Collaborative transboundary water quality monitoring: a strategy for Fezile Dabi District Municipality and its neighbours

by

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Dedication

This mini-dissertation is dedicated
to my late father,

Thinus,

and my mother,

Angela,

I know it was your dream for me to complete this study successfully.

Acknowledgements

First and foremost, I give honour to my Creator for giving me the ability and insight to complete this study. I further wish to acknowledge the support and assistance I received from the following people who made it possible for this study to be compiled:

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Abstract

The geographic location of Fezile Dabi District Municipality is unique in the sense that it is one of five district municipalities in the Free State Province that borders on five district municipalities and three provincial boundaries. The Vaal River, a valuable domestic, industrial and agricultural water resource for millions of South Africans, forms one of the administrative boundaries of this district municipality and of the Free State Province. However, despite the vital role the Vaal River plays in the Fezile Dabi region, there is poor water management and assessment system in place. There is a lack of intergovernmental and transboundary efforts to assess water quality by both district municipalities and provinces. The status of the Vaal River as a visible aquatic boundary line provides an excellent opportunity to develop a transboundary collaborative water quality monitoring strategy between Fezile Dabi District Municipality and its neighbouring district municipalities. The only way to ensure the safety of water and a healthy environment for all, is by addressing the challenges of water quality monitoring in a transboundary, integrated and multidisciplinary manner.

This study provides a strategy for Fezile Dabi District Municipality and its neighbours by proposing an ideal structure to optimise effective water quality monitoring between them. Firstly, it gives an explanation of what is meant by water quality monitoring as a key performance area of municipal health services. Secondly, information is provided and proposals made on how to integrate water quality monitoring across municipal boundaries. Thirdly, the study suggests how transboundary collaboration can contribute to improving water quality assessment strategies between Fezile Dabi District Municipality and its adjacent district municipalities. Lastly, an exposition of an ideal organisational structure and methods to optimise effective water quality monitoring between Fezile Dabi District and these municipalities is provided. A way forward is proposed in terms of a structure negotiated and developed at an environmental health workshop held on 28–29 March 2012 in Sasolburg.

Samevatting

Die geografiese ligging van Fezile Dabi Distrik Munisipaliteit is uniek in die sin dat dit een van vyf distrik munisipaliteite is in die Vrystaat provinsie wat grens aan vyf ander distrik munisipaliteite en drie provinsiale grense. Die Vaalrivier vorm een van die administratiewe grense van die distriksmunisipaliteit en Vrystaatprovinsie. Die Vaalrivier bly ‘n waardevolle bron van water vir huishoudelike, industriële en landbou gebruik vir miljoene Suid-Afrikaners. Ten spyte van die waardevolle rol wat die Vaalrivier vervul in die Fezile Dabi Distrik bestaan daar ‘n swak bestuur- en monitering-/assesseringstelsel omdat die onderskeie munisipaliteite en provinsies nie genoegsame aandag skenk aan oorgrenssamewerking om water kwaliteit effektief te assesseer nie. Die status van die Vaal Rivier as effektiewe visuele akwatiese grenslyn is bewys as uitstekende geleentheid om ‘n oor die grense samewerking strategie vir watergehalte monitoring te ontwikkel tussen Fezile Dabi Distrik Munisipaliteit en sy bure. Die enigste manier om die veiligheid van water en ‘n veilige en gesonde omgewing vir almal te verseker is deur die uitdagings van watergehalte monitoring in ‘n oorgrens, geïntegreerde en transdissiplinêre benadering.

Hierdie skripsie verskaf ‘n strategie vir Fezile Dabi Distrik Munisipaliteit en sy bure deur middel van ‘n voorgestelde struktuur om watergehalte monitering te optimaliseer tussen Fezile Dabi Distrik Munisipaliteit en sy bure. Eerstens gee hierdie studie ‘n verduideliking van wat bedoel word met watergehalte monitering as kernfunksie van munisipale gesondheidsdienste. Tweedens word inligting verskaf en voorstelle gemaak oor hoe om watergehalte monitering te integreer oor munisipale grense heen. Derdens word bespreek hoe samewerking oor grense heen kan bydra tot verbeterde water gehalte assessering strategië tussen Fezile Dabi Distrik Munisipaliteit en sy bure. Laastens gee dit ‘n verduideliking ten opsigte van ‘n ideale organisatoriese struktuur en metodes om effektiewe watergehalte monitering tussen Fezile Dabi Distrik Munisipaliteit en sy bure te optimaliseer. Ten slotte word aanbevelings gemaak ten opsigte van die struktuur soos bespreek en

ontwikkel tydens ‘n omgewingsgesondheid werkswinkel wat op 28-29 Maart 2012 in Sasolburg plaasgevind het.

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Chapter 1

Introduction: orientation and purpose statement

Introduction

This chapter serves to orientate the reader on the unique geographic location of Fezile Dabi District Municipality. It is one of five district municipalities in the Free State Province and borders on five other district municipalities and three provincial boundaries. The Vaal River forms one of the administrative boundaries of this district municipality and of the Free State Province. The Vaal Riveris a crucial water resource in the domestic, industrial and agricultural sectors for millions of South Africans. Despite the valuable role the Vaal River plays in the region, an ineffective water management and monitoring system is currently in place. The reality is that district municipalities and provinces are not operating an efficient intergovernmental and transboundary system to manage and monitor water quality. The status of the Vaal River as an effective visible aquatic boundary presents the ideal opportunity to develop a transboundary collaborative water quality monitoring structure and strategy between Fezile Dabi District Municipality and adjacent district municipalities. A brief background on legislation in chapter one explains what to expect in this mini-dissertation.

The purpose statement emphasises that the only way to ensure safety of water and a healthy environment for all is by means of treating the challenges of water quality monitoring in a transboundary, integrated and multidisciplinary manner.

This chapter further outlines the objectives of the study, central theoretical statements, and methods of investigation. The focus is on the value of transdisciplinary research methodology.

The 2012 North-West Harvard referencing style has been applied in this mini-dissertation. However, minor deviations were implemented and consistently used throughout the text after due consultation with the study leader.

Orientation and problem statement

Fezile Dabi District Municipality is one of five district municipalities in the Free State Province. The district is unique in the sense that it borders on five other district municipalities and three provincial boundaries. These are:

- Sedibeng District Municipality in Gauteng Province to the north (DC42)
- Gert Sibande District Municipality in Mpumalanga Province to the northeast (DC30)
- Thabo Mofutsanyane District Municipality in Free State Province to the southeast (DC19)
- Lejweleputswa District Municipality in Free State Province to the west (DC18)
- Dr Kenneth Kaunda District Municipality in North West Province to the northwest (DC40)
  (*World News Network*, 2011. Date of access: 21 March 2011).

Figure 1 below provides a graphic view of the location of Fezile Dabi District Municipality in relation to its five neighbouring district municipalities.

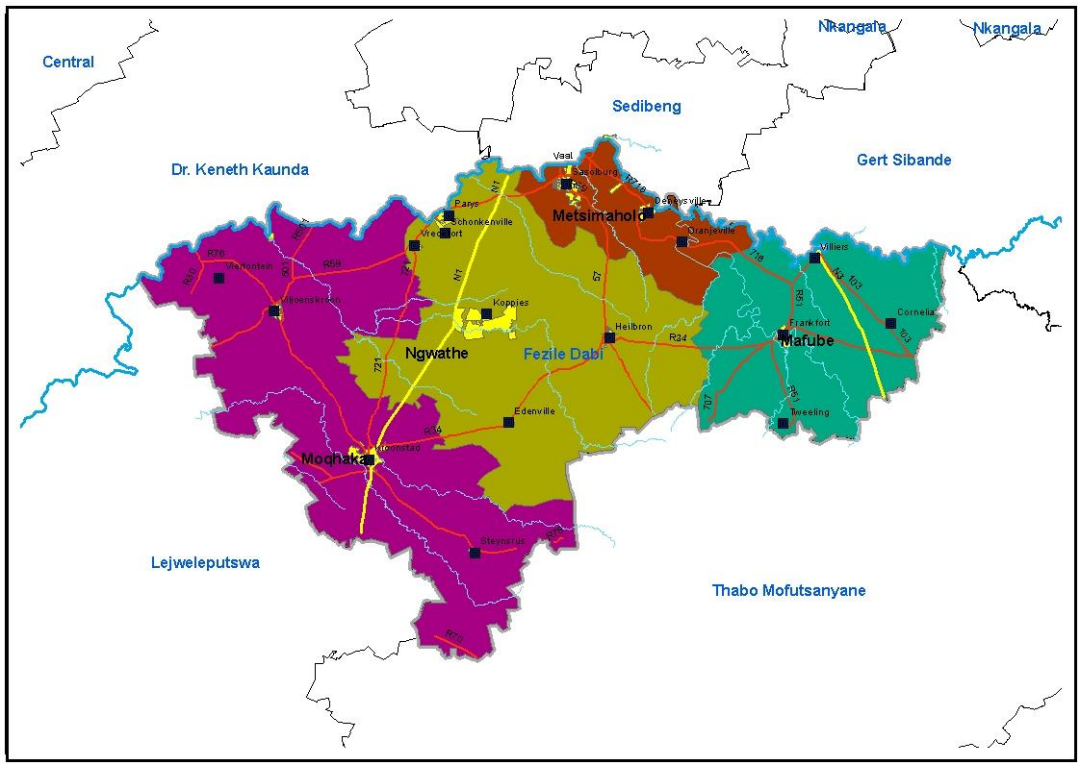

Figure 1 Map of Fezile Dabi District Municipality (FDDM) indicating its four local municipalities as well as five (5) neighbouring district municipalities (Map developed by FDDM GIS division, 22 March 2011)

The Vaal River forms the provincial boundary between Fezile Dabi District Municipality in the Free State Province and the three neighbouring provinces of North West, Gauteng and Mpumalanga (FDDM, 2011). The Vaal River (main stream) and its tributaries (especially downstream of the Vaal Dam) are highly contaminated and in a critical state of ecological decline (UFS, 2006). However, the Vaal River remains a vital water resource for domestic, industrial and agricultural use (Rand Water, 2011. Date of access: 7 August 2011).

The challenge the South African government has faced since 1994 has been to transform the legacy of a colonial and apartheid system of governance. The new democratic government inherited a highly destabilised administrative environment. This was largely as a result of the change from a racially based governance system to that of a non-racial democracy. Up to the present many transformational problems have become evident at the local government sphere. Many communities, especially in the rural regions of South Africa,

face a plethora of social and economic inequalities in terms of basic municipal services (South Africa, 1998b: 21). Some of the critical inequalities identified in 1998 that are still in need of being addressed, include:

- skewed settlement patterns; backlogs in service infrastructure in historically underdeveloped areas;
- viable municipal institutions are needed for dense rural settlements;
- disparities between towns and (former African) townships;
- municipal governance systems which recognise linkages between urban, peri-urban and rural settlements are necessary;
- secure private sector resources are required for development;
- sufficient institutional foundations and capacity in some municipalities have little or no pre-existing structures on which to build; and
- there is a lack of motivation to rebuild relations between municipalities and the local communities they serve (South Africa, 1998b: 21).

Given these problems it is understandable that municipalities have tended to confine themselves primarily to operating within their specific areas of jurisdiction. In many respects they do not focus on the bigger picture. Consequently, there is evidence of disconnections in many areas of cooperative governance. For example, although intergovernmental relations forums exist and function well on strategic management levels, there is a clear need for integration on operational levels. The candidate identifies this need for integration in Fezile Dabi District Municipality.

An effective model is required to address problems of poor water quality. The first step towards attaining this objective and addressing the challenges of environmental pollution, is to involve municipal health services as a key stakeholder. Other stakeholders such as civil society, industry and commerce must also become involved. Existing forums are currently ineffective because practical solutions are not implemented as a coordinated, joint effort by all relevant stakeholders. As one respondent observed in an interview:

> Words are words, explanations are explanations, plans are plans, only performance is reality (VZAS.OI.01. 21 February 2011).

In the White Paper on Local Government (South Africa, 1998b: 21) that preceded the introduction of the first post-apartheid municipal legislation, it was argued that a new local government system, built on the strengths of existing systems, would serve to address inherent weaknesses. It was also intended to improve the capacity of municipalities to address the most pressing challenges inherited from the previous dispensation. However, some issues requiring urgent attention, such as effective waterborne sewage systems to previously disadvantaged communities, compounded emerging problems in local water services. Wastewater treatment works did not have sufficient capacity to respond to the growing demand for service delivery.

Since pollution is not confined to municipal areas, South Africa's district municipalities face yet another challenge. They need to manage water quality monitoring in a collaborative and transboundary manner. It therefore stands to reason that the challenges district authorities face in water quality monitoring can be dealt with more effectively by transboundary collaboration, underpinned by surface water catchment boundaries rather than demarcated administrative district boundaries.

For the purpose of this study, the emphasis is on the Vaal River as provincial and district boundary. Because it is such a prominent aquatic marker, it presents an obvious focal zone around which to initiate a transboundary collaborative water quality monitoring management strategy run jointly by Fezile Dabi District Municipality and the adjacent district municipalities.

Although a multiracial, democratically elected government has been in power in South Africa since 1994, it has taken more than a century for municipal health services to reach a point where civil society and the environment have become direct beneficiaries of environmental health services. For the purposes of this study, it is argued that the existing jurisdictional boundaries of municipal areas contribute to the neglect of certain vital spaces and resources of the commons – such as surface water in natural catchment areas. In governance terms, this means that such resources are not effectively managed in officially demarcated water catchment areas. For example, while

one district municipality implements the national legislation and the requisite provincial and local regulations, a neighbouring municipality might well focus on other key areas. This frequently results in poor environmental health services, with relevant legislation not being implemented in an integrated and holistic manner.

On 1 July 2004, environmental health services was transferred from the four local municipalities of Ngwathe, Mafube, Moqhaka and Metsimaholo to Fezile Dabi District Municipality. This did not involve new responsibilities, but was merely a shift in authority from the level of local municipalities to that of district and metropolitan municipalities (SA, 1998). Since then, district municipalities have accepted responsibility for municipal health services as proscribed in the National Health Act 61 of 2003. This also has a direct bearing on their responsibilities in respect of environmental health. The 2003 Act requires municipal health services to oversee:

- water quality monitoring;
- food control;
- waste management;
- surveillance of premises;
- communicable diseases control;
- vector control;
- environmental pollution control;
- disposal of the dead; and
- chemical safety.

Excluded from municipal health services, but still part of the overarching environmental health professionals' responsibilities are: port health, malaria control and the control of hazardous substances (SA, 2003). The exclusion of these three duties is because provincial governments, through the services of their environmental health practitioners, have the responsibility to render port health services and to control malaria and hazardous substances on a more comprehensive level (SA, 2011).

National Acts that support Fezile Dabi District Municipality in accepting the control of environmental health services previously resorting to respective local municipalities are:

- The Constitution of the Republic of South Africa 108 of 1996;
- The Municipal Structures Act 117 of 1998; and
- The National Health Act 61 of 2003.

The Constitution (1996) stipulates clearly that district municipalities and local municipalities represent a sphere of government in their own right. Chapter 14, Schedule 4 (Part B) of the Constitution identifies municipal health services as fulfilling a key function. See subsections 155 (6) (a); and (7).

The Municipal Structures Act (1998), section 84 (1) (i) furthermore mandates district municipalities with the responsibility for municipal health services in their respective areas as a whole.

Subsection 32 (1) of the "new" National Health Act (2003)[1] also states that metropolitan municipalities and district municipalities must provide municipal health services effectively and equitably in their areas of jurisdiction. A key function of municipal health services – also for the purposes of this study – is water quality monitoring (SA, 2003: 14).

For municipal health services to ensure an effective service to the public as well as access to safe domestic water and an environment that is not harmful to residents' health and wellbeing (SA, 1996), it is important for the bigger picture to be taken into account. In short, municipal water quality monitoring needs to link up with similar activities on a regional level, typically at the surface water catchment management level. However, it is important that the environmental health practitioner should not focus exclusively on water quality monitoring by means of sampling and analyses. A full "assessment" is the better approach because it entails a total survey of water management.

1. The "new" National Health Act (No. 61 of 2003) replaces the "previous" National Health Act (No. 63 of 1977); but some sections of Act 63 of 1977 have not yet been repealed.

Purpose statement

The most efficient way to ensure the safety of water and a healthy environment for all residents concerned is to address the challenges of water quality monitoring in a transboundary, integrated and multidisciplinary manner.

The researcher's preliminary fieldwork observation suggested that local government, as far as environmental health services are concerned, is working in silos (operating independently). Intergovernmental relations forums are held at strategic management level in government, but there is no effective cooperation and integration on an operational level between neighbouring local authorities. In most administrative local government offices, the Batho Pele principles are merely comforting words pasted on the office wall. There is hardly any involvement from civil society in addressing challenges on water quality. Transparency is also a problem because there is no effective stakeholder participation. Municipalities are currently withholding information on water quality challenges and information from the public. It is, therefore, of the utmost importance that isolated efforts in the provision of municipal health services be merged into coordinated, inter-governmental initiatives with adequate community involvement.

It is the opinion of the researcher that an integration model for transboundary water quality monitoring for municipal health services will be the first of its kind and will bridge a gap in the acquisition of more data that provides greater detail on water quality in the district municipalities involved in this particular study. It will also ensure coordinated, effective and transparent transboundary service delivery of environmental health services.

Research questions

For the purposes of this study the following research questions are posed:

- What is meant by water quality monitoring as a key performance area of municipal health services?

- How should integrated water quality monitoring take place across municipal boundaries?
- How can transboundary collaboration contribute to improving water quality monitoring strategies with neighbouring district municipalities?
- Can organisational structures be created to optimise effective water quality monitoring between Fezile Dabi District Municipality and its neighbouring district municipalities?

Research objectives

The objectives of this study are to:

- explain what is meant by water quality monitoring as a key performance area of municipal health services;
- provide proper information and propose how to integrate water quality monitoring across municipal boundaries;
- propose how transboundary collaboration can contribute to improving water quality monitoring strategies between Fezile Dabi District Municipality and adjacent district municipalities; and
- give an exposition of an ideal organisational structure and method to optimise collaborative water quality monitoring between Fezile Dabi District Municipality and its neighbouring district municipalities.

Central theoretical statements

The following preliminary theoretical statements, pertaining to the proposed study are:

- Integrating certain environmental health management strategies across district boundaries will promote more effective governance.
- By making use of transdisciplinary research strategies it will be possible to find linkages that contribute to improved intergovernmental relations.

- Cooperative governmental initiatives and strategies will ensure effective water quality monitoring in both the Fezile Dabi District Municipality's area of responsibility and adjacent districts.

Method of investigation

The study is based on a scrutiny of relevant literature on transboundary collaboration in general. Of particular importance is empirical evidence that was collected by means of transdisciplinary research strategies. In essence, monitoring water quality is a process to locate potential threats of pollution. Wickson, Carew and Russel (2006: 1048) are of the opinion that the problem of pollution in society and environment at large is of a transdisciplinary nature. Water quality is a problem that is "in the world and actual" and not just "in the head and conceptual" (Wickson *et al.*, 2006: 1050). In support of this view, transdisciplinary research methodology is an evolving methodology that is well suited for the purposes of this particular project because it constantly adapts to research needs (Wickson *et al.*, 2006: 1051). Transdisciplinary research methodology also generates substantial and meaningful knowledge between research communities and relevant stakeholders (Wickson *et al.*, 2006: 1051). This integrated research approach enhances cooperation rather than causing dissent between different role-players (Uitto & Duda, 2002: 365. Date of access: 16 April 2011).

A basic tenet of transdisciplinary methodology is a transdisciplinary, integrated planning and synthesis (TIPS) approach. This allows for a formal, scientifically based, integrated approach in a real-world setting with the benefit of mutual learning among scientists and stakeholders. Finally, the study will ensure effective teaching, research and application of findings and proposed recommendations (Hirsh Hadorn *et al.,* 2008: 223).

The study made use of integration theory as outlined in transdisciplinary studies and worked towards a grounded theory for transboundary collaboration. Throughout the research, important and relevant theoretical tools such as integration (Dent, 1998); social learning (Reed *et al.*, 2010); and

interest-based bargaining (Majka, 2000: 37–38) were formulated. A better understanding had to be gained on a number of critical issues. In this respect, attention was given to securing an understanding and acceptance of transboundary collaboration; resilience of water quality monitoring technologies; and environmental health in a complex river catchment environment.

Literature study

Primary and secondary source material was used in this research project. Books, periodicals, government reports, and personal notes from electronic archives of transdisciplinary research projects were among the secondary sources consulted. Computer searches for relevant material were also undertaken as part of the preliminary analysis to determine the availability of literature on this topic. These preliminary investigations indicated that there is ample material and literature on this research field.

The following databases were consulted to ascertain the available material for the purposes of this research:

- Catalogue of theses and dissertations at South African universities and universities of technology;
- Catalogue of books: NWU libraries;
- Scientific articles on journals' databases at NWU libraries;
- Literature acquired from fellow environmental health services managers and district municipalities in South Africa.
- Electronic archives of data on transdisciplinary research projects undertaken by NWU's Research Niche for the Cultural Dynamics of Water (CuDyWat).

Empirical study

Primary source materials, specifically qualitative data, was collected in the form of interviews with relevant stakeholders in neighbouring district municipalities.

- Stakeholders who were involved in drafting guidelines on the scope of practice for environmental health practitioners (SA, 2009) were consulted to determine their views on water quality monitoring. Practising environmental health practitioners' and environmental health managers' interpretations and their implementation of the prescribed scope of practice were also determined via electronic email communication and personal interviews. This information was integrated with the available literature on municipal health water quality monitoring. These findings were then used to compile a recommended water quality monitoring strategy plan.
- Managers of neighbouring district municipalities were also consulted through interviews during a structured workshop on 28-29 March 2012, and electronic communication. They were requested to discuss their views on the integration of existing water quality monitoring strategies and water quality programmes/ projects in areas where district municipalities share water sources (for example, rivers and dams).
- A structured workshop, literature study and structured and semi-structured interviews were used to obtain information on what and how transboundary collaboration and integration of water quality monitoring techniques will improve existing strategies and programmes in the Fezile Dabi District Municipality's area of responsibility and neighbouring district municipalities.
- At the structured workshop and in the structured and semi-structured interviews with relevant stakeholders, input on an improved organisational structure and method was discussed. These findings were used to determine how to optimise water quality monitoring between Fezile Dabi District Municipality and adjacent district municipalities.
- Members of civil society, e.g. riparian property owners on the banks of the Vaal River and its tributaries, were also interviewed for relevant information.

- Representatives from the industrial and commercial sector who have a vested interest in the quality of water flowing in the Vaal River and its tributaries were also asked for their views.

Design

The design of the empirical study was as follows:

- Semi-structured interviews; and
- Structured workshops.

These opportunities were used to collect data in a variety of stakeholder sectors. Furthermore, because data was sourced over district boundaries, there were opportunities to collect data for comparative purposes.

Respondents

Respondents were selected from the identified target group of role-players and stakeholders on a random selection basis. These stakeholders included the industrial sector; bottled water retailers; municipal and provincial government officials; and elected representatives in municipal and provincial government.

Processing

Relevant empirical data was selectively extracted from written notes and digital recordings of interviews with various respondents. These were carefully assessed and then converted into a narrative text to provide insight into the nature of the obstacles to integration of water quality monitoring initiatives. The resultant information was subsequently evaluated (see below) and used to find solutions to fulfil the research objectives outlined above.

Procedure

The procedures followed were:

- A literature study was undertaken (heuristics).

- Qualitative, semi-structured interviews were conducted with a number of respondents from all the relevant stakeholder sectors.
- Based on the research objectives all relevant information was critically interpreted, evaluated and analysed.
- The information, data and recommendations were presented in a scientific, structured text that meets the stated research objectives.

Ethical arrangements

Throughout the research process, sound ethical practice was maintained because this research involved individuals who on occasion provided sensitive, confidential data. In addition, written agreements were obtained from all Fezile Dabi District Municipality's neighbouring municipalities to enable the researcher to have legitimate access to their respective institutional policies, procedural manuals, administrative information and other classified data. However, this did not present a problem, because this project supports effective intergovernmental cooperation which is a legally mandated objective. Nevertheless, a high level of ethics was carefully maintained.

Specific attention will be given to four principles namely autonomy, benefit, non-harmfulness and justice, as outlined in the manual for postgraduate studies of the NWU (2010: 32):

- *Autonomy*
  Research participants, stakeholders, role-players and their information were at all times respected. An understanding of human dignity was key because the major focus was on the poorest of the poor in an effort to accommodate their needs and conditions in water quality monitoring.
- *Benefit*
  The principle of benefit did not pose a challenge because the outcome-based nature of transdisciplinary research is primarily focused on benefiting the research participants, role-players and stakeholders.
- *Non-harmfulness*
  The research was designed and focused on benefiting the research participants, role-players and stakeholders. No unforeseen harm was suffered by any research participant, role player or stakeholder.

- *Justice*

  Visible dispensing of justice was ensured at all times. All communities in the identified study area were treated equally. Any risks and benefits that may ensue as an outcome of this study will also be distributed equally among the communities residing in the study area.

Outline of chapters

The research documented in a five chaptered mini-dissertation divided as follows:

Chapter 1: Introduction: orientation and purpose statement

Chapter 2: Water quality monitoring as a key performance area of municipal health services

Chapter 3: The significance of transboundary collaboration in improving water quality monitoring strategies between Fezile Dabi District Municipality and its neighbours

Chapter 4: The ideal organisational structure and methods to optimise effective water quality monitoring between Fezile Dabi District Municipality and its neighbours

Chapter 5: Summary and recommendations

Chapter 2

Water quality monitoring as a key performance area of municipal health services

Introduction

There are a number of role-players involved in water resource management, of which municipal health services is one. Roles and responsibilities can easily be confused. Theoretically there are several overlapping functions in the water resource management arena. However, when contemplated in a reflexive mode, it becomes evident that apparent overlaps and even duplication, are seldom out of step with the objectives of realising integrated water resource management.

Chapter 2 gives an exposition of the origins of the profession of the "sanitary inspector" and how it has evolved into the "environmental health practitioner" of today (Chaka, 2011: 3). Terms like "health", "environmental health" and "municipal health services" are defined in this chapter. A legislative background provides clarity on what municipal health services (SA, 2003: 14) entail, what can be expected of this service and at what sphere of government this service is provided. An explanation is given on why the environmental health practitioner is seen as the backbone of the profession and the training and level of proficiency that equips/ allows him/ her to practise this profession. There is a special focus on the water quality monitoring function performed by district municipalities' municipal health services division. The scope of practice of environmental health as per Regulation 698 of 2009 under the Health Professions Act 56 of 1974 provides details on the water quality monitoring function undertaken by the environmental health practitioner.

Environmental health services form an integral part in the management of our environment. Municipal health services is classified as an essential service or key function of district and metropolitan municipalities (SA, 1998a: 58).

Municipal health services comprise part of the overarching environmental health services component of the health care system in South Africa (Balfour, 2006: 2). Environmental health can be classified as a diverse science. The primary objective of environmental health is to ensure a safe and healthy environment for all (Agenbag, 2008: 1). Provincial government, through the services of the environmental health practitioners, have the responsibility to render port health services and control malaria and hazardous substances on a more comprehensive level (SDM, 2011: 17. Date of access: 28 August 2011).

The environmental health profession in South Africa

The history of environmental health dates back to biblical times, specifically in terms of sanitation matters (Chaka, 2011: 3). Local government has played a key role in the delivery of environmental health services since the early 1800s. The Cape Colony benefited from action in British cities against filth and disease. Edwin Chadwick was among those who initiated action against poor sanitary conditions and disease in Britain in the nineteenth century. He compiled a report in 1842 on this and other matters, stressing the urgency for national action on the centralised control of public health and explaining the close link between slum conditions and poor levels of public health. In the nineteenth century muddy water for domestic use was still not a matter of great concern because they were unaware of its inherent health risk (Mäki, 2008: 25).

In 1878 the first Public Health Bill was tabled in the Cape parliament, but was later withdrawn. The Bill made provision for municipalities and divisional councils to have certain powers and control over sanitary improvement. The Bill also proposed the right of these municipalities and councils to appoint sanitary inspectors (today known as environmental health practitioners) (Balfour, 2006: 1). Among other duties, sanitary inspectors were tasked with identifying and eradicating all public health “nuisances” (Mäki, 2008: 25). A notable feature was that the role of the health official was similar throughout the British colonial empire (Chaka, 2011: 3). The first Public Health Act was eventually promulgated in the Cape Colony (South Africa) in 1883. The

publication of the Act was triggered by a smallpox epidemic in Kimberley, a city situated in the Northern Cape Province, which at the time was a booming diamond-mining town, notorious for its crowded, unsanitary living conditions (Agenbag, 2008: 3; Mäki, 2008: 25). The 1883 Act formed the foundation for public health legislation in South Africa (Mäki, 2008: 25). The significance of the sanitary/ health inspector's role in monitoring conditions in local communities was underscored in the Public Health Act of 1919, which had a clause that prevented local authorities from dismissing a sanitary/ health inspector without the approval of the minister (Agenbag, 2008: 4).

What transpired from the promulgation of the Public Health Act of 1919 was the appointment of Dr G.H. Fisk, the first part-time medical sanitary inspector. His designation was later changed to medical officer of health. As early as 1892, health officials were responsible for water supply issues in the Cape Colony (Mäki, 2008: 25). Mäki (2008: 29) researched the development of public health in four of South Africa's major cities (Cape Town, Grahamstown, Durban and Johannesburg). His study reveals that in the period 1874 to 1919 major developments took place when laws were promulgated and health officials appointed to deal specifically with water and sanitation challenges.

It is important to note that in South Africa the environmental health profession was previously reserved exclusively for whites. This led to the invidious situation that environmental health services were only available in white residential areas. The primary employer was the government and these officials were known as "government health inspectors". With rapid urbanisation and the development of black townships, the need arose for services to be rendered in these areas as well. The few white sanitary inspectors in South Africa simply neglected African townships, conducted such services as were offered by remote control, and only took positive action when there was a critical need to address specific issues (Chaka, 2011: 3–5).

The 1960s and 1970s saw the introduction of the "homelands" or Bantustan system, a territory that was set aside under "apartheid" for black South Africans, which extended the employment of health inspectors. The designation of health inspectors also changed to environmental health

officers. In addition, the move towards the establishment of professional associations for environmental health officers surfaced, but under the stringent apartheid system, separate associations were established for whites and people of colour. The Environmental Health Officers Association of South Africa (EHOASA) was established for whites and the South African Environmental Health Officers Association (SAEHOA) for black environmental health officers. Municipalities, mainly the big cities, accelerated employment of environmental health officers but again they undertook their duties in the African townships and white areas respectively. Black environmental health officers were supervised by their white counterparts, who basically never made contact with staff or service provision in the townships. This neglect of supervision led to a total collapse of services in townships. The two professional associations did nothing to draw the government's attention to issues of improving environmental health in the country or giving recognition to the environmental health profession. The indications are that if they had done so, they would have received little by way of a favourable response. Furthermore, the Medical and Dental Council of South Africa, the EHOASA and the SAHOA were voiceless on the advancement of environmental health in South Africa (Chaka, 2011: 6, 8).

Between 1995 and 1996 after the ushering in of a democratic government, the South African Institute of Environmental Health was formed as a structure that representing all environmental health practitioners in South Africa. The post-1994 years also saw the transformation of the Medical and Dental Council, which was renamed the Health Professions Council of South Africa with twelve independent boards, each representing professionals registered under the Health Professions Council of South Africa (Chaka, 2011: 9). At the annual general meeting of the KwaZulu-Natal branch, Mr Jerry Chaka, the first black president of the South African Institute of Environmental Health said:

> We [environmental health practitioners] need to continuously advance the environmental health profession, sharpen their professional skills and be geared for future environmental health challenges. We need to be conscious of present political challenges

facing the profession and ensure that we are current in addressing them. We have to continuously gauge ourselves against global trends and developments and move at the same pace with the global village (Chaka, 2011: 9).

Figure 2 Mr Jerry Chaka, first black president of the South African Institute of Environmental Health (VZAS. PA. 2012. Photo 003. [E-mail]. 23 April 2012)

The democratic dispensation and legislative changes such as the implementation of the local government-based district health system also had a marked effect on environmental health services. The purpose of this local government-based district health system is to act as a vehicle to implement an equitable and effective health system based on the principles of the primary health care approach (Agenbag, 2008: 6).

One could argue that environmental hazards have changed little since the 1800s. Mathee *et al.* (1999: 277; Agenbag and Balfour-Kaipa, 2008: 150) propose that environmental hazards are experienced worldwide in the form of “traditional” and “modern” hazards. Health risks emanate from both “traditional” and “modern” hazards, and in this regard, South Africa is no exception. Although South Africa has made some progress in addressing

poverty, much still needs to be done to improve what remains an unhealthy living environment. As a result of high unemployment, millions of South Africans live below the poverty line. The reality is that there is a high degree of inequality in income distribution in South Africa. This accounts for the huge gap in distribution of family income. Inequality of family income distribution is determined by the gini index. The gini index (distribution of family income) is a value calculated between zero (0) and one hundred (100) by means of a scientific formula. The closer the value to zero (0), the more equal the income distribution. Correspondingly, the closer the value to one hundred (100), the greater the disparity of income distribution. With a gini index calculated at 65, South Africa features amongst the countries with the most unequal income distribution in the world (CIA, 2012. Date of access: 14 April 2012).

One could perhaps argue that an unequal income distribution like this might well be a cause of inequality in basic service delivery by local municipalities, because not all residents have the financial means to pay for municipal services. And of course, non-payment for services impacts on municipal cash flow which means that municipalities have had to scale down on the maintenance of equipment and infrastructure. Evidence of a shocking lack of maintenance and inadequate service delivery appear all too frequently in local and national media in South Africa. The Fezile Dabi District local newspapers are full of articles on poor service delivery and the resultant unhealthy living conditions.

Urbanisation is another contributor to environmental hazards and health risks in our society (Mathee *et al.*, 1999: 277; Balfour, 2006: 1). The post-apartheid government gets the blame for rapid urbanisation in South Africa, but signs of a surge in the urban population dates back as far as the mid-twentieth century during World War II when the black population of Johannesburg increased from 244 000 in 1939 to an estimated 400 000 in 1946 (Setswe, 2010: 5). Periods of rapid urbanisation in South Africa catalysed informal development at the turn of the twentieth century, a time when the majority of black urban residents were migrant contract workers and were housed in overcrowded, single-sex compounds. Others who flocked to the cities in search of

employment settled in backyard shacks and makeshift informal settlements/ squatter camps (Setswe, 2010: 3). As in the 1800s, these unsanitary conditions were hazardous for human health and safety.

Although rapid urbanisation remains a concern for the environmental health practitioner in the new South Africa (Agenbag and Balfour-Kaipa, 2008: 150), one of the objectives of the ANC-led government is to improve housing development (Setswe, 2010: 10). This objective is supported by Section 1 of the Housing Act (No. 107 of 1997) which defines housing development as:

> the establishment and maintenance of habitable, stable and sustainable public and private residential environments to ensure viable households and communities … (SA, 1997).

Mathee *et al.* (1999: 277) emphasise that environmental health officers form the "backbone" of the environmental health service. Since 2004, they have been employed at the local sphere of government i.e. in district and metropolitan municipalities, to perform municipal health services. Environmental health practitioners at the provincial and national sphere of government perform and monitor environmental health services in these respective structures.

Over the past decade, training of environmental health practitioners has undergone fundamental changes (VZAS. PA. OI 01. 7 February 2012). In practice, their approach in implementing their duties has moved from law enforcement to community participation and development (Mathee *et al.*, 1999: 277). The objective is to train and educate communities on legislative requirements and to assist them to comply with legislation that is applicable to their circumstances. Strict law enforcement has been replaced by education to enhance awareness.

The devolution of environmental health to district municipalities and the changes in legislation have brought some improvements (Eales *et al.*, 2002: 102), but have also led to some confusion among residents on what can be expected of environmental health practitioners and how they can be contacted. Fragmentation and duplication of services has also occurred

because of the diversity of training (Mathee *et al.*, 1999: 277; Agenbag, 2008: 5-6). Luckily the National Health Act 61 of 2003 (SA, 2003); and the scope of practice of environmental health practitioners (SA, 2009) have come to the rescue by explaining exactly what can be expected of an environmental health practitioner. Furthermore, the scope of practice stipulates that an environmental health practitioner is the sole professional equipped to carry out the designated environmental health services.

Health

In order to understand where municipal health services fit into the bigger picture of the South African health system, one must understand what is meant by the term “health”. The World Health Organisation (WHO) defines health as: “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 2011c). This definition has not been amended since 1948 (WHO, 2011c).

The World Health Organisation goes further to define “health services” as including “all services dealing with the diagnosis and treatment of disease, or the promotion, maintenance and restoration of health. They include personal and non-personal health services” (WHO, 2011b). This implies that health services are the most visible function of any health system, both to users and the general public. It is further of vital importance that key resources are available to improve access, coverage and quality of such services (WHO, 2011b).

Environmental health

Agenbag and Balfour-Kaipa (2008: 149-150) stress the importance of environmental health services in primary health care and health services in general, while Eales *et al.* (2002: 113) express their concern about environmental health as one of the most neglected spheres of health management in South Africa. One environmental health practitioner is quoted as saying it feels as if the entire system is against the environmental health practitioner (Eales *et al.*, 2002: 113). The fact remains that environmental

health is critical and is integral in the “promotion of wellness and prevention of disease”. This is only possible if proper control is exercised over environmental factors that can impact negatively on human and environmental health.

The World Health Organisation (WHO, 2011) defines environmental health as:

> A discipline that addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviours. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments. This definition excludes behaviour not related to the environment, as well as behaviour related to the social and cultural environment, and genetics.

Mathee *et al.* (1999:278) propose in broad terms that:

> Environmental health is concerned with factors in the environment associated with health, well-being and disease, including physical, chemical and biological conditions.

Balfour-Kaipa (2007: 1) also labels environmental health as key in the primary prevention of disease and emphasises the importance of having access to sufficient funding to render effective environmental health services. Traditionally, in South Africa, environmental health officers have had a predominantly reactive, labour-intensive and costly approach in executing environmental health services. Their main focus has been on inspections, monitoring and control; this was usually to ensure legal compliance, often in response to public complaints (Mathee *et al.*, 1999: 282).

Recent South African legislation aims, among other objectives, to improve basic service delivery in all spheres of government, mandating and promoting inter-governmental collaboration and encouraging stakeholder involvement and community participation. The approach has become one of “comprehensive, integrated, preventive management of the environment for

better health". This shift from a reactive to a proactive approach requires intervention by the environmental health sector from the early planning stages of development. It further suggests "continuous environmental surveillance and evaluation across disciplines" (Mathee *et al.*, 1999: 282).

Environmental health strategies must also focus on local problems; integrated cross sectoral and transboundary planning and action; innovation; and the participation of communities (Mathee *et al.*, 1999: 288). Agenbag and Balfour-Kaipa (2008: 157) recommend that more coordination and monitoring of environmental health services must be undertaken by all three spheres of government as well as the South African Local Government Association (SALGA) and the South African Institute of Environmental Health. Mathee *et al.* (1999: 288) highlight the importance of always keeping the "effect of "poverty and inequity on the state of environment and health" in mind.

Efforts by environmental health services to ensure and maintain acceptable levels of environmental health in South Africa need to keep the broad development agenda as well as "complex processes or phenomena" in mind. "Poverty and inequity, rate of urbanisation, consumption and production patterns, economic development and technical and scientific development" are factors that influence the state of the environment (including health) (Mathee *et al.*, 1999: 278). It is an established fact that "diarrhoeal diseases and acute respiratory infections" are of great concerns in South Africa (Mathee *et al.*, 1999: 280). These diseases are the main cause of early childhood deaths. By 1998 the percentage of deaths due to diarrhoea in children below the age of five years averaged at 20.8% in South Africa as a whole. When broken down these percentages were calculated at 34.5% in the Free State Province; 10.7% in Gauteng; 23.1% in Mpumalanga; and 29.3% in North West Province (Mathee *et al.*, 1999: 280). Balfour (2006: 3) indicates that most communicable diseases emanate from the environment. She identifies water as one of the prime causes of diarrhoeal diseases and cutaneous infections. In addition, Balfour (2006: 3) refers to non-communicable diseases that are caused by a variety of poisons and pollutants that are frequently found in some South African water resources.

Legislative framework of municipal health services

Agenbag and Balfour (2008: 151) see the legal framework of environmental health services as being rooted in the Constitution of the Republic of South Africa Act 108 of 1996; the Municipal Structures Act 117 of 1998; and the National Health Act 61 of 2003. The term “municipal health services” originated in South Africa and includes the package of health services to be rendered by local government. It is well defined in the National Health Act 61 of 2003 (Agenbag and Balfour-Kaipa, 2008: 151). Balfour (2006: 1) and Agenbag and Balfour-Kaipa (2008: 151) further stress the importance of municipal health services within the general framework of primary health care; they point more specifically to environmental health and its impact on society. In Figure 3 an indication is given of the relationship of municipal health services to the overarching health services in South Africa.

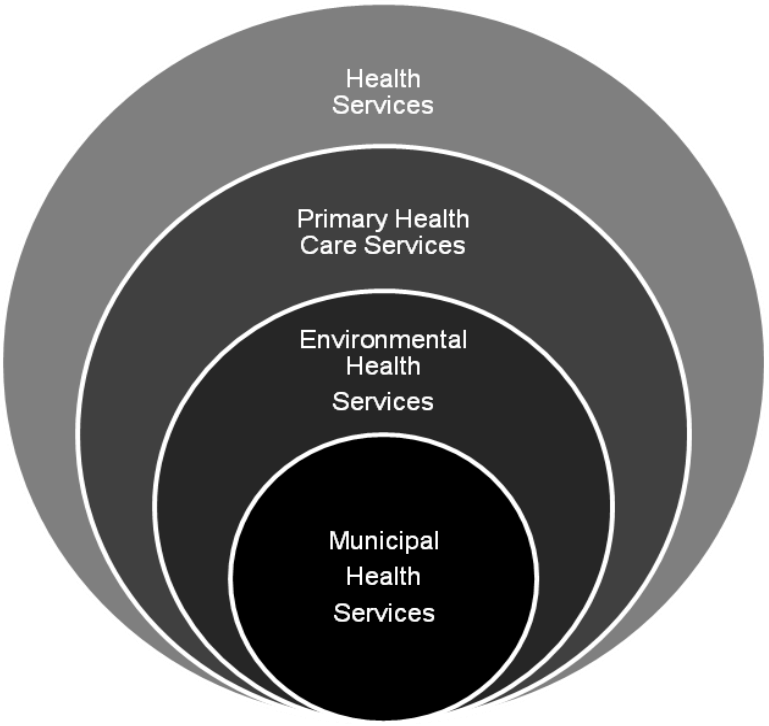

Figure 3 Relationship between municipal health services and health services in South Africa (Balfour, 2006: 2)

In terms of the Constitution of the Republic of South Africa Act 108 of 1996, local government (district and local municipalities) is a sphere of government

in its own right. Municipalities are no longer a function of national or provincial government. Chapter 14, Schedule 4 (Part B) of the 1996 Constitution, identifies municipal health services as one of the functions of local government as set out in section 155 (6) (a) and (7). Monitoring and support to local municipalities by district municipalities is of key importance. Furthermore, it is the role of national and provincial government to regulate local government in the exercising of their executive authority as referred to in section 156 (1).

The Constitution of the Republic of South Africa Act 108 of 1996 in section 24 (a) provides for the right to an environment that is not harmful to their health or wellbeing; and (b) to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that:

- prevent pollution and ecological degradation;
- promote conservation; and
- secure ecologically sustainable development and use of natural resources while simultaneously promoting justifiable economic and social development.

For the purposes of this study it is necessary to read section 27 (1) (b) and (2) of the 1996 Constitution together with section 24 (a). Section 27 (1) (b) provides for the fundamental right of access to sufficient water. Section 27 (2) requires from the state to “implement reasonable legislative and other measures, within its available resources, to realise this human right” (Thompson, 2006: 1, 145-147).

The Municipal Structures Act 117 of 1998 section 84 (1) (i) stipulates that district municipalities in South Africa have the power and responsibility to render municipal health services in their areas of jurisdiction (SA, 1998a: 58).

Section 32 (1) in the National Health Act 61 of 2003 states that metropolitan and district municipalities must ensure that municipal health services are effectively and equitably provided in their respective areas (SA, 2003). This same 2003 Act goes further to define the term “municipal health services” as including:

- water quality monitoring;
- food control;
- waste management;
- surveillance of premises;
- communicable disease control;
- vector control;
- environmental pollution control;
- disposal of the dead; and
- chemical safety.

Services excluded from the ambit of responsibility of municipal health services as per definition in the National Health Act 61 of 2003 are port health; malaria control; and control of hazardous substances (SA, 2003). The reason for this exclusion is that provincial government (through the service of its environmental health practitioners) has been assigned the responsibility to render port health services and to control malaria and hazardous substances (Balfour, 2006: 5).

For the purposes of this study the main focus is on the water quality monitoring function (SA, 2003) which is a key responsibility of district municipalities, particularly in Fezile Dabi District Municipality and its adjacent municipalities.

Environmental health practitioners: the backbone

Section 80 (1) (c) of the National Health Act 61 of 2003 states that the mayor of a district council may appoint any person in the employ of the council as a health officer for the municipality, but that such appointment is subject to the requirements of any other law. In this instance only a qualified environmental health practitioner who is registered as such with the Health Professions Council of South Africa as an environmental health practitioner in terms of the Health Professions Act 56 of 1974 legally qualifies to render environmental health services. Therefore, a mayor may not simply appoint “any person” as an environmental health practitioner unless he or she has the necessary

qualifications in environmental health and is duly registered with the Health Professions Council of South Africa as an environmental health practitioner.

In written communication (SAIEH, 2001: 1–4) from the South African Institute of Environmental Health (SAIEH) to the professional Board for environmental health practitioners of the Health Professions Council of South Africa, a strong motivation was provided for the necessity of drawing up a document on the scope of practice of environmental health practitioners. The SAIEH explained that for an extended time, efforts had been made in the form of meetings with the Board and written correspondence, to convince it to promulgate a scope of practice for environmental health officers under the Health Professions Act 56 of 1974. The SAIEH wanted the Board to promulgate the “acts” (actions, or functions) to be undertaken exclusively by a duly qualified and registered environmental health practitioner in order to protect the environmental health profession (SAIEH, 2001: 1). This would also ensure quality service to the public.

A problem identified by the South African Institute of Environmental Health was that many unqualified people saw themselves adequately informed to provide “expert” opinions and to make decisions on matters of environmental health. The result was that a growing number of people (particularly those in the ranks of the engineering-related professions and other environmental sciences) deemed themselves fit to take on the responsibilities of environmental health officials. A further concern was that non-registered (professionally unqualified) persons were being appointed in middle management posts in environmental health units at provincial government level as assistant and/ or deputy directors. Although it is acknowledged that a “manager” need not necessarily be a registered environmental health practitioner, the trend is that a worrisome number of these incumbents are increasingly inclined (or perhaps tempted) to encroach on professional environmental health officers’ domain either unintentionally or by force of circumstances. In view of this state of affairs, the South African Institute of Environmental Health felt that the status and role of environmental health

officers as professionals in the wider field of environmental health should be more precisely delineated (SAIEH, 2001: 2).

In effect, this ongoing effort by the SAIEH was indicative of a growing awareness in society of the necessity for a healthy environment and the environmental health profession as such. The beneficial effect of the professionalisation of the environmental health practitioner's role was clear. Environmental health has rightfully become an everyday issue in South Africa.

The SAIEH identified a genuine need for a broad front of consent amongst members of civil society, employers, other health profession practitioners, the environmental health profession itself, and the non-health professions. People wanted a clear view and understanding of exactly what the "protected" services ("acts") were that they could with justification demand from the environmental health professionals for the sake of the common good (SAIEH, 2001: 2–3).

The South African Institute of Environmental Health further argued that government notices, such as Government Notice No. 888 of 26 April 1991 (the regulations defining the scope of the profession of health inspectors) were to a large extent and in essence the same as previous notices such as Notice No. R2610 of 29 December 1978. These were basically the same and did not comply with the mentioned needs. The promulgation of the scope of practice of environmental health practitioners had become an absolute necessity. This promulgation, formulated in the new idiom, corresponded with current terminology and the contemporary level of development of the science from a legal point of view. It aims to create increased legal certainty (jurisprudence) as far as interpretation by all interested persons is concerned (SAIEH, 2001: 3).

After the initial drive in 1991, it took almost a decade for the proposals of the SAIEH to be legally promulgated as an annexure. On 26 June 2009 the scope of the environmental health profession was amended with the addition of an annexure headed: Scope of Practice of Environmental Health Practitioners as per Regulation 698 of 2009 under the Health Professions Act 56 of 1974.

To understand the core of this study, it is necessary to familiarise oneself with the contents of this annexure on the scope of practice of environmental health practitioners and what it says about water quality monitoring. Regulation 698 of 26 June 2009 delineates water monitoring as:

- monitoring water quality and availability, including mapping water sources and enforcing laws and regulations related to water quality management;
- ensuring water safety and accessibility in respect of a safe quality (microbiological, physical and chemical) and an adequate quantity for domestic use as well as in respect of the quality for recreational, industrial, food production and any other human or animal use;
- promoting access to water for all communities by providing inputs toward the planning, design and management of the water supply system and ensuring healthy community water supplies through surveillance;
- ensuring monitoring of effective waste water treatment and water pollution control, including the collection, treatment and safe disposal of sewage and other water-borne waste, and surveillance of the quality of surface water (including sea water) and groundwater;
- advocating proper and safe water usage and waste water disposal; and
- sampling and testing water in the field and examining and analysing it in a laboratory.

Supported by all the mentioned legislation, the environmental health services function in South Africa was transferred from local municipalities to district municipalities in 2004. In the case of Fezile Dabi District Municipality, the four local municipalities of Ngwathe, Mafube, Moqhaka and Metsimaholo transferred their environmental health services to Fezile Dabi District Municipality on 1 July 2004. From that date onwards the District Municipality has taken full responsibility for municipal health services as per definition in the National Health Act 61 of 2003 in its geographical municipal area.

For municipal health services to ensure an effective service to the public as well as access to safe domestic water and an environment that is not harmful to residents' health and wellbeing (SA, 1996), it is important for the bigger picture be taken into account. In short, municipal water quality monitoring needs to link up with similar activities on a regional level, typically at a surface catchment management level.

Municipal service delivery challenges in South Africa

Manda Hinsch (2009: 41) claims that currently, governance is far from simple. Van Rooyen (2001: 61) is also of opinion that local government managers are faced with a formidable range of challenges. Hinsch (2009: 41) mentions major hurdles, notably insufficient capacity in local government resulting in poor operation and maintenance of infrastructure. The reasons appear to be "ineffective utilisation of municipal resources; non-compliance with environmental legislation; poor service delivery; and potentially hazardous environmental and human health impacts". She highlights the fact that the management of water is neglected in many parts of South Africa. Service delivery protests as a consequence of unacceptable levels of basic service delivery by local authorities reached a peak between 2004 and 2009. In many parts of the country these protests were accompanied by wanton violence and considerable damage to public and private property. Residents expressed their frustration and anger with the quality of services they received in return for the money they were expected to pay for such services. Calling the country's municipalities "the weakest link" of government is therefore no surprise (Gouws *et al.*, 2009: 5). Hinsch (2009: 41) feels it is crucial that the management of water as a scarce resource be improved in order to protect the general health of South Africans.

Hinsch (2009: 41) points out that the concept of "developmental local government" in Section B of the White Paper on Local Government (SA, 1998b: 44), is defined as:

> local government committed to working with citizens and groups within the community to find sustainable ways to meeting their

> social, economic and material needs and improve the quality of their lives.

It is clearly stated in the policy document that local government is not responsible for creating jobs. Local government is responsible for ensuring that the "overall economic and social conditions of the locality are conducive to the creation of employment opportunities". This, in short, means that local government must create an "enabling environment" for all South Africans but is not, as stated above, responsible per se for providing employment. (SA, 2008b: 44).

Poor decision making by government officials has a negative impact on communities. It is standard practice in government that operational and maintenance budgets are cut to accommodate spending on special needs projects. However, there are negative spinoffs of such spending, such as poor stormwater management and frequent breakdowns of potable water supply and poorly maintained wastewater treatment plants. These breakdowns result in untreated effluent and wastewater seeping into water resources. It is often the poorer communities that fall victim to waterborne diseases and this perpetuates the poverty spiral. For instance, sick children cannot attend school and parents may have to spend time (and lose income) to accompany children to clinics and doctors. It is well noted in the literature that frequent absenteeism reduces productivity and results in knock-on effects on the economy (Hinsch, 2009: 41). Absenteeism owing to the 2009 swine flu pandemic for example, cost the South African economy an estimated R19 billion in direct costs and almost R40 billion in indirect costs (Crain, 2010: 25).

A good example cited by Hinsch (2009: 41–42) is the poor water management in Zimbabwe that led to the cholera outbreak of 2008. That particular situation soon overflowed into the Limpopo Province and also affected communities in Mpumalanga Province. Little or no management of sanitation, inadequate stormwater management; ineffective disposal of grey water; and deficient systems for the reticulation of wastewater are the root causes of such outbreaks of disease. In turn, these may well result in reluctance or even non-payment for services. Secondary to this are cash flow problems that may well

lead to the notion of cutting budgets – which more often than not mean that water services bear the brunt of the cuts. Moreover, vandalism is increasingly prevalent these days, which is a clear sign of disrespect for the government. It is also a means of demonstrating dissatisfaction in response to deficient or non-existent municipal services. In many instances the non-decision making municipal official such as the plumber, the environmental health practitioner, the enquiry clerk or the customer-care clerk, is the person who has to face the furious client whilst the highly-paid decision maker sits in the comfort of his luxury office behind strict security. This leads to low employee morale among those at grassroots level (Agenbag and Lues, 2009: 552).

As is the case in Fezile Dabi District Municipality, neighbouring municipalities are also challenged by a consistently poor level of environmental quality (SDM, 2011: 17).

Opportunities and challenges specific to municipal health services

Opportunities

Eales *et al.* (2002: 113) are of the opinion that legislative changes and the restructuring of environmental health services at provincial and local spheres of government in South Africa mean that environmental health professionals have ample opportunity to impact the provision of service delivery that is "essential for poverty alleviation and primary health care". Balfour (2006: 6) agrees and proposes integrated local development initiatives and concerted local level action as ways of improving municipal health services. Municipal health services in the local municipal sphere is a great advantage for both the profession and the communities. Health professionals in municipalities must make their voices heard by ensuring that their actions are included in integrated development plans. This will ensure that the necessity of municipal health services are taken into account and integrated into municipal strategic and operational plans.

An inter-sectoral and transdisciplinary approach needs to be followed for achieving best results in accordance with identified goals and outcomes in

integrated development plans (Balfour, 2006: 6; Tempelhoff *et al.*, 2011: 7). Balfour (2006: 6) uses the example of interaction with other municipal divisions responsible for infrastructure and management of water and sanitation that are essential if municipal health services are to fulfil their role of monitoring the quality of water provided. In a recent project by the Research Niche Area for the Cultural Dynamics of Water (CuDyWat) at North-West University, it was found that an integrated, transdisciplinary approach to water quality monitoring will ensure an effective and sustainable water quality monitoring service (Tempelhoff *et al.*, 2011: 93).

Action as far as municipal health services are concerned can take place at the local level because the environmental health practitioner works closely with the communities it serves. They know the circumstances and are able to monitor developments in health matters at grassroots level. The environmental health practitioner can provide timeous and realistic solutions to health challenges because of their close involvement in the community (Balfour, 2006: 6).

Challenges

Municipal health services are faced with a number of challenges such as:

- fragmentation of primary health care services (Agenbag, 2008: 5; Balfour, 2006: 6);
- non-uniform institutional frameworks in municipalities (Balfour, 2006: 7);
- differing interpretation of legislation (Balfour, 2006: 7);
- funding and resources for municipal health services (Agenbag and Lues, 2009: 542; Balfour, 2006: 8; Balfour-Kaipa, 2007:1–3; DBSA, 2007: 21, 25);
- lack of human resources (Agenbag and Lues, 2009:543–546; Balfour, 2006: 9);
- transfer of staff (Balfour, 2006: 9); and
- capacity constraints at district municipal level (Balfour, 2006: 6–10; Agenbag and Lues, 2009: 551; Eales *et al.,* 2002: 113).

Balfour (2006: 6–10) explains that it was initially envisaged that the local sphere of government should render all primary health care services. In practice, however, this did not eventuate and primary health care services (personal health care) are the responsibility of the provincial sphere, except in the case of metropolitan municipalities. Both the local and provincial authorities currently render environmental health services, with provinces only in charge of the three areas as mentioned in the National Health Act 61 of 2003 and local government responsible for municipal health services as per definition in the same 2003 Act. Difficulties are experienced with coordination across the two components of environmental health services delivered on local and provincial level. Similar problems are experienced with primary health care issues that have been placed at provincial level.

Ever since the apartheid era, metropolitan municipalities have had strong environmental health services. Most municipalities in “white” South Africa had an environmental health service, but such services were restricted to the municipal and urban areas. Minimal environmental health services were rendered in the rural areas, and even less was provided in the “homeland” areas (Balfour, 2006: 7; Agenbag and Gouws, 2004: 3).

Since 1994, municipal health services have become the responsibility of metropolitan municipalities and district municipalities. However, not all district municipalities have implemented this legal requirement. For some time there was a disjuncture; local municipalities had the resources, but because of the devolution of the service to district municipalities they lost the responsibility for delivering these services. The other side of the coin was that some district municipalities had been accorded the responsibility but did not have adequate resources to deliver such services (Balfour, 2006: 7).

In addition, for a considerable period of time there was uncertainty amongst health officials about health legislation. The expectation was that when the new National Health Act 61 of 2003 was promulgated, everything would become clear. However, inadequate communication between the different

spheres of government failed to clarify matters and resolve uncertainties (Balfour, 2006: 8). For some time South Africa operated with two Health Acts, namely Act No. 61 of 2003; and Act No. 63 of 1977. The reason for this was that some sections of Act 63 of 1977 were not repealed. At a national *lekgotla* (meeting) held in Kempton Park from 6–7 February 2012, this emerged as a challenge that needed to be addressed.

Fezile Dabi District Municipality is one of the municipalities in the Free State Province that accepted the responsibility of introducing municipal health services right from the onset in 2004, but the same cannot be said of its neighbours (DBSA, 2007: 16). Currently, the situation is that all its adjacent district municipalities have taken full responsibility for municipal health service delivery, but there is still the situation of local municipalities rendering municipal health services on behalf of the district municipality, with the potential of municipal health services not being implemented effectively because everyone does not have the same goal in sight.

The World Health Organisation's norm for staffing of environmental health practitioners (EHPs) is 1 EHP/10 000 population. South Africa has adopted a national ratio of 1 EHP/15 000 population. However, currently, South Africa falls way short of the norm they have set for themselves (Agenbag and Gouws, 2003: 7). The 2011 census will assist a great deal in determining the status of this challenge in Fezile Dabi District Municipality and its neighbouring municipalities because population data will be more accurate. The reality is that irrespective of current ratio of EHPs per population, district municipalities still have to render municipal health services (Balfour, 2006: 10).

Environmental health practitioners' views on water quality monitoring

For the purpose of this study, environmental health practitioners in the employ of Fezile Dabi District Municipality were requested to provide the researcher with input on how they interpret their role and responsibility with respect to water quality monitoring as a key responsibility of the district municipality and environmental health practitioner. The following are their responses.

Communities' right of access to safe drinking water

One environmental health practitioner feels so strongly about the issue of water quality monitoring that he titled his response: "Drinking water quality: the community have the right to safe drinking water" (VZAS. PA. 2011. Email 1. 25 August 2011).

He refers to Baker (1948) by saying that there is a real need to take precautions with drinking water to protect public health – a responsibility recognised as long ago as 4 000 years before the present (BP). He claims that drinking water is still a matter of primary concern. Microbial contamination remains the most important health risk in drinking water. In addition, pollution by inorganic compounds derived from sophisticated industrial processes are also of grave concern (VZAS. PA. 2011. Email 1. 25 August 2011).

In general, one can say that consuming any desired quantity of drinking water should not raise concerns about adverse health effects. One can go a step further to say that the consumer is entitled to "high-quality" water that contains no physical, bacteriological and chemical pollutants (VZAS. PA. 2011. Email 1. 25 August 2011).

It is of major concern in some areas that water service providers do not inform the consumers about the exact quality of the water they are selling to them (VZAS. PA. 2011. Email 1. 25 August. 2011). In addition, incidents of pollution are not communicated properly to the relevant stakeholders which pose distinct risks to the health and safety of residents. Proper communication between authorities and civil society is not an option – it is a definite must (VZAS. PA. 2011. Email 4. 25 August 2011).

Opinions on who is responsible for ensuring safe drinking water

The Department of Water Affairs (DWA) is the lead institution for the management of drinking water quality in South Africa (VZAS. PA. 2011. Email 1. 25 August 2011). In terms of the Municipal Structures Act 117 of 1998, the primary responsibility for ensuring the provision of all water services rests with local government via the constituted Water Services Authority (VZAS. PA.

2011. Email 1. 25 August 2011). Other role-players and stakeholders certainly have important contributions to make in ensuring safe and clean water for all. The DWA remains responsible for the implementation of the National Water Act 36 of 1998 and must exercise its responsibilities, whilst the water service providers and water services authorities have to accept and exercise their responsibilities (VZAS. PA. 2011. Email 1. 25 August 2011).

Environmental health practitioners take full responsibility for water quality monitoring for audit and monitoring purposes. They are of the opinion that irrespective of the fact that municipal health services is only responsible for audit monitoring of water quality, district municipalities must implement an effective water sampling strategy plan to ensure accurate audit findings. This opinion is supported by Tempelhoff *et al.* (2011: 93) in a recommendation to Fezile Dabi District Municipality and Moqhaka Local Municipality which states:

> The Moqhaka Municipal Health office should initiate an integrated water monitoring strategy as a pilot project. Among the activities of the entity should be to do efficient and continuous water sampling.

Based on accurate water quality results, the environmental health practitioner can make sound recommendations to water service providers in the district (VZAS. PA. 2011. Email 2. 25 August 2011). One environmental health practitioner has seen the bigger picture and referred to water quality monitoring at different water sources destined for different uses (such as human consumption; animal consumption; agricultural use; recreational use; and industrial use (VZAS. PA. 2011. Email 4. 25 August 2011). The environmental health practitioner has gone further by indicating that monitoring includes physical observation of the aesthetic quality of the water and the environment (VZAS. PA. 2011. Email 4. 25 August 2011). A further opinion is that part of monitoring is to look at the conditions of the entire water system including the treatment plants, dams, reservoirs, wastewater treatment plants and public irrigation systems (VZAS. PA. 2011. Email 4. 25 August 2011). In other words, water sampling and analyses alone are not enough; an entire assessment of water services is essential.

Water service providers are at all times responsible for operational water sampling and analyses. The unfortunate situation in the Fezile Dabi District Municipality is that the majority of local municipalities are both water service providers and water service authorities. In practical terms this means that the municipalities are both referee and player as far was water management is concerned (VZAS. PA. 2011. Email 2. 25 August 2011).

Conclusion

Chapter two attempted to explain the exact position of municipal health services within the bigger picture of South Africa's health system. It also explained the origin of environmental health and the way forward in South Africa. The exact roles and responsibilities of the environmental health practitioner, with special focus on water quality monitoring as one of the nine key responsibilities, is discussed at length in the legislative background to municipal health services.

The environmental health practitioners face serious challenges in their profession because of poor service delivery by local government in South Africa, but the "devolution of environmental health to district municipalities created opportunities for integrating environmental health with development planning and provision of basic services" (Eales *et al.*, 2002: 102). Environmental health practitioners take the constitutional right of people to access to enough, safe drinking water very seriously.

The Department of Water Affairs was singled out by environmental health practitioners as the lead institution for the management of water quality. As a partner in integrated water resource management, environmental health practitioners take full responsibility for water quality monitoring as per the requirements in the National Health Act 61 of 2003.

Chapter 3 will focus on how to integrate water quality monitoring across boundaries. The feeling is that many stakeholders do water quality monitoring, but in isolation of one another. Eales *et al.,* (2002: 113) refer to water quality monitoring as an example of working in silos:

> Water quality, for example, is monitored by DWAF officials, municipal technical departments and by environmental health practitioners. Parallel reports are often prepared, for different authorities, without adequate integration or assessment of their implications for broader development planning.

The saying: “the more pixels, the better the quality of the picture” has a parallel here. The argument is that the contribution of every individual stakeholder in water quality monitoring is a pixel of the bigger picture. The end goal is to portray a true, clear, bright picture of the water quality in Fezile Dabi District Municipality’s geographical area of responsibility and neighbouring district municipalities.

Chapter 3

Transboundary collaboration to improve water quality monitoring strategies between Fezile Dabi District Municipality and its neighbours

Introduction

In August 2011 a senior official of the Department of Water Affairs told the Water and Environmental Affairs parliamentary portfolio committee that it was exceedingly dangerous to use water from many South African rivers because of the threats such water might pose to human health and safety (Sapa, 2011). Pollutants include faecal pollution, eutrophication, high salinity, high toxicity and acid mine drainage (Sapa, 2011; FDDM, 2011: 3–4). A further worrying factor is the statement by the senior official that faecal pollution and pesticides are not monitored widely, yet they pose health risks to humans and agricultural activity (Sapa, 2011). The *Vaalweekblad*, a regional newspaper reported on poisonous algae in the Vaal River (Farr, 2012: 5). As a water user downstream from the Gauteng Province which is known for sewerage and acid mine drainage pollution, the Fezile Dabi District Municipality cannot take this matter lightly. A major concern is that government officials are passing the buck when it comes to maintaining a vigil on behalf of the public. There is a lack of transparency on water quality and complaints from consumers are not attended to promptly (Farr, 2012: 5). In recent years, "rapid development, population growth, urbanisation and the lack of integration on comprehensive water governance strategies" (as discussed in Chapter 2) have been responsible for a number of serious problems in the country's water sector (Tempelhoff *et al*. 2011: 1).

Well aware of the state of affairs regarding surface water pollution and the potential risks to human health and safety, the management of Fezile Dabi District Municipality's municipal health services division, together with North-West University's research niche for the Cultural Dynamics of Water

(CuDyWat) have conducted periodic transdisciplinary research on “environmental health of water resources and infrastructure” in its local municipalities. Since 2008, transdisciplinary research in this District Municipality has produced a number of success stories.

The aim of this research is to encourage environmental health practitioners who are core personnel in water quality monitoring to collaborate across local, district and provincial boundaries. If it is possible to forge transboundary consensus between stakeholders “the outcome should be a collaborative water quality monitoring system in which participants share information on the environmental health of one of the country’s hardest working rivers” (Tempelhoff *et al.*, 2011: 1–2). The need for collaboration has now reached a point where it has become a matter of vital importance.

The monitoring of water quality goes far beyond merely checking the quality of drinking water from a tap at the point of consumption. People use water for a variety of purposes, such as domestic, recreational, industrial and agricultural purposes and for the maintenance of sustainable aquatic ecosystems (SA, 1996b: i).

To ensure proper monitoring of water quality and services it is necessary, at the local municipal level, for environmental health practitioners to think out of the box and focus on the bigger picture, i.e. of embarking upon collaborative transboundary water quality monitoring/assessment. This will be in line with Thompson’s (2006: 13–14) view on the need for a proper framework in addressing current water challenges in South Africa. Needless to say, all spheres of government must follow the same pattern and if this approach is implemented it will lead to greater understanding of the issues at hand and standardisation of the methods used to deal with them. The main thinking behind a collaborative transboundary approach in addressing water quality challenges is that neither the natural flow of water nor pollution know or respect manmade administrative boundaries. Water quality management is hamstrung by administrative boundaries because water resources and their potential pollutants do not begin or end at such borders. If environmental health practitioners want to make a valuable contribution they must begin to

focus beyond mere administrative boundaries. They should understand that natural boundaries (e.g. surface water catchments) are of far greater importance in water management. It is a matter of crucial importance to integrate data collecting and water quality monitoring processes in South Africa. Thompson (2006: 14) stresses that water should be an essential ingredient of all programmes and plans and that an integrated approach should be followed in this regard. A new generation of progressive water professionals in South Africa have already begun to call for transboundary water governance. Interestingly, they are calling simultaneously for the use of transdisciplinary science (Tempelhoff *et al*, 2011: 3).

Chapter 3 reflects on the significance of transboundary collaboration and how this would improve water quality monitoring strategies between Fezile Dabi District Municipality and its neighbouring district municipalities. “Monitoring” and “assessment” are two basic terms in the vocabulary of water scientists. After defining these terms one is tempted to give preference to “assessment” because it tends to speak more to the objective of this study.

Bridging administrative boundaries and embarking on transboundary collaboration is identified as a challenge. But it has become a “must” in water quality monitoring. Primary and secondary boundaries, as defined by the researcher, are not insurmountable if municipal health services divisions are permitted to forge cooperation on the operational level by setting up district municipal health services intergovernmental relations forums. The Constitution of the Republic of South Africa Act 108 of 1996; the Intergovernmental Relations Framework Act 13 of 2005; and the National Water Act 36 of 1998 all categorically support collaboration and integration across administrative boundaries. Although it is core in collaborative initiatives, there are various myths about integration. Be that as it may, the characteristics of integration are such that closer collaboration and breaking away from silo operations will certainly benefit water quality monitoring in the long term. Dent (1998: 2) captures this succinctly:

> It is not possible to build integrated river management on a base of dis-integrated science. The forces causing dis-integration are

> powerful; however, the forces driving the demand for integration are stronger.

Throughout the entire integration process, social learning and interest based bargaining play important roles as part of the transdisciplinary research approach to solving environmental health challenges. The required education of stakeholders and participants will also be addressed if transdisciplinary research is correctly implemented.

Crossing local, district and provincial boundaries in an effort to integrate the water quality monitoring strategies currently implemented by various stakeholders in the water arena is clearly a necessity.

Monitoring or assessment?

Tempelhoff *et al.* (2011: 3) indicate that there is a trend towards new terminology in the discourse on water management. For example, the National Health Act 61 of 2003 (SA, 2003: 14) uses the term “water quality monitoring”, but it is argued that there is a need for a more holistic approach. Instead of the word “monitoring”, it is suggested that “assessment” be used to describe the actions that are necessary for an aware society to be informed about the quality of water to which they are exposed on a daily basis. In a holistic context, the term “water quality assessment” is more meaningful. When explaining “assessment” to environmental health practitioners it is clear that they prefer this word to “monitoring”. They feel that their task is not merely limited to quality “monitoring”, but also involves “assessment” of the bigger picture, i.e. the wider scope of water provision. As water researchers we have a high estimation of the work we do and the word “assessment” is more embracing and more integrative. In this regard, Tempelhoff *et al.* (2011: 3) cite Vygotsky (1986) who metaphorically suggests:

> A word calls to mind its content as the overcoat of a friend reminds us of that friend, or a house of its inhabitants.

To distinguish between “monitoring” and “assessment” it is necessary to look closely at some definitions.

Monitoring

The Oxford Advanced Learners' Dictionary (OALD, 2011a) defines monitoring (verb) as:

> to watch and check something over a period of time in order to see how it develops, so that you can make any necessary changes.

To the Organisation for Economic Co-operation and Development (OECD, 2007) monitoring means:

> The continuous or frequent standardised measurement and observation of the environment (air, water, land/ soil, biota), often used for warning and control.

Bartle (2011) defines monitoring as:

> the regular observation and recording of activities taking place in a project or programme. It is a process of routinely gathering information on all aspects of the project.

It is clear that to "monitor" is to undertake systematic and purposeful observation. Monitoring also includes feedback of progress to donors, implementers and beneficiaries. Effective reporting is key in monitoring and allows for gathered information to be used in important decision making (Bartle, 2011. Date of access: 3 February 2012). Bartle (2011) goes a step further and compares monitoring to watching where you are going while riding a bicycle when he says: "You can adjust as you go along and ensure that you are on the right track".

Bartle (2011, Date of access: 3 February 2012) also proposes that monitoring is useful in:

- analysing the situation in the community and its project;
- identifying problems facing the community and finding solutions;

- ensuring all activities are carried out properly by the right people and in time;
- using lessons from one project experience on to another; and
- determining whether the way the project was planned is the most appropriate way of solving the problem at hand.

From the above it is clear why the South African Institute of Environmental Health, in their contribution to the Health Professions Council of South Africa on the scope of practice of environmental health practitioners, used the term "monitoring" to describe the function of the environmental health practitioner in integrated water resource management (IWRM) (SAIEH, 2001; SA, 2009). However, "assessment" is probably the more appropriate term to use when referring to transdisciplinary integrated water quality monitoring.

Assessment

The *Oxford Advanced Learners' Dictionary* (2011) defines the verb "assess" as making "a judgement about the nature or quality of somebody/ something; and to calculate the amount or value of something". Based on this definition it is the opinion of the researcher that transboundary water quality assessment implies that each stakeholder cooperates in a transboundary context to make a judgment on the nature and quality of water and its surroundings in a qualitative and quantitative manner. Assessment therefore supports the qualitative status of water and water services. Assessment also talks to quantitative judgement by means of sampling and analyses of all water sources. More importantly, it has the ring of a collaborative process; a process of taking note of something that is in the common interest. Tempelhoff *et al.* (2011: 9) maintain that in any given situation, assessment is guided by principles that will:

- ultimately improve the situation;
- enable progress;
- include explicit processes to ensure obtained information is valid, reliable and "fit-for-purpose";
- promote public understanding and how it impacts on current and future generations;

- be treated as approximations and are subject to unavoidable errors;
- be process or product oriented, although ideally an effective assessment should include both orientations;
- promote active engagement of all relevant participants;
- motivate participants in the sense of showcasing what is already done successfully;
- combine a wide variety of different kinds of information; and
- reflect quality.

For an outsider to speak these words is easy and somewhat glib, but the challenge is for environmental health practitioners to integrate their efforts with those of fellow environmental health practitioners; neighbouring district municipalities adjacent to Fezile Dabi District Municipality; and sector departments involved in integrated water resource management. To understand and overcome this challenge it is necessary to have a thorough understanding of what the writer has in mind when talking of boundaries and integration.

Boundaries and integration

As water passes through various phases of the hydrological cycle it does not know political, economic or social boundaries. “Water physically embodies ‘our common future’ through its nature of linking plants, animals, people and ecological processes” (Bokova, 2010: ix). Sharing has the potential to lead to conflict, but historically, in the case of working with water, there has been more evidence of cooperation than conflict (Bokova, 2010:ix). That is why it is so important to focus on theoretical tools such as integration (Dent, 1998); social learning (Reed *et al.*, 2010); and interest-based bargaining (Majka, 2000: 37–38).

Comprehending the meaning and dimensionality of boundaries is complex. The national elections of 2000 were a case in point. The number of local authorities was reduced from 843 to 284. This posed some serious challenges to municipalities. The process meant creating new boundaries and the

population of these newly enlarged local municipalities increased dramatically. The change in boundaries also contributed to a process of organisational restructuring and structural changes in most of the municipalities (Reddy, 2003: 439). These changes then called for appropriate services to follow the change. The move of environmental health services from local municipalities to district municipalities was, in the opinion of this researcher, a step in the right direction.

The nature of boundaries is to restrict spontaneous movement of someone or something. Administrative boundaries have the ability to restrict the movement of people but the same cannot be said of the movement of water and the spread of pollution. In the context of this research, where the focus is specifically on transboundary collaboration and integration of water assessment, it is necessary to adopt a mindset that is able to bridge administrative boundaries and take a far wider perspective than is currently the case. Indeed, the writer is tempted to take this process one step further and categorise the boundaries in which an environmental health practitioner executes his/ her daily responsibilities into primary and secondary boundaries.

Primary boundaries

From experience as manager of municipal health services in a district municipality, the researcher refers to all boundaries inside the jurisdictional area of a specific district municipality or metropolitan municipality as primary boundaries. The thinking is that the first boundary an environmental health practitioner has to cross is the boundary between his/ her working area and that of a fellow colleague in the same region. Even at this stage, collaboration and integration already play an important role.

The next primary boundary to bridge is the first demarcated administrative boundary that divides the district into local municipal areas. It is important that environmental health practitioners working in the same district municipality (but different local municipal areas) also collaborate and integrate their systems and programmes to contribute to the realisation of the bigger objective.

Secondary boundaries

The remaining demarcated administrative boundaries between district municipalities, provinces and countries are referred to in this study as secondary boundaries.

South Africa finds itself in the situation that administrative and water catchment boundaries exist side-by-side. Administrative boundaries were determined and proclaimed by people; they are manmade lines on maps that literally delineate municipal, district, provincial and national entities (Tempelhoff *et al.*, 2011: 4).

Fezile Dabi District Municipality is one of five district municipalities in the Free State Province. As mentioned above, it is unique in the sense that it borders on five other district municipalities and three provincial boundaries. The five district municipalities are Sedibeng District Municipality in Gauteng Province to the north (DC42); Gert Sibande District Municipality in Mpumalanga Province to the northeast (DC30); Thabo Mofutsanyane District Municipality in Free State Province to the southeast (DC19); Lejweleputswa District Municipality in Free State Province to the west (DC18); and Dr Kenneth Kaunda District Municipality in North West Province to the northwest (DC40) (*World News Network*, 2011).

The Vaal River forms the demarcated provincial boundary between Fezile Dabi District Municipality (FDDM) in the Free State and the three (3) neighbouring provinces of North West, Gauteng and Mpumalanga (FDDM, 2011; Tempelhoff *et al.*, 2011: 5). The main stream of the Vaal River and most of the tributaries downstream from the Vaal Dam, are highly contaminated and in a critical state of ecological decline (UFS, 2006; Sapa, 2011; Farr, 2012: 5). Undeniably, however, it is a crucial domestic, industrial and agricultural water resource that sustains South Africa's Pretoria, Witwatersrand, Vereeniging (PWV) region, South Africa's economic hub (Rand Water, 2011; Sapa, 2011).

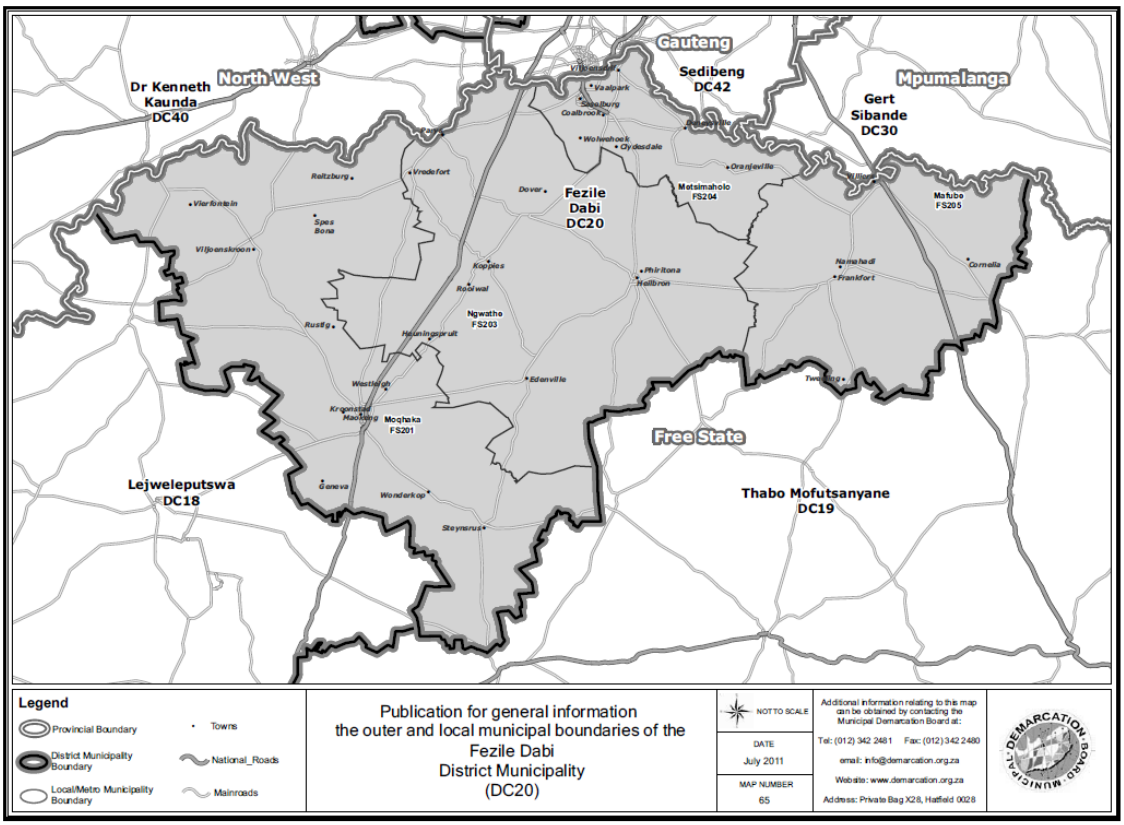

Figure 4 The outer and local municipal boundaries of the Fezile Dabi District Municipality (DC20) (SA, 2011a: 75)

Despite the fact that there is a legal mandate that makes intergovernmental relations obligatory for officials at all levels of government to actively promote co-operative governance, it is clear that officials responsible for the administration and management of local and district municipalities tend to work independently, i.e. in silos (Tempelhoff *et al.*, 2011a: 92).

Observations made in 2011 by a CuDyWat research team on a fieldwork excursion suggest that local government, as far as environmental health services are concerned, is working in silos. There are intergovernmental relations forums at strategic management level, but there is an urgent need for similar cooperation and integration on the operational level between municipal health services in neighbouring district municipalities (FDDM, 2012: 5). In most administrative local government offices the Batho Pele principles, developed to enhance the quality and accessibility of government services, are ignored; they are just platitudes pasted to the office wall. Despite the fact

that stakeholder participation is a key element in adaptive and integrated water resource management, there is hardly involvement from civil society in addressing water quality related challenges (Kranz and Mostert, 2010: 91; Smith, 2009: 2). Transparency remains a problem because there is no effective stakeholder participation, especially in transboundary basins (Kranz and Mostert, 2010: 91). It is, therefore, important that isolated initiatives in municipal health services be merged into joint intergovernmental projects involving proper community involvement. The only way to ensure the safety of water and a safe and healthy environment for all is by treating the challenges of water quality monitoring in a transboundary, integrated and multidisciplinary manner (Tempelhoff *et al.* 2011a: 92).

Figure 5 is an illustration that demonstrates the silo-type effect administrative boundaries can create in the working framework of an environmental health practitioner. This silo effect can be negated by introducing an effective communications strategy for the establishment of a transboundary platform where various stakeholders in the water management arena can interact and work together towards a common set of goals.

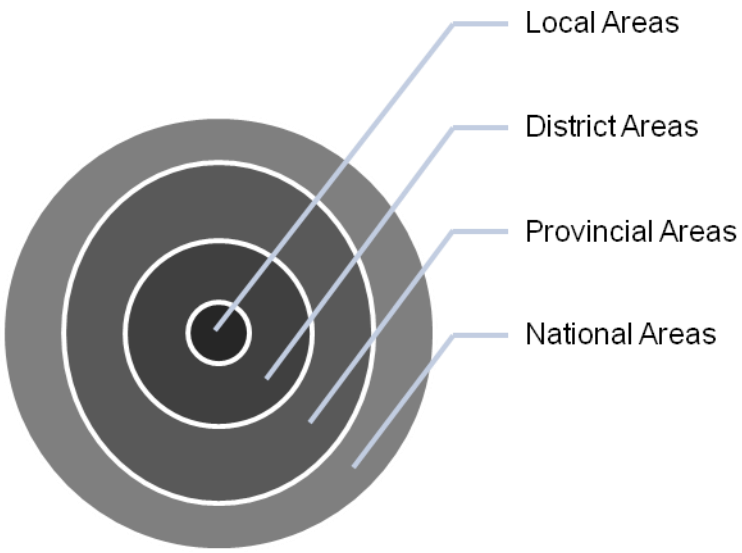

Figure 5 Silo effect of manmade administrative boundaries (Diagram developed by author)

An initiative of this nature will also give effect to one of the three principles of cooperative governance and intergovernmental relations which requires concrete steps towards the realisation of co-operative governance by:

- fostering friendly relations;
- assisting and supporting one another;
- consulting one another on matters of common interest;
- keeping one another informed on these matters;
- co-ordinating their actions and legislation;
- adhering to agreed procedures; and avoiding legal proceedings against one another (Layman, 2003: 9).

Unfortunately, it appears that the current boundaries have over the years become impermeable boundaries for environmental health practitioners (FDDM, 2012: 5). Officials in local and district municipalities and those in the provinces, have created static silo conditions with solid boundaries that are difficult for colleagues who work in the same environment to break through (FDDM, 2012:5).

In addition to the manmade governance boundaries, there are natural boundaries. These are hydro-geological boundaries formed by the forces of nature over a long period (in the case of the Vaal River, about 180 000 million years ago) (Rowntree, 2000: 393). This biological world is already interrelated; there is no need to create its interrelatedness (Dent, 1998: 1). Government has clustered these naturally formed sub-catchments and catchments together to establish catchment management agencies, as is illustrated in Figure 6 below.

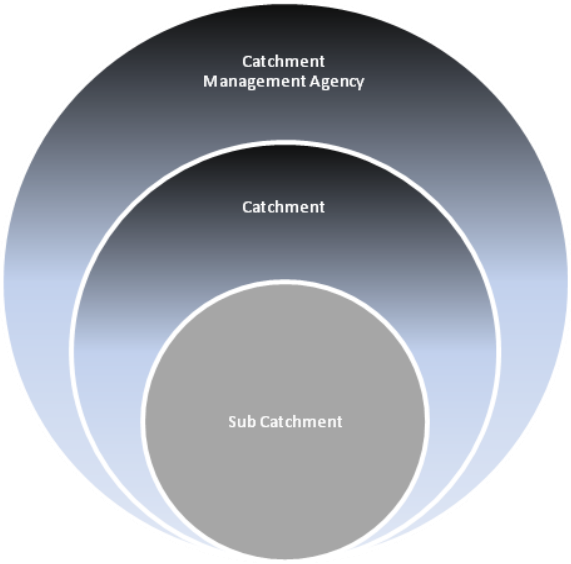

Figure 6 Illustration of a naturally formed catchment that is clustered to form a catchment management agency (CMA)

Integration across boundaries

Transboundary integration can be the solution to the water assessment challenge currently faced in South Africa (Tempelhoff *et al.*, 2011a: 92). Integration is a core feature of transdisciplinary research. In the course of the twentieth century, crossing boundaries between disciplines and research became a feature of good scientific practice. Terms that cannot be neglected when one is discussing integration over boundaries include “interdisciplinarity; crossdisciplinarity: transdisciplinarity; holism; scientific integration; unity of knowledge; boundary crossing; mutual learning; and scientific nomadism” (Pohl *et al.*, 2008: 412). Because of the multiple functions environmental health practitioners undertake, they have to deal with many scientific and societal opinions and problems. Transdisciplinary research can integrate all these diverse views and challenges and come up with effective solutions (Pohl *et al.*, 2008: 414).

Officials in the water sector have an ongoing need to specialise and simultaneously they must integrate areas of specialisation. There is an increasing interdependence between human endeavour in the water arena and this leads to healthy debate and the expression of differences of opinion between stakeholders. Active pursuance of integration allows for “reconciling

conflict through an interest-based rather than a rights-based paradigm of bargaining" (Dent, 1998: 1).

It is important to note some myths about integration in order to understand exactly what is meant when using the term. Dent (1998: 3) corrects some corrections to myths about integration when he explains that integration:

- is neither easy nor painless;
- is something that "does not result in a wishy washy 'bland average'";
- is not a process that will leave individual and organisational behaviour unchanged;
- does not seek to avoid conflict;
- will not lower scientific standards;
- cannot be achieved without practice; and
- is something that does not necessarily seek the answer, but will elicit a range of opinions.

It is simply impossible to define integration in one science, but it is important to understand what integration really entails. The easy way of getting clarity on the term "integration" is to note some of its characteristics. To quote directly from Dent (1998: 3–4), he characterises integration as follows:

- integration can be compared to the creation of a salad in which the identity of individual ingredients is preserved yet simultaneously transcended;
- the word "integrity" comes from the verb "to integrate";
- genuine integration is characterised by integrity;
- integration is the opposite of compartmentalisation;
- integration that we enable ourselves to fully experience the tensions of conflict;
- integration seeks to reconcile conflict;
- integration requires the capacity to discern the presence or absence of integrity'

- integration requires that we transcend barriers to communication; and
- integration is a process which enables people to "live with" paradox and ambiguity.

For environmental health services to effectively integrate water quality assessment strategies across boundaries will require "a level of interaction between individuals, disciplines and organisations" in order to "collectively, wisely, timeously and cost effectively" address the consequences of the "past, present and proposed future actions" (Dent, 1998: 4).

The challenge in South Africa is to enable organisations, government institutions and scientific disciplines to create a "measure of interrelatedness" in order "to better understand the biological world" (Dent, 1998: 1). Because of the spontaneous interaction between man and nature it is necessary to adopt a pragmatic attitude and arrive at a point where the objective of all role-players is to respect the natural boundaries and work together (collaborate across administrative boundaries) to solve water related challenges in South Africa (Tempelhoff *et al.*, 2011: 7). If the relevant role-players are given the freedom to cooperate and are not restricted by administrative boundaries and policies, interaction can be established to address water quality challenges successfully (Tempelhoff *et al.*, 2011: 7).

Dent (1998: 3) refers to "cooperative governance and integration that are not only policy matters, but also constitutionally mandated". It is the opinion of the researcher that there are three important pieces of legislation in South Africa that not only encourage transboundary integration of water quality assessment but are also legally supportive of such collaborative governance. These are (1) the Constitution of the Republic of South Africa Act 108 of 1996; (2) the Intergovernmental Relations Framework Act 13 of 2005; and (3) the National Water Act 36 of 1998.

The 1996 Constitution includes three basic principles that have a bearing on the meaning of cooperative governance and intergovernmental relations. Firstly, it requires that all spheres of government and all organs of state must

cooperate in “mutual trust and good faith” by coordinating their actions and legislation. This means that all spheres of government (national, provincial and local) must be committed to the wellbeing of all South Africa’s residents and must provide an effective, transparent, accountable and coherent governance. Secondly, the distinctiveness the three spheres of government must be safeguarded. This implies that the constitutional status of government institutions (eg. local and district municipalities) and their powers and functions must be respected, and that these institutions are bound to act within their constitutional powers. It is important that when they are exercising these powers they may not interfere on the geographical, functional and institutional integrity of another sphere of government. Thirdly, all three spheres of government must take the necessary steps to make cooperative governance a reality (Layman, 2003: 9).

The Intergovernmental Relations Framework Act 13 of 2005, Article 28 (1) provides for two or more municipalities to establish an inter-municipal forum to promote and facilitate intergovernmental relations. At such a consultative forum participating municipalities will be afforded the opportunity to discuss matters of mutual interest such as:

- information sharing, best practice and capacity building;
- cooperation on municipal developmental challenges affecting more than one municipality; and
- any other issues of strategic importance which affect the interests of the participating municipalities and the wellbeing of its residents.

While environmental health practitioners are in a sense restricted by administrative boundaries, the National Water Act 36 of 1998 is another tool that justifies the crossing of demarcated boundaries for the purposes of collaboration. The 1998 Act provides for the minister to establish catchment management agencies (CMAs). Such a catchment management agency is not dictated by administrative boundaries but by catchment (i.e. natural) boundaries. The functions of catchment management agencies include advising interested persons on the protection of water; the development of a

catchment management strategy; and to promote community participation in the projection, use, development, conservation, management and control of the water resources in its water management area.

As already discussed in Chapter 2, the environmental health practitioner plays a key role in the management and control of water resources by means of the water quality monitoring function as determined by the National Health Act 61 of 2003. As a stakeholder in integrated water resource management, the environmental health practitioner has to be involved in the activities of a catchment management agency. This means that he/ she must be a member of the catchment management forum which is also based on a geographical area with natural boundaries (e.g. surface water divide) rather than manmade administrative boundaries. In Fezile Dabi District Municipality the natural and administrative boundaries differ; they do not run concurrently.

The management of Fezile Dabi District Municipality has already granted its environmental health practitioners permission to attend catchment management forum meetings applicable to their area, irrespective of where these meetings take place. The only proviso is that attendance at these meetings must contribute positively to the environmental health practitioners' legal mandate, namely water quality monitoring. In one instance they travelled as far as Bethlehem in the Thabo Mofutsanyane District Municipality, a neighbouring municipality to the southeast of Fezile Dabi District Municipality, to attend the meetings of the Wilge River Catchment Forum.

Figure 7 is a grounded theory illustration showing how it is possible to move ahead with a collaborative initiative once the smaller cogs of the wheel interlink and begin to operate smoothly together. Even if the smaller entities, by nature, initially tend to turn in the opposite direction, they ultimately gather momentum and begin to turn the large cog in the appropriate direction – as prescribed by nature.

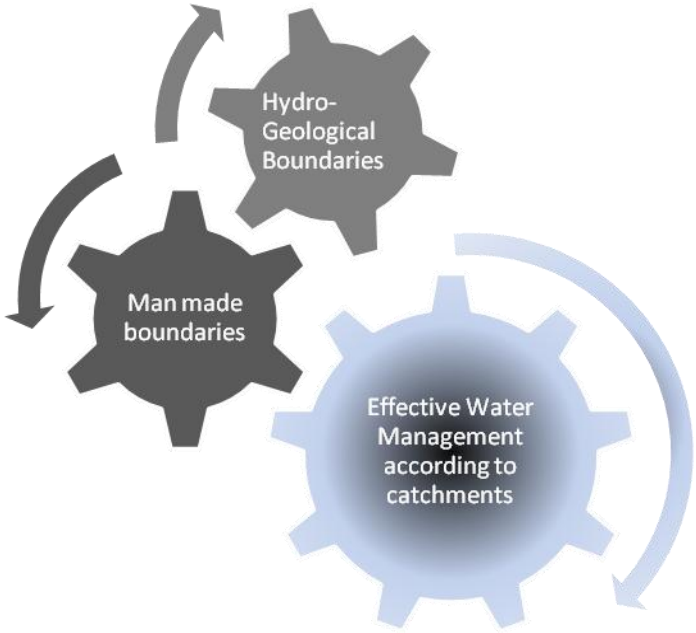

Figure 7 Social learning as a key element in the transboundary integration of water quality monitoring (Diagram developed by author)

For environmental health practitioners who are motivated to integrate successful water quality monitoring programmes across boundaries, it is always important to consider natural, social, economic and political environments. Their involvement in integrated water resource management will help them in achieving this because they will be in contact with various role-players in the water business. Thompson (2006: 162) defines integrated water resource management as follows:

> A process which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. It aims to strike a balance between the use of resources for livelihoods and conservation of the resources to sustain its functions for future generations and promotes social equity, environmental sustainability and economic efficiency. A balanced mix of technological and social approaches should be used to achieve this.

Thompson (2006: 163) also supports the necessity to follow an integrated approach in South Africa because of the interrelatedness and complexity of the different water resources management functions in our country. Chapter 4 of this study will discuss a possible model that will ensure an effective platform where water assessment can be addressed to the satisfaction of environmental health professionals.

Standardisation of water quality assessment strategies

In order for one to collaborate effectively and integrate water quality assessment across boundaries it is important that standardisation be kept in mind to prevent uncertainty and confusion. In practical terms this means that integration will require of stakeholders to develop standardised operational policies and procedures in making transboundary water quality monitoring a reality. It will be necessary to standardise water quality monitoring strategies which will include, for example, standardised objectives, activities and operational procedures; communication and reporting strategies; key performance indicators to measure success; public participation; and mitigation measures where risks are detected during the assessment process (FDDM, 2011a). Integration and standardisation proceed hand in hand.

Social learning

In the process of integrating water quality assessment programmes and projects, social learning will necessarily feature. In response to Pahl-Wostl (2006), Reed *et al.* (2010. Date of access: 2 September 2011) suggest that social learning is becoming an increasingly important normative goal in natural resource management and is a means for managers to face issues of uncertainty. Reed *et al.* (2010 Date of access: 2 September 2011) go on to provide a clear conceptualisation of social learning, which they see as:

- a change in understanding;
- learning that is situated within wider social units or communities of practice: and
- learning through social interaction.

Reed *et al.* (2010) claim that the concept "social learning" must be distinguished from the actual "conditions" or "methods" that may facilitate social learning. Some of the conditions and methods are stakeholder participation and the potential outcomes of social learning processes. To quote them directly, they further maintain that if one claims something to be social learning it must:

> - demonstrate that a change in understanding has taken place in the individuals involved. This may be at a surface level, e.g., via recall of new information, or deeper levels, e.g., demonstrated by change in attitudes, world views or epistemological beliefs; and
> - go beyond the individual to become situated within wider social units or communities of practice within society; and occur through social interaction and processes between actors within a social network, either through direct interaction, e.g., conversation, or through other media, e.g., mass media, telephone, or Web 2.0 applications.

Reed *et al.* (2010) conclude their response to Pahl-Wostl (2006) by defining social learning as:

> A change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks.

It is from this background that it becomes evident that social learning forms a key component in the transboundary integration of water quality monitoring through the application of transdisciplinary methodologies.

Another premise that presents itself is that "transdisciplinary methodologies" play an important role to "create a sense of social knowledge in the process of working towards a system of collaborative integrated water quality assessment across municipal, district and provincial boundaries" (Tempelhoff

et al, 2011: 8). In the process a better understanding is created on transformative knowledge formation. In supporting the findings of Reed *et al* (2010), Tempelhoff *et al.* (2011: 8-9) single out three reasons for this:

- throughout the research process it should be possible to observe the change in understanding that takes place in the minds of individuals participating in the learning process;
- from experience it is apparent that in projects where transdisciplinary research strategies were followed the changes in understanding relevant issues went well beyond individual participants and ended up within wider communities and practices; and
- transdisciplinary methodology of research also relies on social interaction and processes between actors in the research.

All stakeholders (novices and specialists) play a major role in the transdisciplinary method of integrating water quality assessment processes. All of them learn from each other during a transdisciplinary research project. In the end, a common understanding of the topic as well as appropriate solutions will be apparent among the stakeholders. “We are seldom left unaffected or un-influenced after interacting with each other, both in an individual encounter and as a group” (Tempelhoff *et al.*, 2011: 9).

Educational needs in environmental health

At the time of conducting transdisciplinary research in Moqhaka Local Municipality (one of four local municipalities in the Fezile Dabi District Municipality) two members of the CuDyWat research team focused on the education aspects of environmental health and the aquatic environment. Their brief was to identify whether there was a “need for water related hygiene education in the school environment”. As Tempelhoff *et al*. (2011a: 82) put it:

> It is accepted that hygiene education, using a variety of participatory and other learning methods, should enable schoolchildren to develop the knowledge, attitudes and life skills they need for adopting and maintaining a healthy lifestyle, particularly with respect to water, sanitation and hygiene

Discussions amongst researchers in the Moqhaka project revealed that environmental health education is a necessity in the community as a whole. Some respondents told members of the research team that “they had never received any education about environmental awareness of water”. Nor is the need for education confined to hygiene; there is a wide range of water knowledge needs that should be imparted to school children (Tempelhoff *et al.,* 2011a: 82–83).This is a clear indication that as part of the planned transboundary integration of water quality assessment initiative by Fezile Dabi District Municipality, provision must be made to meet the training needs of residents.

Throughout the compilation of a collaborative strategy, it should be borne in mind that the interests of all role-players in water related issues must be carefully considered. Failure to meet this requirement might lead to an oversight, resulting in the failure or collapse of parts of an integration strategy.

Interest based bargaining

In the process of using transdisciplinary methodology to establish a collaborative transboundary integrated water quality assessment strategy, interest based bargaining is an important aspect and needs to be properly managed. According to Majka (2000: 37) interest based bargaining is a negotiation process that originated with the Harvard Negotiation Project. This method of bargaining is perhaps best explained by Roger Fisher, the director of the Harvard Negotiation Project, who titled one of his books *Getting to Yes.* In this book, Fisher proposes that through the process of interest based bargaining, agreements can be reached which will meet the needs of all relevant parties.

Majka (2000: 37) relates a simple story to explain the importance of determining the interests and concerns of all parties involved in a project. In doing so, he shows how working from this basis, solutions can be found that will serve all participants:

> Two children were arguing over an orange. Finally the parent reached a compromise for both of them by simply cutting the orange in half and giving each of the children half of the orange. The girl peeled the orange and threw away the fruit saving the peel to use in a cake she was making. The boy, however, peeled the orange, threw the peel away, and ate the fruit. Obviously, the better solution, if both of the parties' interests had been identified and met, would have been for the girl to receive all the peel, since baking the cake was her primary interest; and the boy to receive all the fruit because he simply wanted to eat an orange and had no use for the peel. Such is the nature of compromise at times in negotiations – the result can be that neither party gets what it wants.

The objective of this study is to develop a collaborative transboundary integrated water quality monitoring strategy for Fezile Dabi District Municipality, its neighbours and relevant government sector departments. This will open many avenues of communication, making it possible to address and resolve, on a sustainable basis, their areas of interest and their concerns. It is of the utmost importance to keep track of the real needs of all stakeholders throughout the collaboration process. This is because in practice, wrong perceptions and interpretations of each other's needs, roles and responsibilities, can arise and may negatively influence the integration process. As the story of the orange shows, if due consultation takes place between all relevant parties, the outcome can be a win-win situation.

Conclusion

The need exists to generate more reliable data on the quality of water resources in South Africa. This will enable the environmental health practitioner to access the water quality situation in their working areas more effectively. There is also a willingness amongst stakeholders to use transdisciplinary strategies to acquire optimum insight. Transboundary collaboration was initiated by Fezile Dabi District Municipality for the implementation of a water quality assessment system. "The weft of water and the warp of scientific technologies, aimed at working in the interest of a

regional society make a great deal of basic sense" (Tempelhoff *et al*. 2011: 15). Appropriate responses to all the complex changes in the environment, especially the hydrosphere, became a necessity. "Addressing emergent problems requires a holistic approach; a pragmatic sense of assessment should lead to an awareness of potential strategies" that will provide solutions. The introduction of an appropriate transboundary water quality assessment system would appear to be the ideal point of departure (Tempelhoff *et al*. 2011: 15-16).

Chapter 4 aims at the development of a practical and workable strategy and model between Fezile Dabi District Municipality, its neighbours, and relevant government sector departments to give effect to intergovernmental relations and cooperative governance in accordance with the existing legal mandate.

Chapter 4

The ideal organisational structure and methods to optimise effective water quality monitoring between Fezile Dabi District Municipality and its neighbours

Introduction

In the latest Environmental Performance Index (EPI), South Africa is ranked an unimpressive 128th out of 132 countries (Yale University, 2012).South Africa is recognised as one of the countries with the fastest rate of environmental decline. It is held by some that although South Africa has some of the most progressive environmental legislation, the implementation of this legislation is inadequate (WESSA, 2012. Date of access: 11 April 2012; Rogers, 2012: 6). On the other hand, the South African government has allocated R9million for a "hospital facelift" project in the Eastern Cape Province (Rogers, 2012: 6). This would seem to reflect that the South African government is more focused on curative than preventative health care. Certainly the question can be asked: Would it not be a better decision to spend R9million on improving the state of the environment than on "hospital facelifts"? There is an adage in environmental health circles that the more that is spent on preventative health (environmental health) the fewer patients there will be in clinics and hospitals.

Throughout this study, reference has been made to transdisciplinary research methodology as a tool that can enhance the level of environmental health services by developing a collaborative transboundary water quality assessment strategy. This chapter provides more detail on transdisciplinary research methodology and transdisciplinary case studies as a means of sustainable learning. A theoretical overview will be provided by discussing some basic concepts, including: ontology; epistemology; methodology; project management; and validity. In addition, detail will be given on the current status and challenges in the case of Fezile Dabi District Municipality which will

provide some guidelines on how the theoretical concepts under discussion should be integrated into the proposed transdisciplinary strategy on transboundary water quality.

The approach in this chapter is to discuss existing platforms for environmental health practitioners in their respective municipalities and provinces. Underpinning this is the research objective which is to develop and implement the organisational structure required to optimise effective water quality monitoring between Fezile Dabi District Municipality and its adjacent district municipal and provincial authorities.

Fezile Dabi District Municipality spends a considerable amount of money, energy and other resources on community awareness projects addressing the prevention of environmental pollution. In what is believed to be the first of its kind, the municipal health services division of the municipality held a workshop on 28–29 March 2012 to focus on “environmental health services in the context of intergovernmental relations”. The initiative had its origins with environmental health practitioners on the operational level who regularly experience the need for transboundary cooperation to address a variety of municipal health services challenges. Thus far, some municipalities and provinces have done a great deal to ensure cooperative governance and the implementation of the Intergovernmental Relations Framework Act 13 of 2005 on strategic management level. However, on the operational level much remains to be done.

At the workshop, environmental health practitioners from Fezile Dabi District Municipality in collaboration with officials from neighbouring district municipalities and relevant government sector departments, succeeded in developing a structure on how to work together to improve on prevention techniques and thus ensure a better life for all. The proposed structure that was developed at the workshop, along with certain theoretical pointers, will potentially ensure coordinated, effective and transparent transboundary service delivery in respect of water quality monitoring. For the purposes of this study the focus will fall on what was discussed and agreed upon in the “water quality monitoring discussion group” and the proposed way forward. Special

attention must be on transdisciplinary research; transdisciplinary case study (TCS) theory; and the systems model concept. All are valuable tools for addressing problematic water quality challenges in communities throughout the country.

Transdisciplinary research: finding solutions to the challenges

Transdisciplinarity is a relatively new field of investigation that emerged at the end of the twentieth century when scientists discovered new forms of knowledge outside and beyond the confines of the academe (Hirsch Hadorn *et al.*, 2008: 20). Knowledge is everywhere. De Beer (2007: 228) proposes that "all human beings" are equipped with some form of intelligence, regardless of who they are. De Beer refers to Pierre Lévy who once said that:

> No one knows everything, everyone knows something, and all knowledge resides in humanity …. If you are tempted to judge someone as ignorant, look for the context in which his knowledge can be turned into gold.

Transdisciplinary research has another advantage. Practitioners of the method claim that it is able to solve problems that are in the real and actual world, rather than in the head and therefore the conceptual world (Hirsch Hadorn *et al.*, 2008: 19; Wickson *et al.*, 2006: 1052). First and foremost this form of research involves civil society; unless the affected population is involved in problem solving, the chances are good that measures and their outcomes will be rejected or ignored (Hirsch Hadorn *et al.*, 2008: 26). Participation in several transdisciplinary research projects has convinced the writer that this method of research has the potential to solve water quality related challenges in South Africa (Tempelhoff, *et al.,* 2008; Gouws *et al*., 2009; Tempelhoff *et al.*, 2011; Tempelhoff *et al.*, 2011a; and Bertram *et al.*, 2011).

In an effort to define "transdisciplinarity", Tempelhoff (2011b: 2) points out that to define transdisciplinarity is not the easiest of tasks. He refers to Christian Pohl, one of the leading proponents of transdisciplinarity, who said:

> If and when one looks under ‘Transdisciplinarity’ in Wikipedia, the chances are that the existing definitions will not be the same by the next time one visits the specific website.

Fortunately, there are a few definitions of “transdisciplinarity” in the literature that is less subject to rapid transformation. Dictionary.com (2012) refers to transdisciplinary as: “Pertaining to or involving more than one discipline; interdisciplinary”, while Baumgärtner *et al.* (Tempelhoff, 2011b: 2) suggest that “transdisciplinarity can be considered to be the interconnection of science and society”.

In a somewhat broader explanation, Tempelhoff (2011b: 2-3) cites Thompson Klein, who explains that transdisciplinarity is

> the interconnectedness of all aspects of reality that transcend dialectics and synthesis in the direction of getting to an understanding of the total dynamics of reality.

In drawing a distinction between interdisciplinarity and transdisciplinarity one can say that interdisciplinarity implies that “researchers from different disciplines use their methodologies, techniques and skills to address a common issue” and “focus on the relevance of the research per se", while transdisciplinarity “aims at finding solutions to existing real world problems” (Tempelhoff, 2011b: 3).

The writer is in agreement with Hirsch Hadorn *et al.* (2008: 29) who spotted four core concerns in definitions of transdisciplinarity. First, its focus is on “live-world problems”; second, it takes the “transcendental and integrationist” approach to disciplinary paradigms; thirdly, it involves “participatory research”; and fourthly, transdisciplinarity aims at ensuring that “knowledge unites”, literally and metaphysically, beyond the confines of disciplines (Hirsch Hadorn *et al.*, 2008: 29). For this reason the transdisciplinary approach can be used as a tool to solve current water quality-related problems.

Before an attempt can be made to explain the phases in the execution of a typical transdisciplinary research project, as proposed by Tempelhoff (2011b: 12–20) it is necessary to define methodology and to determine if there really is a specific methodology of transdisciplinarity.

The word “methodology” is derived from the Latin words *meto* and *logia*. In essence these words have a bearing on “harvesting, gathering, cutting (weeding) and a sense of logical interactivity”. Based on this, it is possible to describe methodology as a “time proven technique” for identified tasks in the effort to realise specific objectives (Tempelhoff, 2011b: 8–9).

The *Free Dictionary* (Date of access: 17 March 2012) explains “methodology” as:

> A body of practices, procedures, and rules used by those who work in a discipline or engage in an inquiry; a set of working methods. The study or theoretical analysis of such working methods.

The dictionary goes further in a usage note, explaining that:

> Methodology can properly refer to the theoretical analysis of methods appropriate to a field of study or to the body of methods and principles particular to a branch of knowledge.

Tempelhoff (2011b: 9) uses the Macmillan *Dictionary of the History of Science* which defines methodology from a natural science point of view:

> The theory and method of the rules and evaluations that should govern (or do govern) the interaction of evidence, argument, and hypotheses, particularly in the empirical realm: sometimes the system of rules itself.

Furthermore, Tempelhoff (2011b: 9) claims that there is currently a tendency to take a broader view of what methodology entails. His opinion is based on an explanation by Clough and Nutbrown that methodology is the “entire process undertaken by the researcher”, which becomes evident from the “persuasive” study that is produced. Other scholars are in agreement that

there is no specifically prescribed methodology for transdisciplinary research because of its constantly evolving characteristics (Wickson *et al.*, 2006: 1049; Tempelhoff, 2011b: 9).

Tempelhoff (2011b: 10) is of opinion that any method is acceptable, provided that "it can be accounted for in a reasonable, systematic and comprehensible way". Transdisciplinary methodology is thus an interactive evolving process (Wickson *et al.*, 2006: 1049). It goes beyond the linear application of a static methodology. The objective in transdisciplinary terms is to come to an understanding of the real issues and challenges and to transfer the problem into a non-problem. Tempelhoff (2011b: 10) refers to a string of pearls in his explanation of how one can go about performing this complex series of activities.

> The string, which in the early phase of formation can be fragmented in short pieces, becomes knotted together with pearls. The pearls are then little miracles of understanding that enable us to get a continuum of what transpires in reality. It then stands to reason that the manner in which we create the extended string will be in terms of a specific methodology. What at first is an experimental procedure in appropriate knotting becomes a skill that although unique with every knot that is tied, becomes a systematic process that can only be appreciated (like a Persian carpet) for the unique characteristics and imperfections in the creation of a sense of the whole.

Since 2008, Fezile Dabi District Municipality, in partnership with North-West University's research niche area for the cultural dynamics of water (CuDyWat) based at the Vaal Campus, Vanderbijlpark, has used transdisciplinary research to document water and sanitation related problems and to recommend solutions to the identified problems and challenges. The research team has also compiled detailed reports on each project to present its results (Tempelhoff *et al*., 2008; Tempelhoff *et al*., 2011; Tempelhoff *et al*., 2011a). These projects and the reports are presented to students at NWU in an informative series of lectures (Tempelhoff, 2011b: 1–21).

Figure 8 Members of the CuDyWat research team consult a map in the Moqhaka Local Municipal area. (Photograph AS van Zyl)

Phases in the execution of a typical transdisciplinary project

Seven phases are followed when CuDyWat conducts a typical transdisciplinary research project (Tempelhoff, 2011b: 12–20). Each is discussed below in some detail as applied to the specific transboundary initiative in Fezile Dabi District Municipality and its neighbours as outlined in this study.

- Identifying the problem

The *South African Pocket Oxford Dictionary* refers to a "problem" as something that is difficult to deal with and is difficult to understand (2006: 710). Of course, what one person might see as a problem is not necessarily a problem for somebody else (Pohl, 2010: 80). Problem identification and structuring in a transdisciplinary context requires involvement of all researchers and actors to understand the exact nature of these problems (Hirsch Hardon *et al*., 2008: 35).

Due care should be taken and a well-focused approach adopted to define the issue once a problem or challenge has been identified for research. The focus should not be too wide or too narrow. A project with too wide a focus can become swamped with excessive detail that cannot readily be harvested for relevant information by those who read the research findings. If the focus of the research is too narrow it may be incomplete and fail to deliver significant solutions. The problem must, therefore, be defined in such a manner that it will ensure a "balance between content and focus" (Tempelhoff, 2011b: 12). Equally important is the correct identification of the water and sanitation related problems in our communities; this requires a well-informed, systematic formulation of the problem. With this in mind, a collaborative water technical committee formed by Fezile Dabi District Municipality's municipal health services division and Ngwathe Local Municipality has undergone a significant name change. Originally it was called the Ngwathe/Fezile Dabi water technical committee, but because of too wide a focus, the name is now the Ngwathe/Fezile Dabi water quality and waste management technical "elephant approach" committee (FDDM, 2012a).

- Search for and consolidation of the necessary source materials (heuristics)

For the entire duration of the project, researchers are given the opportunity to discover and to learn. They are collecting information relevant to the research that is undertaken. This process is called heuristics (*South African Pocket Dictionary*, 2006: 420–421; Tempelhoff, 2011b: 12).

A variety of sources must be consulted for relevant information. Initially, the focus should be on "broad-based sources". It is important for researchers to read as much as possible on the area and the problem in order to equip themselves with in-depth baseline knowledge and understanding of the task ahead. Over a period of time, researchers gradually hone in on the problems and challenges that have been collectively identified and outlined. No information must be seen as unimportant until it has been closely examined. Furthermore, researchers should keep a systematic archive with primary and

secondary sources ordered alphabetically or chronologically. All information gleaned is categorised as “sources” (Tempelhoff, 2011b: 13).

- Classification of the sources

Primary sources are identified by Tempelhoff *et al.* (2011a: 95–97) as the “individual pieces of information collected or created” before, during and after the research. Some examples of primary sources are notes made while conducting interviews; digital voice recordings of oral interviews and meetings; photographs taken during the research process; email communication between researchers and respondents; and agendas and minutes of meetings (Tempelhoff, 2011b: 13).

Secondary sources, according to Tempelhoff (2011b: 14), are sources of which there are many duplicates available. Examples of secondary sources are “theses and dissertations held in libraries; books; academic journal articles; and even newspaper clippings” (Tempelhoff, 2011b: 14).

Distinction between primary and secondary sources: A common but relevant distinction between primary and secondary sources is that “secondary sources deal with information that has already been synthesised from primary information”. “Analysis and/ or interpretation have been undertaken on such sources”. This means that the information will once more be analysed or interpreted from another point of view by another researcher (Tempelhoff, 2011b: 14). In the case of primary sources, it is up to the researcher to interpret or analyse the information so that it makes sense in the context of the specific research project that is under investigation.

- Critical contemplation of the available information

To contemplate is to look at something thoughtfully; i.e. to think about it critically, intelligently and at length (*South African Oxford Pocket Dictionary*, 2006: 186). It is crucial for any researcher to develop the skill of critical thinking. The sources must be closely examined to narrow down the focus on the particular problem. The more critically a researcher deals with available

information, the more “new questions” will come to mind, and the more “new frontiers of transdisciplinary research” will open (Tempelhoff, 2011b: 17-18).

- Interpretation/ analysis of the information

Interpretation of information is the way the researcher explains and assesses the meaning of the information collected (*South African Oxford Pocket Dictionar*y, 2006: 471; Tempelhoff, 2011b: 27). As for “analyse” and “analysis”, according to the *South African Oxford Pocket Dictionary* (2006: 27) this is:

> To examine (something) in detail so as to explain it or to find out its structure or composition; a detailed examination of the elements or structure of something; and the separation of something into its component parts.

Tempelhoff (2011b: 18) explains interpretation as “the opportunity we have in the construction of text to represent in words the ideas one has when evaluating or contemplating the available sources”. Tempelhoff goes on to elaborate that interpretation is at the heart of hermeneutics, which has a bearing on:

> The process where we see the “truth” as it registers in our deepest understanding of the problem under scrutiny. It also enables us to describe and then outline solutions.

Tempelhoff (2011b: 18) argues that “analysis” is to some extent similar to “interpretation”. Analyses is more focussed on real world issues in a more realistic context. Analysis is more relevant to quantitative information. There is no doubt that interpretation and analysis go hand in hand with reading and writing. Although analysis is “contemplative” it is also “part of the process in which sources are transferred into words and sentences that address the reader of the text” (Tempelhoff, 2011b: 18).

- Compilation of a narrative discourse (first version)

Tempelhoff (2011b: 19) uses the format of a written report to present the outcome of a transdisciplinary project. He is of opinion that such a report can be in various forms. In the case of a written text, it is "based on reliable sources and the original insight of the researcher". In essence one is dealing with a "narrative discourse".

> A narrative discourse is a rough guideline for comprehending the centrality of an issue. However, comprehension is variable and directly linked to the human condition as it finds itself in time and space when and where the information is transmitted (Tempelhoff, 2011b: 19).

- Final (second) report

As far as it is humanly possible, the final report must be close to perfect. This means that the language must be easy to understand, sensible and without typing errors. The involvement of a professional language editor for final editing and corrections is crucial (Tempelhoff, 2011b: 20). It is important for the writer of the transdisciplinary report to aspire to working to the above standard of thoroughness.

Transdisciplinary case studies: a means of sustainability learning

Scholz *et al.* (2006: 226) were among the first scientists to provide a sound overview of applying transdisciplinary case studies (TCS) as a means of conducting research for sustainability learning. They refer to environmental sciences and technology management as "prototypical examples that require dealing with complex, multi-scale and multi-layered systems, which also include knowledge from a broad spectrum of disciplines". Problems and challenges nowadays are not as simple as they used to be. Building a bridge to connect two ends is a good example of an action that involves major "social, economic and environmental impacts". It is imperative that the impact of the planned action(s) is considered when taking decisions. Scientists must,

therefore not only cooperate with other disciplines but also work in a transdisciplinary manner.

There is a relation between transdisciplinarity and case studies. For decades, case studies have been used for teaching and research. Transdisciplinary case studies are a powerful tool for research and teaching that involve complex environmental issues (Scholz *et al.,* 2006: 227–228). Therefore it is necessary to interlink transdisciplinary research methodology and transdisciplinary case studies in an effort to solve water quality related challenges. Scholz *et al.* is of opinion that the more complex and contextualised the problems are, the more valuable the case study approach becomes.

According to Scholz *et al*. (2006: 229), the transdisciplinary case study approach has certain characteristics:

- its design type is embedded;
- motivation is intrinsic;
- the epistemological status of a transdisciplinary case study is descriptive;
- the purpose of the transdisciplinary case study approach can be for research, teaching and action/ application;
- normally the case format is unstructured or unstructured for ground breaking;
- the synthesis is formative method driven; and
- the science type is transdisciplinary.

Two basic concepts underpinning the transdisciplinary case study approach are sustainable development and transdisciplinarity (Scholz *et al.*, 2006: 231).

Extensive attention is given to the explanation of sustainable development in the Brundtland Report (1987) entitled “Our Common Future”. This document played an important role in our understanding of the concept of sustainable development (Cronjé, 2008: 4). Cronjé (2008: 2) explains:

> Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable development is a “problem field that presents both practical and conceptual challenges”. The case study approach is, therefore, ideal to treat sustainable development challenges. Sustainable development is not a fixed concept but requires an on-going inquiry process” (Scholz *et al.*, 2006: 231).

The concept transdisciplinarity evolved from “complex, socially relevant problems” that called for the “integration of knowledge of science and society”. Many of these issues are relevant for sustainable development. Scholz *et al.* (2006: 231) maintain that a transdisciplinary approach is required during education and awareness processes. The inherent value of transdisciplinarity is its potential for “producing, integrating and managing knowledge in technological, scientific, and social areas”.

Against this background it is clear why transdisciplinary research and a transdisciplinary case study approach are such useful tools in addressing diverse and complex water quality problems caused by human activities and societal interaction.

Scholz *et al.* (2006: 231) suggest that ontology, epistemology, methodology, project management, and validity underpin transdisciplinary research and teaching. These elements are all interdependent.

Ontology

Ontology attempts to answer the question on what type of problem/ phenomenon/ case one is dealing with in a specific research project. It explains the basic categories of issues and their interrelation. The type or nature of the phenomenon/ problem/ case a researcher is dealing with in transdisciplinary case study normally becomes evident by an ontological enquiry (Scholz *et al.*, 2006: 233).

In this research the writer is familiar with the Fezile Dabi District Municipality as well as the adjacent district municipalities and the problem of water quality (ontology). However, the researcher is approaching the problem from an environmental health management point of view in an effort to create cohesion among everyone involved in water quality monitoring (epistemology).

Epistemology

An Australian educational consultant and freelance writer, Sithambaranathan Prithiviraj (Prithiviraj, 2008. Date of access: 25 March 2012) refers to epistemology as:

> The types and levels of proofs. In sociological knowledge higher level(s) of proofs are necessary to accept something is true. The proofs can be based on trust, faith, personal experience, logic and empirical evidence.

Scholz *et al.* (2006: 233) propose epistemology to be:

> The science of generating, integrating, and using knowledge with special focus on structure, scope, biases, validity, etc. as well as cultural, social, and individual differences.

They further stress the essence of conducting a study by referring to an "appropriate epistemological framework to segregate and integrate pieces of knowledge that has been acquired". The normative and the systemic sphere are two spheres of corresponding epistemologies involved in the transdisciplinary case study approach.

Scholz *et al.* (2006: 234) are of the opinion that "the normative processes are based on the fundamental, partly subconscious preferences and value structures of the involved agents from science and society". They further highlight the importance that these values and preferences be unfolded (brought out into the open) and to make them transparent. An open discourse will then exist among the different groups.

"The systemic sphere is hierarchically structured in three epistemics". The three epistemics are interrelated. The uppermost level of the three is referred to as the "case understanding". The "conceptualisation" of the case forms the second level of the hierarchy, and the third level is the "analysis" of the case facets (Scholz *et al.*, 2006: 236).

Probabilistic functionalism as an epistemological framework

To cope with complex contextualised problems requires an answer to the question:

> How can we manage to accomplish an appropriate/ proper/ reasonable/ acceptable/ adequate/… solution for complex, ill-defined problems? (Scholz *et al.*, 2006: 236).

The probabilistic functionalism developed by Brunswik provides a useful framework. Brunswik's Lens Model provides a "basic representation of the probabilistic functionalism". Because this mini-dissertation is not the right document to deal with the question in detail, only passing reference is made to the four basic principles of the Brunswik Lens Model that should be considered. These are: "functionality; vicarious mediation; probabilistic relation of information acquisition and integration; and functional, evolutionary optimisation of performance" (Scholz *et al.*, 2006: 236).

By way of summary, "the epistemological framework of probabilistic functionalism helps to translate basic epistemological considerations into a corresponding methodology". Transdisciplinary case study methodology as described by Scholz *et al.* (2006: 237) is "designed along the principles of probabilistic functionalism" and the Brunswik Lens Model forms the basis of the methodology that is applied.

Methodology

Although the term "methodology" has already been discussed quite extensively in this chapter, it is important to consider methodology and how it is applied as an important aspect of the transdisciplinary case study

approach. In this context, the term methodology is conceptualised as: “A set of principles of methods and procedures developed and elaborated to tackle problems” (Scholz *et al.,* 2006: 238).

The probabilistic functionalism and the related Lens Model are core in transdisciplinary case study methodology which makes use of a “backward planning” and “forward operating” process. All forward operations are executed with respect to the concept of “backward planning’”. This means that they are determined by the defined goals and steps that have already been put in place. “Backward planning” in essence means that steps in a project are generally approached from “the end to the beginning” before starting the process of “forward operating”. “Backward planning” ensures that projects are “goal orientated” and that there is “functional interplay between the different analytical steps” (Scholz *et al.*, 2006: 239).

Project management

The means by which projects are managed and change is achieved are known as project management. Achieving something unique such as a specified goal requires a specific intervention. The achievement can be in the form of products and/ or services and can only be achieved if something extraordinary is done. Routine tasks, for example, cannot be regarded as projects. Project management assists and ensures movement from a current, specific situation to a desired position (Fox and Van der Waldt, 2007: 5).

More focused on transdisciplinary case study, Scholz *et al.* (2006: 242) explain project management as:

> The purposeful application of different techniques, tools, and methods for efficiently and effectively utilising existing skills and knowledge in order to meet the requirements of a certain project. Hereby, both procedural and organisational aspects play an essential role.

A general procedural project plan and a general organisational setting form the framework of the transdisciplinary case study approach. There are three

major phases in the procedural project plan: the “preparation” phase; the “project work” phase; and the “elaboration and documentation” phase (Scholz *et al.*, 2006: 242).

Backward planning plays an essential role in the first phase, because the general framework for the project is defined here. “The selection and definition of the case to be analysed; the establishment of the transdisciplinary agent network; and the development of a written project concept” are all included in the first phase. The actual conduct of the project (as outlined in the discussion on project management) is the second phase. The “results of the project are elaborated and documented” in the third phase. Follow-up projects that can transpire from the primary project depend on the results of the work undertaken in the implementation of the project. Finally, “long term success and further development” are dependent on effective “evaluation of the project and its results” (Scholz *et al.*, 2006: 242–244).

Validity

Scholz *et al.* (2006: 245–246) see validity as “the most challenging issue for research, particularly in qualitative studies”. They indicate that validity has not yet been satisfactorily dealt with in the debate on transdisciplinary research. It is also their opinion that the issue of validity is often a neglected area in qualitative empirical research. According to Scholz *et al.* (2006: 246), there are five key aspects for investigating the validity of transdisciplinary case studies and their results. They are:

> First we can judge whether the study in general or different facets and subprojects are reasonably, effectually, and successfully devoted to the goal or guiding question of the study. This aspect, which has been called functional validity, strongly refers to the conceptualisation of the case, in particular to the question whether the faceting or embedding seems reasonable to answer the guiding question of the study.
>
> Second, the case study team can inquire whether the appropriate information from the case been inquired in an unbiased way. This

refers to ecological validity, which is a key term in the Theory of Probabilistic Functionalism.

Third, the implications of the study should be in line and not conflict with the goals of the study. This refers to the aspect of consequential validity and can, for example, be an object of ex-post evaluation.

Fourth, from a scientific perspective, some key findings of a transdisciplinary case study should be generic and therefore be also valid for other cases. This refers to the aspects of external validity, for which – to our best knowledge – no standard approval procedure exists.

Fifth, when designing a case study, the research team could plan to investigate key issues by different methods (e.g. interview and questionnaire) or plan to answer the guiding question by a different method (e.g. expert interview). This is a way of assessing the aspect of convergent validity. This aspect is related to triangulation, which is a key method of validation in qualitative research.

The writer is in full agreement with Scholz *et al.,* (2006) that this issue needs to be subjected to much more investigation in future.

Change management

In order to achieve identified objectives, change needs to take place from what it currently is, to what it is planned to be. This change must be properly managed throughout implementation of the identified/ developed model (Businessballs.com. Date of access: 23 March 2012). In this study, change will occur when the current situation of working in silos is transformed into a situation where there is collaborative transboundary integration.

Change management requires “thoughtful planning and sensitive implementation”. Most important of all is “consultation with, and involvement of all the stakeholders affected by the changes”. Problems are sure to arise if one forces change upon people and institutions without consulting them to gauge their opinions and consider their grievances. For change to be

successful it must be “realistic, achievable and measurable”. Before one can begin one should ask oneself the question:

> What do we want to achieve with this change, why, and how will we know that the change has been achieved? Who is affected by this change, and how will they react to it? How much of this change can we achieve ourselves, and what parts of the change do we need help with? (Businessballs.com. Date of access: 23 March 2012).

For the purposes of this study it is impossible to give a detailed exposition on change management, but briefly the eight step change model of the American John P. Kotter, a leading thinker and author on organisational change, can be applied together with the system model towards improved development (see discussion below and Figure 7). Businessballs.com (Date of access: 23 March 2012) has summarised Kotter’s eight step change model which provides directives on how to proceed with organisational change:

- **Increase urgency:** Inspire people to move, make objectives real and relevant.
- **Build the guiding team:** Get the right people in place with the right emotional commitment, and the right mix of skills and levels.
- **Get the vision right:** Get the team to establish a simple vision and strategy; focus on emotional and creative aspects necessary to drive service and efficiency.
- **Communicate for buy-in:** Involve as many people as possible, communicate the essentials simply; respond to people’s needs.
- **De-clutter communications:** Make technology work for you rather than against you.
- **Empower action:** Remove obstacles, enable constructive feedback and lots of support from leaders; reward and recognise progress and achievements.
- **Create short-term wins:** Set aims that are easy to achieve – in bite-size chunks and manageable numbers of initiatives. Finish current stages before starting new ones.

- **Don't let up:** Foster and encourage determination and persistence.
- **Ensure on-going change:** Encourage on-going progress reporting; highlight achieved and future milestones.
- **Make change stick**: Reinforce the value of successful change via recruitment, promotion, and new change leaders. Weave change into culture.

System model towards improved development

General systems theory

In the nineteenth century there were few separate disciplines, but many questions that required answers. Despite the fact that there were no separate disciplines, sciences were broken down into broad categories such as chemistry, physics, biology; and then gradually into biophysics, biochemistry, and physical chemistry. This was done to allow the investigation of related components of a problem that was previously in isolation. Then in the 1930s a biologist, L. von Bertalanffy, introduced the systems theory (Hirsch Hadorn *et al.*, 2008: 23) and the integration of parts of a problem became a necessity. Bertalanffy felt that a problem could not be solved satisfactorily if the different components of the problem were considered in isolation As (Fritz, 2006: 1) puts it:

> A system is a set of related components that work together in a particular environment to perform whatever functions are required to achieve the system's objective.

In their response the question: "What is system theory?" Chen and Stroup (2003: 448) refer to a "system" as:

> An ensemble of interacting parts, the sum of which exhibits behaviour not localised in its constituent parts. (That is, "the whole is more than the sum of the parts").

In answer to the same question, Carl (2005: 237) describes system theory as: “An interdisciplinary science that uses systems to describe and explain complex phenomena.”

Chen and Stroup (2003: 448–449), to some extent supported by the views of Carl (2005: 237), explain that a system can be “physical, biological, social or symbolic”. A system can also comprise of one or more of these components. “Transformation of the system in time” leads to change, however, it maintains its identity. Throughout the changes in the state of the system, one observes “goal-directed behaviour” and “feedback” forms the mediation mechanism between the goal and system behaviour. “Time” forms an integral part as a “variable in system theory”. It is also necessary that the system be “delineated from the environment, and any sub-system from the system as a whole”. This is achieved by the so-called “boundary”. Chen and Stroup (2003: 449) define “system-environment interaction” as:

> The input and output of matter, information, and energy. The system can be open, closed, or semi-permeable to the environment.

The author of this dissertation is in agreement with Chen and Stroup (1993: 449) that “it is not for us to decide whether or not general systems theory is capable of unifying all branches of human understanding”. However, systems theory is identified as the most applicable theory for developing a structure to achieve the objectives of this study.

The systems model is a handy graphical illustration of how public needs and demands imbedded in the political system can crystallise into public policies. Nealer (2009: 78) sees political systems as:

> The legitimate public institutions that have authoritative allotment of values and resources. These political institutions may be government departments in national, provincial or local spheres or parastatal institutions.

Figure 9 (Nealer, 2009: 78) is a simplified diagrammatical illustration of how, for example, the system theory functions within the public sector in order to establish a more effective public service and promotes general development.

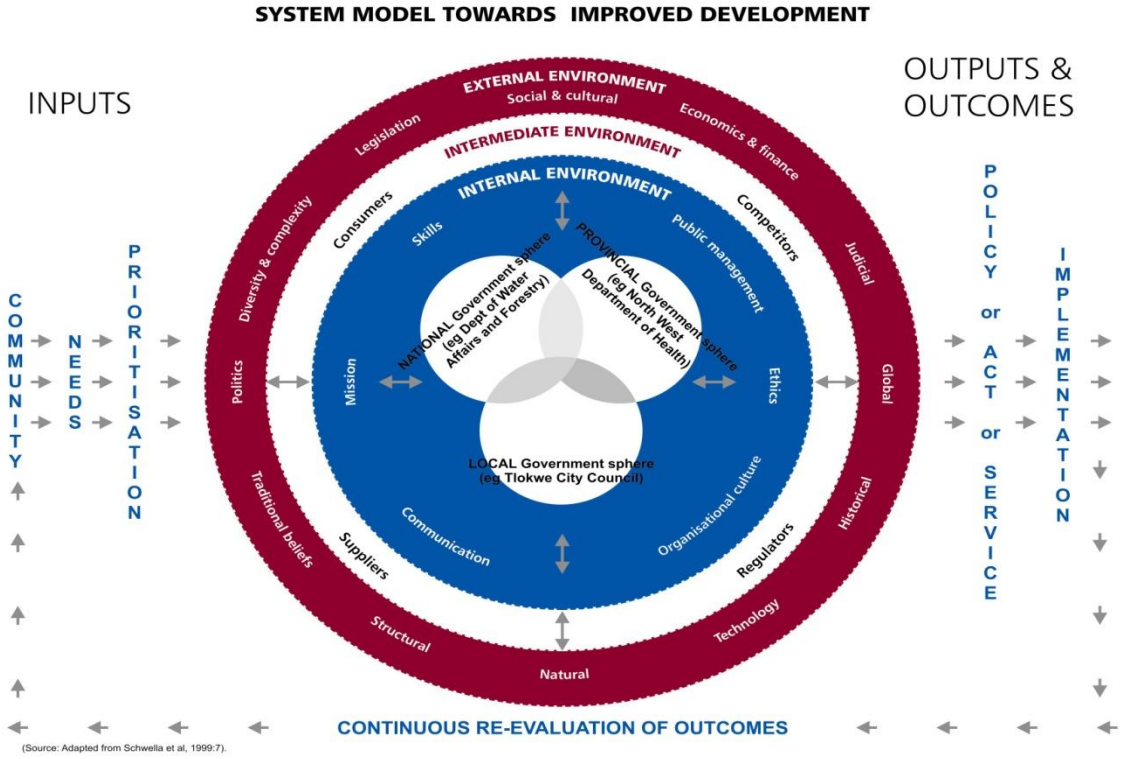

Figure 9 System model towards improved development (Nealer, 2009: 78)

Not only the communities in the Fezile Dabi and neighbouring district municipalities, but also the environmental health practitioners have needs that enable them to deliver an adequate water quality monitoring service. It is also a given reality that the environmental health practitioners on their own cannot deal with all the water quality challenges that arise. A joint effort by all role-players is necessary to ensure safe and healthy water for everyone.

An environmental health workshop was held by the Fezile Dabi District Municipalities Environmental Health Forum on 28 and 29 March 2012 to discuss certain municipal health services functions in the context of intergovernmental relations. One of the tasks of the water quality monitoring discussion group was to determine the current status and challenges in water

quality monitoring in the responsibility areas of Fezile Dabi District Municipality, its neighbouring district municipalities and relevant government sector departments. The following is a summary of the issues discussed at the workshop.

Current status and challenges in water quality monitoring

The water quality monitoring discussion group at the Fezile Dabi District Environmental Health Forum workshop used the SWOT-analysis as a tool for easy classification of current status and challenges regarding water quality monitoring in and around the Fezile Dabi District Municipality (VZAS. PA. WMDG. FN95. 29 March 2012). The acronym SWOT represents the strengths (S) and weaknesses (W) of an institution's intra- and internal position as well as the opportunities (O) and threats (T) that exist in the surrounding (external) environment (Nealer, 2009: 78).

Presenters at the forum emphasised the responsibilities of the environmental health practitioners in water quality monitoring by referring to mapping of water resources; protection of water sources; monitoring water reticulation systems; and physical water sampling and testing (VZAS. PA. WMDG. FN08. 29 March 2012; VZAS. PA. WMDG.FN11. 29 March 2012).

Strengths

The following were identified as advantages and resources which environmental health services in Fezile Dabi Municipality and its neighbouring districts have at their disposal to further effective water quality monitoring:

- In some parts of Fezile Dabi District Municipality water is supplied by Rand Water (VZAS. PA. WMDG. FN95. 29 March 2012).
- The majority of the district municipalities have water quality monitoring strategies/ plans in place (VZAS. PA. WMDG. FN95. 29 March 2012).
- Environmental health practitioners from two of the district municipalities that were represented at the water quality discussion group are equipped with water quality test kits. This enables them to conduct

some basic tests on water in the field. This also saves them a substantial amount of money because they do not have to outsource these tests (VZAS. PA. WMDG. FN08. 29 March 2012; VZAS. PA. WMDG. FN69. 29 March 2012).

- The relationships between district municipalities and the Department of Water Affairs (DWA) are cordial (VZAS. PA. WMDG. FN08. 29 March 2012; VZAS. PA. WMDG. FN08. 29 March 2012).
- Rand Water Board has an international, award-winning water quality monitoring plan in place. This includes a reliable water quality database. They have offered to share this information, knowledge and experience with district and local municipalities to enable them to improve on water quality monitoring (VZAS. PA. WMDG. FN34. 29 March 2012).
- Sedibeng Water Board is involved in some municipalities that are keen to participate in collaborative discussions at forums (VZAS. PA. WMDG. FN08. 29 March 2012; VZAS. PA. WMDG. FN69. 29 March 2012).
- Waterwise, a division of Rand Water has an informative training programme in place that caters specifically for school children. District municipalities have been given the go-ahead to make use of this for education and awareness programmes (VZAS. PA. WMDG. FN08. 29 March 2012).
- Sub-catchment forums in the different districts are a strength; they provide the opportunity for networking and local water matters can be discussed (VZAS. PA. WMDG. FN08. 29 March 2012).
- Accredited laboratories are accessible to Fezile Dabi District Municipality and its neighbours (VZAS. PA. WMDG. FN08. 29 March 2012; VZAS. PA. WMDG. FN41. 29 March 2012; VZAS. PA. WMDG. FN69. 29 March 2012; VZAS. PA. WMDG. FN77. 29 March 2012).
- Fezile Dabi District Municipality has its own water laboratory and is also in the process of constructing a bigger laboratory which will be available for support to local municipalities in and around the Fezile Dabi District Municipality municipal area at a minimal cost (VZAS. PA.

WMDG. FN08. 29 March 2012; VZAS. PA. WMDG. FN95. 29 March 2012).

- Water technical committees have been set up in some district municipalities but this move has not met with complete success (VZAS. PA. WMDG. FN08. 29 March 2012).
- Fezile Dabi District Municipality has a biochemist in its employ. This is of great benefit to the entire district as he offers a great deal of knowledge and experience on water management is provided (VZAS. PA. WMDG. FN08. 29 March 2012).
- Sasol firm offers free support to the Metsimaholo Local Municipality. This forms part of their commitment to corporate social responsibility (CSR) (VZAS. PA. WMDG. FN46. 29 March 2012).
- Relations between Fezile Dabi District Municipality (FDDM) and tertiary institutions are very good. North-West University's CuDyWat is closely involved with research in the Fezile Dabi District. In addition, Vaal University of Technology assists with the training of plant operators in local municipalities (VZAS. PA. WMDG. FN95. 29 March 2012; VZAS. PA. WMDG. FN41. 29 March 2012).
- SAVE (Save the Vaal River Environment) is active in the Upper Vaal River Catchment area and has lately established a branch in Ngwathe Local Municipality to address water quality issues. SAVE is an association of concerned people who wish to protect and maintain the integrity and ecology of the Vaal River and its environments in both the short and the longer term (SAVE, Date of access: 5 April 2012).
- There is a health information system in place in three of the district municipalities that participated in the water quality monitoring discussion group. This information system can be used to process data and present less technical water quality reports to be submitted to senior management.

Weaknesses

The following aspects were identified as resources or competencies that environmental health services in Fezile Dabi District Municipality and its

adjacent district municipalities have, but are in short supply or of inferior quality compared to the legislative requirements and human needs:

- Water quality data is not readily available to the public (VZAS. PA. WMDG. FN95. 29 March 2012).
- District municipalities' municipal health services divisions are under staffed which means there is a human resource capacity problem (VZAS. PA. WMDG. FN95. 29 March 2012).
- In some district municipalities there are no dedicated staff members to attend water forum meetings. This means that there is no consistency and continuity of representation at the forums (VZAS. PA. WMDG. FN95. 29 March 2012).
- There is insufficient specialist knowledge on water management in municipalities.
- The lack of proper Geographic Information Systems (GIS) in municipalities means that there is no mapping of water quality monitoring data (VZAS. PA. WMDG. FN69. 29 March 2012; VZAS. PA. WMDG. FN95. 29 March 2012).
- There is inadequate law enforcement to deal with issues of non-compliance (VZAS. PA. WMDG. FN69. 29 March 2012; VZAS. PA. WMDG. FN95. 29 March 2012).
- Water demand management needs to become holistic water (surface and groundwater) basin management.
- There is lack of communication of water quality information between water service providers and consumers (VZAS. PA. WMDG. FN95. 29 March 2012).
- In some municipalities the environmental health practitioners lack political support in the execution of their legal responsibilities with regard to water quality monitoring (VZAS. PA. WMDG. FN95.29 March 2012).
- Some municipalities are distant from the necessary laboratory facilities (VZAS. PA. WMDG. FN95. 29 March 2012).

- Not all environmental health practitioners are properly trained in project management (VZAS. PA. WMDG. FN95. 29 March 2012)
- There is no dedicated person to water quality as is the case with designated waste management officers and air quality management officers (VZAS. PA. WMDG. FN95. 29 March 2012)
- Senior managers lack the necessary knowledge and experience with regard to water quality management (VZAS. PA. WMDG. FN95. 29 March 2012)
- Most of the laboratories at local municipal level have closed down. This means that operational monitoring of water quality is not done according to SANS 241 requirements (VZAS. PA. WMDG. FN95. 29 March 2012)
- With the exception of one waste water treatment plant in the Fezile Dabi District Municipality, operators at all water and waste water treatment plants lack the required qualifications to do the job (VZAS. PA. WMDG. FN95. 29 March 2012)
- In most of the districts, there is under budgeting for environmental health services. The service can therefore not be rendered according to legislative requirements and public needs (VZAS. PA. WMDG. FN95. 29 March 2012)

Opportunities

The following aspects were identified as major positive factors in environmental health services in Fezile Dabi District Municipality's responsibility area and its adjacent district municipalities. These aspects put the service in a better position to meet the legislative requirements as well as the needs of the general public:

- There are various opportunities to create awareness among residents on the "water footprint". People must know the value and the quantity of water they are consuming on daily basis. This awareness will contribute to water saving (VZAS. PA. WMDG. FN95. 29 March 2012).
- There are existing wetland forums in some districts. Other districts can learn from these and establish similar wetland forums that can

contribute to water and wetland conservation (VZAS. PA. WMDG. FN95. 29 March 2012).

- All district and local municipalities have local economic development departments. Joint efforts by environmental health and local economic development can contribute to the national job creation objectives in water related projects (such as repairing leaking taps; eradication of alien plants; cleaning of surface water sources from litter, etc.) (VZAS. PA. WMDG. FN95. 29 March 2012).
- Despite the fact that Geographic Information Systems (GIS) are not up to standard in most municipalities, this is a tool that can be developed further to accommodate mapping of water quality monitoring data (VZAS. PA. WMDG. FN95. 29 March 2012).
- The existing health information system that is in use at some district municipalities creates the opportunity to standardise water quality monitoring reporting (VZAS. PA. WMDG. FN95. 29 March 2012).
- Laboratory equipment that is currently not in use at local and district municipalities because of minor defects can be serviced and put back in operation again. This will ensure more regular testing of water quality (VZAS. PA. WMDG. FN95. 29 March 2012).
- The Chris Hani District Municipality project on renewable energy and water savings is an excellent project to roll out countrywide (VZAS. PA. WMDG. FN25. 29 March 2012; VZAS. PA. WMDG. FN95. 29 March 2012).
- There is a great deal of external funding available to implement water quality related projects; district municipalities must be made aware that funding must be applied for (VZAS. PA. WMDG. FN95. 29 Mar. 2012).
- There is a willingness among environmental health practitioners to address all challenges and weaknesses, provided they get the necessary financial, managerial and political support (VZAS. PA. WMDG. FN95. 29 March 2012).
- Four research studies have already been undertaken in Fezile Dabi District Municipal area and Thabo Mofutsanyane District Municipality's area of responsibility. The recommendations made by the North-West

University in these studies can be used to address some major water quality related challenges (VZAS. PA. WMDG. FN95. 29 March 2012).

Threats

The following aspects were identified as negative issues in environmental health services in Fezile Dabi District Municipality and its neighbouring district municipalities. They put these local authorities at a disadvantage when attempting to meet the relevant legislative requirements and public needs:

- External service providers demand high rates of payment to analyse water samples for municipalities. This contributes to the decrease in frequency and number of water sampling which results in civil society consuming water of unknown quality (VZAS. PA. WMDG. FN95. 29 March 2012).
- Acid mine drainage is polluting surface and groundwater sources. This poses a huge threat to human health and safety with irreversible consequences (VZAS. PA. WMDG. FN95. 29 March 2012).
- Non-compliance with water standards and legislation are not addressed effectively by government departments. The public is exposed to these sub-standard water and environmental conditions. This certainly constitutes a health and safety risk (VZAS. PA. WMDG. FN95. 29 March 2012).
- A number of illegal water providers are plying their trade in local communities. They are involved in the sale of bottled water for drinking purposes. Government departments are not testing this bottled water frequently enough because of high costs. Since the quality of this water is not always known to the public, they are exposing themselves to a possible health risk (VZAS. PA. WMDG. FN95. 29 March 2012).
- Most towns have reached the point where the water and wastewater treatment plants cannot keep up with demand. This results in towns frequently running out of domestic water supply. In some areas untreated sewerage has been discharged into surface water sources (VZAS. PA. WMDG. FN95. 29 March 2012).

- Because of the long distances involved and the number of samples that need to be taken at farm schools, district municipalities tend to neglect testing drinking water quality at these facilities. As schools have a concentration of large numbers of children, they are at risk of waterborne disease outbreaks (VZAS. PA. WMDG. FN95. 29 March 2012).
- Non calibration of equipment as well as possible analyst error contribute to incorrect water quality data (VZAS. PA. WMDG. FN95. 29 March 2012).
- Poor training and incompetence of analysts and samplers pose a threat to reliability of water quality data (VZAS. PA. WMDG. FN95. 29 March 2012).
- Rapid urban development and urbanisation contribute to government having insufficient capacity to supply in the needs and demands of residents (VZAS. PA. WMDG. FN95. 29 March 2012).
- Frequently, drinking water and wastewater final effluent do not comply with requirements. This means that the public is exposed to water that does not comply with the necessary standard. The risk of getting waterborne diseases from such water is very high (VZAS. PA. WMDG. FN95.29 March 2012).

Keeping these strengths, weaknesses, opportunities and threats in mind, it is necessary that platforms be set up where environmental health practitioners can discuss water related matters of mutual interest. The following section addresses the question of platforms that are currently held for environmental health practitioners to make their voices heard on water related matters.

Current platforms to deal with water quality monitoring

There are a number of platforms where environmental health practitioners have the opportunity to table and discuss issues of water quality. In most cases it is only expected of the environmental health practitioners to table water quality results because many of the local municipalities in and around Fezile Dabi District Municipality's municipal area do not have effective water

quality monitoring plans and systems in place. From the water quality discussion group at the Fezile Dabi District Municipality's Environmental Health Forum workshop on 28 and 29 March 2012, the following platforms and the level of involvement of environmental health practitioners on these platforms were listed:

Lejweleputswa District Municipality (VZAS. PA. WMDG. FN 69. 29 March 2012)

- The Blue Drop / Green Drop Forum: Data is presented and there is discussion on results and any other related water issues.
- Sand River Lower Sub-catchment Forum: Water quality results are communicated and water issues discussed with other role-players.
- District Environmental Health Forum: District municipality and Provincial Department of Health officials discuss water quality monitoring related issues amongst other municipal health services.
- Disease Outbreak Response Team: At these committee meetings environmental health officials and primary health care officials accommodate water quality related discussions as and when the need arises.
- Disaster Management Advisory Forum: This is an extremely useful platform where environmental health practitioners currently have the opportunity to sensitise relevant sector departments on risks related to water quality.

Fezile Dabi District Municipality (VZAS. PA. WMDG. FN 95. 29 March 2012)

- District Environmental Health Forum: Officials from the district municipality and the Provincial Department of Health discuss water quality monitoring related issues among other municipal health functions.

- Disease Outbreak Response Team: At these committee meetings environmental health officials and primary health care officials also accommodate water quality related discussions as and when the need arises.

- Fezile Dabi District Disaster Management Advisory Forum: This forum provides the ideal opportunity for environmental health practitioners to sensitise relevant sector departments on risks related to water quality. In Fezile Dabi District Municipality “water quality” is a standing item on the agenda of the District Disaster Management Advisory Forum. The reason for this is the high risk that drinking and surface water sources pose to human health and safety in the Upper Vaal River Catchment.

- Ngwathe Sub-Catchment Forum: In early 2009 the situation in Ngwathe Local Municipality (one of four local municipalities in the Fezile Dabi District Municipality) reached a point where government officials and members of civil society felt the desperate need for a water catchment forum. This need arose because residents in the town Parys are on the receiving end of sewerage spillages; acid mine drainage; industrial effluent; and agricultural runoffs into the Vaal River downstream from hazardous activities in the North Eastern Free State, Mpumalanga, Gauteng and the North West Province. The Municipal Health Services division of Fezile Dabi District Municipality initiated the launch of a sub-catchment forum in the Parys area to address the needs of government and civil society. On 26 February 2009 a public meeting was held during which the Ngwathe Catchment Forum was launched. Currently, all water quality related issues are discussed at this forum (Ngwathe Catchment Forum, 2009: 1–3).

- Blue Drop / Green Drop Provincial Standing Committee: An official from Fezile Dabi District Municipality attends this committee meeting to be appraised of the latest developments on blue drop/ green drop certification in the Fezile Dabi District Municipal area and the Free State Province.

- Premier Rapid Response Task Team: This forum was established to attend to water quality concerns and risks in the Fezile Dabi District Municipality area, especially in the Ngwathe Local Municipality. The municipal Health Services Division of Fezile Dabi District Municipality, through the services of its laboratory official, plays an integral part in this forum with respect to technical knowledge and support to the local municipality in the form of water quality monitoring and training.

- Ngwathe Technical Committee: This is a forum for the Ngwathe Local Municipality, Fezile Dabi District Municipality, the Department of Water Affairs, and the Department of Agriculture to discuss matters of mutual interest on issues such as water quality and waste management (FDDM, 2012a).

- Wilge River Catchment Forum: Environmental health practitioners from the Mafube Local Municipality area communicate water quality results at this forum and discuss water issues with other role-players.

- Leeu-Taaiboschspruit Catchment Forum: Environmental health practitioners from the Metsimaholo Local Municipality area communicate water quality results and discuss water issues with other role-players at this forum.

- Mooi River Catchment Forum: This catchment forum accommodates environmental health practitioners from Dr Kenneth Kaunda District Municipality and the Tlokwe Local Municipality to communicate water quality results and water quality related issues with other role-players.

- SAVE (Save the Vaal River Environment): SAVE is an association of concerned people who wish to protect and maintain the integrity and ecology of the Vaal River and its environs in both the short and the long term (SAVE, Date of access: 5 April 2012). Environmental health practitioners attend meetings of SAVE to share members' concerns about water quality in the Vaal River catchment areas. SAVE is a non-governmental organisation (NGO) that has been operating since the 1990s with considerable success in the field of water quality that is

detrimental to the health of property owners in the proximity of the Vaal River; at the Vaal Dam; Vaal River Barrage; and at Parys, downstream of the Barrage.

- In addition to all these forums environmental health practitioners are frequently invited to other ad hoc water related meetings.

Thabo Mofutsanyane (VZAS. PA. WMDG. FN 55. 29 March 2012)

- District Environmental Health Forum: District municipality and Provincial Department of Health officials discuss, among other municipal health services functions, water quality monitoring related issues. There is a need in Thabo Mofutsanyane District to establish cross-border relations with relevant government departments in Lesotho so that communication can take place on water quality related issues.

- Disease Outbreak Response Team: At these committee meetings environmental health officials and primary health care officials hold discussions on water quality matters as and when the need arises.

- Wilge River Catchment Forum: At this forum, environmental health practitioners from the Mafube Local Municipality area communicate water quality results and water issues with other role-players. A frustration for environmental health practitioners from this district municipality is that there is no continuity in who attends the forum. The impression is that the environmental health practitioner available on the day is obliged to attend.

Emfuleni Local Municipality (VZAS. PA. WMDG. FN 77. 29 March 2012)

- Disease Outbreak Response Team: At these committee meetings environmental health officials and primary health care officials hold water quality related discussions as and when the need arises.

- Sedibeng District Disaster Management Advisory Forum: This forum provides the ideal opportunity for environmental health practitioners to sensitise relevant sector departments on the risks related to water quality.

- District Intergovernmental Relations Forum: At this forum, officials responsible for environmental health services have the opportunity to table and discuss water quality related issues. The benefit of this forum is that contentious water issues gain political “buy-in”, which strengthens planned action.

Ideal organisational structure for water quality monitoring

From the discussion above on the existing platforms for environmental health practitioners to table and address water quality related issues, it is clear that these officials are overburdened in coping with public needs and demands as well as their attendance at a variety of meetings and forums. Consequently, a decision was taken at the Fezile Dabi District Municipality Environmental Health Forum workshop on 29 March 2012 to minimise the number of meetings and forums environmental health practitioners are expected to attend. At the workshop all stakeholders agreed that the District Environmental Health Forum, currently functioning independently, should be made a sub-structure of the District Technical Intergovernmental Relations Forum. It is foreseen that this will result in more political involvement and support for environmental health issues as matters discussed at this level are also forwarded to the District Coordinating Forum where politicians are well represented (VZAS. PA. WMDG. FN 95.29 March 2012).

The establishment of a water quality portfolio committee under the District Environmental Health Forum was proposed by the water quality discussion group at the Workshop. As is the case with designated officers in waste management and air quality management, the workshop proposed that a recommendation be submitted to the Department of Water Affairs to legislate on the appointment of designated water quality management officers on national, provincial and local spheres of government. These designated water

quality management officers from local and district municipalities will then form a Water Quality Portfolio Committee as a sub-structure of the District Environmental Health Forum. In the case of Fezile Dabi District Municipality, this will mean a portfolio committee of six such officials (one from the Department of Water Affairs; one from each local municipality in the District Municipality; and one from the district municipality) to deal with water quality matters. The chairpersons of the various Water Quality Portfolio Committees, together with the designated provincial water quality officers will then constitute a Transboundary Water Quality Management Portfolio Committee. Its focus must be on the sharing of information, knowledge and best practices within and across local, district and provincial boundaries (VZAS. PA. WMDG. FN95. 29 March 2012)

This structure will ensure the optimisation of effective water quality monitoring between Fezile Dabi District Municipality, its neighbouring district municipalities and identified sector departments. However, the detail on roles and responsibilities of these respective portfolio committees and the designated water quality officials call for further research.

Conclusion

From Chapter 4 it is clear that transdisciplinary research is a solution to the challenges environmental health services experience in South Africa. Fezile Dabi District Municipality, for example, has ample proof on the effectiveness of transdisciplinary research in dealing with water quality related challenges (Tempelhoff, *et al.,* 2008; Gouws *et al*., 2009; Tempelhoff *et al.*, 2011; Tempelhoff *et al.*, 2011a; and Bertram, 2011). One might assume that transdisciplinary research merely produces a written document that is comforting to display on a shelf, but this is not the case. The final reports produced by these transdisciplinary research teams include realistic recommendations that will certainly make a positive contribution to service delivery and to addressing the needs of government officials and more importantly, those of civil society.

A valuable aspect of transdisciplinary research is the transdisciplinary case study approach. It is not necessary to reinvent the wheel; one can base one's approach and learning on existing cases. Environmental health practitioners must move beyond the point of merely noting the basic water quality problems in the confines of the small environment in which they work (ontology). They must get to the point of addressing the problem from a more scientific environmental health approach by assessing and addressing the root of the problem (epistemology).

In trying to address the needs of environmental health practitioners in an ideal organisational structure to optimise effective water quality monitoring between Fezile Dabi District Municipality, its neighbouring district municipalities and identified sector departments, efficient change management is required. This chapter argues that effective change from existing structures to an overarching structure for water quality management calls for thoughtful planning and sensitive implementation. Most important is consultation with and involvement of all people affected by the changes. Problems will most certainly arise if change is forced onto people and institutions who are directly involved.

The general system theory and system model towards improved development is another tool that can be used to ensure effective stakeholder involvement in addressing the needs of the public and the government officials who, after all, have been appointed to provide services for society at large. An important component of a typical transdisciplinary research method of operation is the continuous re-evaluation of outcomes as well as ongoing communication with all parties involved.

At the Workshop held on 28–29 March 2012, a water quality monitoring discussion group ran a SWOT analysis to determine the current status of water quality monitoring and the challenges faced by Fezile Dabi District Municipality, its adjacent district municipalities and relevant government sector departments. The group identified important strengths (S); weaknesses (W); opportunities (O); and threats (T) currently influencing the quality of the water quality monitoring service rendered by district municipalities,

government departments (Department of Water Affairs) and water services providers. The discussion group further listed platforms that have been formed at which environmental health practitioners are able to discuss water quality related issues. After collating all this information the discussion group finally agreed upon an organisational structure to optimise effective water quality monitoring, involving Fezile Dabi District Municipality, its neighbouring district municipalities and identified sector departments. It was decided that the existing District Environmental Health Forum, currently functioning independently, would become a sub-structure of the District Intergovernmental Relations Forum. As explained above it was argued that this would result in increased political involvement and support (VZAS. PA. WMDG. FN 95.29 March 2012). As an extension to the District Environmental Health Forum, a portfolio committee is proposed to deal exclusively with water quality related matters.

The next chapter will provide a summary of the entire study and conclude with relevant recommendations and proposed avenues of future research in this field.

Chapter 5

Conclusion and recommendations

The geographic location of Fezile Dabi District Municipality (FDDM) is unique because it borders on five other district municipalities in the Free State Province and three provincial boundaries. The Vaal River forms one of the administrative boundaries of this district municipality and the Free State Province. Despite the valuable role of the Vaal River, a poor water management and monitoring system is in place in the region because district municipalities and provincial authorities have not forged adequate intergovernmental and transboundary relations to manage and monitor water quality effectively. As explained at some length in this study, the Vaal River, a vibrant aquatic boundary line, provides an excellent opportunity to develop a transboundary collaborative water quality monitoring strategy between Fezile Dabi District Municipality and its neighbours.

Conclusion

Chapters 1 and 2 provided a preliminary legislative overview and detailed the role and function of environmental health practitioners. Importantly, observations were also made on what can be expected of environmental health services. This study has shown that the only way to ensure the safety of water and a healthy environment for all is by means of addressing the challenges of water quality monitoring in a transboundary, integrated and multidisciplinary manner.

The aim of this study was to provide a collaborative transboundary water quality monitoring strategy for Fezile Dabi District Municipality and its neighbours by devising an appropriate structure to optimise effective water quality monitoring between Fezile Dabi District Municipality and its adjacent district municipalities. This strategy will ensure that intergovernmental

relations become a reality for environmental health services on an operational level in district municipalities.

Four objectives were identified. Firstly, an explanation was provided on what is meant by water quality monitoring as a key performance area of municipal health services. Secondly, information was provided and proposals made on how to integrate water quality monitoring across municipal boundaries. Thirdly, it was explained how and why transboundary collaboration can contribute to improving water quality monitoring strategies between Fezile Dabi District Municipality and its neighbouring district municipalities. Lastly, an exposition was provided on the organisational structure and methods to optimise effective water quality monitoring in the area under consideration. The chapter also suggested a way forward in terms of a structure negotiated and developed at an environmental health workshop held in Sasolburg on 28–29 March 2012.

In Chapter 2, an explanation was given on what is meant by water quality monitoring as a key performance area of municipal health services. District municipalities are mandated with the water quality monitoring function in the local government sphere, but this function is merely one among many others involved in integrated water resource management. Chapter 2 also focused on the role of the environmental health practitioner in water quality monitoring. In this regard a clear explanation was provided on how municipal health services fit into environmental health services in the South African health structure. Secondary to this, the chapter outlined the history of environmental health as well as relevant definitions such as “health”, “health services”, “environmental health” and “municipal health services”. It was also explained that the document defining the “scope of practice” of an environmental health practitioner indicates his/ her exact role and role in water quality monitoring.

As municipal health services is a government function, the researcher also gave some information on challenges and opportunities municipal health services are faced with in post-1994 South Africa.

Chapter 3 reflected on the significance of transboundary collaboration on improving water quality monitoring strategies between Fezile Dabi District Municipality and its neighbours. “Monitoring” and “assessment” are two terms that are used frequently in the vocabulary of water scientists and these were carefully explained. After defining these terms it was shown that based on the general opinion of environmental health practitioners, “assessment” tends to be the more preferred term of the two because it speaks more to the objective of the implications of the wider project.

Boundaries, on the other hand, are identified as a challenge that must be overcome in order to ensure transboundary collaboration in water quality monitoring. Boundaries were classified as primary and secondary and it was pointed out that they should not pose a major challenge if municipal health services divisions are allowed to forge meaningful collaboration in forums that allow intergovernmental relations on operational level. The Constitution of the Republic of South Africa Act 108 of 1996, the Intergovernmental Relations Framework Act 13 of 2005, and the National Water Act 36 of 1998 are the three pieces of legislation that support collaboration and integration across boundaries. What is important is that integration is crucial when contemplating water quality monitoring in the longer term as a vital component of water resource management.

Throughout the entire integration process, social learning and interest based bargaining play a significant role in the transdisciplinary research approach to solving environmental health challenges. Furthermore, the education of all stakeholders and participants must be addressed if transdisciplinary research is to be correctly implemented.

Throughout this study, reference was made to transdisciplinary research methodology as a tool to develop a collaborative transboundary water quality assessment strategy to improve environmental health services. Chapter 4 provided more detail on transdisciplinary research methodology and the transdisciplinary case study approach as a means of sustainability learning. A comprehensive overview was provided on how to apply transdisciplinary case studies to promote sustainability learning. Prevailing water quality monitoring

challenges in Fezile Dabi District Municipality can be researched and solutions found by means of the outlined strategies. The researcher approached this study by consulting environmental health practitioners currently working in neighbouring municipalities and provinces at the available forums. General systems theory and the system model towards improved development formed the theoretical basis in the development of a Transboundary Environmental Health Services Intergovernmental Relations Forum for the Fezile Dabi District Municipality, its neighbours and all relevant sector departments.

The objectives outlined for this study were shared and extensively discussed with peer stakeholders at the workshop held from 28 to 9 March 2012. Here, various water quality monitoring discussion groups gave their approval for a more efficient organisational structure and methods to optimise water quality monitoring between Fezile Dabi District Municipality and adjacent district municipalities.

Recommendations

The research that was conducted suggests that certain areas need to be explored further. The following recommendations are offered:

- In this study an improved organisational structure was outlined in an effort to optimise effective water quality monitoring between Fezile Dabi District Municipality and its neighbours. This outline included a comprehensive description of roles and responsibilities within the structure that still require further research.
- The strategic nature of research necessitates an investigation into the possibility of including a section in the National Water Act 36 of 1998 on the appointment of a designated water quality management officer on the national, provincial and local government spheres.
- The exact roles and responsibilities of this designated water quality management officer on each sphere of government needs to be determined and legislated.

- Because there is more than one government department involved in water quality monitoring, the necessity has arisen for a memorandum of understanding between the various departments. This needs to be researched and documented.
- District municipalities via their municipal health service divisions, must play a more supportive role to local municipalities (the water service providers) on water quality assessment because the capacity and expertise of water quality assessment lies with the environmental health practitioners.

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