Catchment management through integrated water resource management and co-operative governance in a municipal area

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ABSTRACT

The* Local Government: Municipal Demarcation Act*, 27 of 1998 established new municipal areas according to, amongst other, geographical parameters such as interdependence of communities, grouped and connected logistical capacity, existing magisterial boundaries, land use patterns (e.g. topocadastral farm boundaries), political reasons (e.g. location of voters), and the topographical, environmental and physical characteristics of an area.

Unfortunately, the geographical jurisdiction of the municipalities for the purpose of improving integrated municipal management (e.g. planning, organising and control) neither acknowledges nor utilises the Department of Water and Sanitation (DWS)'s identified and demarcated surface water (rivers) catchment boundaries. This could lead to ineffective, inefficient and uneconomical municipal environmental services, and water and sanitation management.

By determining the status of the geographical, geo-hydrological and macro-organisational arrangements of the municipal service providers and public managers in various municipal areas through an extensive literature review and archival research since 2010, the author found the aforementioned prevalent in all the researched municipal areas. It was concluded that the use of surface water catchments in regional public planning and organising is essential to facilitate, amongst other, effective integrated water resources management and co-operative governance in the local sphere of government in a developing South Africa.

INTRODUCTION

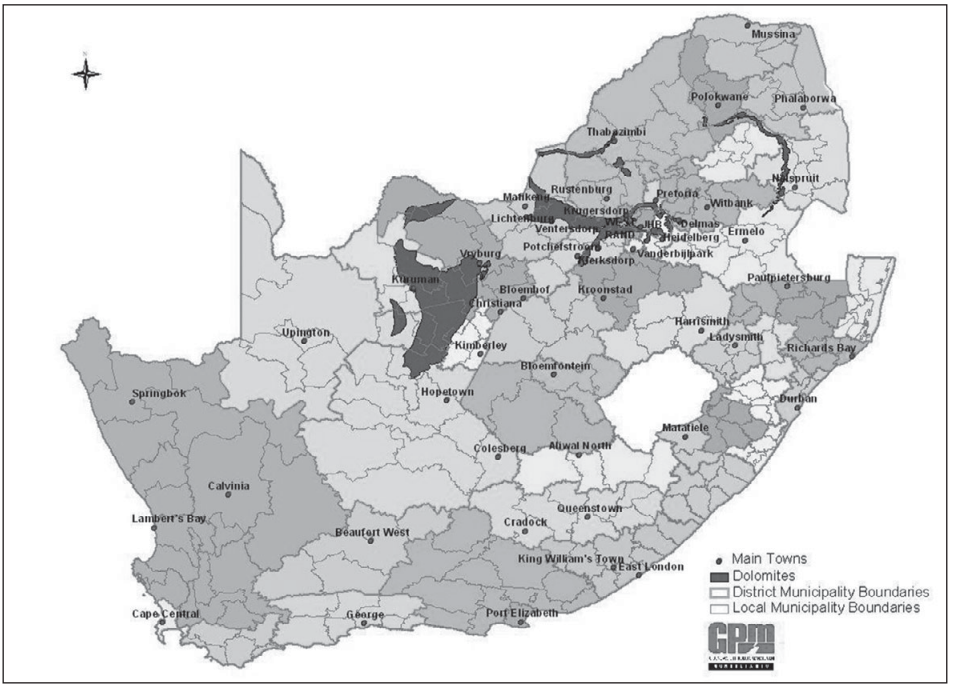
The *Constitution of the Republic of South Africa*, 1996 and local sphere of government related legislation define post-1994 local government as *developmental* in nature, involving,

inter alia, integrated development planning. This requires municipalities to function and co-ordinate development activities in their geographically demarcated municipal areas of jurisdiction (Pycroft 1996:151). The *White Paper on Local Government*, 1998 suggests that municipalities develop management mechanisms and organisational arrangements to, *inter alia*, facilitate effective municipal public policy formulation and implementation as well as citizen participation in their respective geographical areas of jurisdiction.

The municipalities soon realised that they would be unable to undertake the development initiatives and interventions by themselves. The focus moved towards the establishment and maintenance of an effective and integrated co-operative governance partnership between the role-players and the stakeholders. The developmental local government approach is committed to working with groups and citizens in the various communities to realise sustainable approaches to meet their social, economic and material needs in order to improve the quality of life (Coetzee 2000). The aforementioned approach requires strong leadership, clear vision, and maximum participation by the role-players, community(s), private sector and all stakeholders to meet the basic needs of all and facilitate visible, accessible and solid foundations for growth and lasting prosperity (Van der Waldt *et al.* 2014:21).

The South African Government facilitated a total transformation of the nature and extent of governance – especially in the local government sphere. Subsequent to the Constitution, 1996, the *Local Government: Municipal Demarcation Act*, 27 of 1998 and the *Local Government*: *Municipal Structures Act*, 117 of 1998, resulted in the establishment of 278 municipalities (which completely cover the country in a *wall-to-wall* manner). Currently,

Figure 1: Topographical map of the wall-to-wall municipalities and dolomite areas in South Africa



(Du Plessis, 2013).

approximately 226 Category B local municipalities exist, grouped together in four to five under the command and control of 44 Category C district municipalities. In addition, there are eight Category A metropolitan municipalities (South African Government, 2015: Online). See Figure 1 for a depiction of the local municipalities.

In light of the recent emphasis on settling citizens in environmentally safe and sustainable environments (e.g. except areas in the East- and West Rand which are undermined or underlain by dolomite rock), the occurrence of dolomite is also indicated in Figure 1 in the darkest shading. This matter is important for municipalities (especially in terms of human settlements) to take cognisance of and endeavour to manage the dolomite underlain areas responsibly, in order to prevent the formation of ground surface cracks, subsidances and probable sinkholes.

The geographical areas of jurisdiction (municipal areas) are demarcated according to spatial interdependence, logistical capacity, existing municipal boundaries, typical land use, political reasons (e.g. location of voters), administrative consequences, historical reasons, traditional reasons, and topographical-, environmental- and physical characteristics such as the location of farm boundaries, rivers or mountain ranges.

The South African Government, through the continuous re-demarcation of municipalities' geographical area of jurisdiction attempt to, amongst other, facilitate the effective growing of local economies. The respective public institutions in the three spheres of government also endeavour to provide, maintain and improve an increased number of diverse and complex basic municipal services through the various service providers to new geographical areas which encompass millions of citizens. These citizens could have previously been ignored and neglected and for the first time in their lives, are legitimate to participate in a holistic and integrated quest towards developmental municipal management by the Government and participating partners and stakeholders. The focus is on the complex process of effective, efficient and economic public policy-making and implementation, that is, the realisation of co-operative governance. With the aforementioned development in mind, the World expects South Africans to think globally and act locally. Cognisance and care must be taken that whatever is done to the land upstream in a catchment or river basin can drastically affect large numbers of people, their land and water downstream (Gregersen *et al*. 2007:2).

Unfortunately, it is often reported in the public media that the opposite manifests than envisioned in the aforementioned *developmental* vision and strategies for the local sphere of government. Protests by the residents in the Botleng in Delmas, Bekkersdal, Khutsong, Ikageng and Khuma townships are evidence of their dissatisfaction with the below-standard basic municipal service delivery. Due to gold mining and dewatering of underground located water aquifers in the dolomite rock areas on the West- and Far West Rand, cracks, ponors and sinkholes have formed (and continue unceasingly) on the ground surface. Consequently, the area between Westonaria and Carletonville was declared *abandoned due to sinkholes* (Department of Land Affairs 2006: Map).

Subject-specific research tools such as topographical- and geological maps, municipality websites, information data bases, Likert-scale data collection questionnaires and semi-structured interviews with experienced and knowledgeable academics, practitioners and community members were undertaken. An organisational arrangement focused on the manner in which surface water catchments of the Department of Water and Sanitation (DWS) are utilised in an attempt to facilitate Integrated Water Resources Management (IWRM) and subsequently, co-operative governance.

It can be argued that the quest for effective municipal management of basic municipal services in the West- and Far West Rand area can only be brought about by the consistent utilisation of surface water catchments in a holistic and collaborative manner through public planning and organising.

PROBLEM STATEMENT

It is unfortunate that in the demarcation process of municipalities' geographical areas of jurisdiction, the surface water catchment (watershed) areas identified by the former Department of Water Affairs as well as the overall geology (sensitive dolomite rock in areas with geo-hydrologically unconfined groundwater aquifers) were not taken into consideration. This oversight was also identified by Fuggle and Rabie (2005:315) who are of the opinion that non-utilisation of the surface water catchments in macro-demarcation of and planning in municipal geographical areas could lead to the ineffective, inefficient and non-economic municipal management of water, sanitation and environmental services.

TRANSFORMED SPHERE OF LOCAL GOVERNMENT

The transformed local government environment in South Africa has brought about many changes in the basic public services delivered at the grass-roots level with limited resources and unlimited needs – especially, public potable water (drinking water)-, and sanitation- and housing services. The management of the supply of potable water by a municipality in its geographically demarcated area of jurisdiction (municipal area), demands the execution of highly complex hydrological, geo-hydrological and public management functions in a dynamic and highly regulated environment (Bertram 2012: Interview).

Another reality that could be a challenge for municipalities to facilitate an improved level of basic service delivery and co-operative governance in their respective municipal areas is the possible paradox in the legislation regulating water services management in their respective municipal areas. Thompson (2006:235) and Craythorne (1998:157) state that according to the Constitution, 1996 and the Municipal Structures Act, 1998 a Category C (district) municipality has, amongst other, the power and functions to administer potable water supply systems, domestic waste-water, sewage disposal systems and solid waste disposal sites for the municipal district as a whole. A Category B (local) municipality located in a specific Category C (district) municipality's geographical area of jurisdiction only has to take care of and administer storm-water management systems in its own built-up areas. The Category B municipality could, however, be authorised by the Minister of Co-operative Governance and Traditional Affairs (CoGTA) to perform a delegated function or exercise a power relating to potable water supply systems after consultation with the Minister of Water and Sanitation and the Member of the Executive Council responsible for local government in the province concerned (RSA 1998c: sections 83 – 85).

In practice, one finds that in many instances the existing Category B municipalities are responsible for the potable water supply as well as the management of their waste-water and sewage systems in their individual areas of jurisdiction. They usually have strengthened

Figure 2: Google map of the Bekkersdal area

Source: Nealer 2013

their skills- and experience capacity, and are *connected* to the grass-roots water users by means of satisfactory co-operative governance. Currently, in many instances, the Municipal Structures Act, 1998 retracts the delegated water services management authority and transfers it to the overseeing Category C municipality. Occasionally, the supervising and managing Category C municipalities are a considerable distance from the services (too far to drive), often not capacitated with the experience and skills to manage a similar type of potable water supply service in line with, for example, the individual Integrated Development Plans (IDP), and are not connected with the geographically dispersed citizens of their respective Category B municipal areas to facilitate effective communication, co-ordination and co-operative governance.

As a result of the aforementioned, the following negative situations arise in many of the municipal residential areas on the West- and Far West Rand area (see Figure 2):

In the Bekkersdal area, an informal human settlement (approximately 13 000 households) was established on an undermined and dolomite underlain area. The ground surface cracks, subsidances and even sinkholes are developing on the northern side of the non-formalised area. A graveyard has been approved and developed in the dolomite area characterised by an un-confined (open on top) groundwater aquifer immediately east of the Donaldson Dam. The Dam is the only recreational facility in the area and the water is polluted to such an extent by the Acid Mine Drainage (AMD) that the fish caught is inedible and must be destroyed to prevent a health hazard.

Figures 3 and 4 depict the condition of the streets, buildings, storm-water canals, resident protests, and children swimming in the toxic waters of the Donaldson Dam in the Bekkersdal area.

Figure 3: Photos of the devastated Bekkersdal environment

Source: Nealer 2014

Figure 4: Children's health at risk as they swim at the outlet of Donaldson Dam

Source: Earthlife 2011: Online

The critical question is what could the members of the Department of Public Administration and Management, Unisa and Ecohealth Forum members (NWU) do to address the identified challenges?

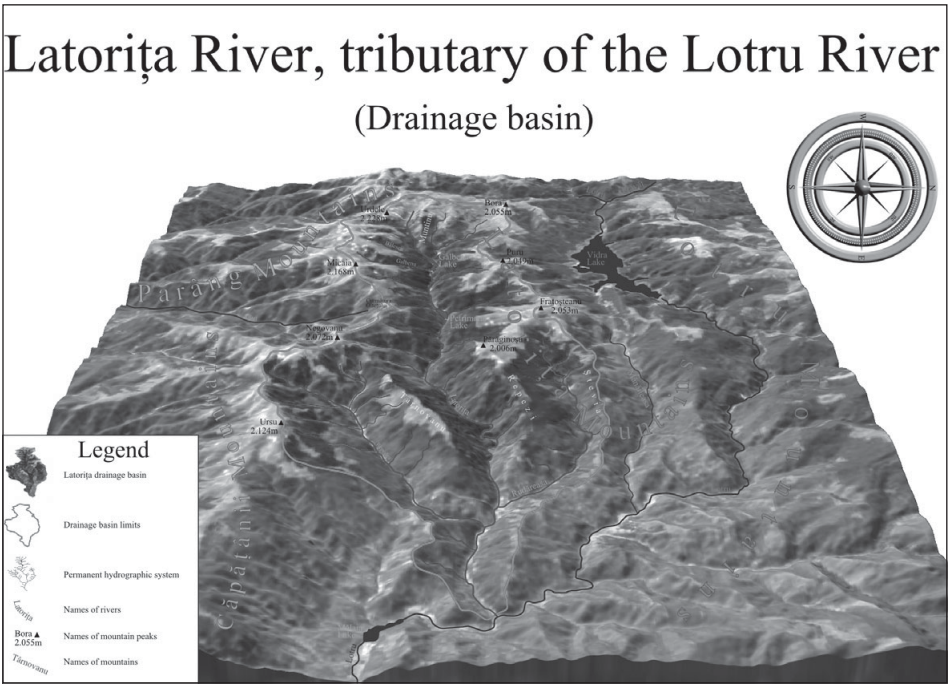
The author argues that the quest for effective municipal management of basic municipal services in the West- and Far West Rand area can be strengthened by the utilisation of surface water catchments in a holistic and collaborative manner through public planning, organising and community engagement and thereby facilitate effective integrated water resources management (IWRM) and co-operative governance. Before the municipal management goal of the IWRM is analysed in a specific geographical area, the aspect of surface water catchment must be defined.

SURFACE WATER CATCHMENT AND DIVIDE

A surface water catchment (watershed) is an area of land where surface water from rain, or melting snow or ice converges to a single point at a lower ground surface (metres above mean sea level [mamsl]) elevation (usually the exit of the catchment) and where the waters join another waterbody such as a river, lake, reservoir, estuary, wetland, groundwater aquifer, or ocean (PediaView 2015: Online). See Figure 5 for an example.

The difference between a river basin and a water catchment (watershed) is that the term "watershed" is used to refer to smaller units that contain all land and waterways that drain to a given common point. A river basin can, therefore, contain many watersheds within its boundaries" (Gregersen *et al.* 2007:2).

Figure 5: Example of a surface water catchment



Source: (PediaView 2015: Online).

The delimiting line between two adjacent surface water catchments (e.g. river systems) is called the surface water divide and stretches along the highest points, for example, a ridge or crest of a spur from where rain water can flow in either direction (United States Geological Survey 2015: Online). The exact location and stretch of a divide is generally delineated from topographic maps based on land elevations indicated with brown contour lines. However, the actual location and stretch of boundaries may be differently demarcated at different times due to interpretation, assumptions or changes affected by human beings since the map had been drawn. It might be necessary to undertake field inspections of the areas in question.

Groundwater divides are conceptually similar to surface water divides because groundwater also flows from high points (divides) to low points (outlets, discharge areas). However, the surface water and groundwater catchment boundaries do not always coincide. Groundwater movement occurs in underground located aquifer systems and is subject to: hydraulic properties of the aquifer; input to (recharge) and outflow from (discharge) the aquifer system; and geological factors such as formations that block the flow of water and tilted formations that create a flow gradient (Minnesota Department of Natural Resources 2015: Online).

In the next section the place and role of IWRM as a strategically important *vehicle* with which a geo-hydrologically sensitive area such as the Mooi River catchment can be developed and managed will be described.

INTRGRATED WATER RESOURCE MANAGEMENT

The reform of potable water services provisioning by means of the promulgation of the *Water Services Act*, 108 of 1997 and the *National Water Act*, 36 of 1998 have been revolutionary. The aforementioned two Acts address the imbalances of how the national resource was distributed. Water is now recognised as a scarce resource that belongs to the citizens of the country. Consequently, it should be managed in an integrated manner for social and economic development including future growth (Fuggle & Rabie 2005:293; Riemann, Chimboza & Fubesi 2012:446). The aforementioned encompass sensitivity to careful cognisance and management of the aggregate of surrounding objects, conditions, and influence that impact on the life and habits of humans or any other organism or collection of organisms.

Gregersen *et al.* (2007:ix) state that

> *The challenge of managing the environments in which people live becomes more complex as the human population expands, demands on the natural resources increase and new technologies are developed that permit people–knowingly or unknowingly–destroy their environment with less effort than in the past. People have learned through experience that what is done to upstream watersheds can drastically affect large numbers of people, their land and water downstream. Furthermore, man has learnt that what may appear to be isolated human interventions actually interact with each other – and sometimes the effects are amplified and probably affect humankind across vast landscapes, river basins or even on the global scale. The World Commission on Sustainable Development's dictum – 'think globally, and act locally' – thus has become increasingly clear, relevant and urgent.*

The provision of potable water by the water services authorities is an important basic service that faces a number of challenges such as the use of out-dated infrastructure, lack of skilled and knowledgeable people, improper planning, and the booming population that place overt pressure on demand for service delivery. The municipalities and government departments now realise that Government cannot achieve development on their own. An Integrated Water Resources Management (IWRM) approach has been adopted internationally as the way forward for efficient and sustainable development and management of the world's limited water resources and for coping with conflicting demands. It is widely defined by the Global Water Partnership: "as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (United Nations Water 2008:5).

For purposes of this research, the term municipal management refers to the process of management and all related functions and tasks (public policy making, planning, structuring [communication included], financing, human resources, procedures, and control) of a municipality (public sector institution with a specific geographical area of jurisdiction) in the local sphere of government to meet its set goals and objectives. Cognisance should be taken of the subsequent order in which the individual phases of the management process in practice unfold with planning being realised initially and control in the final instance. However, attention should be given to the public policy-making and –implementation activities which have to be executed prior to planning.

In order to improve IWRM and the subsequent facilitation of co-operative governance, the logical order and the role of structuring and organisational arrangements (especially communication) together with the allocation and management of financing, human resources and work procedures should also be taken into account. Additional management tools such as Information Communication Technology, performance management (monitoring, reporting and evaluation) as well as effective representative citizen participation complete the comprehensive definition. Diedericks emphasises that planning should be approached strategically for future situations and circumstances, taking into account political realities and decisions to keep abreast of changing environments through an articulated mission, goals and objectives (2013:30). One, however, must strive to de-politicise water management areas by having them defined by surface water catchment- rather than political boundaries. It is internationally recognised as lending itself to effective IWRM.

Modern approaches to water resources management acknowledge that water resources can only be managed effectively and efficiently when the entire river basin or catchment forms the basic management unit. Furthermore, because surface water and groundwater are inextricably interlinked, they must be considered and managed together as a single resource. These principles form the foundation for integrated water resources management (IWRM), and are rapidly gaining acceptance throughout the world (Ashton & Turton 2005:19). According to Nealer and Raga (2008:41), this management process takes into account the amount of available water (ground- and surface water), water use, water quality, and environmental and social issues as an integrated whole to ensure sustainable, equitable and efficient use. As indicated, a key aspect of IWRM is participation by identified role-players and stakeholders in public decision-making where decisions are decentralised.

In summary, the average public manager in the local sphere of government understands (or should) that IWRM is a process comprising, amongst other, organising of units and personnel in or between institutions in a co-ordinated manner. This should be done by implementing public policies according to effective planning, structuring, financing and leading according to pre-set procedures and regulations. These actions should bring about clear and visible control with transparent access by all interested and committed role-players and stakeholders.

CO-OPERATIVE GOVERNANCE

Co-operative governance cuts across various governmental spheres. The Constitution, 1996 stipulates a governance system that compels "all spheres of government and all organs of state" to co-operate with each other in "mutual trust and good faith". This should be taking place among all public sector departments, regardless of the activity and its location in the project cycle. The *National Environmental Management Act,* 107 of 1998 (NEMA) and the *National Water Act,* 36 of 1998 support co-operative governance, for example, through the provision for arrangements such as catchment management agencies and environmental co-operation agreements (DEA, n.d.: Online).

In the facilitation of effective co-operative governance there is a shift away from the narrow focus of governance to a broader good governance focus which inter alia, includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound public policies; and the respect of citizens and the state for the institutions that govern economic, social and environmental interactions among them.

According to Edwards (2009:49), the following five principles of good governance which stem from the King III Report can be identified:

- public participation;
- transparency;
- responsiveness;
- effectiveness and efficiency; and
- accountability.

An important key to the aforementioned wider and encompassing focus of co-operative governance is the existence of effective organisational arrangements (internal and external) of which two-way communication is foremost. This should lead to higher levels of visibility, transparency, access and willingness of all actors and stakeholders to become involved, to lead and to participate actively in a more active manner towards holistic and synergised group attempts of public service delivery and sustainable development *per se*.

Unfortunately, it has been proven that it was and still is difficult to work in a collaborative manner and that the efforts needed to implement effective co-operative governance can be problematic (MacKay & Ashton 2004).

> *Collaborative work has always felt stronger than go-it-alone work. But I'm now realizing just how difficult genuine collaboration is and how un-natural it can feel at first. For most people*

and organizations, there is a natural tendency to go to your own corner with your ideas, and work in isolation. It's certainly easier and faster. But we're not supposed to be in the business of easy and fast (Surdna Foundation 2014: Online).

Despite signs of improvement in the rendering of basic services by the South African municipalities in their respective geographical areas of jurisdiction, the following challenges to facilitate improved co-operative governance in the water resources management sector still exist:

- The order of co-operative and optimally co-ordinated deliberations and subsequent governance unfortunately is still such that most of the time "the left hand does not know what the right hand is trying to do" and there is also "domination and manipulation by government or large private sector institutions".
- There is a lack of effective community involvement. A representative of a civil community forum once said that: "We go there, we eat, we drink, we sleep and then we go home empty headed".
- Urban flow and urbanisation of people, goods and capital do not acknowledge human-demarcated boundaries (even across unsafe dolomitic areas).
- Government with its public policy implementing institutions is not always visible and active in facilitation of effective co-operative governance.
- There are inadequate public management and geo-hydrological skills and knowledge in municipalities.
- Complex sets of inter-governmental relationships (IGRs) prevent the manifesting of co-operative governance and integrated water resources management.

The research revealed that too often, municipalities lack skills with regard to:

- origin of the water (raw as well as potable) in the geographical jurisdiction area of a municipality;
- the management of the water;
- the destiny of the used water; and
- the most suitable developmental protocol to follow in terms of human settlement, especially in an undermined or dolomite underlain area.

In the next section the effects of municipal demarcations and catchment management challenges in a municipal area are analysed.

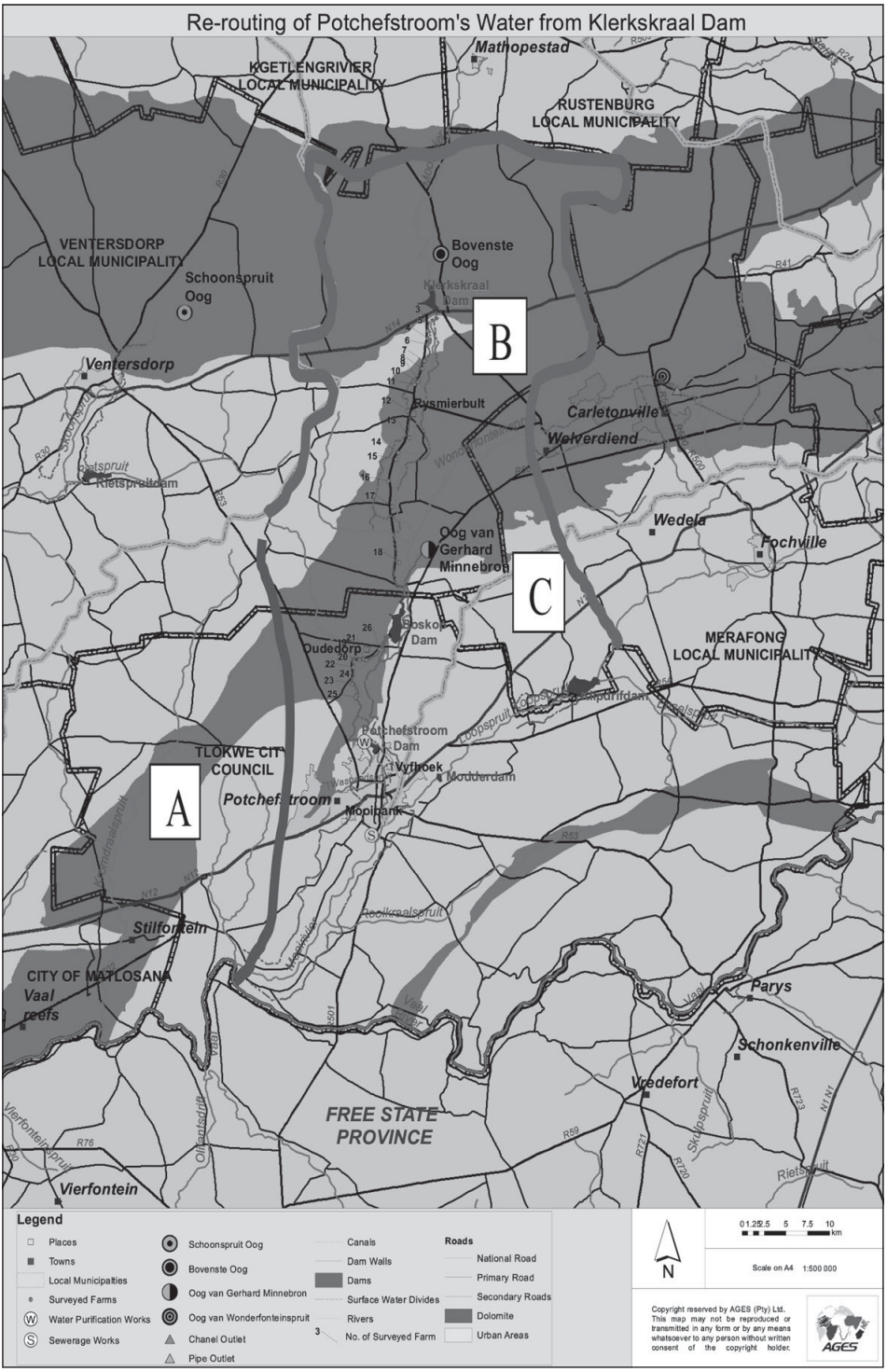
MUNICIPAL DEMARCATION AND SURFACE WATER CATCHMENT CHALLENGES: MOOI RIVER AND WONDERFONTEIN SPRUIT SUB-CATCHMENTS

The realisation of municipal demarcation according to many other parameters, but surface water catchments are analysed in the next section. Figure 6 depicts the location of towns, occurrence of dolomite rock (grey area), proclaimed municipal boundaries, surface water divides, rivers, and major and secondary roads in the Mooi River and Wonderfontein Spruit sub-catchments. The following aspects that affect the nature and extent of integrated water

resources management and a quest to instil effective co-operative governance can also be identified from Figure 6:

- Merafong Local Municipality is situated in the Gauteng Province while the remainder of the local municipalities (Rustenburg, Kgetlengrivier, Ventersdorp, Tlokwe City Council and City of Matlosana) are part of North West Province. The western and southern municipal boundaries of Merafong Local Municipality are also the provincial boundary.
- Only Potchefstroom and Ventersdorp are in this area. Their source of surface water originates from dolomitic compartments across which the Wonderfontein Spruit, Mooi River and Schoon Spruit drain. The other towns in the area are supplied by the Vaal Dam and Vaal River. The water is purified by the Rand Water and Midvaal Water companies.
- Tlokwe City Council's municipal area of jurisdiction is located downstream from the Merafong Local Municipality whose residents, mines and industries are supplied by Rand Water with clean and safe water and are apparently not concerned about the management and destiny of their used water.
- The Mooi River surface water catchment's head-waters are located in the jurisdiction of the Ventersdorp Local Municipality's geographical area. They are apparently not concerned about good water resources management because its residents' water originates from the Schoon Spruit Spring which is not connected to the Mooi River sub-catchment.
- Tlokwe City Council's main potable water reservoir is the Boskop Dam which is located five km south and downstream of the confluence of a clean and safe Mooi River and a polluted Wonderfontein Spruit.
- Area A: The Kromdraai- and Koekemoer brooks (spruite) drain the gold undermined and dolomite underlain area in which the Stilfontein- and Khuma townships developed. It is currently part of the Tlokwe City Council's geographical area of jurisdiction. The facilitation of IWRM and co-operative governance rests with, amongst other, the Schoon Spruit Community Forum and Matlosana Local Municipality in Klerksdorp.
- Area B: The Mooi River and Wonderfontein Spruit drain the dolomite underlain and primarily farming area. Except for some surface diamond digging, the area is not undermined by gold mines. It is currently part of the Ventersdorp Local Municipality's geographical area of jurisdiction. The facilitation of IWRM and co-operative governance rests with, amongst other, the Mooi River Community Forum and Tlokwe City Council in Potchefstroom.
- Area C: The Loop Spruit drains the area which is undermined for gold and partly underlain by dolomite in which only small mining and farming communities have developed. It is currently part of the Merafong Local Municipality's geographical area of jurisdiction. The facilitation of IWRM and co-operative governance rests with the Mooi River Community Forum and Tlokwe City Council in Potchefstroom.
- Human settlement areas of concern (e.g. geologically underlain by dolomite and also undermined for gold) are indicated in Figure 6 with grey shading, namely, Carletonville, Khutsong, Welverdiend, Ikageng, Khuma and Stilfontein. Over many decades, sinkholes on dolomite formations have occurred 800 times in the greater Pretoria area and 150 times on Gauteng Province's East Rand. The West Rand has had in excess of 1 000 sinkholes. To date, 38 people have died in the process and damage

Figure 6: The Mooi River catchment, North West Province



Source: AGES, 2014

to homes and financial losses have exceeded R1 billion (*The Intelligence Bulletin* 2013: Online). "[Residents don't realise] it comes during the night... People can wake up and the section [of the township] is not there." (News 24 2011: Online).

Dolomite forms a loose belt around Johannesburg and makes up a quarter of the Gauteng Province. It stretches from Stilfontein in the far-west to Centurion in the north and Thokoza in the east.

In its 2001 report, Westonaria Local Municipality stated: "It is viewed as immoral to allow people to live on dolomitic land, as preliminary geological surveys show that problems can occur in respect of damage to property and possible loss of life due to collapsing ground and the forming of sinkholes. It is now 12 years after that report and still the problem has not been properly resolved" (*The Intelligence Bulletin* 2013: Online).

Figure 7 reveals the dolomite rock in the veldt and sinkholes that developed near Carletonville.

Figure 7 Sinkholes that developed near Carletonville.

(Author's personal library) (Panoramio, 2006: Online) (Schuitemaberend 2012: Online)

All along the Wonderfontein Spruit (approximately 80 km immediately south of Krugersdorp up to its confluence with the Mooi River near Welverdiend) the environmental formula for disaster and potential mining-created waste land become more complicated. These include, amongst others, Far West Rand issues of gold undermined surface areas, sinkholes, acid mine drainage (AMD), and non-commitment and careless social corporate responsibility on the part of mines and industries towards the natural- as well as the human-changed environment. The area is characterised by dewatered dolomitic compartments, over-the-surface transport of polluted surface water and effluent from up-stream areas such as Randfontein, Bekkersdal, Westonaria and some mines in a one metre diameter pipeline over a distance of 40 km to be dumped immediately west of Carletonville into the Wonderfontein Spruit. This polluted water might leak into and *recharge* the groundwater reserves of the Boskop-Turffontein dolomitic compartment on top of which the Boskop Dam as main water reservoir for Potchefstroom is located and where the groundwater quality of the Gerhard Minnebron Spring might be compromised.

Judging by the local municipalities of Westonaria and Randfontein's very low level of participation in community forums such as the Wonderfontein Spruit- and Mooi River forums, one can assume that they do not understand the diversity and complexity of the municipal- and environmental health management challenges at hand (Janeke 2014: Interview). The area is geo-hydrologically acknowledged as "the most complex area in the country" (Bertram 2012:

Interview). The fact that the natural environment features are land-locked between several municipal boundaries, cover areas of two adjacent provinces, and are purely politically and administratively oriented, possibly increases the municipal management complexity in the area and adds to the perceived absence of effective IWRM, co-operative governance, and management of human settlements in the area. A demarcation and formal declaration on all public maps of the revisited *area abandoned due to possible forming of new sinkholes* may sensitise all the role-players and stakeholders in the area.

CONCLUSION

One can understand the importance of utilising a public planning tool such as the surface water catchments of DWS in the day-to-day management of a geographical area such as the Mooi River and Wonderfontein Spruit sub-catchments.

The nature and extent of the demarcated municipal areas are in a constant state of flux. The government realises that it cannot achieve the developmental local government goals on its own. The effective utilisation of a macro organising vehicle such as catchment management is imperative to create integrated water resources management and co-operative governance. This can be realised by establishing partnerships of effective co-operative governance through, *inter alia*, trans-disciplinary research and collaboration and strengthening public policy-making and implementing actions. The creation of sensitivity towards the origin of potable water, the management thereof and the destiny of the grey water in the area, the actors in authoritative positions as well as the municipal residents might capacitate themselves with particular basic geo-hydrological- and municipal management skills.

To give effect to the aforementioned, where possible, the adjustment of municipalities' geographical areas of jurisdiction according to the demarcated surface water catchments of DWS will assist in the facilitation of effective IWRM and co-operative governance. It also is of critical importance to appoint personnel in the municipalities with the required skills to deal with water resources management and co-operative governance openly and collaboratively.

THE WAY FORWARD

In view of the aforementioned exposition on the importance of surface water catchments in the management of municipalities on the West- and Far West Rand in South Africa, the following recommendations are proposed to strengthen IWRM and co-operative governance in the Mooi River- and Wonderfontein Spruit sub-catchment areas:

Capable municipal managers, subordinate municipal officials as well as the responsible political office-bearers in a municipality should endeavour to facilitate and ensure effective, efficient, economic and disaster risk-free management of the physical as well as the human-changed environment.

An organised and well-managed land-use survey (with clear big-scale and effective identification, surveying, demarcation and mapping) of the entire drainage region must be

undertaken. *An area abandoned due to the forming of new sinkholes* must be re-demarcated and its extent reported to the residents of the area.

The current state of the potable water supply, sanitation and storm-water infrastructure of all the municipalities' geographical jurisdiction areas in the catchment areas must be inspected, tested, maintained and upgraded in an attempt to improve sustainable basic service rendering.

In terms of water, sanitation and environmental issues, the Tlokwe Local Municipality (Potchefstroom) must play a visible, dominant, leading and managerial role in the entire Mooi River and Wonderfontein Spruit up to, for example, the towns of Carletonville, Fochville and Westonaria.

In general, the occurrence, nature and extent of dolomite in a river catchment area requires an urgent new municipal management protocol through effective, efficient and economical IWRM and co-operative governance.

NOTE

1. The NRF is acknowledged for funding the research undertaken at the Bekkersdal, Westonaria Local Municipality of the Eco-health and Wellbeing of mining communities. The Project Leader is Prof E S van Eeden, North-West University, Vanderbijlpark.

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