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# The challenges of infrastructure development in the Eastern Limb of the Bushveld Complex of South Africa

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As the platinum mining industry expands in the Eastern Limb of the Bushveld Complex, it is increasingly evident that a major constraint to development is a lack of appropriate infrastructure. Of critical concern are water resources and spatial development/infrastructure. This paper identifies the context for infrastructure development in the Eastern Limb and two solutions that have evolved in the areas of water supply and spatial development.

## Introduction

The ability to effectively realize value from mineral resources is affected by a variety of factors ranging from the specific physical characteristics of the orebody through to the skills composition of the available workforce. However, an aspect that is often overlooked or taken for granted, except in extremely remote or isolated areas, is that of the infrastructure supporting the mining operation. Sustainable value realization from a mineral resource cannot be achieved without the effective integration of infrastructure provision into long-term planning and execution.

Development of the Eastern Limb of the Bushveld Complex has been delayed by the relatively lower average grades and higher palladium to platinum ratios inherent in the UG2 horizon and the extent of potholing in the Merensky. However with increasing maturity of Western Limb operations and perceived shifts in long-term metal pricing, the emphasis on new mine development has shifted to the Eastern Limb.

Coupled with this shift has been the realization that existing regional infrastructure is insufficient to support a long-term mining industry investment that has the scale to rival the Rustenburg district of the Western Limb.

Within this context there is an expectation, and an implicit responsibility, for the mining industry and other role players, to act responsibly in the infrastructure development process in order to ensure long-term industry and regional sustainability. The challenge facing the industry is to effectively integrate with and influence, as necessary, national, regional, provincial and local infrastructure development planning and execution.

The objective of this paper is to highlight the complexity of the infrastructure context and showcase two recent initiatives in water supply and spatial development that have achieved some success in the integration of stakeholder requirements in the Eastern Limb.

## Infrastructure

In an economics context, infrastructure is considered to be the structural elements of an economy, which allow for the

production of goods and services, without themselves being part of the production process. Despite the lack of a specific definition, infrastructure has largely become understood as to comprise road and rail transport systems, public transport systems, airports, public educational facilities, water supply and water resources, wastewater management, solid waste treatment and disposal, electric power generation and transmission, telecommunications and hazardous waste management systems. Critically it is important to understand that infrastructure not only comprises these physical elements but also the operating procedures, management practices and developmental policies that facilitate the effective utilization and development of the infrastructure in response to societal demand.

Conceptually, the nature (concentration, quality and efficacy) of infrastructure will therefore vary from national level through provinces and regions, ultimately to municipalities, subject to a range of political and economic legacies. Within this context South Africa suffers from a disparate distribution of infrastructure ranging from established and maintained urban and industrial areas such as Gauteng through to the challenges prevailing in the Eastern Cape.

Infrastructure plays an important role in the social and economic development of communities. Areas without access to effective infrastructure are inevitably characterized by high levels of poverty, with municipalities tending to focus on two key infrastructure delivery issues; the provision of access to basic municipal services (water, sanitation, electricity and solid waste removal) and the provision and maintenance of general infrastructure and services within the municipal area. This approach typically manifests itself in a prioritized programme covering:

- Provision of free basic services
- Access to municipal services in previously disadvantaged areas
- Water services (provision and maintenance)
- Solid waste removal
- Electricity provisioning
- Transport
- Roads
- Storm water management.

## The Eastern Limb of the Bushveld Complex

The Eastern Limb of the Bushveld Complex, centred on the town of Steelpoort, and extending in an arc to Fetakgomo in the northwest and Groblersdall in the southwest, is an area that has suffered from a legacy of limited infrastructural development. Further development of infrastructure in this area is complicated by the fact that the platinum producing areas of the Eastern Limb span two provinces, Limpopo and Mpumalanga, and is administered by the Sekhukhune Cross Boundary District Municipality (CBDM).

The Sekhukhune CBDM covers the following areas:

- Northern District Council
- Bosveld District Council
- Hlogotlou/Lepelle
- Eastern Tubatse
- Dilokong
- Tubatse/Steelpoort
- Ngwaritsi/Makhuduthamaga
- Nebo North
- Nokotlou/Fetakgomo
- Highveld District Council
- Lowveld Escarpment District Council
- Groblersdal
- Marble Hall
- Moutse
- Steelpoort/Ohrigstad/Burgersfort.

Each province develops and implements a Provincial Growth and Development Strategy (PGDS), which is a framework to guide growth and development over a 10-year period. The PGDS is underpinned, nationally, by a range of initiatives such as The National Spatial Development Plan, The Reconstruction and Development Plan, and the Accelerated and Shared Growth Initiative for South Africa (ASgiSA). A provincial growth and development strategy is thus an expression of a national policy framework at provincial level to provide a clear vision for growth and development and to set the pace, and tone, for growth and infrastructural development for the province.

The enduring infrastructure legacy of pre-1994 Nationalist policies is institutional fragmentation, backlogs in basic services delivery, a lack of centralized local government in rural areas and marginalized provincial economies. In the Eastern Limb this institutional fragmentation was exacerbated as the area was divided into the homelands of Lebowa, Gazankulu, Venda and Kwa-Ndebele within an area administered by the Transvaal Provincial Administration. This situation concealed many capacity constraints paving the way for corruption and inefficient service delivery. Rectifying this legacy is a major, ongoing challenge, which is still compounded by a lack of reliable data on backlogs and sustainable industry development options.

The demographics of the Sekhukhune Cross Boundary District Municipality and inter alia the Eastern Limb can be broadly characterized by:

- young population
- high percentage of women
- largely unskilled/semi-skilled component of the economically active sector
- high unemployment rate
- despite economic growth since 1994, a high dependency ratio (~19 unemployed to one employed).

Essentially the majority of the people are unemployed, unskilled or semi-skilled and living in poverty. This poses significant socio-economic challenges in the sustainable provision of services and development of infrastructure.

In addressing these challenges the Provincial Governments have identified and implemented a number of development clusters, one of which is the Platinum Mining cluster on the Dikolong corridor between Polokwane and Burgersfort. Development clusters create critical mass, spatial concentration, lead to competitive advantage and promote a self-reinforcing cycle of growth. They encompass an array of linked industries, from suppliers and providers of infrastructure to downstream activities and service organizations, inclusive of training, research and governmental institutions. Promoting cluster formation requires policies on:

- Improving education and skills
- Providing essential infrastructure
- Building capacity in technology
- Opening access to capital
- Improving institutions and institutional efficiency.

The platinum mining industry in the Eastern Limb therefore faces a challenge of not only defining and understanding individual and collective infrastructure requirements but also effectively integrating with local, provincial and national initiatives, structures and individuals in the establishment of appropriate infrastructure.

## The water challenge

The biggest challenge to development of the Eastern Limb of the Bushveld has been, and will remain in the foreseeable future, water. When a group of mining companies approached the Department of Water Affairs and Forestry (DWAF) to make water available in 1999 for new ventures, the department categorically stated that further water allocations from existing sources was unavailable and that new additional water resources would have to be developed to sustain any new proposed ventures. Realizing that they would have to come up with a different and innovative solution, the mining companies began a consultation process with the Limpopo province namely the Office of the Premier, Department of Agriculture, Department of Economic Affairs and the Department of Water Affairs and Forestry to develop a new sustainable (DWAF design parameters) water scheme for the 76.7 M<sup>3</sup>/day anticipated to be required.

During the consultation process it became evident that there was an unused agricultural allocation of 35.6 M<sup>3</sup>/day to emerging farmers downstream of the Flag Boshielo dam. In order to create access to this water allocation a water steering committee under the National Water Act of 1998 was established. This steering committee was tasked with:

- Negotiating with the Department of Water Affairs and Provincial Government to make the unused agricultural allocation available to the new scheme
- Agreeing on the best legal vehicle to establish and maintain the new scheme
- Appointing consultants to design and project manage the scheme.

During this process and subsequent negotiations it was agreed that:

- The water steering committee would for a period of five years have temporary use of the unused allocation for emerging farmers downstream of the Flag Boshielo dam at a cost of R7m. This payment would be used to repair irrigation infrastructure

- The water steering committee would pay for the raising of the Flag Boshielo Dam wall which would allow for the replacement of the 35.6 Mℓ/day after the five-year period and create the capacity for an entitlement of 76.7 Mℓ/day as per anticipated requirement
- The water steering committee would build its own infrastructure (the Scheme) to distribute its entitlement to its various members.

Under this agreement the Lebalelo Water Users Association (LWUA) was established, with work commencing in May 2001 and completion occurring in July 2002. The cost of building the Scheme amounted to R230m.

The scheme, as established, comprises the following infrastructure:

- A permanent weir of about 5 000 m<sup>3</sup> of concrete, pump station with four 90 kW pumps with total capacity of 1 172 litres per second in the Olifants River on the Farms Lucerne 84KT and Havercroft 99KT
- A desilting plant with a pumping main of 900 mm diameter from the weir and two main storage dams totaling 537 Mℓ that provide for 7 days' storage at full design capacity. These dams are connected to the desilting plant with a 900 mm diameter gravity pipeline
- The two dams provide the suction capacity to three sets of 3600 kW pumps with pumping capacity of 1 158 litres per second supplying a 20 megalitre concrete reservoir through a 9.75 km 900 mm diameter steel pipeline
- A 7.97 km 900 mm diameter gravity pipeline distributes to the Twickenham/Hackney mine off-take. From this point the gravity pipeline decreases to 800 mm diameter, to the Clapham reservoir and pump station. The reservoir at Clapham has a capacity of 15.6 Mℓ and the pump station with three 835 kW pump sets with a pumping capacity of 532 litres per second
- A 9.9 km 700 mm diameter pipeline distributes to the Mooihoek reservoir and the terminal reservoir has a capacity of 10 Mℓ
- The Mooihoek reservoir supplies the Maandagshoek reservoir by gravity with a 600 mm pipeline of 11.37 km
- The total length of the pipeline from the Olifants River to the Maandagshoek is 45.8 km and the branch lines to Winnaarshoek and Dilokong are 5.98 and 1.49 km with 450 mm and 250 mm diameters, respectively
- The raising of the Flag Boshielo Dam.

A southern extension to the scheme was completed at a cost of R165m following development of the Mototolo Platinum Mine, a joint venture between Xstrata Plc and Anglo Platinum Limited.

With the current and future proposed investment by mining companies in the Eastern Limb, the demand for water continues to grow. The Department of Water Affairs and Forestry is therefore developing the Olifants River Resources Development Project (ORWRDP Phase 2) with raising of the Flag Boshielo Dam having been Phase 1. The ORWRDP Phase 2 extends across the middle part of the Olifants river and Sand river catchment, broadly covering the band of new mining developments.

The following main infrastructure will be developed by the ORWRDP Phase 2

- A large dam at de Hoop including the realignment of the R555
- Abstraction works at Steelpoort for the abstraction of water from the Steelpoort River

- Bulk distribution system (pipelines and pumping station) from the Steelpoort works along the R37 road
- Bulk distribution system from the Flag Boshielo Dam to the Mokopane area.

The configuration of the planned bulk distribution system of the ORWRDP Phase 2 will enable the operating of the Flag Boshielo and De Hoop dams as a single system ensuring supply of water at a higher level of assurance. Existing rights/allocations/entitlements will be honored but may be reallocated from a different source. Negotiations are currently in progress for the incorporation of the Lebalelo Scheme into the ORWRDP Phase 2 with the principle being that the LWUA members should in future not find themselves in a worse off financial position.

### The spatial development challenge

One of the major challenges facing mining operations in the Eastern Limb is the efficacy of integrated development at a municipal level. An absence of appropriate municipal infrastructure has created difficulties in:

- Sufficient housing for workers and inhabitants
- A lack of services to support housing (water, roads, sanitation, electricity)
- Limited spatial development frameworks.

Within this context, the continued development of mining operations ahead of the municipal infrastructural development has created negative perceptions of the mining industry, in essence that:

- Mines create informal settlements outside the spatial development frameworks
- There is poor support for local procurement by mining operations
- As a consequence there is little meaningful support for sustainable local economic development.

The root causes of this situation were identified as being:

- A lack capacity at the municipal level to support integrated development
- Poor integration of development efforts between Government and the private sector
- Uncoordinated effort by individual mines in terms of social responsibilities.

In order to address these issues it was agreed, as per the principles indicated in the sections above:

- To develop a structured producers forum
- To focus development on identified nodal points
- That initiatives should be in partnership with Government structures
- That all work done should be in support of local municipal industrial development plans.

This approach resulted in the creation of the Steelpoort Valley Producers Forum, which operates in terms of the structure indicated in Figure 1, and over the footprint area indicated in Figure 2.

The goal of the producer's forum is to co-ordinate and develop joint strategies between government and mining that ensure local economic development on a sustainable basis:

- Housing development
- Service provision (water, roads and transport, electricity, waste, etc.)

Some of the typical issues that have been addressed by the Producers Forum are:

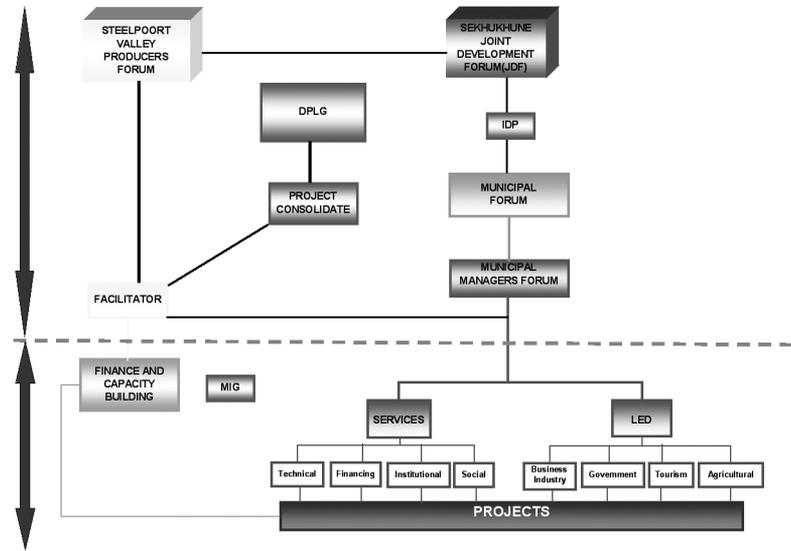


Figure 1. Steelpoort Valley Producers Forum—structure

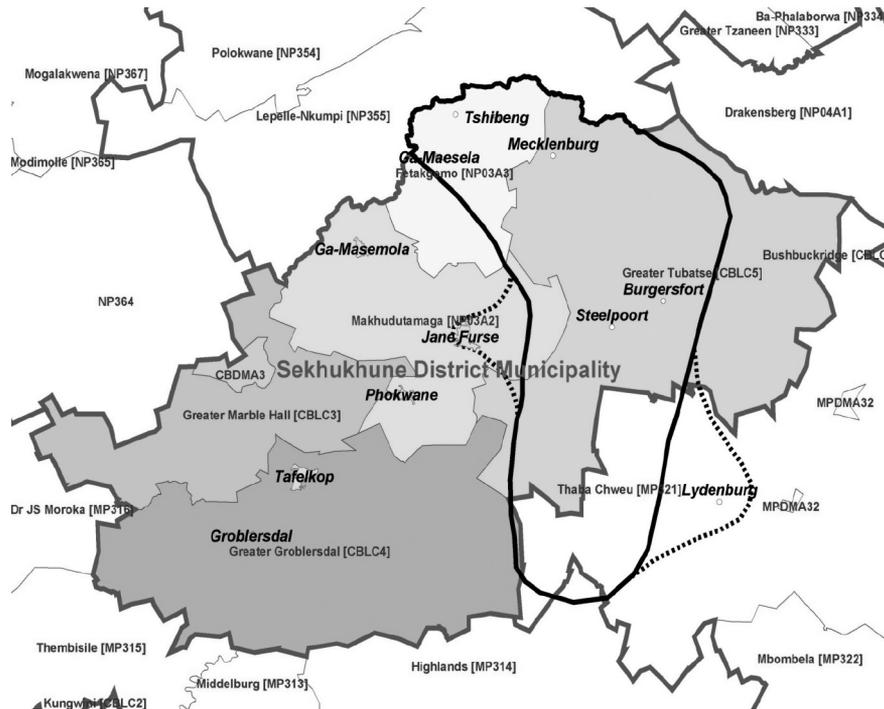


Figure 2. Steelpoort Valley Producers Forum—operational footprint

- Spatial development frameworks, land use management schemes and master planning
- Drafting and implementing of appropriate by-laws
- Incorporating orebody and mining operation boundaries into spatial development frameworks
- Waste removal planning and implementation facilitation
- Water services planning and implementation facilitation
- Transport master planning including setting up transport forums
- Training and capacitating of councillors and officials
- Setting up project management units to assist in municipal project implementation
- Planning and facilitation of electrical services and

acting as a communication conduit in negotiations with Eskom

- Facilitating the access to Government grants such as the Municipal Infrastructure Grant (MIG), Provincial Infrastructure Grant (PIG) and others.

Since conception the Producers Forum has had success in the areas:

- Spatial development and GIS: completed and promulgated land use management schemes (LUMS) for Burgersfort, Steelpoort, Mecklenburg and Driekop, mining and rural strategic policies
- Water management: completed Burgersfort Water management plan.
- Transport: a wide range of initiatives, namely:

- Gained approval for a multi model transport facility (Taxi Rank) in Burgersfort
- Obtained R18m for a taxi rank from Office of the Premier and South African National Roads Agency Ltd (SANRAL)
- Completed Burgersfort Master Transport Plans
- Gained approved for Burgersfort Northern By-Pass and Burgersfort CBD roads by SANRAL and GTM
- Gained approval for R37 Road – four lane expansion by SANRAL
- Established local transport forums for Fetakgomo and Greater Tubatse municipalities.
- Capacity building and training of the Greater Tubatse Municipality (GTM) Technical Department:
  - Completed GTM Skills Audits for directors, managers and supervisors
  - Submitted workplace skills plan to Local Government Sector Education Training Authority for the first time
  - Established Municipal Project Management Unit (PMU)
  - Funded and provide professional support to PMU to manage past and current projects.

The Steelpoort Valley Producers Forum has thus proved to be an effective mechanism for engagement with, and alignment of, stakeholders to allow infrastructure development.

### **Mining and the associated impact on the region**

Inevitably mining operations will have an impact on the Eastern Bushveld as is evident in extracts from commentary made by Irma Venter of *Mining Weekly* (6 April 2007), about the mining impact on the Eastern Limb towns:

‘Mines mean rising employment figures and improved income. However, they also demand more water, more electricity, and more roads—and local government is finding out exactly how hungry a beast the mining industry can be.

‘The principal of the Mpumalanga town realtor says the average rise in property prices over the last decade exceeds 300%, owing to ‘the intensive growth of mining and industry in the area. Mining has affected the residential, commercial and retail market. More businesses have opened, ranging from food and clothing stores to suppliers of infrastructure, IT and communications.

‘According to the local economic development strategy report for the Greater Tubatse Municipality (under which Burgersfort and Steelpoort fall, with Lydenburg part of the Thaba Chweu municipality), a total of R6,6-billion has been committed for new mine development in the region for the period 2003 to 2008. When the expected capital budgets for projects still under exploration are added, the total for 2003 to 2015 increases to just short of R15-billion, or R1,1-billion a year. Then take into account that the entire capital budget for the Limpopo provincial government for the 2006/7 financial year is a ‘mere’ R1,4-billion. This is indicative of the potential impact of the mining sector on the municipal economy,’ notes the report. (The mining industry in the area is represented through the Steelpoort Valley Producers’ Forum, which represents about ten mining companies.)

‘Currently, platinum mines contribute more than 50% to employment figures (7 417 people in 2005), but platinum mines contributed more than 60% to turnover figures

(R4-billion in 2005). In addition to direct employment, mines also employ contractors, which could add as much as 30% to job figures. In total, current employment in the mining sector within Tubatse is estimated at 9 650 people—a threefold increase since 2001. The four new platinum mines that are currently under construction could add another 8 000 new jobs before the end of next year. Add to this the six new prospects that are expected to graduate from exploration to production, and the figure increases by another 12 000 people.

‘In addition to mining activities, there are also three active chrome smelters (Xstrata, Samancor and ASA Metals) in the area, employing 1 200 people, at a turnover of R3,7-billion a year, and a combined capacity of 844 000 t a year. Xstrata and Samancor have projects in the pipeline which will see smelter capacity double over the next five years, with employment increasing by a thousand people.

‘Although all these figures certainly sound positive for the area’s continued and accelerated economic development, there are some complications. For one, the mining industry requires a skilled labour pool, which can be difficult to accumulate in what has always been a strong, but poverty-stricken, agricultural region. A deliberate intervention is required to improve the recruitability of local labour, and to secure the stake of the Tubatse municipality in the benefits of mining development,’ states the Tubatse municipality’s local economic development strategy.

‘According to the municipality’s 2006–2011 Integrated Development Report (IDP), there were only 35 graduates within its borders in 1996. At the same time, only 2 000 people matriculated, and 2 334 people completed grade 8 – compared to 3 072 people who received no schooling. Unemployment is 23%. The report states that these figures indicate that ‘illiteracy is prominent within the Greater Tubatse Municipality’. It also notes that the ‘proposed expansion of the mines presents an opportunity to address unemployment in the area’. Education should be geared towards meeting the skills need of the mining industry.

‘Apart from employment, mining also offers other opportunities, such as local companies providing the mining industry with the goods and services it requires. At current turnover levels, there is almost R3,2-billion a year available in procurement contracts which could be taken up locally.

‘This is a notable opportunity for empowerment companies, as legislation is driving the transformation of the mining sector. ‘It is essential that a conversation is initiated with mining companies to explore opportunities for local business people in this supply chain,’ states the municipality’s local economic development strategy. It indicates that current procurement could increase almost fivefold to R15-billion by 2015, if all the expected mining developments are realised. If a target of 30% procurement from historically disadvantaged South Africans is achieved this year, specifically for suppliers based locally, then expenditure of an additional R1-billion will be directed through the local Tubatse local economy, which will effectively double personal disposable income. However, according to the local economic development report, it also means that ‘local business people must improve their competitiveness in order to secure procurement contracts from mines’.

‘The Tubatse municipality is still in its infancy. It came into existence in 2000, as part of the municipal demarcation process, grouping together several small towns.

'Yet, the influx of miners means it now has to deal with infrastructural demands more typical of a large city. The population in Tubatse, according to Census 2001, is around 305 000 people. This is expected to double by 2015.

'Lydenburg, as part of the Thaba Chweu municipality, suffers the same fate in terms of infrastructure strain. Residents in the eastern part of town often go without electricity for prolonged periods, with informed sources indicating that this is due to a lack of funding to install new switchgear, for example, as well as an inadequate maintenance regime. With the influx of people into Lydenburg, people started to subdivide properties. The subsequent doubling in demand is now ensuring that the lines are not able to carry the required loads in some areas.

'It is, however, widely recognised that developing two specific corridors should improve things, better linking the area to its larger neighbours, and the rest of South Africa. One corridor is the R37 from Polokwane to Burgersfort, providing the north-south link, with the second stretching from Lydenburg to Jane Furse. The IDP report adds that the general condition of roads in the area is 'below standard and requires upgrading'.

'It highlights that rail infrastructure does exist in the area, with stations at Steelpoort, Ohrigstad and Burgersfort, used mainly for the transportation of goods and minerals. However, it notes that there is a proposed expansion on the table, which will see the railway line run from Polokwane, through Tubatse, to the Mozambican port of Maputo. The main function of the railway link will be to afford the mining industry easy movement of its goods.

'Sanitation is another headache for the Tubatse municipality. The IDP report notes that there are currently seven sewage plants in the area, of which four are functioning adequately, but in need of upgrading. The development pressure for the expansion of the municipal area and the need for new housing development have put a great burden on the existing bulk sanitation facilities.

'The municipality is also in need of additional water supply – which is, in fact, a problem the entire region is facing, as mines and their processing facilities are huge water consumers. One solution to this problem is the proposed De Hoop dam, with construction work having started this month. The dam is part of the R4,9-billion Olifants River Water Resources Development Project (ORWRDP), driven by the Joint Water Forum, the same group of mining entities that make up the Steelpoort Valley Producers Forum. The project will see the construction of the De Hoop dam on the Steelpoort tributary of the Olifants River; 25 km of new road, including three bridges; nearly 300 km of pipeline; as well as a number of pump stations and balancing reservoirs. The main purpose of the ORWRDP is to stimulate social and economic development. This will be achieved through the provision of water for rural domestic purposes and urban use (about 50% of the water), with the remainder allocated to new mining developments. According to DWAF, water requirements in the area amounted to 215-million cubic metres in 2005, a figure which is expected to rise to 319-million cubic metres in 2025 – an expected growth of 104-million cubic metres over 20 years. Currently available resources are 224-million cubic metres a year, which meant a 2005 surplus of nine-million cubic metres. Including interventions such as reuse of return-flows and water demand management, the 2025 deficit is expected to reach 90-million cubic metres. However, the raising of the Flag Boshielo dam (phase one of the ORWRDP) will add 16-million cubic metres a year, and the De Hoop dam

(phase two) another 80-million cubic metres a year – turning the deficit into a marginal surplus. All of this means more water will be needed – despite the De Hoop dam – and probably sooner rather than later. There is, however, rising public concern over the desirability to build yet more dams on the Olifants River system.

'Housing is yet another concern for the Tubatse municipality. It notes that a 'very limited amount' of middle- to high-income residential developments are available for occupation at any time, in Burgersfort, for example. The town is expected to house 15 000 people in 2020, up from 2005's 5 360 people. In reaction to this, several portions of farmland have been put aside for residential developments for all income levels in the area – all are in need of water, sewerage and electricity connections, though, which means the municipality must be able and willing to spend some money. To put it into perspective, in 2005 it was estimated that Burgersfort requires bulk infrastructure spending of about R65-million, however, its current total capital budget is about R30-million. The town needs to fatten its purse, either from local means, but more likely from provincial and national sources. It could, for example, cash in on government's Integrated Rural Development Strategy.

'According to the 2006–2011 IDP report, the fact that the local municipality straddles two provinces 'complicates access to financial resources'; it adds that being a newly-established body means that 'all structures and systems are not fully in place and, hence, management and project implementation may lag for some time'. Apart from housing, water and sanitation demands, Burgersfort is also in need of a hospital, a secondary school, sports facilities and a cemetery.

'While the Tubatse municipality is attempting to gear up for the demands economic development is placing on it, it is also acknowledging that mining cannot be its sole economic thrust. This is why the municipality has embarked on a local economic development strategy which sees it embracing six economic programmes. These are platinum- and chrome-mining, followed by the development of a horticulture sector, a growing local economy, meat production, tourism, urban development (making it a well-developed area attracting people for a variety of reasons), and the development of an informal economy. 'The excessive reliance on a single economic sector brings with it a potentially fatal vulnerability to unexpected shocks,' states the Tubatse municipality's local economic development report.'

What is clear from this expression of social concern is that there is an expectation, and an implicit responsibility, for the mining industry and other role players, to act responsibly in the infrastructure development process in order to ensure long-term industry and regional sustainability.

### Comment

The mining industry, by its very nature, will have an impact on community regardless of the sophistication, or otherwise, of existing or planned infrastructure. The challenge facing the industry is to effectively integrate with and influence, as necessary, national, regional, provincial and local infrastructure development planning and execution. This is predicated on the logic that sustainable value realization from a mineral resource cannot be achieved without effective integration of infrastructure provision into long-term planning and execution.

Infrastructure cannot be developed in isolation of political and governmental structures, processes and systems. There has to be effective integration of stakeholder requirements and appropriate skilling to allow for effective planning and execution.

This philosophy has manifested itself, in the Eastern Limb, in the formation and operation of structures such as the Lebalelo Water Users Association and the Steelpoort Valley Producers Forum, which have significantly advanced infrastructure provision.

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