rezoning where required.

**One-Year Project and Budget Plan**

This short-term plan will cover projects to be delivered in the immediate future, for which the land allocation and most of the services have been provided. In deciding whether development may commence, it must confirmed that all services will be available by the end of the development, including water supplies to feed both the water and sanitation networks, treatment works, electricity supplies, waste disposal capacity and adequate access to and from the development. The plan should also indicate funding sources and the support to be put in place for handover and community education. See Chapter 3 for more guidelines.
Part IV offers a typical Terms of Reference for use and customisation by municipalities calling for master planning exercises. The document offers guidance on the source documents to consult, the scope of work for the stakeholder engagement and level of expertise required. This part concludes with a detailed Bibliography and List of Legislation governing each sector.
Introductory Note to a Municipality Calling for the Preparation of a Master Plan

In order to select a service provider to prepare the relevant Master Plans, a Request for Proposal (RFP) should be issued. This should contain a Terms of Reference as well as appropriate Terms and Conditions. The Terms of Reference should be issued with sufficient detail to elicit proposals that have been thoroughly researched and provide sound future direction for each service. Typically, where the level of detail required has not been spelled out, master planning documents of the past have been nothing more than an updated Asset Register or at best a condition assessment.

A typical Terms of Reference is outlined below. It is important to note, that this guideline covers only the Terms of Reference. Terms and Conditions and other clauses peculiar to each municipality should be combined with this Terms of Reference to complete the RFP. Proposals for one or more Master Plans may be called for in one document. Hence, throughout the Terms of Reference the discipline is left blank. Typical Master Plans that this document could cover are:

- Water Services Master Plan
- Sanitation Master Plan
- Stormwater Master Plan
- Roads and Transport Master Plan
- Electricity and Energy Master Plan
- Solid Waste Master Plan
- Integrated Housing Master Plan
- Municipal Facilities Master Plan

In preparing any one of these, all the others should be consulted, as well the Spatial Development Framework, the Town Planning Scheme and Growth and Development Strategies from all levels of government and neighbouring municipalities. It will therefore be necessary to adjust the lists in the outline below to address the discipline under discussion. Where it is necessary for the municipality to write something from scratch or define the name of the Master Plan(s), municipality or other variables under consideration, the text is written in bold italics and should be replaced with text relevant to the Terms of Reference being issued.

The Terms of Reference

Background

Note to municipality – In this paragraph, a description of how the need for the Master Plan arose is required. Describe the area under consideration and previous studies undertaken leading to the need for the new Master Plan. For example, when a new Spatial Development Framework or Growth and Development Strategy is prepared outlining priority areas for short-, medium- and long-term development, new Master Plans will be required. The reasons for prioritisation should be given, along with copies of previous Master Plans to enable service providers to understand what has previously taken place and to understand better the needs of the municipality going forward. The amount of detail available and the depth of any studies need to be described to enable service providers to gauge the accuracy of the information available.

The Project Brief

To realise the abovementioned objectives, the . . . . . . . . . . Municipality will appoint engineering consultants to develop a comprehensive . . . . . . . . . . Master Plan covering the needs of the municipality in the short, medium and long term, considering not only urban, but also peri-urban and rural areas.

The purpose of the . . . . . . . . . . Master Plan is to compile an implementation strategy, with goals and objectives, which will be followed by a Business Plan detailing the objectives in such a way that clear direction is given to implementation. The Business Plan will include a funding model and a programme for the implementation of all the projects identified. It will be necessary to evaluate the long-term viability of existing infrastructure to cope with expansion and augmentation, and to identify new infrastructure required, and to propose time lines regarding when such infrastructure will be required. The assessments will address the primary and secondary networks, and the primary and secondary equipment needed to deliver a reliable, safe and affordable service to all existing and future consumers within the area.

The contents of the Master Plan created by the service provider must be expanded to the level of
detail at which the municipality can commence with development. Each project description should call for the service provider to assist in acquiring land, registering servitutes, undertaking an Environmental Impact Assessment (EIA) and providing detailed designs for construction, including Scope of Work and Bills of Materials with associated budgets for the short, medium and long term.

Study Location
The investigation covers . . . . . .

Study Objectives
The Terms of Reference includes the evaluation and analysis of existing documents, the determination of existing backlogs, current demands and capacity, the expected growth of the region, and models which will maximise the development potential. The process will comprise the compilation of a . . . . . . . Master Plan and will involve officials, political representatives, organised local business and the communities from grass roots level, and applicable spheres of government. Therefore, as part of the Terms of Reference, provision must be made for an inclusive participation process involving all the parties mentioned. The technical process will rely on the participation of officials and political representatives from the municipalities, provincial and national government regarding technical inputs and the decision-making process. It will thus be a collective process with incremental decision making and with a focus on capacity building of all involved in terms of the contents of this study.

Project Deliverables
Final deliverables will be decided on at a Project Initiation Workshop convened by the Project Consultant. Changes to the final deliverables must be approved by the Steering Committee. Preliminary deliverables, subject to approval at the Project Initiation Workshop, will include the development of:
- A . . . . . . . Master Plan considering all the variables that must be in place for sound development
- A land-acquisition strategy, which will be required to secure land in the long term for the development of bulk supplies, through routes, major supply lines, facilities or housing
- A Project Prioritisation Model addressing short-, medium- and long-term strategic plans
- The formulation of proposals on appropriate Funding Models to fund project implementation
- A review of existing institutional arrangements on municipal level and the formulation of a proposal to build capacity to implement sustainable human settlements
- Any further deliverables as identified in the proposed Project Initiation Workshop.

Source Documents
The . . . . . . Master Plan must be aligned with the visions and targets outlined in various source documents which will be made available to the appointed Service Provider. The sector strategies and plans to be considered, including all Master Plans, are as follows:
- Water services
- Roads and transport
- Stormwater
- Electricity and energy
- Solid waste
- Municipal amenities
- Integrated housing

Other municipal planning and strategy documents include, but are not limited to:
- Environmental strategies and plans
- Local Economic Development strategies and plans
- Social services strategies and plans
- Urban Renewal Strategy

It is essential that the above plans are read in conjunction with the Integrated Development Plan (IDP) and the Spatial Development Framework (SDF) to ensure that they support the growth direction proposed for the municipality, or highlight areas that need to be reconsidered in terms of the SDF. Proposals should also be formulated so that they align with applicable national and provincial programmes, projects and initiatives. In particular, there are many provincial development strategies that must be consulted. These include, but are not limited to:
- The Gauteng 20 Priority Township Programme (PTP)
- 2016 Uni-City vision of the region
- The Gauteng Rural Development Strategy
- The Gauteng Spatial Development Perspective
- The Gauteng Growth and Development Strategy

Typical national documentation to be consulted will include:
- The National Spatial Development Framework
- The National Growth and Development Strategy
- The National Economic Development Framework

At local level, an analysis of the regional demand for the service being considered should also be studied to determine whether partnerships can be negotiated to share in the formulation of proposals for major developments which could be handled more cost-effectively or efficiently on a regional basis, such as a regional water treatment works, through routes, etc.

It is expected that the Service Provider will be well versed in the planning and public sector environments. It is therefore incumbent on the Service Provider to incorporate strategies and directions demanded by documents apart from those listed above, or more recent than those, which were not available when this Terms of Reference was prepared. A list of additional source documents should be included in the tenderer’s list of documents consulted.
Where disparities and conflicts between the above strategies, plans, programmes or projects are identified at local, provincial and/or national levels, these should be brought to the attention of the Steering Committee and proposals should be developed to address these.

Provision should be made in the project proposal for an initial research period that will be used to identify any additional information needed for the formulation of the Master Plan where the Municipality is not in possession of relevant documents.

The Planning Process and Detailed Deliverables

It is envisaged that a comprehensive planning process will be embarked on, from which the Master Plan will emerge, incorporating a detailed list of deliverables as outlined below. The list should act as a guideline which may be expanded or amended but must be aligned with the high-level project deliverables described above and the strategic long-term vision of the Municipality. The planning process will commence with the preparation of an Asset Register, understanding the status quo and determining future demand. A comprehensive analysis of options will then be carried out which will offer long-term development guidelines and specify the priorities for medium- and short-term development. Considering the scope of work in more detail, the tenderer is required to:

- Identify the sector plans, programmes, projects and initiatives in all spheres of government that will affect the development and viability of the service under consideration
- Prepare or update the Asset Register and GIS and determine conditions, remaining useful life, efficiency levels, reliability, losses and carrying capacity
- Determine backlogs
- Determine future demand by considering growth patterns, spatial development, land use and the levels of service required within the framework of existing legislation and policy
- Determine socio-economic status quo i.e. consumer and user profiles and affordability
- Determine what capacity increases can be achieved through refurbishment, upgrades and demand management and provide cost estimates
- Determine the extensions required to address backlogs and provide cost estimates
- Determine the levels of service and the extent of new developments required to meet future demand and provide cost estimates
- Determine provider arrangements such as who is providing water, treatment facilities, through routes in the area
- Consider the use of alternative technologies to achieve reduced costs, ease of operation and maintenance or protection of the environment where appropriate
- Facilitate access to national, provincial and municipal authorities or their service providers
- Facilitate Environmental Impact Assessments where required
- Identify sources of funding, including tariff structuring, levies, investment or payment models to raise sufficient funds for development
- Identify methods of delivery, including community participation, traditional service provider models and public-private or public-public partnerships where appropriate
- Carry out a risk analysis to identify critical assets, the impact of their failure, the level of exposure to risk, and to determine alternative services or sources as the case may be
- Determine priorities and determine the phasing of projects and programmes for short-, medium- and long-term development
- Identify critical material, equipment, skills and labour requirements to be sourced in other regions or internationally as an input to supply chain management
- Compile a comprehensive Master Plan, including long term (20 years plus), medium term (Three-To-Five-Year Capital and Operational Plan) and short term (One-Year Project and Budget Plan), to ensure sustainable development
- Regarding the medium- and short-term plans, compile specifications to be used for tender purposes
- Ensure that all drawings are incorporated into the Asset Register and GIS
- Compile project specifications to enable the Municipality to call for tenders and implement projects easily
- Review existing institutional arrangements and formulate proposals to develop systems and procedures and to build capacity as required to operate and maintain the infrastructure developed
- Workshop the drafts with the Municipality and incorporate comments
- Ensure adoption of the Master Plan by the Council of the Municipality
- Comply with any further requirements identified in the proposed Project Initiation Workshop

The following lists offer a summary of what should be considered when preparing Master Plans for each sector. For more details on what to consider and the process to follow, it is recommended that the reference document A Guideline to Infrastructure Master Planning – The Blueprint for Sustainable Development be consulted. It is available from the Gauteng Department of Local Government and Housing, and is also available for downloading from the SAICE website www.saice.org.za under the section headed Documents.

Water

- Sectorise the water network into discrete district-metered areas (districts and zones).
- Determine existing demand by means of water balances and water metering at end points.
• Prepare or update the Asset Register and determine existing water sources, bulk supply and network capacity, reliability and efficiency.
• Determine backlogs.
• Assess the status quo of the infrastructure and the need for refurbishment, and update Infrastructure Asset Management Plans.
• Assess water conservation and water demand management practices and make recommendations regarding the implementation of such programmes to ensure that loss reduction is addressed.
• Interact with town and development planners to identify new and proposed developments.
• Decide on levels of service.
• Determine the anticipated growth in demand and the need to upgrade or expand networks, pump stations and bulk services.
• Optimise water networks and bulk services in terms of the demand.
• Compile a demand forecast model which can be updated on a continuous basis as the demand changes or new areas are developed.
• Consider the possibility of using alternative technologies.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, tariff models, possible funding sources, land, servitudes and staffing requirements.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

Sanitation

• Determine the existing load on the network by means of flow records.
• Prepare or update the Asset Register and determine existing network and bulk capacity, reliability and efficiency.
• Determine backlogs.
• Assess the status quo of the infrastructure and the need for refurbishment, and update Infrastructure Asset Management Plans.
• Ensure that loss reduction is addressed to reduce high flows of potable water into treatment works.
• Interact with town and development planners to identify new and proposed developments.
• Decide on levels of service.
• Determine anticipated load growth and the need to upgrade or expand networks, pump stations, bulk services and dry sanitation solutions.
• Optimise sewer networks and bulk services in terms of load distribution.
• Compile a load forecast model which can be updated on a continuous basis as the load changes or new areas are developed.
• Consider the possibility of using alternative technologies
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, tariff models, possible funding sources, land, servitudes and staffing requirements.

Roads

• Carry out traffic counts to determine the existing road loading conditions.
• Determine road network conditions, capacity and the need for refurbishment, and update the pavement management system (PMS) and the building management system (BMS).
• Prepare or update the Infrastructure Asset Management Plans.
• Interact with town and development planners to identify new and proposed developments.
• Decide on levels of service.
• Determine the anticipated load growth, transportation models, including intermodal models, and the need to upgrade or expand the network.
• Determine any network changes that could increase capacity, including geometric and structural changes.
• Compile a traffic forecast model which can be updated on a continuous basis as patterns change or new areas are developed.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, possible funding sources, land, servitudes and staffing requirements.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

Stormwater

• Acquire the plans of existing stormwater systems and topographic details of the area, including the surrounding areas.
• Prepare or update the Asset Register and determine existing flood lines and the capacity of the network.
• Determine backlogs.
• Assess the status quo of the infrastructure and the need for refurbishment, and update Infrastructure Asset Management Plans.
• Interact with town and development planners to identify new and proposed developments.
• Decide on levels of service.
• Determine the anticipated load growth and all factors required to determine the capacity for new stormwater system and the necessity for upgrades to existing systems; this will include the determination of new flood lines, retention pond sitings, etc.
• Compile a flow forecast model which can be updated on a continuous basis as inflow and the runoff patterns change.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, possible funding sources, land, servitudes and staffing requirements.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

**Solid Waste**

• Determine the existing waste-collection capacity and routes, taking into account households, businesses and industries.
• Prepare or update the Asset Register and determine the disposal capacity, considering waste minimisation, recycling, mini-dumps, transfer stations, landfills, illegal dumping and other forms of disposal.
• Determine backlogs and existing operational and environmental health needs.
• Interact with town and development planners to identify new and proposed developments.
• Prepare or update the Infrastructure Asset Management Plans.
• Decide on levels of service.
• Determine the anticipated load growth and the need to upgrade or expand networks and substations.
• Optmise networks and supply points in terms of load distribution.
• Compile a load forecast model and conduct a sensitivity analysis which can be updated on a continuous basis as the load changes.
• Consider the possibility of using alternative technologies or Independent Power Producers.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, possible funding sources, supply sources, alternative energy, staffing requirements, strategic site and servitude requirements and timelines, and update infrastructure asset management plans.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

**Electricity**

• Take maximum demand load readings by means of load recorders at the various substations to determine existing load conditions.
• Prepare or update the Asset Register and determine existing network and supply capacity, reliability and efficiency and the need for refurbishment, and ensure that loss reduction is addressed.
• Determine backlogs.
• Update Infrastructure Asset Management Plans.
• Interact with town and development planners to identify new and proposed developments.
• Decide on levels of service.
• Optimise networks and supply points in terms of load distribution.
• Compile a load forecast model and conduct a sensitivity analysis which can be updated on a continuous basis as the load changes.
• Consider the possibility of using alternative technologies or Independent Power Producers.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, possible funding sources, supply sources, alternative energy, staffing requirements, strategic site and servitude requirements and timelines, and update infrastructure asset management plans.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

**Housing**

• Determine the need for housing and the type of housing, from upgrading and formalising informal settlements, providing RDP houses and/or rental houses, and working with the private sector to provide bonded houses ranging from affordable to middle and high income.
• Identify land suitable for housing considering geotechnical reports, environmental impact assessments, registered servitudes and wayleaves, among others.
• Where services exist, prepare or update Asset Registers and determine existing network and supply capacity, reliability and efficiency and the need for refurbishment.
• Where services do not exist, determine the level of service required and the time frame for development.
• Compile an infrastructure load forecast model, inclusive of water supply, water-borne sanitation, waste removal services, electricity supply and roads and stormwater systems where required.
• Determine present and anticipated future demand regarding access to amenities.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, possible funding sources, land requirements and staffing requirements, and update infrastructure asset management plans.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

**Municipal Amenities and Facilities**

• Prepare or update the Asset Register and determine existing amenities, facilities, usage and fitness for purpose.
• Determine backlogs and existing operational needs.
• Identify land suitable for amenities and facilities considering geotechnical reports, environmental impact assessments, registered servitudes and wayleaves, among others.
• Where services exist, prepare or update Asset Registers and determine existing network and supply capacity, reliability and efficiency and the need for refurbishment.
• Where services do not exist, determine the level of service required and the time frame for development.
• Interact with town and development planners to identify new and proposed developments.
• Determine the anticipated growth in and the demand for amenities and facilities.
• Optimise the use of existing amenities and facilities and consider the need for new developments.
• Prepare long-, medium- and short-term plans covering expansion, operations and maintenance, costings, possible funding sources, land requirements and staffing requirements, and update infrastructure asset management plans.
• Compile short- and medium-term project specifications to enable the Municipality to call for tenders and implement projects easily.

Note that the above lists are not exhaustive. The tenderer must indicate, where possible, any perceived deficiencies in the different planning areas for consideration by the municipality.

Project Duration

Each Service Provider shall submit a detailed breakdown of the project duration for the preparation of the ........ Master Plan linked to the above deliverables, together with the envisaged tasks and duties that need to be carried out for the successful compilation of the ........ Master Plan. The anticipated completion time is ... months from the date of appointment.

Stakeholders

Provision shall be made for a stakeholder participation process. The appointed Service Provider shall submit a Communication Plan on how to involve all stakeholders. A meeting will be required to consider the Scope of Work and perhaps to refine it, based on the input received during the tender process. A Steering Committee and Project Technical Team should be set up and meetings scheduled to monitor progress and review the final document.

Steering Committee meetings shall be held monthly to oversee the compilation of the ........ Master Plan, monitor progress and give guidance when and where necessary. The Committee shall report to the line function department and shall consist of representative(s) of the following institutions and organisations:
• The appointed Service Provider
• Politicians and officials of ........ Municipality, including all those who are involved in preparing municipal plans and financial plans, such as the IDP, Town Planning, Engineering Service, Housing, Disaster Management and Local Economic Development
• Officials from funding agencies if appropriate
• Officials of national and provincial departments
• Community representatives and representatives of any other institutions and organisations as necessary, including organised business, or representatives of groups, including NGOs, etc., as the Steering Committee may decide

The Service Provider shall be responsible for ensuring the delivery of the ........ Master Plan with the assistance of the Project Technical Team, taking into consideration the deliverables indicated in this document or as and when amended by the Steering Committee. The Service Provider shall chair the Project Technical Team which shall report to the Steering Committee.

The Project Technical Team shall consist of representative(s) of the following institutions and organisations:
• The Service Provider and associated specialists
• Officials of ........ Municipality
• Officials from any external funders
• Representatives of any other institutions and organisations as necessary, including organised business, or representatives of groups, including CBOs, NGOs, etc., as the Steering Committee may decide

Regular Project Technical Team meetings shall be provided for in the proposal to ensure the successful compilation of the ........ Master Plan.

Criteria for Evaluation of Proposals

Note to the municipality – No specific criteria are included here as the municipality should have its own approved supply chain policy and should employ its own standard supply chain criteria for the evaluation of proposals. It is essential, however, that experience and expertise be available within the Service Provider’s organisation and it is suggested that the following experience and expertise be called for:

Experience

The company should have undertaken at least three (3) projects of a similar nature and/or magnitude. In the case of a joint venture, the companies should have undertaken at least five (5) projects of a similar nature and/or magnitude. These projects must be clearly indicated in the proposal and contact details for reference purposes must be provided. Projects of a lesser nature and/or magnitude should not be submitted. The company or companies, in the case of a joint venture, must have individually been in practice for a period of at least five (5) years. Adequate proof of this must be submitted. Any company that previously operated under another name, however, will not be disqualified, as long as adequate proof can be given of a name change the last five (5) years.
**Expertise**

The proposed team should have a principal member who is a registered professional with at least a Master’s degree, or equivalent qualification and fifteen (15) years’ relevant experience. The professional team, furthermore, should consist of at least three (3) or four (4) registered professionals with a Bachelor’s degree, or equivalent qualification, from the following list of fields:

- Municipal Engineering
- Town Planning and/or Spatial Planning
- Environmental Studies
- Geotechnical Studies
- Local Economic Development and/or Economics
- Other applicable fields *(please specify)*

Registration numbers with the Engineering Council of South Africa (ECSA) or other professional bodies shall be provided, along with the CVs of the professionals, which should be included as annexures. One or more people to be designated as team leaders should be nominated, as well as a contact person for assignments, billing and general contract administration. Any subcontractors whom the bidder expects to engage should also be listed, with details of their background and experience of the practice. Details of professional indemnity must also be supplied.

**Facilities**

Particulars should be included of the tenderer’s office accommodation and the design tools and engineering software available to produce detailed designs, systems modelling and GIS, which will ensure satisfactory execution and production of Master Plan projects.
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Department of Water Affairs’ Water Quality Management Policy

Energy

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Electricity Regulation Act, 2006 (Act No. 4 of 2006): NRS 090 (being developed)
Maintenance of Electricity Networks: NRS* 089 Parts 0 to 5 (under review)
Maintenance Work Execution: NRS* 090 (being developed)
Quality of Service: NRS* 047 Parts 1 and 2
Quality of Supply: NRS* 048 Parts 1 to 5
*NRS = National Regulatory Services

Roads and Transport

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