

Towards a Holistic View of Land and Water Management in the Gamtoos River Catchment: Applying a Political Geoecology Approach

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Abstract

The Eastern Cape of South Africa is characterised by water scarcity, constraint on usage, and inter-basin transfers. Water from the Gamtoos River catchment supplies water users both within the catchment and outside the catchment boundaries. This requires careful management of water and land to prevent overexploitation. However, management is complex as it is divided among various stakeholders with differing interests. Political geocology is an approach that has the potential to provide holistic insight into the catchment's water context. It was proposed to account for spatial patterns underlying interrelationships between resource distribution, human productive activity, and power relations by integrating the fields of political ecology and geocology. This research was undertaken to further develop political geocology as an approach for examining human–environment relations in geography through a case study of land and water management in the Gamtoos River catchment and its sub-catchments. Distribution of resources and human influences were elucidated through generation of maps. To facilitate spatial analysis, the study area was delineated into catchment zones. Additionally, stakeholders were identified and classified at local, regional, national, and international levels. Power relations between stakeholders were investigated through qualitative content analysis of transcribed semi-structured interviews and survey questionnaires that were administered to 34 research participants (selected through purposive and snowball sampling) directly involved in resource management in the catchment. Findings were spatially interpreted for each of the zones. The source zone was characterised by natural vegetation, steep, rugged topography, limited access ability, and power relations around restoration and conservation interests, which arose most significantly in the Baviaanskloof. The natural recapture zone was characterised by irrigated cultivation in areas of less harsh terrain in the upstream (Baviaanskloof and Kouga) sub-catchments. In the marginal Baviaanskloof, localised power relations over water distribution primarily arose. In the thriving commercial

farming context of the Kouga, power relations included a local upstream–downstream legal conflict, competing levels of governance, issues with establishing water users’ associations (WUAs), and lack of adequate implementation of processes by government. Regional power relations are most prominent in the thriving commercial farming context of the overlapping regulated recapture and final use zones in the downstream Gamtoos sub-catchment. The reliance on upstream sub-catchments and tensions with the city of Port Elizabeth over water use are mediated through decisions made at the national level. Non-location specific power relations included indirect influence through energy, markets, and standards organisations, barriers in government preventing successful process implementation, and equity issues (particularly limiting the success of emerging farmers). These results illustrated that resource distribution, human productive activity, and power relations combine to produce unique characteristics in each of the zones in the Gamtoos catchment. The application of political geocology in this case study situated the approach as useful for examining human–environment relations in geography.

Declaration

I have read and understood the Rhodes University plagiarism policy. This study presents original work by the author. Where use has been made of the work of other authors it is acknowledged in the text accordingly.

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Acronyms and Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ANC	African National Congress
BEE	black economic empowerment
BMR	Baviaanskloof Mega-Reserve
CMA	Catchment Management Agency
DA	Democratic Alliance
DAFF	Department of Agriculture, Forestry and Fisheries
DEM	digital elevation model
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ECP	Eastern Cape Parks
ECPTA	Eastern Cape Parks and Tourism Association
Eurepgap	Eurep Good Agricultural Practices
GIB	Gamtoos Irrigation Board
GIS	geographical information systems
GlobalGAP	Global Good Agricultural Practices
GWP	Global Water Partnership
HACCP	Hazard Analysis and Critical Control Points
HIV	human immunodeficiency virus
IAPs	invasive alien plants
IUCN	International Union for Conservation of Nature
IWRM	integrated water resources management
MAP	mean annual precipitation
MAR	mean annual runoff
masl	metres above sea level
NGO	non-governmental organisation
NMBMM	Nelson Mandela Bay Metropolitan Municipality
NU	non-urban
NWA	National Water Act
P-000	Participant-[number]
PE	Port Elizabeth
PRESENCE	Participatory Restoration of Ecosystem Services and Natural Capital, Eastern Cape

QGIS	QuantumGIS
SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WfW	Working for Water
WUA	water users' association

Chapter 1: Introduction

1.1 Context of Water in South Africa

It would be clichéd to begin by characterising South Africa's land and water management context as plagued by water scarcity. Rather, this thesis will go beyond this notion by opening with a declaration that water scarcity is not the primary problem surrounding land and water management in South Africa. While it cannot be denied that this country is largely semi-arid, possesses inadequate water resources to satisfy the demands of its growing population, and is below the water stress threshold (Davies and Day 1998: 28; UNDP 2006: 133, 135; Schreiner 2013), this is merely the background to numerous water-related problems in the country. Water scarcity continues to be exacerbated by multiple challenges such as poor service delivery; critical lack of technical capacity and skills; poorly maintained infrastructure; unnecessary water losses through the supply system; socio-economic inequalities among the population; and pollution, over-utilisation, and degradation of resources (Haigh 2004; Malzbender *et al.* 2005; Van der Zaag 2005; Funke *et al.* 2007a, 2007b; Herold 2009; Swatuk 2010; Kemerink *et al.* 2011; Hay *et al.* 2012; Carden and Armitage 2013). These challenges emerge from a historical context in which the policies were not only discriminatory and exclusionary towards the majority of the population but were also inappropriate to South Africa's semi-arid context (Davies and Day 1998; Funke *et al.* 2007a; Swatuk 2010).

During the transition to the post-apartheid era, the National Water Act (NWA) of 1998 (Republic of South Africa 1998) was formulated based on the integrated water resources management (IWRM) principles of sustainability, equity, efficiency, and decentralisation (Funke *et al.* 2007a; Swatuk 2010; Kemerink *et al.* 2011). Despite this strong policy foundation—at the time hailed as comprehensive and progressive (Funke *et al.* 2007a)—implementation of South Africa's water reform has been ineffective and inefficient (Funke *et al.* 2007b; Schreiner 2013). South Africa's water context will be examined in greater depth in Chapter 2.

1.2 Study Area: The Gamtoos Catchment

The Gamtoos River catchment is the study area for this research; it is delineated in Figure 1.1 in terms of location, size, and sub-catchments¹. The Gamtoos catchment comprises three major perennial rivers, namely (from north to south) the Groot River, the Baviaanskloof River, and the Kouga River. The Kouga and Baviaanskloof rivers join upstream of the Kouga Dam to form the Gamtoos River. The Groot River joins immediately downstream of the dam. The Gamtoos River then drains into the Indian Ocean in an estuary northeast of the coastal town of Jeffrey's Bay (Haigh 2004: ii; Boshoff 2008: 38). The catchment is primarily located in the Eastern Cape province with parts of the Kouga and Groot sub-catchments traversing the Western Cape and Northern Cape provinces. It has a combined drainage area of over 34,819 km². The Groot sub-catchment is by far the largest of the sub-catchments (29,557 km²), followed by the Kouga (2,825 km²), then the Baviaanskloof (1,235 km²), and finally the tertiary Gamtoos (1,201 km²) (Haigh 2004; WR2005 dataset; Jansen 2008: 41). The area is characterised by high geological, topographic, and climatic diversity (Boshoff 2008: 10), resulting in high diversity of land uses.

1.2.1 Context of Water in the Study Area

The water sector's numerous challenges are particularly evident in the Eastern Cape. The western part of this province is prone to chronic water shortages due to increasing demand from rural-to-urban migration, expanding populations, and intensifying industrial activity; subsequently, water users face usage constraints (Jansen 2008: 40; Mander *et al.* 2010: 4; DWA 2014a). Significant temporal and spatial differences in water availability compound these challenges. To compensate for uneven distribution and increasing demand, rivers are subject to artificial regulation (Falkenmark and Rockström 2004: 183-184). This takes the form of large projects—such as the Algoa Water Supply System—redistributing water to those areas that need it most (DWA 2014a, 2014b). Water is thus allocated and distributed to competing areas and uses, including the agricultural, industrial, and domestic sectors.

The Gamtoos catchment is strategically important in the Eastern Cape. It supplies water within the catchment for agricultural production as well as domestic use in several small towns in the Kou-Kamma and Kouga local municipalities (DWA 2013; DWA 2014a). In addition, through

¹ This thesis uses the term 'catchment' when referring to the whole of the Gamtoos catchment, 'sub-catchment' when referring to the Baviaanskloof, Kouga, and Gamtoos (tertiary) sub-catchments, and 'tributary sub-catchment' when referring to the sub-catchments of the tributaries of the three main rivers.

the Algoa Water Supply System and the Kouga Dam, it supplies a significant amount of the total water used by domestic and industrial sectors in Nelson Mandela Bay Metropolitan Municipality (NMBMM)—including the city of Port Elizabeth (PE)—which lies outside the catchment boundaries (DWA 2013; DWA 2014a).

1.2.2 Exclusion of the Groot River Sub-Catchment from the Study

This study focuses on the Baviaanskloof, Kouga, and Gamtoos sub-catchments, but excludes the Groot for the following reasons. Firstly, water from the Groot sub-catchment is not being actively used for agricultural and urban purposes within the system (Jansen 2008: 29–30). This is because (i) despite being by far the largest of the sub-catchments it is semi-arid and contributes relatively little water downstream, (ii) the water that does flow downstream is poor quality (highly saline), and (iii) although it contributes streamflow to the Gamtoos River it does not contribute water to Kouga Dam (and therefore the Algoa Water Supply System) (Jansen 2008: 29–30). Secondly, the Groot River has also been excluded from previous studies of the area for similar reasons (e.g. Haigh 2004). Thus, this study excludes the Groot as there are no competing interests for the water that would impact on political geocology, the focus of this study.

1.2.3 Motivation for Study Area Choice

The Baviaanskloof, and more recently the Kouga, has been the focus of numerous studies, largely through the PRESENCE Network (for example: de la Flor Tejero 2008; De Paoli 2008; Janssen 2008; Van der Burg 2008; Chuchmakova 2009; Javed 2009; Draaijer 2010; Blanksma 2011). The PRESENCE (Participatory Restoration of Ecosystem Services and Natural Capital, Eastern Cape) Network was established in support of management initiatives in the area, which are partly carried out through research activity. This provided an established body of work for this research to contribute to and build on. Additionally, the distinct spatial arrangement, diverse characteristics, and multiplicity of actors involved in land and water management in the area is expected to yield an interesting case study of the interrelationships between land and water resources and the power relations between stakeholders over the management of these resources. The characteristics of the study area are investigated in-depth in Chapter 3.

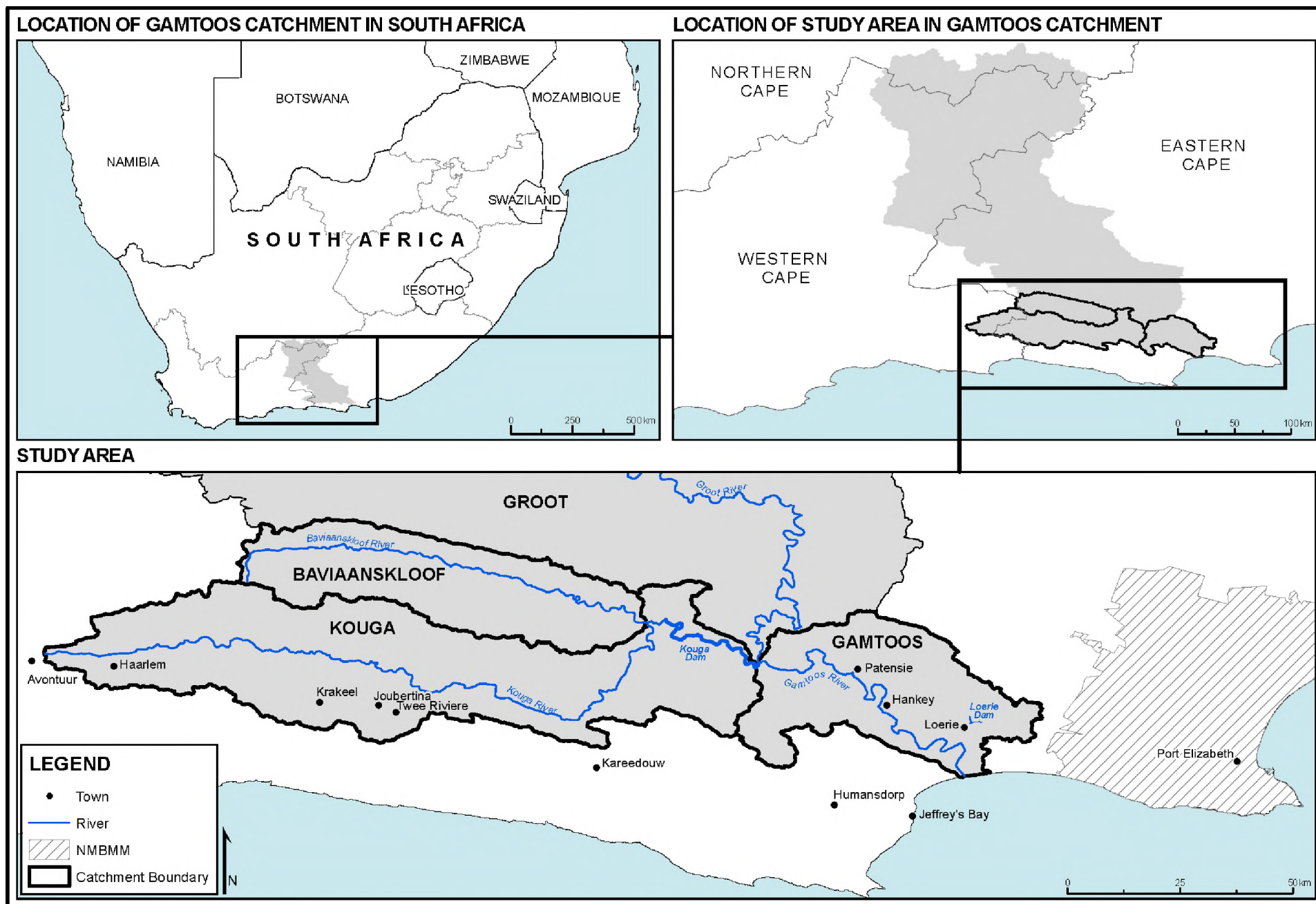


Figure 1.1: Study area location map illustrating the Gamtoos catchment and its sub-catchments

1.3 Background: Water Resources, Management, and Power Relations

River catchments are characterised by upstream-downstream linkages; downstream users rely on the quality and quantity of water provided by upstream users. They are faced with the risk of water depletion if upstream consumption reduces the water available for further use downstream (Falkenmark and Rockström 2004: 207). Thus, trade-offs need to be made at the catchment scale taking into account the demands of all interested parties, either in the same catchment or—in situations where inter-basin transfer schemes transfer water from one system to another—outside the catchment boundaries (Falkenmark and Rockström 2004: 206). Management, therefore, involves considering the multiple uses of water (for drinking, sanitation, industry, irrigation, and the ecological reserve) and deciding which sectors and spatial locations receive a greater volume and better quality water. This potentially results in power relations between competing sectors, upstream-downstream stakeholders, and those agents responsible for the control, management, protection, and allocation of water and related resources. Indeed, Mander *et al.* (2010: 1) indicate that, in the study area, conflicting interests dominate interactions between landowners and wider society. In extreme cases, trade-offs between competing demands can lead to disagreements and even conflict (Ashton 2000a). This risk is compounded in contexts where infrastructural supply systems, such as the Algoa Water Supply System, transfer water out of the catchment, contributing additional actors and adding increased complexity to the management process. Political choices and public policies also shape supply and demand issues, adding an additional dimension to power relations (UNDP 2006: 134). Power relations within the water management context are further examined in Chapter 2.

Importantly, management of resources occurs within, and cannot be removed from, a myriad of natural factors and processes. Thus, power relations within a catchment are also influenced by the spatial distribution of resources and the physical connectivity of the land. The Gamtoos catchment's management context provides a particularly interesting case study as mountain ranges separate the landscape into distinct areas which are potentially subject to a range of differing interests, stakeholders, and environmental conditions. This is potentially a good illustration of how a landscape's layout can affect resource management and power relations around these resources.

Therefore, five hypotheses can be posited about the Gamtoos catchment's complex management context. Firstly, the spatial and temporal distribution of land and water resources shape the access, control, use, and management practices by multiple actors (such as farmers, conservation organisations, water management institutions, and government) from both within and outside the catchment boundaries. Secondly, the varying resource use practices, management strategies, and interests of these multiple actors impact the availability, quality, and quantity of water and related resources. Thirdly, it could be hypothesised that power relations arise between the multiple actors as well as between these actors and the environment and that these interrelationships can be characterised as relations of access, relations of influence, and relations of control. Fourthly, that these power relations exist on multiple scales and multiple levels (including the catchment and sub-catchment scale, the local community level between land managers, the regional level between organisations, and from international level influences and processes). Finally, it could be hypothesised that these power relations serve to constrain, enable, and/or drive natural processes, management practices, and associated challenges.

To investigate these complex interactions, there is a need for a holistic approach within which to examine the management of land and water resources, the power relations surrounding these processes, how these issues operate spatially, and how these both shape and are shaped by the physical landscape. Rowntree (2008) proposed a political geocology framework to explore such socio-ecological relationships within the context of an African drainage basin. Applying the political geocology approach to the Gamtoos catchment has the potential to provide a holistic understanding of the interrelationships surrounding the use and management of land and water resources in the area. The following section outlines the political geocology approach.

1.4 Theoretical Approach: Political Geocology

The conceptual approach of political geocology was developed to simultaneously examine: (i) the flows of matter and energy within a drainage basin, (ii) the global, regional, and local power relations affecting these flows, and (iii) the impact of the power relations on the drainage basin ecosystems and their ability to provide goods and services to those depending on them (Rowntree 2008: 2). The strength of political geocology is that it integrates two contrasting approaches—namely, political ecology and geocology—to “move towards a better

understanding of... complex longitudinal socio-ecological systems that are driven by upstream–downstream connectivity and upstream–downstream power relationships” (Rowntree 2008: 6).

Political ecology is a field of human–environmental research that approaches environmental problems by examining ecological and social processes and their interrelationships, examining how ecology shapes social struggles and how the outcomes of those struggles ultimately influence environmental change (Blaikie and Brookfield 1987; Greenberg and Park 1994; Peet and Watts 1996; Zimmerer 2000; Zimmerer and Bassett 2003; Peet and Watts 2004; Walker 2005; Robbins 2012). It is an approach that seeks to understand the mutual interactions between human society, human productive activity, and the natural environment (Greenberg and Park 1994: 4).

Geoeology (see Huggett 1995; Safford 2002), also referred to as ‘landscape ecology’ (see Hobbs 1997; Wu and Hobbs 2007), is a systematic conceptual framework for studying landscape pattern and processes (Wu and Hobbs 2007: 276). It is the study of the relationship between the dynamics of spatial pattern and ecological processes in a landscape across hierarchical levels of biological organisation and different scales in space and time (Wu and Hobbs 2007: 277, 284). It explicitly recognises the role of geographical relations—such as space and elevation—in modulating complex biotic–abiotic environmental interactions (Safford 2002; Rowntree 2008: 2). It examines landscape structure and function, as well as the change in structure and function over space and time (Forman and Godron in Wu and Hobbs 2007: 275-276).

Political geoeology integrates the paradigms of political ecology and geoeology to examine power relations on international, national, regional, and local levels affecting access to and use of land and water in different geographic areas of a catchment (at the landscape scale) (Rowntree 2008). It can be applied to critically examine power relations around resources through an explicitly spatial lens. A political geoeology approach is thus suited to spatially investigate power relations surrounding the management of land and water resources in a South African context of contested rights and socio-economic tensions. This study situates the political geoeology approach within the broad and diverse literature of both political ecology and geoeology and applies the approach, using a case study methodology combined with methods from the fields of political ecology and geoeology, to the context of land and water

management in the Gamtoos catchment and its sub-catchments. Political ecology, geoecology, and political geoecology are further examined in Chapter 2.

1.5 Motivation

A study that examines the context of land and water use, management, and distribution in the Gamtoos catchment has the potential to contribute to improved sustainability, efficacy, equitability, and decision-making of resource use in the future. Swatuk (2010: 523) asserts that “understanding South Africa’s complex history of water management, in particular the web of powerful actors, interests and motives that lie at the heart of decision-making is the necessary starting point for uncovering reasonable ways forward for integrated water resources management (IWRM)”. Falkenmark and Rockström (2004: 195) call for a better understanding of human–environment interactions in catchments to see how ecosystems affect human activities, are affected by human activities, and are linked by water flows. Therefore, through examining the interrelationships between physical factors, management practices, and power relations, this study has the potential to provide holistic insight into the drivers of the challenges facing water management in the region, possible measures for addressing these, and the perceptions and attitudes of local stakeholders. In addition, it has the potential to contribute towards understanding barriers to equitable distribution between competing uses and ways to prevent potential conflict.

1.6 Research Goals

1.6.1 Research Aim

The aim of this research is to apply and further develop the political geoecology approach for examining human–environment relations in geography through a case study of land and water management in the Gamtoos River catchment and its sub-catchments.

1.6.2 Research Questions and Objectives

The aim of this research will be reached by answering four research questions. Each of these research questions is broken down into multiple objectives, each of which leads to a measurable outcome. Table 1.1 specifies the research questions and objectives.

Table 1.1: The research questions and objectives of this study

Research Question 1	What is the spatial distribution of land and water resources and human influences on the landscape in the Gamtoos catchment?
Objective 1a	To map the spatial distribution of selected land and water resources.
Objective 1b	To identify human influences on the physical landscape through mapping of selected factors relating to human–environment interactions (such as land use).
Objective 1c	To delineate the catchment into zones to facilitate spatial analysis.
Research Question 2	What are the power relations between stakeholders regarding management of land and water resources in the catchment?
Objective 2a	To identify stakeholders at local, regional, national, and international levels.
Objective 2b	To identify issues surrounding access to, control, use, and management of land and water resources in the catchment on multiple levels.
Objective 2c	To identify the extent to which power relations operate in an upstream–downstream direction in the Gamtoos catchment.
Research Question 3	What are the interrelationships between the spatial distribution of land and water resources and power relations in the area?
Objective 3a	To spatially interpret resource distribution, human productive activity, and power relations according to zones in the catchment.
Objective 3b	To describe the interrelationship between the biotic and abiotic landscape components and power on multiple levels.
Objective 3c	To analyse how the environment shapes power relations and how power relations in turn shape the environment.
Research Question 4	To what extent does the political geocology approach taken in this study explain the spatial interrelationships between physical resources and power relations over those resources in the Gamtoos catchment?
Objective 4a	To critically evaluate the value of the political geocology approach in the context of land and water management, and to the discipline of geography more broadly.

1.7 Methodology

This study can be classified as social scientific research as it attempts to describe social reality through making sense of patterns and relationships (Berg 2007). It follows a case study approach, exclusively focussing on the Gamtoos catchment. Political ecology research, one of political geocology’s foundational fields, is well known for engaging multiple approaches and methods (Rocheleau 2008: 718). This study primarily utilises a qualitative methodology; however, there are aspects in which quantitative methods have also been adopted. Thus, it combines methods from both the social sciences and geographical information systems (GIS) to elucidate power relations and explain these spatially alongside descriptions of resource

distribution. This section first motivates the case study approach, then describes the qualitative methodology, and concludes with a brief overview of the methods employed.

1.7.1 Case Study Approach

In this research, the Gamtoos catchment is used as a case study of the interrelationships between the landscape's physical characteristics and power relations among stakeholders. A case study is defined as a systematic inquiry into a particular setting, event, or group to describe how the subject functions (Bromley 1990; Bogdan and Biklen 2003; Berg 2007). In addition to being a prominent research approach in the discipline of geography, the case study has been widely applied in social science research in disciplines such as management (Gilbert 2005; Eisenhardt and Graebner 2007), psychology (Bromley 1990), organisational research (Edmondson *et al.* 2001; Galunic and Eisenhardt 2001), education (Bogdan and Biklen 1992), criminology (Champion 1993; Hagan 1993), international political economy (Odell 2001), and various healthcare and medical fields (Gilson 2012).

With increasing demands for water being felt in the country, water management and its associated land management processes are contemporary 'hot topics'. Yin (2009, 2011) conceptualises the 'case' as a contemporary phenomenon which is empirically studied in its real-world context. The context and complex settings of a case are central to case study research and often the spatial and temporal boundaries between phenomenon and context are blurred (Yin 2011). A case study of the Gamtoos catchment therefore involves exploring the "contemporary real-life processes" of land and water management through a "detailed contextual analysis of [the] conditions, and their relationships" (Zainal 2007: 1–2).

Specifically, this research can be described as a descriptive and analytical instrumental case study as it provides a snapshot of a single research entity (the Gamtoos catchment) in the form of a detailed, objective description and analysis of emerging patterns which are compared among sub-entities (the sub-catchments) (Berg 2007: 293). Case studies use descriptive theory as frameworks for the study (Berg 2007); political geoeology is used in a similar fashion. Stake (in Berg 2007) states that an instrumental case study's purpose is to provide insight into an issue or to refine a theoretical explanation. This study provides insight into the spatial distribution of power relations over water resources and, in doing so, refines the political geoeology approach. Investigating a case in-depth to gain a theoretical understanding is a key characteristic of instrumental case studies (Berg 2007: 291). This research does not attempt to

assert that the political geocology of the Gamtoos catchment is typical of all catchments in South Africa, but rather seeks to understand the types of human–environment interrelationships that exist within a river catchment.

The case study approach is not without its criticisms. Yin (2011) states that case studies are often criticised for not protecting against biases where a researchers seem to find what they set out to find. However, he also notes that this challenge can be overcome by using systematic procedures. Several authors highlight a major flaw as the inability to scientifically generalise case study findings to broader levels (Bromley 1990; Yin 2011; Zainal 2007). However, Bromley (1990) argues that the purpose of a case study is to uncover a pattern of meaning within the description, not to generalise and therefore a representative sample and statistical inference are not important. Other criticisms include that case studies lack rigour, are too long, are too difficult to conduct, and produce massive amounts of documentation (Zainal 2007). This research takes into account these criticisms.

Despite these criticisms, there are several compelling reasons why the case study approach is valid and useful. Firstly, it produces new knowledge concerning real-world behaviour and its meaning (Yin 2011). Secondly, rather than producing abstract statistical generalisations about a phenomenon, it delivers a holistic, in-depth description about a complex setting that emphasises the real-world context of processes and relationships (Yin 2011). Furthermore, case studies examine data within its context, allow use of several lines of data gathering and analysis, incorporate both quantitative and qualitative techniques, and meaningfully contribute to theory application (Yin in Berg 2007; Zainal 2007). In addition, Berg (2007: 284) states that by concentrating on a single phenomenon, case studies allow for focus on manifest interactions of significant factors alongside the ability to capture latent nuances and patterns that other approaches might overlook. Thus, the case study approach is able to capture the complexities of real-life situations in detailed qualitative accounts (Zainal 2007).

1.7.2 Qualitative Methodology

Through the case study approach, this research follows a qualitative, descriptive–analytical methodology. Qualitative research examines how people structure and give meaning to their lives (Berg 2007: 7) and yields insight into the subject’s perspective to understand actions and meanings within their social context (Hakin in Robinson 1998). It, therefore, investigates the nature of things: the what, how, when, and where (Berg 2007: 3). Thus, through the political

geocology approach, this research qualitatively explores how physical characteristics, human activities, and power relations over land and water management structure the social realities of the catchment and how these structures drive practices, problems, and challenges (Berg 2007; Robinson 1998).

A qualitative methodology is suitable for this research as the statistical analysis characteristic of quantitative approaches fall short in explaining human and social processes (Robinson 1998). Reducing land and water management processes to a statistical quantitative model that explains causative relationships would neglect the descriptive narrative of the relations of power and influence, conflict and compromise that impact physical catchment processes (Robinson 1998).

To explain the underlying structures dictating patterns of social relations, this research engages a realist theoretical paradigm (Kitchin and Tate 2000: 15). Realism, as an approach, posits that “the task of research is not simply to collect observations but to explain these within theoretical frameworks which structure people’s actions” (May in Kitchen and Tate 2000: 15). As realism examines how something happens, how extensive a phenomenon is, what produces changes, and what allows and forces change, it is well suited to accomplish the aims of this study (Kitchen and Tate 2000).

1.8 Methods

Through a qualitative, realist paradigm, this research combines multiple methods. Common sources of evidence in case study research include direct observations of human actions or a physical environment, interviews, archival records, documents (including articles and reports), and participant observation (Eisenhardt and Graebner 2007: 28; Yin 2011: 10). This research used multiple sources of evidence in the form of spatial data, interview transcriptions, Lickert scale questionnaire responses, and documents. This data was collected in two ways, namely through secondary data sources (GIS data and documents), and semi-structured interviews with a survey questionnaire component. Multiple methods were used in data analysis both across and within research questions. Analysis of spatial data was performed through the creation of maps using ArcGIS and QGIS software. Patterns in the data were identified and descriptively interpreted and analysed. Qualitative content analysis was used to analyse interview transcripts through latent and manifest coding (see Miles and Huberman 1994; Berg 2007; Esterberg 2002;

Ezzy 2002), and questionnaire responses were analysed through the use of graphical measures such as graphs and tables. Specific data collection and analysis methods will be discussed in further detail in Chapter 3 (Section 3.1) and Chapter 4.

1.9 Outline of Thesis Structure

Chapter 1 provides background to the study, introducing the context of water in South Africa and the relationship between water resources, management, and power relations. Additionally, it describes the Gamtoos catchment as the study area for this research. It motivates the study, outlines research goals, and introduces the methodology and methods for the study.

Chapter 2 is the literature review for the study. It reviews political ecology and geoeology literature and puts forward the political geoeology approach. It then interprets water management literature through a political geoeology lens and outlines catchment zonation concepts to be used under political geoeology.

Chapter 3 details the spatial framework of the Baviaanskloof–Kouga–Gamtoos sub-catchments to address both the methods and results to Research Question 1. Thus, it provides an in-depth exposition of the spatial distribution of resources and human activity in the study area. Additionally, it delineates the study area into zones for further investigation in Chapter 6. It also identifies the relevant stakeholders for the study, addressing Research Objective 2a.

Chapter 4 addresses the methods and methodology for investigating power relations (Research Question 2). It examines data collection, data processing and organisation, and data analysis through content analysis.

Chapter 5 addresses Research Question 2. It presents the results to interview and survey questionnaire data analysed through qualitative content analysis. Results are presented as a qualitative description, supported by participants' quotes and graphs from the survey questionnaire data, thereby describing local level land and water managers' perceptions of management processes and other stakeholders, and highlighting key power relations in the study area.

Chapter 6 addresses Research Question 3, drawing together and discussing the results from Chapters 3 and 5 according to each of the zones in the study area. It interprets the results in terms of IWRM and South Africa's water management literature and evaluates the utility of the political geoecology approach. Furthermore, it addresses Research Question 4 and evaluates the political geoecology approach and examines limitations of the study.

Chapter 7 concludes the study, synthesising the findings of the research in terms of the research goals. Additionally, it provides recommendations for future research and water management in South Africa.

1.10 Conclusion

Management of land and water resources in South Africa is characterised by a myriad of challenges occurring against a backdrop of socio-economic tensions resulting from inadequate redress of historical inequities. To adequately address these, insight is needed into the drivers of these problems. The physical landscape and power relations shape land and water management. The Gamtoos catchment provides a unique case study in which to qualitatively examine the interrelationships between land and water management, the physical environment, and power relations on multiple levels of socio-economic organisation. Political geoecology is well suited to examine the complex water management context in South Africa as it combines geoecology and political ecology into a holistic approach. Thus, this research attempts to understand the nature of land and water management in the Gamtoos catchment in terms of what resources are available, how they are managed, and how the space and place of the catchment and sub-catchments affect the management thereof.

Chapter 2: Literature Review

This review develops a political geocology approach for examining the spatial manifestation of the interactions humans have with each other, other organisms, and with abiotic components of their environment. It is informed and inspired by political ecology and geocology. This review takes the viewpoint that political geocology's strength lies in the way it combines these two fields to spatially investigate power relations over resources. Furthermore, as this study focuses on water management, this chapter also reviews how water management literature has dealt with themes of power, politics, and space.

2.1 Review of Political Ecology

Political ecology is one of the key approaches informing political geocology. It is an approach through which to examine human–environment interactions and the power relations surrounding these. This review takes the viewpoint that political ecology's strength lies in its ability to apply multiple approaches to the investigation of power and environment, combining both physical and social factors in a single approach. Thus, political ecology is an example of a theoretical approach that simultaneously examines (i) human impacts on the environment, (ii) how the environment shapes human activities, and (iii) power relations between actors over resources.

Literature is reviewed insofar as it contributes towards a strong theoretical foundation for political geocology. Major trends, conflicts, and criticisms of political ecology as a theoretical approach are highlighted. The review draws primarily on review papers rather than applied practical examples and case studies. The reason for this is that political ecology informs, rather than prescribes, the political geocology approach.

This review begins by evaluating early political ecology's pursuit of structural explanations for environmental degradation. It then outlines political ecology's evolution towards an emancipatory goal alongside the emergence of a post-structural political ecology with its local level focus and emphasis on power. The literature is then synthesised through an evaluation of, firstly, how the field has dealt with 'ecology' and 'politics' through time, and, secondly, its utility as a field that balances social and biophysical concerns. Finally, political ecology's breadth is critically examined in terms of its multiplicity and multidisciplinary.

2.1.1 Early Political Ecology: In Search of Explanations for Degradation

Multidisciplinary Background to Political Ecology

From its inception, political ecology used analytical tools from both natural and social sciences (Blaikie and Brookfield 1987: xvii). It sought to develop common ground at the confluence of hitherto disparate disciplines such as ecology, geography, environmental sociology, political science, and anthropology. Thus, it arose out of diverse theoretical thrusts including cybernetics, systems theory, hazards school of thought, community ecology, cultural ecology, and political economy. For an in-depth exploration of why and how political ecology arose out of these diverse disciplines see Greenberg and Park (1994), Paulson *et al.* (2003), Watts and Peet (2004: 6–8), Blaikie (2008), and Robbins (2012).

Structural Approach for Explaining Degradation

The term ‘political ecology’ itself was coined in the 1970s to provide a toolkit for political economy that dealt with questions of access and control over resources, particularly emphasising explanations of accelerated environmental degradation (Watts and Peet 2004: 6). The most widely cited statement of early political ecology’s principles defines the field thus: “The phrase ‘political ecology’ combines the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself” (Blaikie and Brookfield 1987: 17). This definition is mirrored by Greenberg and Park (1994: 4) who, while not explicitly proposing a definition, describe it as an approach for understanding the mutual interaction that exists between human society, human productive activity, and the natural environment. This emphasis on political economy, classes in society, and productive activity reflects the structural stance of early political ecology.

Political Ecology as Chains-of-Explanation

Up until the advent of political ecology, explanations of human–environment relations and associated ecological change were generally based on systems or functional-adaptation approaches (Neumann 2005: 19). These were problematic because they applied simplistic ecological models to human societies (Greenberg and Park 1994: 4). To integrate questions of access and control over resources with human ecology, Blaikie and Brookfield (1987) proposed a political ecology approach based on ‘chains of explanation’ (Peet and Watts 1996: 6). Political ecology’s originality stemmed from this attempt to combine disparate social and biophysical methods in the analysis of power relations and the environment in an explicitly

theoretical approach (Rocheleau 2008: 718). Central to this was an overt focus on local level analysis and stand-alone case studies (Watts and Peet 2004: 6).

The chains-of-explanation approach situates local land managers and their relationship to the environment within a broader historical, political, and economic context with the purpose of explaining the drivers of localised ecological change, resource degradation, and development problems (Robbins and Bishop 2008: 748; Rangan and Kull 2009: 31). The approach combines structure and agency (Rocheleau 2008: 718) where ‘structure’ can be understood as the broader political-economic context and ‘agency’ as the drivers of the environmental problem. For Blaikie and Brookfield (1987) this involves framing local land management within ‘external structures’: the state, the core–periphery model, and elements of the world economy (Watts and Peet 2004: 9).

Robbins and Bishop (2008: 747–748) outline three steps of the chains-of-explanation approach: (1) identify an environmental problem; (2) analyse the proximate drivers of the problem (usually in terms of the actions of land managers or local decision-makers); and (3) contextualise these drivers within broader political–economic constraints. Under this approach, environmental problems and the actions of land managers are examined in terms of local spatially-explicit ecological patterns (Watts and Peet 2004: 9). Chains of explanation, therefore, extend “out from the individual land manager” (Rangan and Kull 2009: 31) to “look to the world beyond” (Robbins and Bishop 2008: 748). This approach links local environmental variations with cartographies of local decision-makers and structural constraints (Watts and Peet 2004: 9; Robbins and Bishop 2008: 748). Therefore, the chains-of-explanation approach subsumes local level case studies within multi-layered and multi-scale analyses (Watts and Peet 2004: 9).

Through applying the chains-of-explanation approach, political ecology examines how place-specific environmental outcomes are produced through social–political–economic interactions operating at global, international, national, regional, local, community, household, and individual levels (Greenberg and Park 1994: 8; Watts and Peet 2004: 4; Rocheleau 2008: 718; Rangan and Kull 2009: 28, 30). Thus, it engages both multiple geographical scales and multiple

levels—both spatial extent and vertically-imagined hierarchies of socio-economic organisation (Blaikie and Brookfield 1987: 17).²

As it is characterised by “stacked boxes and arrows of realist causation” (Robbins and Bishop 2008: 750), the chains-of-explanation approach yields an understanding of these relationships in two ways. Firstly, it explains how local, spatially-explicit ecological patterns are linked with—and contextualised within—wider economic and political processes on multiple levels. Secondly, it emphasises how the local, spatially-explicit environmental outcomes are produced by these cartographies of decision-making and structural constraints. Significantly, the approach does not provide answers themselves but rather provides a roadmap for seeking answers (Robbins and Bishop 2008: 754). The chains-of-explanation approach is praised for its epistemological flexibility, holism, and its emphasis on non-human actors and the land itself (Robbins and Bishop 2008: 754).

Themes of Early Political Ecology

This structural emphasis on causes of environmental degradation characterised much of political ecology in the 1980s and early 1990s. Early writings were characterised by: (i) analysis of biophysical ecological change (Walker 2005: 74–75); (ii) a tendency to centrally situate poverty, poor management, and environmental degradation as mutually causal (Watts and Peet 2004: 9); and (iii) a focus on how cultural ‘modernisation’—under a global capitalist political economy and unequal power relations and conflict—destabilised and reshaped human–environment interactions (Walker 2005: 74). Thus, early political ecology dealt with a wide range of topics, for example: global market integration marginalising third-world land users’ localised environmental knowledge (Watts 1983); flows of energy and matter from the global periphery to the core (Bunker 1984); the link between soil productivity and state-subsidised cattle ranching (Hecht 1985); critique of desertification theories, linking economic

² Numerous authors (in both human geography and political ecology) differentiate between ‘scale’ and ‘level’ and argue that the two are frequently confused (Lebel *et al.* 2005; Marston *et al.* 2005; Sayre 2005; Neumann 2009; Rangan and Kull 2009). It is, therefore, important to understand the distinction between the two; some reflections have been offered in this regard. Rangan and Kull (2009: 30–31) understand ‘scale’ as a range and ‘level’ as a position on that range. Alternatively, Neumann (2009: 400) conceptualises ‘geographical scales’ as spatial extents and ‘levels’ as hierarchies of socio-economic organisation. On the other hand, Marston *et al.* (2005: 240) understand ‘scale’ as size and ‘level’ as a vertically-imagined nested spatial hierarchy. Level, scale, and space have been engaged in political ecology in a number of ways. Ramutsindela (2012) examines the usefulness of scale for geographical inquiry and for engaging with contemporary people–environment relations. In the parts of this thesis that deal explicitly with power relations, focus is on multi-level analysis as it is engaged in political ecology. Unfortunately, an in-depth examination of scale in political ecology is beyond the scope of this thesis.

and ecological disequilibrium (Watts 1985); the link between erosion and crop yields contextualised within an area's broader socio-economic context (Blaikie and Brookfield 1987); and the impact of HIV on productive processes in the context of political and economic change (Barnett and Blaikie 1992).

Criticisms of the Structuralist Approach

Structuralist political ecology, as outlined thus far, has been subject to numerous criticisms. The chains-of-explanation approach, specifically, has been criticised for: (i) consisting of disconnected linkages resulting in diluted explanations that offer “no sense of how, or why, some factors become causes” (Peet and Watts 1996; Watts and Peet 2004: 11); (ii) neglecting inherent variations in time–space scales of environmental and social change by reducing the conceptualisation of geographic scale to an objective hierarchy of pre-given spatial categories of socio-economic organisation (Zimmerer and Bassett 2003: 3; Rangan and Kull 2009: 32); and (iii) unreflectively situating the local in wider processes (Neumann 2009: 404).

Early political ecology as a whole has been criticised for: (i) unduly emphasising poverty as the cause of environmental degradation, with the associated risk of blaming the victim (see Hecht and Cockburn 1989); (ii) a bias towards rural, agrarian, and ‘Third World’ studies; (iii) privileging land over other resources (Watts and Peet 2004: 10); (iv) neglecting politics in the form of day-to-day struggles over the control of and access to productive resources; and (v) ignoring the symbolic contestations that constitute those struggles (Watts 1990: 128–129; Moore 1993). Additionally, for its focus on the role of political economy in shaping land managers’ environmental decision-making, it has been criticised as overly deterministic (Walker 2005: 75). In response to these criticisms, biophysical ecology became less central as numerous authors began examining the role of politics in shaping human–environment relations (Walker 2005: 75, 79; Walker 2007: 363).

2.1.2 Evolution of Political Ecology: Increased Focus on Power

Political Ecology with an Emancipatory Goal

One way that political ecology attempted to increasingly engage politics was by using environmental ideas for emancipatory purposes (Walker 2005: 79). Indeed, Walker (2007) suggests that the ability to effect change and make a practical difference is what makes the field specifically ‘political’. Watts and Peet (2004: 3) reflect this evolving direction, conceptualising political ecology as seeking “to understand the complex relations between Nature and Society

through careful analysis of social forms of access and control over resources—with all their implications for environmental health and sustainable livelihoods”. Interestingly, this broadened focus encompassing ‘sustainability’ reflects the contemporary dominant global discourse. Thus, political ecology has expanded—continuing to combine approaches from the natural and social sciences—to examine not only causes of degradation but also a wider range of environmental contexts and problems characterised by different forms of access, control, and governance of numerous environmental resources and space on multiple levels (Watts and Peet 2004; Neumann 2009: 403).

Emergence of a Post-Structural Political Ecology

Another direction in which the field moved in the 1990s was towards post-structuralism, turning attention to: critical perspectives; green Marxism; Foucauldian theories; discourse theory; symbolic and identity politics; the social construction of nature and knowledge; politics of meaning; the institutional nexus of power, knowledge, and practice; and local level studies of environmental issues, politics, and institutional powers (see Watts 1997; Paulson *et al.* 2003: 205; Watts and Peet 2004: 5; Walker 2005: 75; Blaikie 2008: 776; Rocheleau 2008: 722; Robbins 2012: 92–93). This reflects a discursive turn in geography generally in the 1990s that embraced post-structuralism, post-modernism, and post-colonial studies; it helped political ecology reformulate the understanding of society–nature relations (Watts and Peet 2004: 5; Blaikie 2008: 766). This shed light on complexity and contingency in power relations, situated knowledge, and the positionality [sic] of multiple actors (including researchers) (Rocheleau 2008: 722).

Analysis began to explore how environmental problems were represented—focussing on the discursive formations of ‘Nature’—and how this representation shaped policy and practice (Watts and Peet 2004: 9). Specifically, political ecologists examined: (i) the institutionalisation of knowledge; (ii) why particular knowledges and practices are privileged, produced, and reproduced through time; and (iii) the globalisation and institutional relations of environmental discourse, governance, and management (Watts and Peet 2004: 14).

A Return to an Emphasis on ‘the Local’

As illustrated under the chains-of-explanation approach, political ecology has always been characterised by empirical data gathering at local levels (for example, household and community) (Rocheleau 2008: 718). This remains a strength of the field (Blaikie 2008: 768;

Robbins and Bishop 2008: 752). Local level analysis was given renewed emphasis under the post-structural approach in a bid to pay increased attention to politics in the form of day-to-day struggles over resources. Understanding phenomena within the local context—representing the myriad realities of daily life, resources, and labour—is important as it is rooted in structured economic and ecological conditions of infrastructure and resources (Robbins and Bishop 2008: 754). Additionally, local level analysis provides detailed insight into diverse circumstances, local contexts, and subjective worlds (Blaikie 2008: 768). Such analysis also allows problems to be understood as local, ecological, and intimate; it reveals sites of decision-making and contextualises local landscapes and players within general principles and broader contexts (Watts and Peet 2004: 6; Robbins and Bishop 2008: 752). As the field's focus evolved, political ecologists began to debate whether research should focus explicitly on 'ecology' or the 'political'.

2.1.3 Balancing Focus on Power and Environment in Political Ecology

Analysis of Power in Political Ecology

Through time, political ecology increasingly focussed on the analysis of power. Paulson *et al.* (2003: 205) situate the field's analytic focus on factors shaping power relations among human groups and between those groups and the environment. They indicate that it strives to uncover causes of environmental problems through understanding how power struggles operate in multiple scales [levels] and contexts (Paulson *et al.* 2003: 217). Significantly, this conceptualisation explicitly links politics and environmental problems.

The dynamic interactions between people, places, and resources result in multiple forms of power (Paulson *et al.* 2003: 205). Power relations are influenced by how a given population (whether local, national, or international) interacts with (i.e. accesses, manages, uses, protects) the resources in a particular place. Thus, the understanding of power as explored in this research follows Paulson *et al.* (2003: 205) who conceptualise power as a social outcome of the uneven distribution of resources and risk. As resources are unevenly distributed across the landscape, access (and associated risk) is inevitably asymmetrical for different groups—a situation amplified by historical–political factors in many parts of the world, especially South Africa. Thus, geographic location partly determines a population's ability to access resources and their vulnerability to risk. It is critical to pay attention to power asymmetries to understand how relations are networked within and between scales and levels (Neumann 2009: 399). Greenberg and Park (1994: 8) conceptualise this as 'relative power'. The circulation of power in these

social relations is understood by Paulson *et al.* (2003: 205) as ‘politics’. Understood in this way, the politics in a given case study are characterised by the ways in which power is held, passed on, and negotiated.

Power negotiation under a structuralist approach is understood in terms of structural constraints at various levels (Robbins and Bishop 2008: 748), for example, examining “scalar politics of the state in struggles over the control of resources and the environment more broadly” (Neumann 2009: 403). Under a post-structuralist approach, politics and power are not only understood as encompassing governance mechanisms but also struggles over human practice, meaning, and environmental representation (Paulson *et al.* 2003: 217). Thus, investigations into power struggles can take either a structural approach (examining struggles over access and governance) or a post-structural approach (examining meaning and representation). Because power is found in multiple levels and forms—of which governance mechanisms are only a part—multi-level analysis in political ecology allows for “analytical links between power relations, institutions, and environmental regulation and ecological outcomes” (Watts and Peet 2004: 13).

Cyclical Criticisms: (Re)-Locating the ‘Ecology’ in Political Ecology

It has been argued that in response to Watts’ (1990) criticism (that political ecology lacked sufficient focus on politics) politics became so central that the field was later criticised for failing to truly interact with concepts of ecology (Walker 2007: 363). Specifically, Vayda and Walters (1999) contend that the wider political–economic system’s importance is overemphasised and power’s influence over environmental change is neglected. A similar criticism is that too often the biophysical environment is simplistically treated as the setting for struggles over resources (Zimmerer and Bassett 2003: 3). Arguments surrounding the location of ‘ecology’ in political ecology centre on the extent of the concept’s inclusion and scientific engagement, as well as its definition and interpretation. Walker (2005) examines how ‘ecology’ is overlooked in political ecology research but also asserts that numerous cases exist where ecology is directly employed, for example, the engagement with equilibrium and non-equilibrium ecologies in a number of studies. For in-depth responses to Vayda and Walters’ criticisms, see Watts and Peet (2004: 15–18) and Walker (2005).

Balancing the Social and Biophysical

In response to criticisms, political ecologists began to rethink their approaches, balancing political–economic concerns with ecological ones (Paulson *et al.* 2003: 206). This is important as political ecology’s capacity to contribute original solutions to environmental problems is located in its position at the interface between social and natural sciences (Walker 2005: 77). A number of ways to achieve this balance have been suggested. Vayda and Walters (1999) advocate for increased focus on the impact of political controls on environmental resources. Walker (2005: 76–77) promotes the examination of how biophysical ecology shapes power struggles and how outcomes of power struggles influence environmental change.

In examining biophysical ecology’s centrality in the field, it could be argued that its marginalisation reflects society’s tendency to increasingly marginalise the environment as it pursues development. Subsequently, human–environment studies’ focus necessarily becomes how biophysical resources are accessed, controlled, and managed. Political ecology, therefore, examines the environment in terms of its central role in human survival and development. Indeed, Watts and Peet (2004: 4) characterise ‘Nature’ as being deeply embedded in modern political identities, suggesting that the two cannot be separated. Walker (2005: 75) links his commentary to the definition of ecology, intimating that studies only merit the label political *ecology* [emphasis in original] where ecology is treated as the study of interactions between humans (as living organisms) and their biophysical environment. Broadly interpreting political ecology in this way allows for multiple research approaches.

Thus, responses to the criticism that the field neglects ‘ecology’ acknowledge that ecological implications are side-lined in some cases but refute the idea that political ecology lacks engagement with ecology, citing the understanding that the field allows multiple representations of the environment to be explored in multiple ways (Walker 2005). Therefore, a political ecology study is safe from criticisms that it neglects ecology provided it maintains a focus on human–environment relations (even if it does not directly engage with biophysical ecology concepts). Thus, political ecology employs multiple approaches, methods, objectives, and audiences in examining human–environment relations (Rocheleau 2008: 718). The following section discusses political ecology’s engagement with multiple approaches.

2.1.4 Political Ecology as a Multidisciplinary Field

Multiple Approaches of Political Ecology

Multiple branches of political ecology research have been pursued through time. This review has examined structuralist, post-structuralist, and emancipatory approaches. Other approaches include feminist political ecology, participatory political ecology, practical political ecology for alternative development, and engagement with activism and social movements (for in-depth discussions of these thrusts, see Watts and Peet (2004: 8–15) and Rocheleau (2008: 721–723)). As a cursory examination of the dates of the literature will attest, these branches overlap in time. They should be understood as broad classifications of the field’s evolutionary track, not discrete phases. Although political ecology has moved in new directions, it has not disowned its “Marxian” [sic] roots; it maintains a central focus on how social relations of production and power—including structural relations of justice, inequality, poverty, and exploitation—shape human–environment relations (Walker 2006: 388). In the context of catchment research, Rowntree (2008: 2) suggests that the structuralist approach can be used to examine local communities’ marginalisation, resource over-exploitation, or how regional basin authorities (partnering with other organisations) have taken control of upstream–downstream geocology to the detriment or benefit of groups living within the catchment. On the other hand, Rowntree (2008: 2) suggests the post-structuralist approach can be used to examine local level end-users and governance, and to uncover power relations between central government and local societies.

Multiple Methods in Political Ecology

The varied approaches of political ecology research naturally result in the employment of multiple methods, both across and within studies. Rocheleau (2008: 718–719) identifies numerous political ecology researchers whose work embodies a mix of qualitative and quantitative methods, informed by technological, ecological, and social imagination. These include participant observation, formal field surveys, analysis of regional datasets, critique, resource and ecological mapping, geographical information systems (GIS), and remote sensing (Rocheleau 2008).

Multiple Objectives of Political Ecology

Additionally, through time, political ecology has pursued numerous different objectives (Rocheleau 2008: 718) including: (i) critical theoretical explanation (directed at other academics); (ii) engagement in applied practical analysis and problem solving (e.g. Blaikie

1985; Blaikie and Brookfield 1987); (iii) applied practical research for emancipatory purposes (e.g. Peet and Watts 1996, 2004); (iv) engagement with activism and social movements; and (v) the framing of national and international policy (policy-relevant research). Political ecology research, therefore, engages with multiple audiences including academics, non-governmental organisations (NGOs), and policy-makers on national and international levels (Rocheleau 2008: 718).

Multiple Criticisms of this Multiplicity

The diversity of objectives, epistemologies, and methods alongside political ecology's multidisciplinary nature has led to serious criticisms: it lacks coherency and is difficult to make overall sense of (Walker 2006: 384); it contains inconsistencies, mixed metaphors, crossed interpretations, bibliographic overload, a "bewildering range of topics", and faces "serious threats to the quality of knowledge" (Blaikie 2008: 767, 771); it is an "everything pill" (Robbins and Bishop 2008); in trying to be "all things to all people" it lacks unity and strength (Blaikie 1999: 31); and it is guilty of "disciplinary transgression" and being "anarchic" (Bryant 1999). Of concern is that some of political ecology's main proponents have proffered these criticisms. Blaikie (2008: 770) points to some authors' arguments that political ecology "has had its day" and has a "limited shelf life". Indeed, a prominent author states "one can only discuss this 'subfield' with enormous trepidation" (Walker 2006: 384).

Multidisciplinarity as a Strength

Countering these criticisms is the argument that political ecology's multidisciplinary nature contributes to a dynamic epistemological foundation and offers many opportunities (Blaikie 2008: 767). Despite the problems inherent in combining different disciplines in a single approach, Blaikie (2008: 766) maintains that it offers an "organising framework where natural and social sciences can re-negotiate their subjects". Neumann (2010: 848) views multidisciplinary nature as political ecology's strength, in a similar fashion to the discipline of geography more generally. Thus, it could be argued that the lack of a single coherent approach is not a weakness; like geography, political ecology could be viewed as a discipline that successfully embodies multiple methods and approaches, allowing the researcher to investigate varying angles of the issues at hand. Alternatively, some authors suggest that political ecology should not be judged on the basis of theoretical consistency but instead on the value of its outputs (Rocheleau 2008). Therefore, political ecology research can pursue numerous valid approaches, each of which potentially highlights varying aspects of power relations

surrounding management, use, and protection of environmental resources. What is important is that political ecologists explicitly define the methods, objectives, and audiences for which a given study caters.

2.1.5 Summary: The Five Hallmarks of Political Ecology

In summary, five hallmarks of political ecology are highlighted—each has been examined in the literature. Rocheleau (2008: 718) identifies these hallmarks, stating that they were established by two foundational works of the field, namely Blaikie (1985) and Blaikie and Brookfield (1987). Firstly, political ecology emerges from a diverse multidisciplinary background and therefore includes multiple methods, objectives, actors, and audiences. Combining multiple approaches is necessary to successfully integrate social and biophysical analysis of power relations and the environment, which is the second hallmark of the field. This review has illustrated that the bias towards social or biophysical analysis has oscillated through time. Thirdly, political ecology makes use of analyses on multiple scales and levels. Fourthly, there is an explicit focus on empirical local level analysis in political ecology, which is directly related to the fifth and final hallmark, whereby chains of explanation are employed to understand the roles of both structure and agency (within which local level analysis is subsumed). Importantly, individual political ecology studies do not necessarily encompass all five hallmarks, but engage these to varying degrees. This review has explored the theory of political ecology in terms of its utility for investigating power relations over resources on multiple levels, highlighting major trends, conflicts, and criticisms in the field.

2.2 Review of Geoecology

Geoecology is the other key approach that informs political geoecology. It is an approach through which to examine landscape structure and function, specifically the relationship between spatial pattern and ecological processes. Geoecology is reviewed insofar as it contributes to its potential use within the political geoecology approach. This review takes the viewpoint that geoecology provides a guideline of how a theoretical approach can be used to holistically explain spatial patterns of multiple landscape factors at various temporal and spatial scales. As the political geoecology approach is inspired by—not based on—geoecology, this review draws on key texts rather than journal articles and applied practical examples. It outlines the major theoretical orientation of geoecology, discusses how it deals with scale, and highlights relevant weaknesses and strengths.

2.2.1 What is Geocology and What Does It Study?

Geocology is a term often used interchangeably with the term ‘landscape ecology’. Huggett (1995) offers a comprehensive text on geocology from which the information in this section is taken, unless otherwise specified. As a field, it is closely related to ecology, spatial ecology, and human ecology. Broadly speaking, ecology studies the relationship between organisms and their environment (Chapman and Reiss 1999; Marten 2001). Human ecology—an offshoot of ecology—studies the relationship between humans (as organisms) and their environment, including impacts on both ecosystems and social systems (Marten 2001). Geocology studies the relationship between spatial pattern and ecological processes across spatial and temporal scales as well as across hierarchical levels of biological organisation (Wu and Hobbs 2007: 277, 284). It is distinguished from traditional ecology and human ecology as it explicitly recognises the role of geographical relations—such as space, scale, and elevation—in modulating the results of complex biotic–abiotic interactions in the environment (Safford 2002; Rowntree 2008: 2).

Specifically, geocology examines the structure and function of landscapes, and how these change over space and time (Forman and Godron in Wu and Hobbs 2007: 275–276). It views all landscape components—biotic and abiotic—as interrelated and influencing one another (Huggett 1995). Thus, it investigates (usually quantitatively) the causes and effects of spatial patterning within geoecosystems, combining horizontal-geographical and vertical-ecological approaches to the study of these interactions (Huggett 1995: xviii; Wu and Hobbs 2007: 274). It studies aspects as wide-ranging as how the landscape mosaic is created and changed through time, the movement of organisms and materials across a landscape, how landscape spatial heterogeneity influences biotic and abiotic processes, and the management of spatial heterogeneity (Huggett 1995).

2.2.2 Geocology and Scale

Huggett (1995: 16–17) uses scale to conceptually differentiate between landscape ecology and geocology, defining scale as “the spatial or temporal dimension of a system”. He argues that landscape ecology studies processes at fairly narrow spatial scales, while geocology accounts for all levels in geoecosystem hierarchies—from less than a square metre in area through to regions, continents, and the entire geoeosphere. Furthermore, geoecosystem processes are seen to be dependent upon scale. For instance, climate is the chief determinant of geoeological processes at the continent scale (due to latitudinal and longitudinal climatic gradients) and at

mountainous landscape scales (due to altitudinal gradients). However, at regional to local landscapes, soil parent material and topography—in terms of aspect, slope, landscape position, and insularity—have predominating influence. Despite some environmental factors having prominence at certain scales, all factors may make themselves felt at all scales. Importantly, scale in a geoecological study “is determined by an observer according to the problem he or she is interested in” (Huggett 1995: 17).

2.2.3 Weaknesses of Geoecology

Geoecology has a number of weaknesses. Firstly, it does not seem to be a well-established term, with most authors instead identifying with landscape ecology. Secondly, it lies in the fuzzy ground between many intersecting fields including—but not limited to—ecology, landscape ecology, spatial ecology, geodiversity, geosciences, ecosystem geography, and environmental geography. Thirdly, many studies narrowly focus on interrelationships between one or two ecological factors, neglecting holistic engagement with interrelationships between multiple geoecological factors. Finally, it could be argued that the quantitative methods often employed in geoecological studies lack effective explanatory power, simplify complex interrelationships down to numerical measurements, and can be difficult to carry out with accuracy and reliability.

2.2.4 Strengths of Geoecology

Geoecology also has numerous strengths making it well-suited to inform the political geoecology approach. Firstly, it examines interactions between multiple factors—climate, geology, soils, topography, hydrology, human adaptations, flora, and fauna. Secondly, it interrogates the landscape processes resulting from these interlinked factors. Thirdly, it holistically explains resulting spatial patterns. Fourthly, it allows multiple temporal and spatial scales to be investigated, but is flexible enough to allow patterns to be examined at scales suitable to the study at hand.

2.2.5 Summary: Geoecology

Geoecology is useful for studying catchments as they are comprised of multiple interrelated factors and processes that change in structure and function over space and time. This review has briefly explored geoecology in terms of its utility for investigating the relationship between spatial pattern, scale, and ecological processes. It has highlighted the relevant strengths and weaknesses of the field. Geoecology and political ecology are similar in their capacity to deal with multiple levels and scales, an important aspect for political geoecology.

2.3 Developing the Political Geoecology Approach

Thus far, this chapter has reviewed political ecology and geoecology. Drawing on these two theories, this section recommends political geoecology as an approach to examine the spatial manifestation of the interactions humans have with each other, other organisms, and with abiotic components of their environment. First, it outlines political geoecology's origins. Second, it orients political geoecology in relation to geoecology, then political ecology. Finally, it motivates for political geoecology as an explicitly spatial approach to the study of human–environment relations.

2.3.1 Origins of Political Geoecology

The approach was originally proposed by Rowntree (2008: 2) to simultaneously examine (i) flows of matter and energy within a drainage basin, (ii) the global, regional, and local power relationships affecting these flows, and (iii) the impact of the power relationships on the drainage basin ecosystems and their ability to provide goods and services to those depending on them. It is designed to elicit an understanding of “the relationship between ecosystem processes, livelihoods, and power structures that takes account of the spatial connectivity within the geographic unit of study” (Rowntree 2008: 6). Rowntree (2008: 6) argues that the approach can improve understanding of complex socio-ecological systems and associated power relationships by contextualising them within their spatial settings, for example, upstream–downstream connectivity within a drainage basin.

2.3.2 Geoecology in Political Geoecology

This approach views all components of a landscape system—biotic and abiotic—as interrelated and influencing one another. This has ramifications for resource management. Political geoecology engages geoecology through investigating landscape systems' structure and function, as well as how this structure and function changes across space. In doing so, it investigates multiple landscape factors, such as topography, hydrology, and climate, alongside human activities. Thus, it investigates the relationship between landscape spatial pattern surrounding resource distribution and human activities, for instance, how landscape configuration determines spatial distribution of resources and human activity.

2.3.3 Political Geoecology: An Explicitly Geographical Political Ecology

Political geoecology shares many similarities with political ecology. However, it does not seek to replace political ecology. Instead, it offers an alternative approach for those studies seeking to orient themselves in a specifically spatial manner. Thus, it builds on the field of political ecology by adding new thought, direction, and innovation.

As illustrated earlier in this chapter, prominent political ecologists have asked questions such as ‘Where is the ecology?’ (Vayda and Walters 1999; Walker 2005) and ‘Where is the politics?’ (Walker 2007). Since numerous authors (e.g. Forsyth 2003; Walker 2005) have pointed to the centrality and importance of political ecology to the discipline of geography, it could be argued that the time has also come to ask, ‘Where is the geography?’

While political ecology initially took a spatial approach to investigating power and environment (e.g. Blaikie and Brookfield 1987), the field has since diversified to the extent that studies no longer need to explicitly address spatial aspects to warrant the label ‘political ecology’. Political geoecology is posited as a solution to this. Encompassing many facets of political ecology, it offers a flexible, adaptable approach for spatially investigating human–environment relations. It is distinguished from political ecology as the role of space in modulating human–environment relations is explicitly recognised. Additionally, it has been seen that the combination of social and biophysical approaches is seen as a strength of political ecology (Zimmerer and Bassett 2003; Walker 2005). Political geoecology extends this, taking into account the ‘political’, the ‘biophysical’, and the ‘geophysical’.

2.3.4 Motivation for Developing the Approach

The political geoecology approach that this study puts forward is not intended as an independent field separate from disciplines such as political ecology, environmental geography, anthropology, or environmental sociology. Instead, it is intended as an explanatory tool that can be used within these fields to investigate and explain spatial interrelationships between humans and the environment, taking into account multiple levels of interaction.

2.3.5 Political Geoecology in this Study

Under the political geoecology approach, this study combines aspects of both structuralist and post-structuralist political ecology. It engages a structural approach by simultaneously (i) dealing directly with questions of access and control over resources, (ii) examining shifting

power balances between classes and groups within society, and (iii) examining how external influences impact those directly involved in land and water management within the study area. Thus, it contextualises local level productive activity within the broader historical, political, economic, and environmental context. A post-structural approach is engaged by focussing on stakeholders' subjective representations of their day-to-day experiences of power struggles around land and water management, labour, and decision-making. To a lesser extent, it also examines the reproduction of global environmental discourse at the local scale. Therefore, environmental conditions within the catchment are explained in terms of (i) the actions of local level stakeholders, and (ii) influences from multiple levels of socio-economic organisation. The spatial manifestation and implications of these power relations are critically investigated, firmly situating this study within political geocology rather than political ecology.

Furthermore, this study investigates the spatiality of these power relations (e.g. in the form of upstream–downstream linkages) relative to landscape patterns and the interplay between hydrology, topography, climate, vegetation, and human activities at catchment and sub-catchment scales. Thus, an understanding of how resources are accessed, used, controlled, and managed is gained within a context of their spatial distribution.

2.4 The Political Geocology of Water Management

Thus far, this chapter has advocated for political geocology through a review of political ecology and geocology literature. This section reviews water management literature through a political geocology lens. As this study investigates power relations surrounding land and water resources, it is necessary to explore how the literature has dealt with these themes and what the key findings have been. In this vein, this review explores the primary trends and conflicts about water management in South Africa and contextualises these within the wider southern African and global context. Specifically, it examines how water management literature characterises power relations and portrays the status of water management in South Africa, Africa, and globally. Furthermore, it points to the spatiality of water management evident in the literature. It adopts the viewpoint that power relations are inherent in water management (especially in South Africa) and are evident in the literature even when authors have not explicitly sought to discuss them and highlights the major trends, themes, conflicts, and criticisms in the field. It also outlines zonation concepts that have been employed to spatially investigate water management.

Literature evaluated represents a mix of review papers (e.g. Biswas 2004; Swatuk 2005; van der Zaag 2005; Jonker 2007; Biswas 2008; Schreiner 2013), discussion papers (e.g. Ashton 2000a, 2000b; GWP 2000a, 2000b; Molden *et al.* 2001; Allan 2003; Merrey 2008), reports (e.g. Msibi and Dlamini 2011; Reijerkerk *et al.* 2012), and academic case studies (e.g. Ashton and Haasbroek 2002; Schreiner and van Koppen 2002; Funke *et al.* 2007a, 2007b; Pollard and du Toit 2008; Herrfahrtdt-Pähle 2010a, 2010b; Swatuk 2010; Brown 2011; Kemerink *et al.* 2011; Bourblanc 2012; Brown 2013; Bourblanc and Blanchon 2014).

First, the review explores how power, politics, and space are represented in South Africa's historical water governance context. Second, it explores how power is represented in the context of integrated water resources management (IWRM) and water reforms in southern Africa and South Africa, including an example of IWRM in practice in the form of Working for Water (WfW). Third, IWRM is evaluated in terms of its suitability as a water management approach in South Africa, specifically in light of the challenges related to decentralisation and equity. Finally, zonation concepts are outlined and assessed as explicitly spatial approaches to understanding and explaining water management.

2.4.1 Power and Politics in South African Water Governance Historically

South Africa's complex water management history reflects its socio-political history. This is explored by numerous authors (Ashton 2000a; Ashton and Haasbroek 2002; Funke *et al.* 2007a; Muller *et al.* 2009; Swatuk 2010). Funke *et al.* (2007a) succinctly overview the history of water management in South Africa, from the Khoisan through Dutch and British rule to apartheid, and finally democracy. Swatuk (2010) analyses—through a critical investigation of water, state theory, and various state forms in South Africa—how water legislation and institutions reflect the use of central-state power to serve dominant interests through time. This section examines these inherent power relations in South Africa's historical water management context.

Biophysical and Geophysical Factors Shaping Water Management Decisions

Through time, South Africa's water policies have been shaped to cope with water scarcity, uneven distribution of resources, and pressures of economic growth (Ashton and Haasbroek 2002: 197). Importantly, South Africa's original water legislation was developed using the rules of 'well-watered' colonising countries of Europe—a system inappropriate to the dry and variable climate of southern Africa which has limited groundwater supplies and seasonal

rainfall and river flows (Davies and Day 1998: 361; Swatuk 2010: 529). An engineering response was taken to mitigate these risks and new sources of water located at great distances from demand centres were developed; this is often referred to as the country's 'hydraulic mission' or 'supply phase' (Turton 1999; Ashton and Haasbroek 2002: 197). It was characterised by legislation facilitating rapid acceleration of inter-basin transfers alongside storage capacity enhancement through the construction of both small, on-farm dams and state-initiated, large storage dams across South Africa (Ashton and Haasbroek 2002: 188; Swatuk 2010: 530). Muller (2000) asserts that, provided they are based on a sound legal framework, inter-basin transfers can be considered an effective method of meeting increasing water demands. Ashton (2000a: 1) characterises water management during this time as following a 'command and control' approach, dominated by technical considerations imposed unilaterally by a central government body. This illustrates the political and management response taken to the biophysical and geophysical realities of water distribution in South Africa.

Land and Water: Misused Weapons of State Control

Thus, the apartheid government promoted large water projects harnessing water to meet the needs of industrialising, urbanising, mineral-rich, and financially lucrative areas of South Africa in an effort to spur economic development (Funke *et al.* 2007a: 13; Swatuk 2010: 531). At the same time, racial distinctions were legally formalised under the ideals of 'self-government' and 'separate development' among the races (Funke *et al.* 2007a: 14; Swatuk 2010: 531). These discriminatory laws physically segregated the population; separate ethnically-defined residential areas were created and millions of black people were forced to resettle in official 'non-white areas' and 'homelands' (Funke *et al.* 2007a: 13–14; Swatuk 2010: 531). Homelands were overpopulated, many were located in semi-arid and arid areas, and had sham governments funded by the apartheid regime (Swatuk 2010: 533). This resulted in interrelated social and environmental problems including land degradation, which were worsened by laws forbidding land ownership resulting in a disincentive to invest in the land (Swatuk 2010: 533). Through this, productive access to water was denied to vast numbers of rural, black South Africans: the majority of the population (Funke *et al.* 2007a: 13; Swatuk 2010: 531). Thus, state power was used to harness water unsustainably, inequitably, and inefficiently "to satisfy the interests of dominant social groups: i.e. white farmers; industrialists; companies; and cities" to the exclusion of the black majority who "were systematically starved of the principal means of sustaining their livelihoods: land and water" (Swatuk 2010: 532). Water was therefore "a very effective weapon in the apartheid

government's arsenal of oppression and control" (Funke *et al.* 2007a: 13). This illustrates how wider socio-political goals influenced water and land management decisions, which were taken regardless of economic and ecological viability (Swatuk 2010: 532). These decisions not only had lasting consequences for the spatial distribution of land and water resources but also for the spatial distribution of human population groups and their productive activities.

Water Management at Multiple Levels

Ashton (2000a: 5) asserts that the legal framework at the time was inappropriate for effective, coordinated water management, resulting in an ad hoc approach. Additionally, government structure led to narrowly segmented functions and responsibilities and ineffective inter-departmental collaboration (Ashton 2000a: 5). Furthermore, not all water management was governed at a national level. Schreiner and van Koppen (2002: 971) point to the emergence of large-scale irrigation schemes that were managed by self-elected irrigation boards who collectively governed portions of rivers; an example in the study area is the Gamtoos Irrigation Scheme managed by Gamtoos Irrigation Board (GIB). Kemerink *et al.* (2011: 593) highlight historical analyses illustrating how wealthier farmers asserted their claims to water by constructing permanent hydraulic infrastructure, emphasising that "water systems are not only shaped by, but also themselves shape and reinforce, social-political and economic relations". Thus, historically, South Africa's water management has been plagued by problems related to private ownership and multiple levels of influence whereby national, provincial, and local authorities all exerted a variety of controls on the use, development, and pollution of water (Davies and Day 1998: 365).

History's Legacy: Unequal Access and Unequal Risk

Following the country's first democratic elections in 1994, the water sector underwent an extensive reform. This is discussed by numerous authors (Ashton and Haasbroek 2002; Funke *et al.* 2007a; Jonker 2007; Swatuk 2010). During this complex political transition, the new government sought to redress (partly through water reform) apartheid's legacy of inequality (Ashton and Haasbroek 2002: 191; Funke *et al.* 2007a: 12). Swatuk (2010: 532) highlights this legacy of structured power and control in the form of state institutions that were "specifically designed to marginalise and oppress the majority of people". Similarly, Bourblanc and Blanchon (2014: 2390) emphasise the importance of recognising the "structural effects that vested interests exert[ed] on the South African waterscape" through time. Thus, it is argued that South Africa's history of land and water is linked to the country's continuing socio-

ecological problems, for example, high unemployment and poverty rates and inadequate access to safe water and sanitation for much of the population (Swatuk 2010: 523, 532–533). Inevitably, these inequalities are distributed in explicit spatial patterns.

Summary: South Africa's Political Geoecology of Water

This section has reviewed literature relating to the history of water management in South Africa through a political geoecology lens. It has illustrated how geophysical distribution of resources led to inadequate management, how power was yielded to control water resources, how water resources were manipulated to political ends, how this shaped the physical characteristics of these water resources, and how this affects the ability of people to access these resources.

2.4.2 Water Reforms, Power, and IWRM

IWRM: Global Discourse and Water Reform

Integrated water resources management (IWRM) was the prevailing water management discourse globally at the time of water reform in South Africa (following the country's first democratic elections in 1994). Additionally, widespread IWRM-based water reforms had been instituted throughout southern Africa from the 1980s in response to challenges experienced by the water sector (Swatuk 2005). Following these trends, South Africa's water reform was based on IWRM guided by four key principles: decentralisation, equitable access, efficiency, and sustainability (Funke *et al.* 2007a: 15). IWRM is defined as “a process which promotes the coordinated 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” (GWP 2000a: 22). Thus, IWRM aims to integrate social, biophysical, and geophysical aspects of water management. Through adopting IWRM, the water reform was influenced by Western ideologies and interests, regional trends, and prevailing global discourse; this lent international legitimacy to the difficult national decisions that needed to be made (Swatuk 2005; Swatuk 2010: 533). Power in water reform, therefore, has the potential to manifest itself on multiple levels (regionally, nationally, and internationally). Furthermore, power in water management has the potential to manifest itself in multiple ways, from overt oppression (as seen under the apartheid regime) to subtle influence (through the prevailing IWRM discourse).

Despite the strength of the IWRM discourse—as evidenced by extensive publications on the topic—successful implementation remains elusive. Numerous authors explore the state of

water management policy and practice in South Africa, including water reform (Schreiner and van Koppen 2002; Funke *et al.* 2007a, 2007b; Jonker 2007; Merrey 2008; Muller *et al.* 2009; Herrfahrdt-Pähle 2010a, 2010b; Swatuk 2010; Dent 2012; Schreiner 2013). This section explores the failures to implement water reform in South Africa, specifically issues surrounding decentralisation and equity. These are primary themes explored in the literature and are identified as significant challenges to the implementation of water reform. Additional challenges will also be outlined.

Water Governance: The Quest to Find an Appropriate Management Scale

From the subjective viewpoint of a water sector professional in South Africa, Schreiner (2013) examines the failure to successfully implement the National Water Act (NWA). She asserts that implementation has experienced failure in establishing catchment management agencies (CMAs), transforming irrigation boards into water users' associations (WUAs), reallocating water, licensing and registering water use, choosing an appropriate national water infrastructure strategy, and protecting aquatic ecosystems (despite successfully determining requirements for such) (Schreiner 2013: 240). This section explores the failure to establish CMAs and transform irrigation boards into WUAs with reference to the principle of decentralisation. Decentralisation is embodied by the principle of subsidiarity, which devolves responsibility of water resources to the lowest appropriate level through the formation of CMAs and WUAs working under the Department of Water Affairs (DWA) (now Department of Water and Sanitation (DWS))³ (Ashton and Haasbroek 2002; Funke *et al.* 2007a; Pollard and du Toit 2008; Schreiner 2013).

South Africa's new water legislation shifted control from riparian users—often the white minority—to the new government, which as custodian of water, has responsibilities of protection, management, and development of water resources (Ashton 2000a: 1; Schreiner and Van Koppen 2002: 969). Legislation provides for central government to retain control over joint management of international catchments and policy and strategy formulation and regulation (Funke *et al.* 2007a: 22). Ashton (2000a: 1) describes the responsibilities of DWAF (now DWS) as leadership and guidance (rather than control) making it more people-oriented

³ The author acknowledges that the department is currently named Department of Water and Sanitation (DWS). DWS, DWA, and DWAF are used interchangeably in this thesis to refer to the same department. Choice of acronym used reflects the time context in which the department is being mentioned. Note that at the time of the field research, it was still DWA and, therefore, this acronym is used most frequently.

than the past. Specifically, the department's Minister's responsibilities include ecological reserve requirements, international water requirements, and water for strategic uses that are of national importance (Funke *et al.* 2007a: 22). Local authorities, on the other hand, are expected to address local and regional issues and to take responsibility for local decisions (Ashton 2000a: 6).

South African water policy development and implementation has experienced a significant increase in non-state actors alongside the multiple legislative local water management authorities (CMAs, WUAs, irrigation boards, and international water management bodies) (Meissner *et al.* 2013). This increase in the number of actors in the sector inevitably results in increased potential power relations. However, Meissner *et al.* (2013) find that literature focuses narrowly on CMAs to the exclusion of other institutions. CMAs have been investigated in terms of: their role in water management (including arbitration) (Bourblanc 2012; Dent 2012); failure to transform existing structures into CMAs (Bourblanc and Blanchon 2014), their functioning as political arenas dealing with competing objectives, and power struggles within them (Bourblanc 2012).

In their investigation of stakeholder interaction in South African water governance at local and international scales, Mirumachi and van Wyk (2010) find that the state continues to play a prominent role in decision-making and that other actors (such as business, civil society, and regional institutions) have limited power. Bourblanc and Blanchon (2014) identify a principle obstacle to CMA creation as competing levels of governance, which manifests as power struggles between CMAs and the DWA (now DWS).

This experience is not unique to South Africa. Swatuk (2005) reviews various studies conducted in Angola, Botswana, Malawi, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. He points to the inherent difficulties in creating new institutions with different jurisdictional boundaries to previous institutions. A pattern emerges whereby government departments are reluctant to participate with new institutions. This is because overhauling institutions displaces existing power structures and requires a fundamental reconstitution of how decisions about access, allocation, and use are made. This realignment of decision-making power in already fragile, underdeveloped states inevitably results in numerous political challenges. Here, the socio-political challenges of transformation are inextricably linked to the geophysical reality of resource distribution and spatial management

boundaries. Van der Zaag (2005) attributes power imbalances in the creation of new water management institutions in southern Africa to the lack of clear guidelines on, firstly, how they can be integrated with existing institutions and, secondly, on what their roles and functions should be.

Bourblanc and Blanchon (2014) argue that, in South Africa, DWA obtained a dominant power position in water management, in contrast to IWRM's decentralisation principle. However, it could be argued that this is not necessarily a bad thing. Bourblanc and Blanchon (2014: 2391) conclude that decentralising water governance through the creation of new institutions is not necessarily required to ensure equity. Brown (2011) also argues against decentralisation, maintaining that increased state intervention may actually be needed in extremely heterogeneous catchments to ensure marginalised groups' interests are upheld. Here, the need for recognition of unique local conditions is emphasised. Bourblanc and Blanchon (2014: 2391) suggest that instead of decentralising, it might be sufficient to design new agreed-upon institutional arrangements. Indeed, Van der Zaag (2005) suggests that to avoid power struggles, new institutions should perform an advisory role towards existing institutions instead of replacing them. Thus, future water governance could approach problem-solving without imposing structural change from outside, and instead find cooperative solutions within existing power structures. Given the difficulties in transforming South Africa's water sector (establishing WUAs and CMAs), this type of approach may be necessary. However, this may be difficult; Dent (2012) highlights that no alternatives to CMAs as water management structures are provided for in South African water policy.

In any case, an alternative transformation process would also face challenges. For example, in the context of promoting stakeholder cooperation, Mirumachi and van Wyk (2010) highlight challenges relating to power disparity, interdependence of actors, and the perceptions of risks involved with inclusive decision-making. Additionally, Schreiner and van Koppen (2002: 975) point to changing power balances between formal water institutions and "well-organised high-volume water users" (i.e. (white) commercial farmers). It is likely these challenges would persist regardless of whether the process was to decentralise or to design new institutional arrangements.

Globally, IWRM has been critiqued for the paradox of pursuing both decentralisation and integration simultaneously. Biswas (2004: 255) argues that IWRM objectives—such as

increased stakeholder participation, decentralisation, and decision-making at the lowest possible level—contradict the ideal of integration and are, therefore, unlikely to promote it. Consolidation of institutions is necessary to achieve integration; this is likely to lead to increased centralisation and bureaucratisation, and decreased transparency and responsiveness to stakeholder needs (Biswas 2004: 255; 2008: 277). The difficulties in cross-sector coordination evident in the southern African and South African examples are inherent to the challenge to achieving integration.

Scale is a further challenge to successful WUA and CMA establishment. Herrfahrdt-Pähle (2010a, 2010b) examines the transition from administrative to hydrological spatial boundaries under South Africa's water reform. She argues that this transition requires a trade-off between the improved fit of social and ecological systems and misaligned social system scales. Further, she highlights the paradox between a holistic approach aligning management boundaries and hydrological boundaries and achieving a feasible management scale for effective stakeholder participation and financial viability. Bourblanc and Blanchon (2014) also highlight the issue of scale resulting from the apartheid regime's construction of inter-basin transfers, which present difficulties in finding an appropriate management scale as the catchment scale becomes unsuitable. They emphasise that South Africa's past has shaped the water resource's physical and hydrological dimension and see this as an obstacle to the creation of CMAs. This has important implications for the planning of proposed future inter-basin transfers within SADC which aim to stabilise regional water supplies (Turton 2010: 5). Furthermore, spatial incompatibilities also occur in data collection. This potentially complicates efforts to understand, and thus manage, the system. De Lange *et al.* (2010) point to the frequent spatial incompatibility between socio-economic and biophysical data resulting from separate collection and observation processes. In their study of the Inkomati Water Management Area, they advocate an approach to overcome these spatial incompatibilities. These difficulties shed light on the importance of an approach such as political geoecology. Firstly, political geoecology provides an approach through which to examine and understand these difficulties. Secondly, these difficulties could point to potential challenges in applying the political geoecology approach itself.

Failed Transformation: Enduring Inequities

Equitable access is one of the pillars of South African water legislation. Redistributing access is inextricably linked to power negotiations. Thus far, enduring inequities are a key failure of

South Africa's water reform, with a lack of transformation in water resource access, use, and control. Numerous authors explore enduring inequities and associated power struggles (Schreiner and van Koppen 2002; Cullis and van Koppen 2007; Brown 2011; Kemerink *et al.* 2011; Msibi and Dlamini 2011; Movik 2012; Naster and Ramasar 2012; Brown 2013; Kemerink *et al.* 2013; Movik 2014). Significantly, access to water remains skewed along racial lines; powerful actors and long-established institutional frameworks of the past continue to dominate the political, social, and economic reality in post-apartheid South Africa (Brown 2011, 2013; Kemerink *et al.* 2011). Due to the spatiality of South Africa's past policies, inequity also manifests in distinct spatial patterns.

Kemerink *et al.* (2011, 2013) find that, in the Thukela catchment, water is still unfairly distributed along racial lines; (white) commercial farmers continue to dominate the WUA and historically disadvantaged (black) individuals remain underrepresented. Taking a political ecology approach to examine biodiversity conservation in South Africa, Kepe (2009) argues that social, political and economic change is likely still limited by the reluctance of social actors to acknowledge and engage with the issue of race. Similarly, the avoidance of explicitly acknowledging and confronting race issues in water management could be contributing to maintaining the status quo of inequitable access. Kemerink *et al.* (2011: 593) argue that the water law and reform is contested even in those situations where there are no explicit disputes, asserting that struggles over access manifest in multiple ways. They assert that these struggles are "linked to self-perceived capacity of the actors to challenge or maintain the existing situation" (Kemerink *et al.* 2011: 593). Structurally entrenched racial and gender inequalities render low self-esteem which prevents marginalised (black) smallholder farmers from challenging the unequal access and claiming their rights: "[They] adopt an underdog position and their attitude tends to be submissive, especially the female smallholder farmers" (Kemerink *et al.* 2011: 593). Derman and Hellum (2007) argue that the Dublin Principles do not result in water management that is responsive to gender and wealth inequities. Instead, they advocate for framing water as a human right and recommend incorporating local norms and practices into water management policies at local, regional, and national levels. Kemerink *et al.* (2013) argue that black smallholder farmers and communities are excluded from within the WUA structure, which is aligned with the neo-liberal normative standpoint of commercial farmers. In the Inkomati Water Management Area, Brown (2011) argues that fundamental weaknesses in the participatory water governance model serve to reinforce inequitable outcomes. Speaking of the same catchment, Brown (2013) notes that power imbalances have prevented successful

water reallocation. This is compounded by the existing elite's determination to preserve their relative advantage. In the Olifants catchment, Lévite *et al.* (2003) highlight tensions between competing water users, finding lack of information and dialogue constrain meaningful participation in water management. These abovementioned themes highlight the opposing discourses of viewing water as a human right and viewing water as a commodity. A balance needs to be struck between (i) ensuring equity through recognising the right to water for all groups, (ii) the need to finance water management, distribution, and protection, and (iii) water use by competing economic sectors and associated social groups.

In addition to exploring causes of enduring inequity, authors also investigate possible solutions. In her conceptualisation of IWRM, Pollard (2002: 943 in Swatuk 2005: 873) asserts that the integrity of water resources at the catchment scale should be maintained within agreed limits. Consensus amongst stakeholders is needed regarding water governance so that all users (including the ecosystem) may benefit equally. Using the Baviaanskloof as a case study, Reijerkerk *et al.* (2012) discuss mediation for effective water distribution through participative landscape approaches and suggest an approach through which to pursue this. However, the focus of the interventions is primarily on convincing large-scale landowners to commit to restoration, to the exclusion of the issue of reallocation, thus further marginalising the black and coloured⁴ communities residing in the area. Kemerink *et al.* (2013) argue that transformation will not be achieved unless the inherently political nature of the participatory process is recognised. Given the Baviaanskloof example, this is particularly important in the case study area. Malzbender *et al.* (2005) suggest that traditional governance systems need to be integrated into formal water management structures on a case-by-case basis—as provided for in legislation. Van der Zaag and Bolding (2009 in Kemerink *et al.* 2011: 593) argue that increasing smallholder farmers' physical access to water is dependent on simultaneously tackling distributional issues alongside infrastructure management capacity issues. Physical access to water is an important aspect of equity issues, underscoring the importance of understanding the spatial distribution of resources for successful management to be achieved.

Thus far, this section has explored the failure to (i) transform existing water management bodies under the IWRM ideal, and (ii) ensure equity in water use, control, and access. However, it is important to remember that these are only two examples amongst a plethora of challenges

⁴ 'Coloured' is an official term used in South Africa to describe a distinct population group of mixed ethnic origin.

facing water management. Attention now turns to the current state of the water sector as reflected in the literature.

Current State of the Water Sector

Literature links current water management challenges in South Africa to the context of historically-entrenched socio-economic and political inequities (Funke *et al.* 2007a; Kemerink *et al.* 2011). Additionally, it evaluates current water management in terms of the extent to which it could be said that IWRM has been implemented.

Numerous authors investigate the failure to adequately implement IWRM through the NWA. Funke *et al.* (2007b) indicate that IWRM has not been implemented fully in the Mhlathuze catchment. Schreiner (2013: 243) asserts that the task of implementing the progressive NWA was vastly underestimated—perhaps beyond the country’s technical capabilities. She argues that it draws focus from basic priorities such as maintaining infrastructure and ensuring compliance. Jonker (2007) contrasts water policy discourse with the discourse of later strategy documents. He finds that the focus is reduced from IWRM to sanitation, infrastructure development, and domestic water supply. Contemporarily, this is reflected in the name change from ‘Department of Water Affairs’ to ‘Department of Water and Sanitation’. Furthermore, despite recognising evidence in DWAF reporting of water management activities that “could be considered” IWRM, Jonker (2007: 1260) concludes that the discourse lacks an emphasis on ‘integration’ and argues that DWAF (now DWS) is regressing from an IWRM regime to a ‘hydraulic mission’ regime similar to that of the mid-twentieth century. Similarly, despite arguing that South Africa transitioned from a water management supply phase into an end-user efficiency phase, Ashton and Haasbroek (2002) highlight that little evidence exists to support the idea that end-user efficiency has indeed improved in the country. Thus, most authors agree that IWRM has not been implemented in South Africa.

Numerous authors highlight the challenges preventing full implementation of IWRM (Rogers *et al.* 2000; Funke *et al.* 2007b; Jonker 2007; Merrey 2008; Herold 2009; Swatuk 2010; Kemerink *et al.* 2011; Quinn 2012; Schreiner 2013). In the first place, limited resource availability is a problem, specifically human resources; lack of experience and technical capability combined with ‘brain drain’ to the private sector cause a high rate of staff turnover and leadership change. This results in a lack of accountability for failure to achieve targets. Within the department, ideological and political power struggles exist alongside resistance to

institutional reform. Where reform does occur, a sectoral view of water management is often taken, narrowly focussing on one aspect (for example, water allocation reform). Furthermore, there is a lack of policy alignment between different government departments, particularly land and water reform policies. This is compounded by lack of buy-in by water managers ‘on the ground’ to IWRM, partly due to daily crisis management limiting their ability to engage with the concept. Herold (2009) states that South Africa is currently facing numerous generalised ‘water crises’, including water theft within the system reducing system yield, significant water losses through decaying infrastructure, widespread sanitation failure, deteriorating water quality, and water deficits resulting from demand outstripping supply (a consequence of failure to achieve demand management targets).

Many of these challenges stem from, or result in, power struggles. Specifically, Merrey (2008) and Pollard and du Toit (2008) link the failure to integrate land and water reform to DWAF’s lack of jurisdiction over land management. As land and water management occurs at the landscape scale, this misalignment has spatial implications. Merrey (2008) also criticises reallocation efforts for maintaining the status quo by avoiding threatening large-scale users. The NWA’s high expectations compound these challenges by placing overwhelming pressure on officials in the water sector to implement a vast swathe of new functions simultaneously (Schreiner 2013).

The challenges faced by the South African water sector mirror those faced in the wider southern African region. Despite being hailed as a much-needed holistic solution to problems surrounding water, the region’s IWRM-based reforms have also had limited success (Swatuk 2008). Challenges include: widespread financial and human resource capacity constraints; discontinued support programmes; infrastructure problems; poor service delivery; lack of awareness of issues; attempts to resolve issues prior to—rather than through—water management; poor stakeholder involvement; cultural barriers; lack of political will; conflicting sector policies; institutional fragmentation; land and water reform incompatibilities; preference to increase supply rather than manage demand; problems with economically valuing water; and incompatibility between traditional and formal conflict resolution (Ashton 2000b; Allan 2003; Rahaman and Varis 2005; Swatuk 2005, 2008; Funke *et al.* 2007b; Jonker 2007; UN-Water and GWP 2007; Turton 2010). Cleaver (2012) disputes the idea that development (for example, IWRM) can be successfully implemented as designed, arguing instead that institutions are formed through the patching together old practices, accepted norms, and new arrangements.

Under this framing, power is seen through people having an active role in shaping such arrangements, however, the role of legitimate authority is emphasised. Thus, the understanding of water management and institutional reform cannot be removed from the understanding of why and how people manage their water as well as how access to water is secured or denied. Water scarcity compounds these challenges, with future water-related conflict being seen as a significant risk. Ashton (2000b, 2002, 2007) examines the potential for water-related conflict in Africa and concludes that, firstly, risk is most significant during drought, secondly, preventative strategies are key to mitigating risk, and, thirdly, full-scale military water-related conflict is unlikely.

Despite these failures, problems, and challenges, authors also highlight successes and promising aspects of water reform implementation (see Funke *et al.* 2007a, Pollard and du Toit 2008, Muller *et al.* 2009, Dent 2012). Pollard and du Toit (2008) praise South African water policy for embodying a strategic, adaptive, holistic approach which allows catchments to be governed as complex, linked systems. However, they offer a theoretical—not critical—interpretation with little insight into the success of IWRM in South Africa. Swatuk (2005: 872) highlights studies that show positive outcomes of the reforms; decision-support tools, capacity-building exercises, research output, and knowledge production have all been of utility. In its examination of the current state of water management in southern Africa, overall this section has found that the majority of authors focus on the failures and challenges to IWRM implementation.

Power is Inherent in Water Management

Kemerink *et al.* (2011: 593) conclude that while water reform in South Africa raised expectations for a more prosperous future, there has not been enough change—as is evidenced by ongoing protests and eruptions of violence. These represent “resurgences of the underlying struggle over the structural inequities in society” (Kemerink *et al.* 2011: 593). Thus, the “difficulties encountered in the water reform process are illustrative of what is happening in the society at large” (Kemerink *et al.* 2011: 593). Importantly, Schreiner and van Koppen (2002: 975) conclude that “water management is never ‘neutral’, ‘technical’, or ‘an end in itself’”. They contend that neutral water management institutions do not exist, that DWAF (now DWS) is not a neutral facilitator, and that decentralising is not a matter of a neutral state handing over neutral authority to a neutral public. This is something that is also recognised by GWP (2000a: 23) who emphasises that water managers need to realise that their behaviour also

affects water management and that their role is not as neutral as might be assumed. Thus, power issues are intrinsically embedded in water management; as Biswas (2004: 250) asks: “Who decides what is equitable, for whom, and from what perspectives?”

Working for Water: An Attempt to Implement IWRM

This section briefly examines Working for Water (WfW), a South African programme simultaneously pursuing social and environmental issues (job provision and improved land and water management respectively). It aims to empower marginalised groups in society through clearing invasive alien plants (IAPs) (Buch and Dixon 2009). As such, it embodies the ideals of IWRM to sustainably coordinate and manage land and water resources while pursuing economic and social welfare (GWP 2000a: 22). Furthermore, it is a unique example of integrating social and biophysical aspects of water management in practice. As WfW is active in the study area, a brief examination of how it has been presented in the literature is warranted. It has been investigated by multiple authors (e.g. Binns *et al.* 2001; Magadlela and Mdzeke 2004; Buch and Dixon 2009; Hough and Prozesky 2012).

Binns *et al.* (2001) investigate WfW’s environmental impacts, namely, clearing IAPs and increasing water supply. They also highlight the social advantages of WfW to predominantly poor, local rural communities, namely, improving livelihoods, providing employment, fostering skills, engendering community spirit, and community empowerment (especially among women). They point to the importance and value of WfW alongside the problematic fact that it is designed to “work itself out of a job” (WFWP in Binns *et al.* 2001: 353). Magadlela and Mdzeke (2004) state that WfW addresses unemployment, skills training and empowerment, HIV/AIDS, and transformation issues. They highlight numerous challenges it faces as: “rapid expansion, technical and social complexity, a narrow base of social development staff, and pressure to spend large sums of money in very short periods of time”.

Buch and Dixon (2009) question the WfW’s social benefits, arguing that despite some positive social outcomes, these are neither substantial nor sustainable. Hough and Prozesky (2012) highlight that WfW aims to empower beneficiaries to exit the programme into the labour market as independent, entrepreneurial contractors. Instead, they find that many have become financially dependent on WfW and either struggle to, or are reluctant to, find alternative employment. Thus, WfW pursues ideals aligned with IWRM, but like other aspects of water management in South Africa faces challenges.

2.4.3 IWRM: Time to Move On?

Due to difficulty in implementation, the concept of IWRM has come under heavy criticism from numerous authors (for example, Biswas 2004; Jonker 2007; Biswas 2008; Butterworth *et al.* 2010; Schreiner 2013). As a concept originating in developed countries, it is argued that IWRM faces numerous barriers in developing countries even before implementation is attempted, such as low literacy levels, widespread poverty, lack of access to water for basic needs, lack of technical capacity, and lack of adequate budgets (Funke *et al.* 2007b).

Despite the Global Water Partnership's (GWP 2000a, 2000b) assertion that national institutions should develop their own IWRM practices within the global framework, we have seen that it has not been successfully implemented in South Africa where IWRM policy was drawn up specifically to suit the country's context. This underscores the fact that the question of how IWRM should be implemented was never fully addressed (GWP 2000a: 6). This is an ongoing problem. UN-Water and GWP (2007: 3) emphasise that "IWRM needs to be more than just a planning mechanism". However, Jonker (2007) and Schreiner (2013) highlight that establishing the necessary enabling environment, for example the NWA, is not enough to ensure implementation. Indeed, even a strong policy environment is open to manipulation. Kemerink *et al.* (2011: 593) expose how the water law is actively used and misused by actors to shape negotiations over water. Thus, even the law itself "is dynamically linked to deeper entrenched power structures in society" (Kemerink *et al.* 2011: 593). For IWRM to be considered successful, actual implementation at catchment, local, regional, national, and international levels needs to be witnessed.

Allan (2003) identifies power struggles as a barrier to successful IWRM implementation. Addressing this requires political will and increased popular awareness, factors that GWP (2000b: 5) identifies as integral to IWRM's success. Swatuk (2005) concludes that these reforms may not be possible in their current format and suggests that IWRM advocates may need to reconsider the basic ideologies driving reform in the region. Biswas (2004, 2008) conceptually analyses the concept of IWRM, exploring its origin, definition, operational potential, usability in practice, and popularity. He concludes that IWRM is flawed both in concept and implementation, as evidence he points to his own experience as an advisor to 18 countries worldwide where IWRM has proved very difficult to implement (Biswas 2008: 274). He asserts that it offers "no agreement on fundamental issues like what aspects should be

integrated, how, by whom, or even if such integration in a wider sense is possible” (Biswas 2004: 248). He reasserts his original assessment in his 2008 paper, remaining convinced that “the concept has not worked in the past, is not working in the present, and is highly unlikely to work in the future” (Biswas 2008: 278). However, he does not suggest solutions nor provide alternatives. Swatuk (2010: 535) negatively concludes that “it is unlikely that further movement towards the ideals of IWRM will be realised until more water is harnessed, and this includes the great rivers of the wider [southern African] region”. However, the feasibility of this statement should be questioned. In a water scarce region like southern Africa, it is unlikely that the solution to IWRM’s failures lies in simply harnessing more water. Furthermore, if more water were harnessed from the wider region for the benefit of South Africa, how would this impact IWRM in southern Africa?

Jonker (2007: 1261) suggests that the challenges to IWRM implementation result from conceptualising IWRM as a process and proposes that it should instead be thought of as a framework that views integration at the level of achievement rather than practice. However, the utility of such a shift is questionable as the focus remains on IWRM discourse rather than on actual needs ‘on the ground’. Indeed, Allan (2003) characterises IWRM not as a template for management but instead as an intellectual arena wherein actors seek consensus on ways of using water equitably.

In this vein, some authors instead propose alternatives to IWRM. Integrated natural resources management (INRM) is advocated as an approach that should be implemented alongside IWRM, or as an approach that IWRM could learn from (see Merrey *et al.* 2005; Twomlow *et al.* 2008). In recent literature, adaptive management has also emerged as a popular concept for water management (see Pahl-Wostl and Sendzimir 2005; Pollard and du Toit 2008; Butterworth *et al.* 2010; Engle *et al.* 2011; Pahl-Wostl *et al.* 2011; Dent 2012). Herrfahrdt-Pähle (2013) investigates the extent to which adaptation is catered for in South African water legislation and finds that IWRM should be complemented with adaptive governance.

Swatuk (2010: 521) emphasises that “While it is correct to say that ‘the world water crisis is a crisis of governance’, it is problematic to assume that all states can follow a similar path towards environmentally sustainable, economically efficient, and socially equitable water resources governance and management”. Funke *et al.* (2007b) also underscore the importance of good governance to IWRM’s successful implementation. Proper water governance is central

to the functioning and development of society. Water governance issues in Africa are complex, multi-layered and occur within the context of increased risk brought by climate change. Innovative approaches are thus required to bring about water governance that is effective, sustainable, and resilient, regardless of the approach taken to water management.

This section has critically assessed IWRM. The following section examines concepts of zonation for understanding water management in a catchment; these are useful for interpreting water management, especially since IWRM is a catchment-based approach to water management.

2.4.4 Towards a Spatial Understanding of Catchments: Zonation Concepts

The political geoecology approach employed in this study engages the water management zonation concept (Molden *et al.* 2001) to explain the spatial manifestation of human–environment relationships occurring in the Gamtoos catchment. Water management zones are similar to the geomorphological zones (Schumm 1977) used by Rowntree (2008: 3) in her original conceptualisation of political geoecology. The zonation concept is useful for explaining human–environment relations in a catchment as each zone has a distinctive combination of environmental characteristics, and is consequently subjected to different power issues concerning the management and use of land and water (Rowntree 2008: 3). The previous sections have examined these power issues over water at multiple socio-economic levels of control and management. This section outlines the zonation concepts to bring the catchment scale back into focus.

Geomorphological Zones

To understand river morphology, behaviour, and water and sediment movement through a river system, Schumm (1977) conceptualises three artificial, generalised geomorphological drainage basin zones, namely (1) the production or source zone, (2) the transfer zone, and (3) the deposition or sink zone. Figure 2.1 illustrates that these zones conceptually exist on a longitudinal profile, manifesting in a downstream direction.

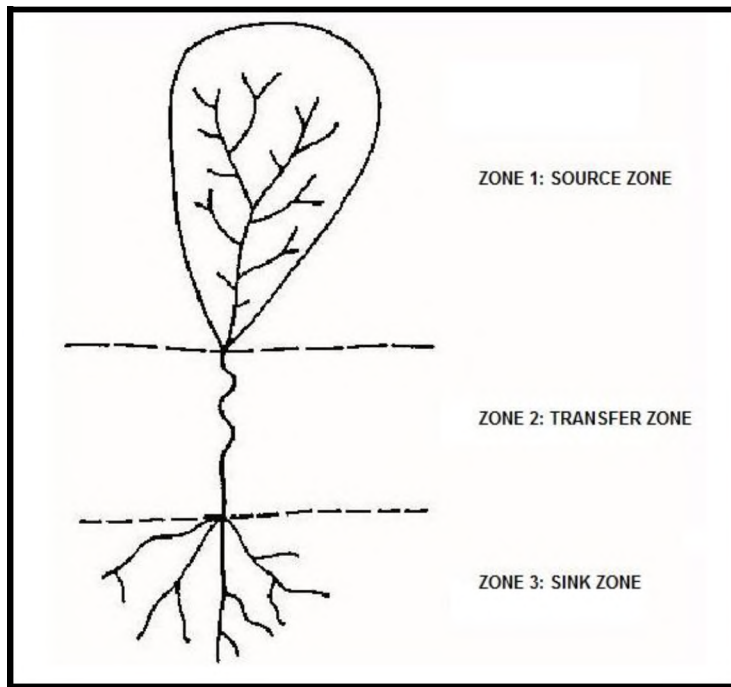


Figure 2.1: Conceptual diagram showing three geomorphological zones of a drainage basin (adapted from Schumm 1977)

Different environmental features and processes characterise each zone (Rowntree 2008: 3). Uppermost is the source zone, closest to the watershed (Schumm 1977: 3). Water and sediment originate from this part of the drainage basin (Schumm 1997: 3; Rowntree 2008: 3). In this zone, terrestrial ecosystems regulate hillslope hydrology and sediment processes, which are also affected by human activity (Rowntree 2008: 3). Thus, land use practices that transform environmental features can directly impact downstream zones; consequently, resource management here is important to the entire basin (Rowntree 2008: 3).

The transfer zone is the section of the drainage basin where the river channel carries water, sediment, and other materials through the system (Schumm 1977: 3; Rowntree 2008: 4). In this zone, sediment input can equal output (Schumm 1977: 3). The sink zone is characterised primarily by deposition and accumulation of sediment in an alluvial fan, alluvial plain, delta, or in deeper waters (Schumm 1977: 3; Rowntree 2008: 4). These lower zones are important as sediments provide fertile areas for agriculture and river water provides a resource for irrigation. Schumm (1977: 3) emphasises that sediment storage, erosion, and transportation can occur in all three zones and that the zones are defined by their predominant processes.

An inherent assumption behind geomorphological zones is that processes in downstream zones cannot be divorced from those in upstream zones (Schumm 1977: 14). Therefore, Schumm (1977) calls for an awareness of upstream–downstream linkages in a fluvial system. Furthermore, he calls for understanding of interrelationships between geologic, sedimentary, climatic, hydrologic, and land use characteristics that shape the structure and function of different parts of the fluvial system.

Water Management Zones

Similar to Schumm's (1977) geomorphological zone conceptualisation, Molden *et al.* (2001) conceptually propose six water management ('hydronomic') zones (see Figure 2.2). The purpose is to understand complex river basin interactions towards developing appropriate management strategies. The water management zonation concept is more detailed than geomorphological zonation and therefore more useful for explaining human–environment interactions within a catchment. Each zone encompasses a different river basin area, is characterised by varying hydrological, geological, topographical, and human use conditions, and is defined primarily by outflows after withdrawal and use: whether return flows are recoverable, of sufficient quality, and available for reuse downstream (Molden *et al.* 2001; GWP 2003). Each zone requires different management approaches due to these varying conditions (Molden *et al.* 2001; GWP 2003). Information in this section is sourced from Molden *et al.* (2001) unless otherwise specified.

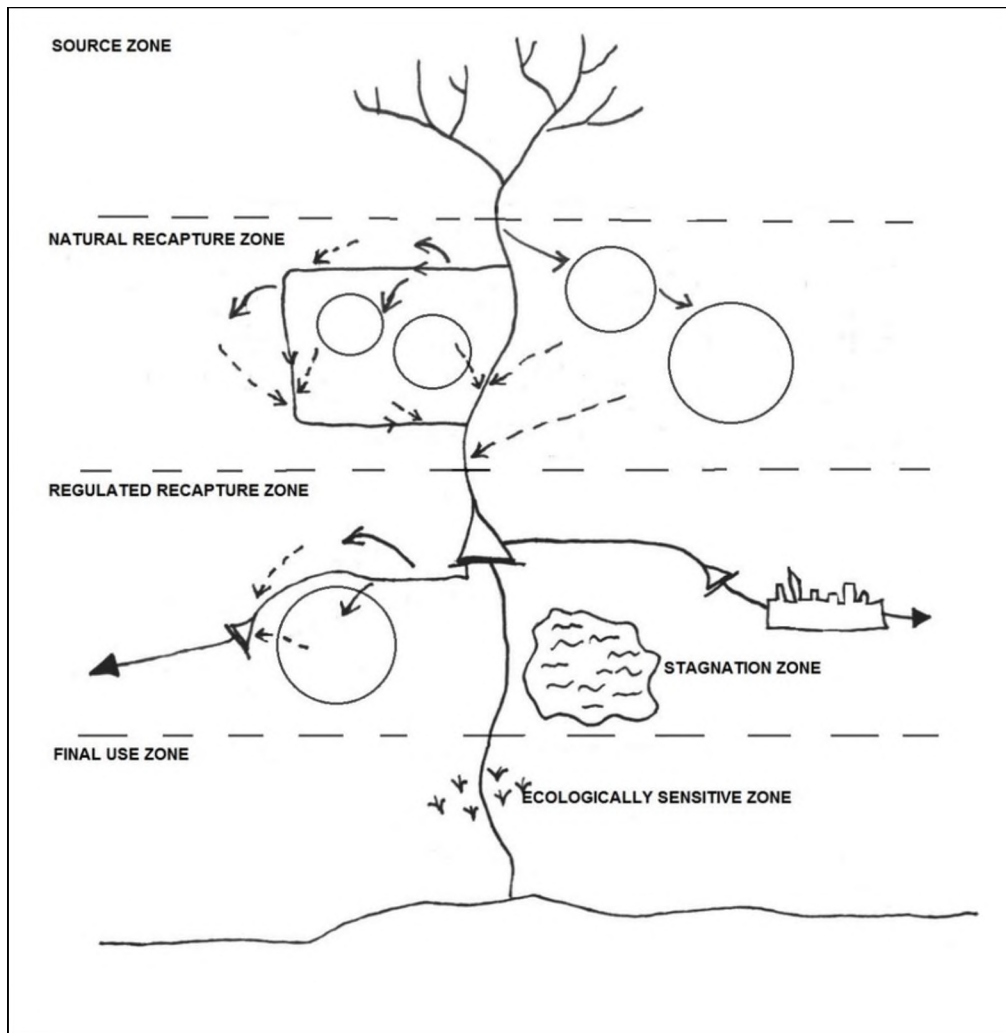


Figure 2.2: Conceptual diagram showing six water management zones of a drainage basin (adapted from Molden *et al.* 2001)

Mirroring Schumm (1977), the first water management zone is the source zone, from where the majority of water supply originates either in the form of direct runoff from precipitation or groundwater recharge. Management here determines water and sediment yield to downstream zones and therefore affects basin-wide use. The second zone is the natural recapture zone where water is diverted for use (for example, irrigation) and the portion of water not depleted is recaptured naturally by the same river, making it available for reuse downstream. It is usually located in the upland hills and valleys along rivers and their tributaries. A key characteristic is that it is a self-conserving system: surface and sub-surface flows naturally return to the water supply distribution system without being pumped. Importantly, there is little opportunity for the management of mixing and reuse of drainage water in this zone.

The regulated recapture zone is the third water management zone. Unlike the natural recapture zone, reuse of water—from surface runoff, spills, drainage, and seepage—can be regulated. Specifically, return flows do not return to the same river; they are captured by a physically separate drainage network. Constructed physical linkages facilitate reuse of diverted water which is transferred either through gravity diversions or pumps. Importantly, water quantity and quality can be managed in this zone. Regulation—in the form of dam construction and fixed irrigation infrastructure—can be for the purposes of large-scale commercial agriculture or for development projects (Rowntree 2008: 4). Often, regulation is controlled by central government authorities (Rowntree 2008: 4), an aspect that political geocology investigates. This zone is typically located in the upper reaches of river deltas adjacent to coastal plains. Any water not captured in this zone will flow to the sea. The natural recapture and regulated recapture zones—from which water can be abstracted for irrigation—are equivalent to the transfer zone of Schumm (1977).

The final use zone is the fourth zone; it is any area within a basin where no further opportunities for reuse downstream exist due to low water quality or lack of storage capacity. It is situated at the most downstream location of the basin, adjacent to the salt sink.

The first four zones have been described in a longitudinal profile similar to Schumm (1977). Two additional zones—the stagnation and environmentally sensitive zones—can occur at any point in the system. The stagnation zone has inadequate drainage capacity, high levels of leached salts, a rising water table, and excess water. Flows are not readily recoverable in this zone. Excessive water use and reuse in this zone results in waterlogging, salinisation, and decreasing yield. The environmentally sensitive zone has a high water requirement for ecological purposes (for example, wetlands) and is vulnerable to water quantity and quality changes.

Applying Zonation: Benefits and Weaknesses

Delineating catchments into these water management zones is useful through: characterising overall basin water use; taking into account distinctly different water management considerations; drawing up water management improvement strategies; identifying areas likely to have similar problems; and developing context-specific solutions (Molden *et al.* 2001: 26). Numerous authors have found utility in the water management zones concept, for: adapting IWRM application (Merrey *et al.* 2005); understanding and responding to water scarcity

(Rijsberman 2006); upgrading rain-fed agriculture in water scarce regions (Rockström *et al.* 2004); and addressing collective decision-making challenges in a catchment (Swallow *et al.* 2006). However, the concept does have some limitations (Molden *et al.* 2001: 24). Its utility lies in its ability to provide an overview; consequently, it lacks the resolution required for more detailed assessment of issues. Additionally, divisions between zones may be unclear, leading to difficulties in precisely mapping zone boundaries. Furthermore, as basins are subject to changing usage and management patterns, the precise locations of each of the zones may shift (Molden *et al.* 2001: 23).

Utility of Zonation Concepts for Spatially Explaining Human–Environment Relations

By conceptually delineating catchments into zones, the distribution of resources and associated power relations can be studied in an explicitly spatial manner. Molden *et al.* (2001: 24) point to the spatial interplay between the natural hydrologic system and the human-made structures that shape water flows through harnessing it for productive purposes. Furthermore, they point to the constantly shifting cultural, political, and other incentives that shape the natural environment for human purposes which inevitably result in changing power relations over water in a given catchment. Examining catchments in terms of zones allows these characteristics and relationships to be investigated and compared with other zones, providing valuable insight towards management decisions.

2.5 Conclusion

This chapter has reviewed literature towards the development of a political geoeology approach for the investigation of human–environment relations in an explicitly spatial manner. Political geoeology, proposed by Rowntree (2008), builds on and combines the fields of political ecology and geoeology, which have been reviewed in this chapter insofar as they contribute to the development of political geoeology. Water management literature was then investigated through a political geoeology lens, providing context for this study's investigation into power relations surrounding land and water management in the Gamtoos catchment in South Africa. The review of this literature has illustrated that power issues are inherent in water management, and are obvious in the literature even where they are not explicitly dealt with. Zonation concepts for the study of catchment processes were also outlined as appropriate concepts for use under political geoeology to spatially investigate relationships surrounding land and water resources.

Chapter 3: The Spatial Framework of the Baviaanskloof–Kouga–Gamtoos

Thus far this thesis has established that the management of resources in a catchment cannot be removed from a multiplicity of natural characteristics and processes as well as power relations between human actors. To understand the way power relations over resources are manifested spatially, it is necessary to first understand the distribution of those resources and human influences on the landscape. This chapter employs the political geoecology approach to present the methods and findings of Research Question 1: What is the spatial distribution of land and water resources and human influences on the landscape in the Gamtoos catchment? This research focuses on the Baviaanskloof, Kouga, and Gamtoos sub-catchments but, as explained in Chapter 1, excludes the Groot. This chapter also presents methods and findings for Objective 2a: To identify the stakeholders at local, regional, national, and international levels.

This chapter opens with a brief outline of the methods and data used to generate the results (Section 3.1). Secondly, it details the spatial distribution of resources (Section 3.2), namely: topography; geology and soils; climate and rainfall; and hydrology. Thirdly, it details human influences on the landscape (Section 3.3), specifically: governance boundaries and administrative jurisdiction; road access routes; demographics; land ownership, use, and management; water use and management; and stakeholders involved in land and water management. Finally, it delineates the catchment into zones (Section 3.4) for further spatial interrogation (provided in Chapter 6). Thus, this chapter explores the key biophysical, geophysical, and human activity characteristics of the study area that are relevant to political geoecology.

3.1 Methods

The spatial distribution of resources was explored through the creation of maps which were interpreted through information obtained from various reports about the Gamtoos catchment. Using the data illustrated in Table 3.1, ArcGIS software was used to create maps of topography, rainfall, hydrology, governance, access, population density, and land use. Each map identifies only relevant features, for example, town and river labels are omitted where they mask more important features. Section 3.4 delineates the study area into zones following Schumm (1977) and Molden *et al.* (2001) (as described in Chapter 2).

Table 3.1: Description of spatial data files and sources used in map generation

Data File Name	Type	Processing	Data Source
dams and lakes	vector; polygon	Clipped	WR2005
prim_riv	vector; line	Clipped	WR2005
sec_riv	vector; line	Clipped	WR2005
quat	vector; polygon	Clipped; Dissolved	WR2005
rip	vector; polygon	None	WR2005
mar	vector; polygon	None	WR2005
country92	vector; polygon	None	FUNDISA
AG_Towns_WGS84_200702	vector; point	Clipped	FUNDISA
AG_Province_WGS84_200702	vector; polygon	No	FUNDISA
EC_PROV	vector; polygon	Merged	NLC2000
WC_PROV	vector; polygon	Merged	NLC2000
ZA_DEM_90m_UTM35	raster	Hillshade	SRTM_90m_DEM
DistrictMunicipalities2011	vector; polygon	None	SAEX2011
LocalMunicipalities2011	vector; polygon	None	SAEX2011
Protected_Areas_NBA_2011	vector; polygon	None	NBA2011
Transport_Mainroads	vector; line	None	FUNDISA
transport_roads	vector; line	None	FUNDISA
Census_2001_gwgs84	vector; polygon	Dissolved	FUNDISA

To address Objective 2a, stakeholders were identified through observation and communication with the PRESENCE Network. They are actors whose actions influence processes within the catchment; they were not identified as individuals but rather as organisations (e.g. irrigation boards), places (e.g. Port Elizabeth (PE))⁵, or groupings of people (e.g. farmers). To achieve this objective, stakeholders were classified according to the level at which the stakeholder originates, acts, or has influence. Accordingly, local stakeholders originate within the catchment boundaries while regional stakeholders originate beyond the catchment boundaries, yet are still in proximity to the catchment. Similarly, national stakeholders include government departments at a state level and international stakeholders are organisations or institutions who originate—or receive funding from—outside South Africa.

3.2 Results: Spatial Distribution of Resources

This section presents the results to Objective 1a: To map the spatial distribution of selected land and water resources. In doing so, it presents results relating to the study area's topography, geology and soils, climate and rainfall, and hydrology.

⁵ Although it is not strictly-speaking an actor itself, for the purposes of this study the city of PE (as a place) is classified as a stakeholder because a significant amount of water sourced from the study area is used by the domestic and industrial industries there.

3.2.1 Topography

Figure 3.1 uses a hillshade to illustrate the steep, rugged, and deeply-folded terrain of the study area (Haigh 2004). It highlights the topographical features in relation to catchment boundaries and drainage lines. Three parallel mountain ranges run in an east–west direction, namely (from north to south), the Baviaanskloof, the Kouga, and the Tsitsikamma ranges, hydrologically separating the Groot, Baviaanskloof, and Kouga sub-catchments respectively (Haigh 2004: 10; Boshoff 2008: 1; Jansen 2008: 35; Mander *et al.* 2010: 4–5). Figure 3.2 overlays a digital elevation model (DEM) on a hillshade to demonstrate the elevation of the study area. The altitude varies from 0 to 1,758 masl (Mander *et al.* 2010: 5), with the highest elevations found in the Kouga Mountains.

The maps illustrate that the Baviaanskloof sub-catchment has a steep outer ring of high mountains (from 650 masl) surrounding a floodplain with subdued relief (300–650 masl). The northernmost Baviaanskloof Mountains have the highest elevations. The valley floor is divided into large alluvial basins by erosion-resistant higher ground, with elevation decreasing in a west–east direction (Haigh 2004). The Baviaanskloof River runs through the centre of the valley (Jansen 2008: 30).

In the Kouga sub-catchment, extremely mountainous terrain encloses the Langkloof, Bo-Kouga, and Onder-Kouga valleys (Haigh 2004). The Kouga River flows through a steep-sided, incised gorge in the Kouga Mountains not through the centre of the Langkloof. Instead, the Langkloof valley is hydrologically divided by several tributaries flowing northwards from the Tsitsikamma Mountains across the Langkloof to join the Kouga River. Altitude decreases in a west–east direction in the Langkloof. Additionally, at some point in geologic history, the Kouga River's eastward flow was captured by another river flowing northward between the Kouga and Suuranys Mountains and joining the Baviaanskloof River. The altitude at the Kouga–Baviaanskloof confluence is 160 masl (Haigh 2004).

The Kouga Dam is situated below the confluence of the Baviaanskloof and Kouga Rivers. Below the Kouga Dam, the Gamtoos sub-catchment has lower elevation overall than the upstream sub-catchments. A wide floodplain is surrounded by steep hills, with the hills to the east having a higher altitude than the hills to the south-west (Haigh 2004).

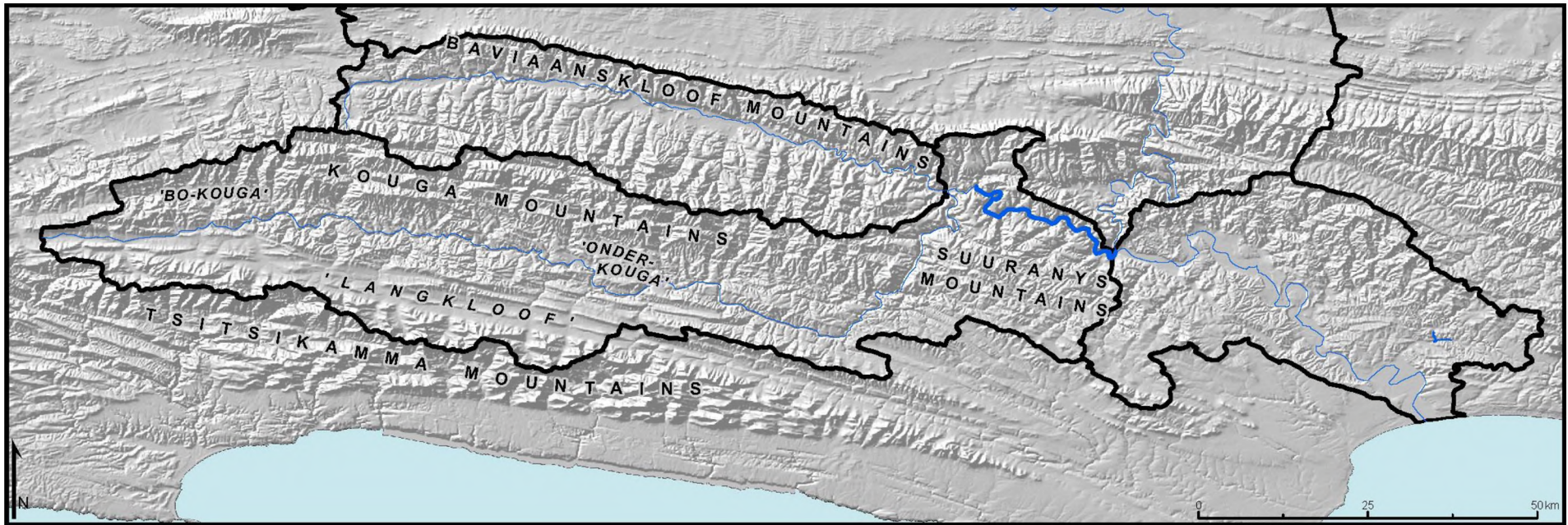


Figure 3.1: Terrain map of the study area using a 90m DEM hillshade

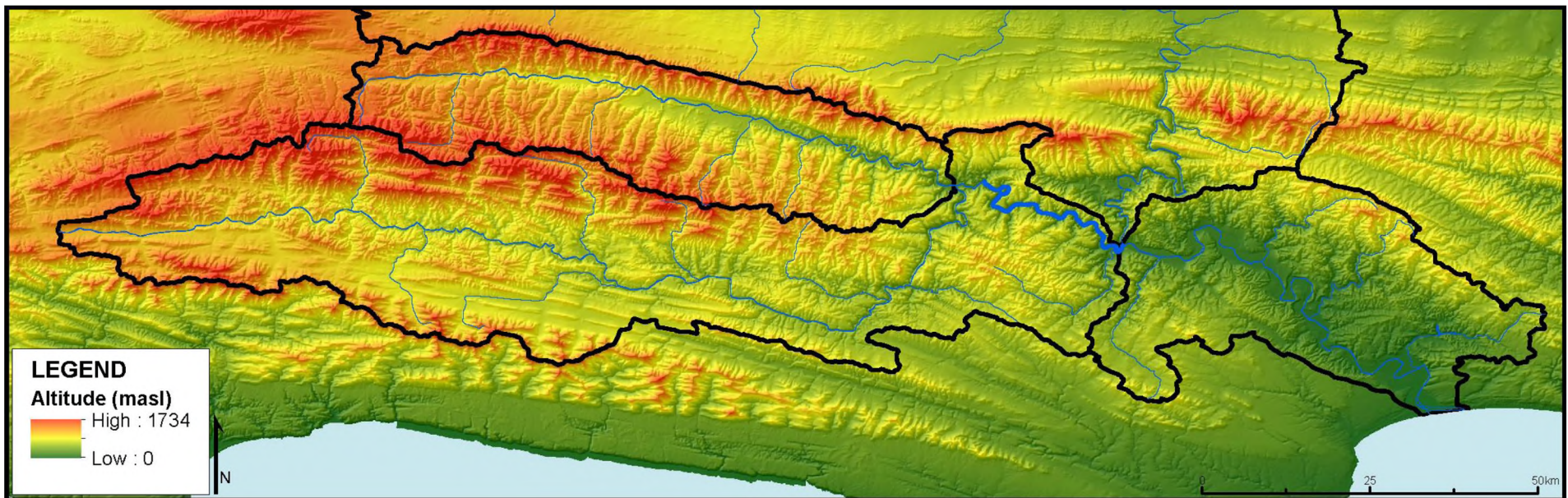


Figure 3.2: Elevation map of the study area using a 90m DEM overlaying a hillshade

3.2.2 Geology and Soils

The following information regarding geology and soils is derived from Haigh (2004). The catchment's geology directly affects topography and soil development. Table Mountain sandstone dominates the three sub-catchments. Bokkeveld shales are present in the Baviaanskloof and valley floors of the Kouga, and intermittent Enon conglomerate outcrops (Uitenhage group) occur in the Baviaanskloof and Gamtoos. The Baviaanskloof has shallow soils on the steep slopes, with deep soils—dominated by stratified alluvial Dundee soils with some clay—only on the flatter plateau areas and the valley floor. Soil cover in the Kouga is fragile; however, the river's sediment load is small. The Gamtoos River flows through soft shale and mudstone bedrock (Uitenhage group); these compose the river's depositional materials. Alluvial, yellow-brown, loam and sandy loam soils that are prone to compaction predominate in the Gamtoos sub-catchment, with loamy clay composing a smaller percentage.

3.2.3 Climate and Rainfall

Mild summers and cold winters generally characterise the study area's climate, with snow in winter occasionally experienced on the high mountains in the Kouga, and, until recently, in the Baviaanskloof (Haigh 2004). The study area lies in a bimodal rainfall zone; rainfall occurs year round with spring and autumn maximums (Haigh 2004: 13; Mander *et al.* 2010: 5). Generally, the area is characterised by low average rainfall, however, high rainfall variability through time results in regular drought and flood cycles. Figure 3.3 illustrates the spatial variation in rainfall. The parallel mountain ranges mediate rainfall, acting as rain traps; amount of rainfall decreases as distance from the coast increases (Haigh 2004; Mander *et al.* 2010: 5). The Tsitsikamma Mountains and high lying areas of the Kouga Mountains experience the highest mean annual precipitation (MAP) at over 800 mm. The downstream half of the Baviaanskloof sub-catchment experiences the lowest MAP, in the 400 mm isohyet.

Reports about the study area detail differing rainfall amounts. Mander *et al.* (2010: 5) reports Kouga Mountain rainfall as exceeding 1,600 mm, while Haigh (2004) reports MAP in the Kouga as 300–850 mm. Jansen (2008: 14) reports Baviaanskloof MAP to be about 300 mm, while Mander *et al.* (2010: 5) report 225 mm. Haigh (2004) states that the Gamtoos sub-catchment consists of four rainfall zones with a low MAP of approximately 500 mm. In both the Baviaanskloof and Kouga, potential evapotranspiration is reported to exceed rainfall throughout the year (Jansen 2008: 43).

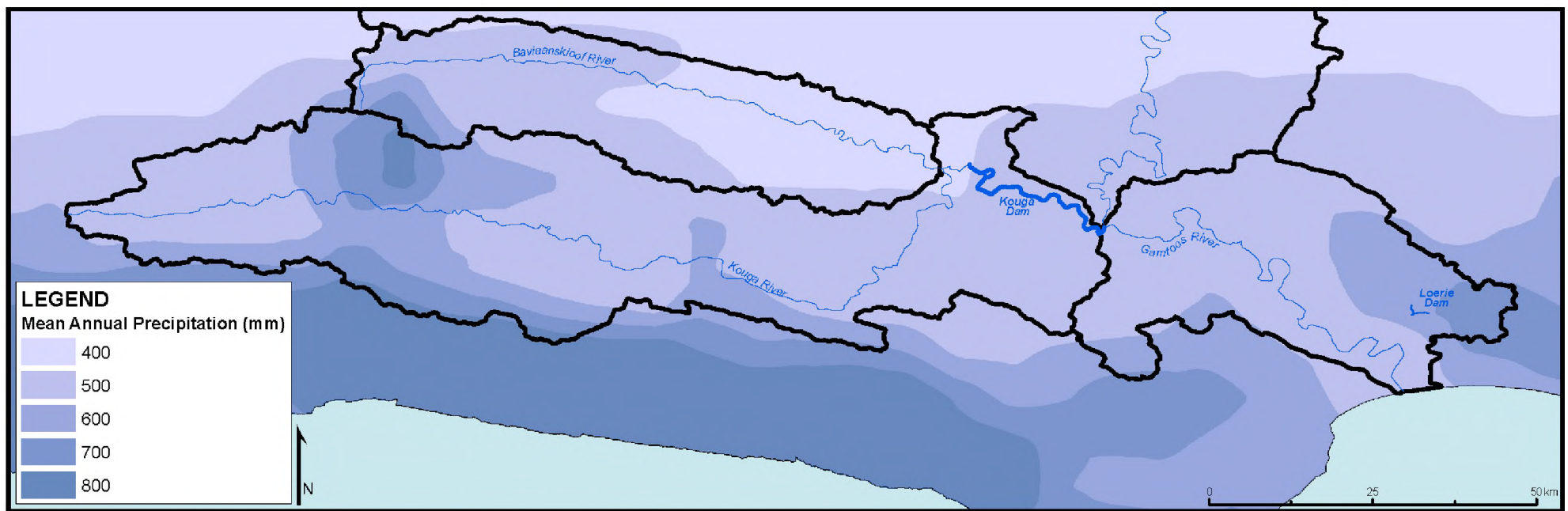


Figure 3.3: Rainfall map of the study area using isohyets at 100 mm intervals

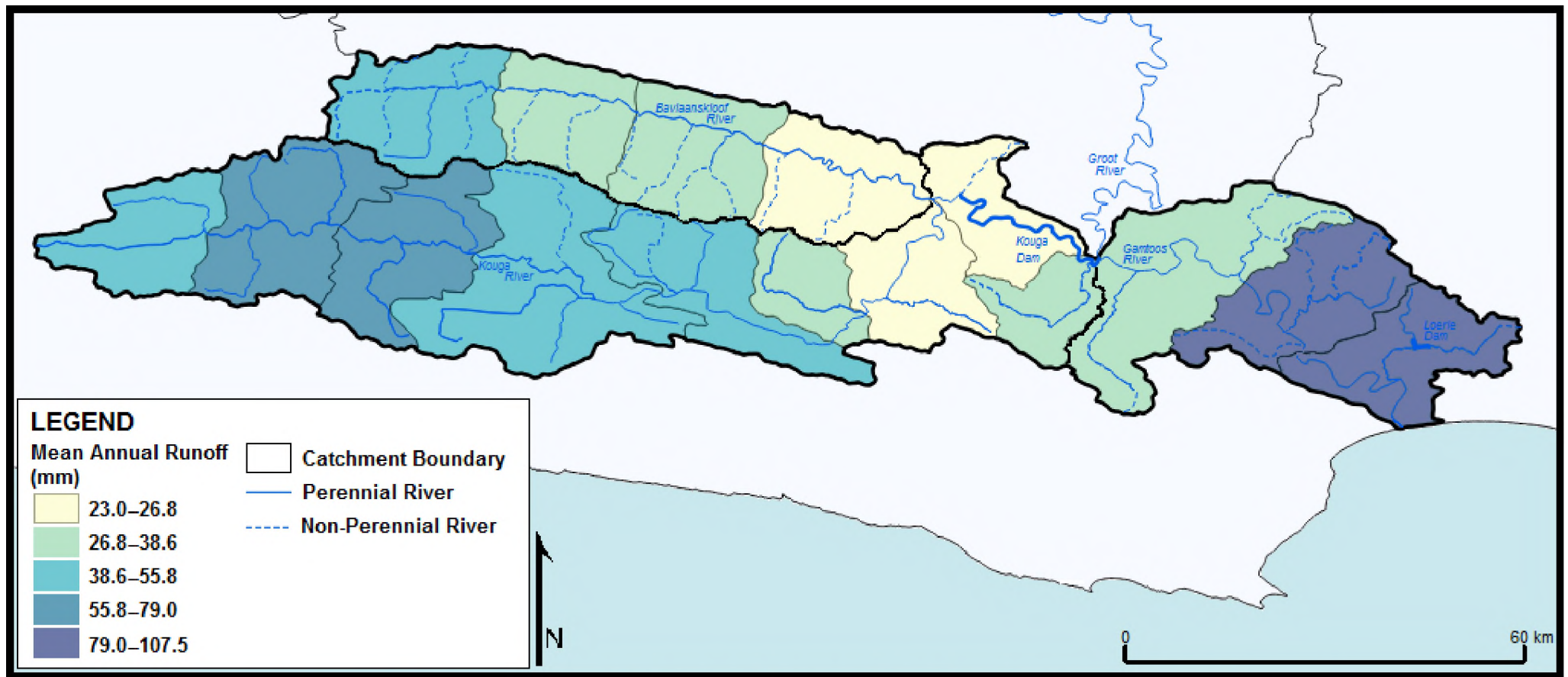


Figure 3.4: Mean annual runoff by quaternary catchment and perennial and non-perennial rivers of the study area

3.2.4 Hydrology

Topography, geology, soils, and climate directly affect the catchment's spatial drainage characteristics (Haigh 2004). Figure 3.4 illustrates the study area's mean annual runoff (MAR) and perennial and non-perennial rivers, thereby indicating the relative wetness or dryness of the areas. Table 3.2 illustrates the MAR volume by tertiary and quaternary catchment. This section discusses the hydrology of the two upstream sub-catchments first and then the downstream Gamtoos sub-catchment. Water management is discussed in Section 3.3.5: Water Use and Management.

Table 3.2: Volume runoff by quaternary and tertiary catchment (Data source: WR2005)

Tertiary Catchment Name and Number	Tertiary Catchment MAR Volume (million m ³)	Quaternary Catchment Number	Quaternary Catchment MAR Volume (million m ³)
Baviaanskloof (L81)	45.68	L81A	17.70
		L81B	8.41
		L81C	11.39
		L81D	8.18
Kouga (L82)	148.01	L82A	15.02
		L82B	31.49
		L82C	28.60
		L82D	31.31
		L82E	18.51
		L82F	5.68
		L82G	7.11
		L82H	5.29
		L82J	5.00
Gamtoos (L90)	91.87	L90A	19.91
		L90B	37.68
		L90C	34.28

The Baviaanskloof River runs through the centre of the Baviaanskloof valley (Jansen 2008: 30). It is not visible as surface flow throughout the valley length; in the narrow, confined sections of the valley it is perennial but in other sections it proceeds as interflow through permeable alluvial deposits and joints in the underlying rocks (Jansen 2008: 30). During dry spells, an alluvial aquifer sustains the river's base flow. It is recharged by (occasional) rainfall and infiltrating surface runoff. Figure 3.4 illustrates that runoff depth decreases down the valley, corresponding with the lower rainfall levels. MAR total volume in quaternary catchments ranges from 8.18 million m³ to 17.70 million m³. Overall, the Baviaanskloof has the lowest total MAR volume (45.68 million m³), illustrating its relatively small contribution

downstream compared to the Kouga. Numerous small ephemeral tributaries arising in the surrounding mountains also feed the river, with alluvial fans and wetlands occurring at various locations in the valley (Haigh 2004). Floodplains and terraces occurring along the Baviaanskloof valley floor are important features for agricultural activities. Erratic rainfall combined with a direct response of runoff to rainfall causes a high risk of floods, with heavy flooding occurring approximately once in every 10 years (Boshoff 2008; Jansen 2008: 30). Figure 3.5 illustrates the Baviaanskloof River with no visible surface flow in the downstream portion of the Baviaanskloof valley.



Figure 3.5: Dry Baviaanskloof River in downstream portion of Baviaanskloof valley. At the time of photograph, surface flow was visible further upstream in the valley. Baviaanskloof Mountains in the background.

In the Kouga Mountains, the Kouga River flows through a steep-sided, incised gorge with a narrow riparian zone and few floodplains (Haigh 2004). In its natural state, the Kouga River is perennial; presently however, numerous impoundments in the catchment area result in periods of no flow (Haigh 2004). Like the Baviaanskloof, the Kouga River and its tributaries are also prone to flooding due to erratic discharge and rapid response to rainfall events (Jansen 2008: 52). Like the Baviaanskloof, MAR depth decreases in a downstream direction. Quaternary

catchments have a wider range of MAR volume, from 5.00 million m³ to 31.49 million m³. Total MAR volume for the Kouga is 148.01 million m³. The Kouga River is fed from the north by small steep, isolated tributaries that flow southwards through constricted mountain valleys. The entrenched Kouga River separates these from the tributaries flowing northwards across the Langkloof from the Tsitsikamma Mountains (Haigh 2004). These hydrologically divide the broad Langkloof ‘valley’ into nine small tributary sub-catchments; Figure 3.6 diagrammatically represents the arrangement (from east to west): Twee Riviere, Waboomsrivier, Krakeel, Louterwater, Aapiessrivier, Misgund, Ongelegen, Haarlem, and Avontuur (Haigh 2004: 6).

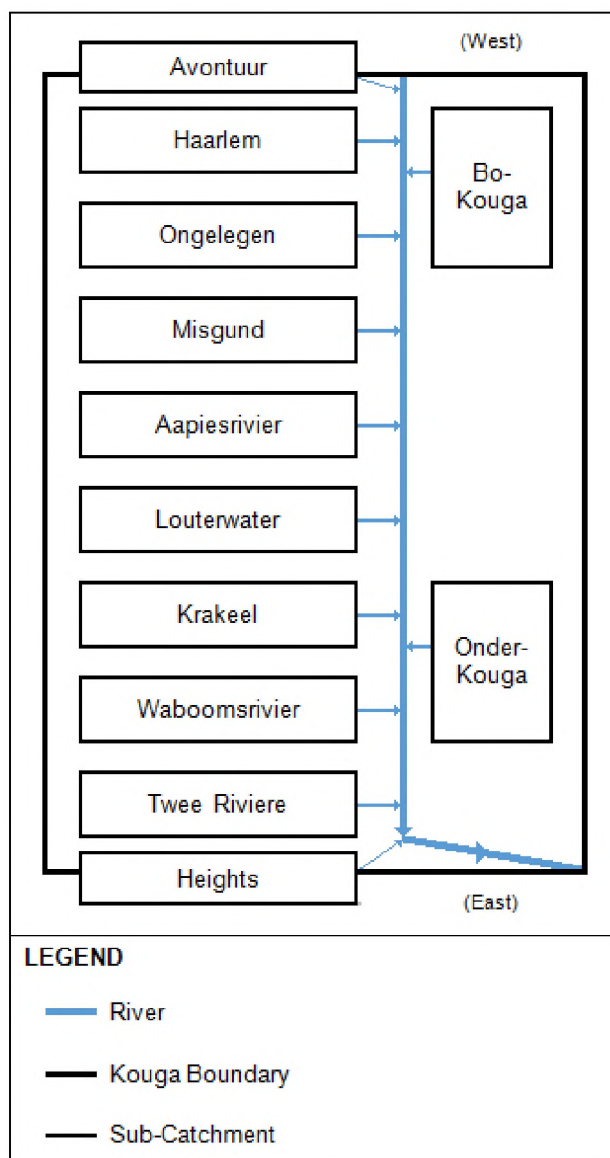


Figure 3.6: Diagrammatic representation of the Kouga’s tributary sub-catchment arrangement

Downstream of the confluence of the Baviaanskloof and Kouga rivers and of the Kouga Dam, the Gamtoos River flows through a long, winding floodplain, draining into the sea northeast of Jeffrey's Bay (Haigh 2004: 2). This is illustrated by the terrain and elevation maps (Figure 3.1 and Figure 3.2) as well as Figure 3.7. The Kouga Dam is discussed in Section 3.3.5: Water Use and Management. Since the dam's construction, the river has experienced an altered flow regime illustrated by its disproportionate width to amount of water, braided channel, amount of in-channel vegetation, and channel bar vegetation (Haigh 2004: 2). Before the dam, it was susceptible to frequent flood events causing major pattern changes and channel position shifts. However, floods occur relatively infrequently since the dam's construction (Haigh 2004). Brackish Groot River water supplies the Gamtoos River's natural flow, supplemented by irrigation spills, small tributaries (namely the Klein, Loeriespruit, and Geelhoutboom Rivers), and only occasionally overflow from the Kouga Dam at times of excessive flows (Jansen 2008: 36). As such, these overflows have high ecological importance (Jansen 2008: 52). MAR volume ranges from 19.91 million m³ to 37.68 million m³. The total MAR volume for the Gamtoos sub-catchment is 91.87 million m³.



Figure 3.7: The Gamtoos River flowing through a long, winding floodplain in (a) upstream (just below the Kouga Dam) and (b) downstream (just above estuary) portions of the sub-catchment. Arrows indicate direction of flow.

3.3 Results: Human Influences on the Landscape

This section presents the results for Objective 1b: To identify human influences on the physical landscape through mapping of selected factors relating to human–environment interactions (such as land use). In doing so, it presents results relating to governance boundaries and administrative jurisdiction, road access routes, population density, land use and management, and water use and management in the study area.

3.3.1 Governance Boundaries and Administrative Jurisdiction

Figure 3.8 illustrates administrative boundaries. The study area is primarily located in the Sarah Baartman District Municipality (formerly Cacadu) in the Eastern Cape province. The three local municipalities of relevance are the Baviaans, Kou-Kamma, and Kouga. The westernmost section of the Kouga sub-catchment is located in the Western Cape province in George Local Municipality, falling under Eden District Municipality. Due to its reliance on water from the Gamtoos catchment, the Nelson Mandela Bay Metropolitan Municipality (NMBMM) is also of significance, despite being outside the catchment boundaries.

3.3.2 Road Access Routes

Figure 3.9 illustrates the study area's road access routes. Significantly, only a single, gravel road enters and exits the Baviaanskloof sub-catchment. This road traverses sizable mountain passes which can become impassable for non-4x4 cars after heavy rains (see Figure 3.10). In addition, a single, one-way journey into or out of the Baviaanskloof takes up to three hours. This hints at the isolation of the Baviaanskloof sub-catchment. Additionally, no roads traverse the Kouga Mountains separating the Baviaanskloof and Kouga sub-catchments. In the Kouga sub-catchment, there is one main, tarred road through the Langkloof, with smaller, gravel roads providing access to the Bo-Kouga and Onder-Kouga valleys. Figure 3.11 compares the gravel road in the Baviaanskloof with the tarred road in the Langkloof. The Gamtoos sub-catchment has a much higher density of quality access routes than the two upstream sub-catchments. The high mountains prevent direct access between the Kouga and Gamtoos sub-catchments, requiring one to travel around the mountains on main routes outside of the sub-catchment. Of importance here are the significant distances between the three sub-catchments in terms of access and transport, as well as the limited routes and quality of access between and within the sub-catchments.

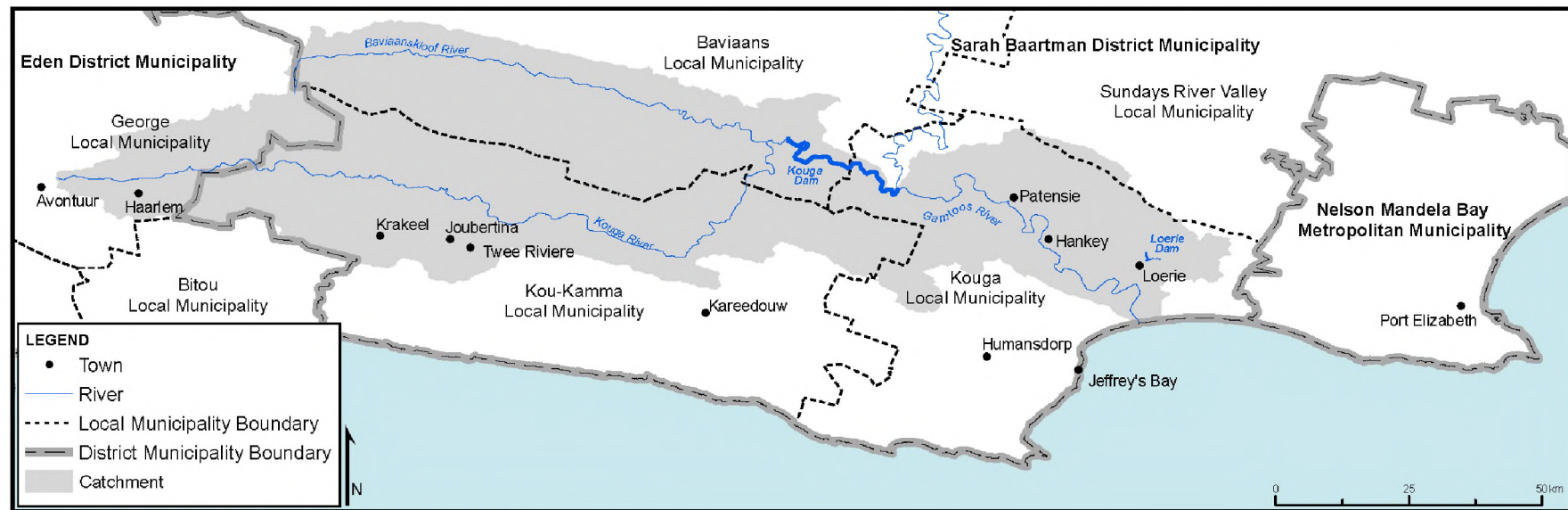


Figure 3.8: District and local municipalities in the study area

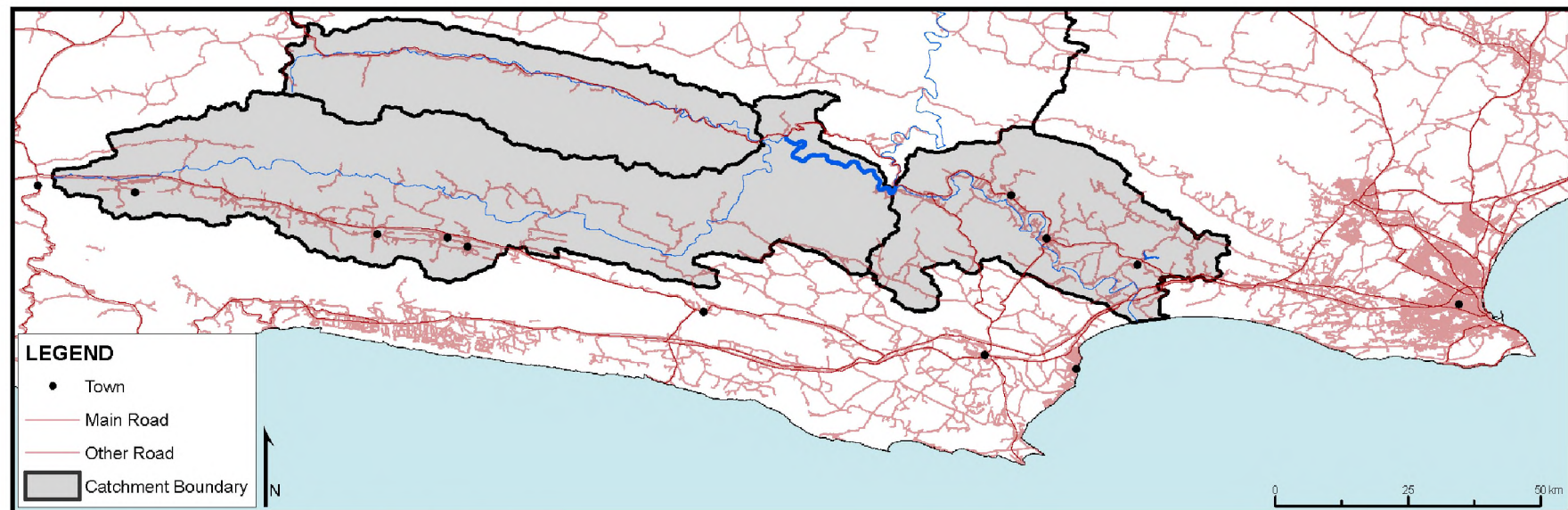


Figure 3.9: Road access routes in the study area

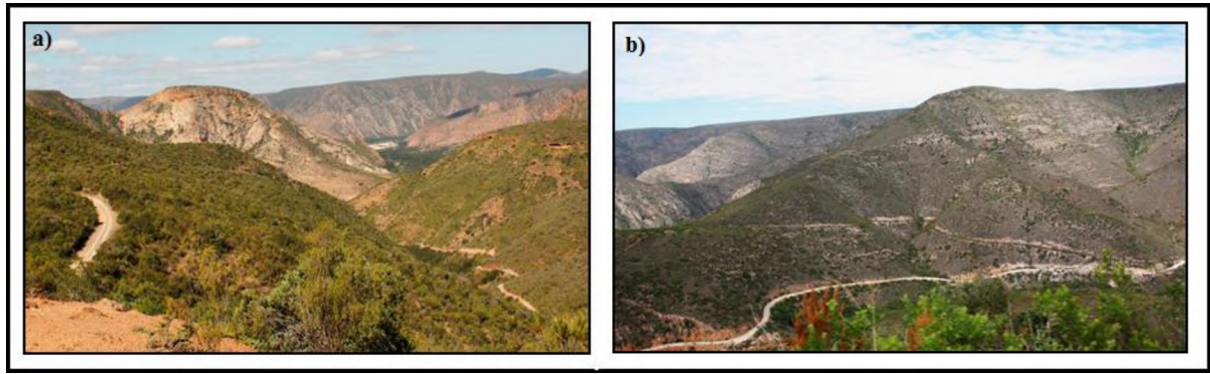


Figure 3.10: The gravel road mountain pass into the Baviaanskloof from the east



Figure 3.11: Comparison of main access roads in (a) the Baviaanskloof valley and (b) the Langkloof valley in the Kouga

3.3.3 Demographics

Given South Africa's history of racial inequality, the racial composition of the population in the study area is of significance. Table 3.3 illustrates the total population and demographic composition by local municipality and sub-place for the study area, as derived from census 2011 data (Frith 2011). Of importance is the fact that local municipality boundaries are wider than the catchment boundaries and thus population totals are for an area larger than the study extent. Non-urban (NU) statistics are also subject to this distortion. However, the data provides a relative indication of demographic composition in the study area. Significantly, Kouga Local Municipality (encompassing the Gamtoos sub-catchment and surrounds, not the Kouga) has the highest total population, followed by Kou-Kamma (Kouga sub-catchment), then Baviaans (Baviaanskloof sub-catchment). In all municipalities and sub-places—except NMBMM and

the small town of Gamtoos Mouth in Kouga Local Municipality—the coloured population has the highest composition. Given that the majority of privately owned land in the study area is owned by white people, it is of significance to note the relatively small percentage of the population that this group comprises.

Table 3.3: Study area demographic composition by local municipality and sub-place

Local Municipality	Total Population (people)	Population Group				
Sub-Place*		Black (%)	Coloured** (%)	Indian/Asian (%)	White (%)	Other (%)
Baviaans	17,761	11.98	80.25	0.19	7.00	0.57
Baviaans NU†	4,882	7.31	76.53	0.16	15.69	0.33
Kou-Kamma	40,663	30.58	59.85	0.28	8.20	1.10
Kou-Kamma NU†	11,203	29.90	54.38	0.29	13.57	1.86
Misgund	415	40.24	57.35	0.24	0.72	1.45
Louterwater	4,829	27.36	70.35	0.14	1.01	1.14
Krakeel	1,931	13.15	78.15	1.14	6.73	0.83
Joubertina	5,752	16.83	73.45	0.26	9.01	0.45
Twee Riviere‡	485	14.43	50.10	0.00	35.26	0.00
Kouga	98,558	38.83	42.60	0.25	17.63	0.68
Kouga NU†	14,043	33.49	50.53	0.17	15.50	0.31
Patensie	5,263	39.73	50.18	0.17	8.04	1.86
Hankey	11,761	45.46	51.47	0.13	2.33	0.62
Loerie	2,787	37.75	59.06	0.79	1.65	0.75
Thornhill	2,462	44.39	52.97	0.08	1.83	0.73
Gamtoos Mouth	153	1.31	0.65	0.00	95.42	1.96
George	193,672	28.23	50.41	0.48	19.69	1.19
George NU†	22,360	11.58	62.13	0.71	24.66	0.91
Haarlem	2,376	4.21	94.11	0.04	0.93	0.76
NMBMM	1,152,115	60.13	23.56	1.11	14.36	0.84

Source: Frith, A. 2011. *Census 2011*. Online. Available: <http://census2011.adrianfrith.com/>. [2016/06/12].

Notes:

* Data is given for sub-places as captured in census 2011 data. Only sub-places significant to the study area are included.

** 'Coloured' is an official term used in South Africa to describe a distinct population group of mixed ethnic origin.

† Non-urban (NU) sub-places encompass all non-urban areas in the specific local municipality. It is assumed that this includes private farming households as well as small rural communities and villages. Importantly, it encompasses areas outside the catchment boundaries. This is an example of misalignment between social and hydrological scales. Therefore, totals are not accurate for the catchment, but the percentage composition gives an indication of population group composition in the study area.

‡ Twee Riviere encompasses the agricultural small-holdings surrounding Joubertina.

Figure 3.12 illustrates population density in the study area by enumerator area (not catchment). Overall, population density is low with less than 100 people/km². Pockets of higher population densities occur in the small towns in the Langkloof and Gamtoos valleys. In the Kouga, urban

and peri-urban land covers approximately 7 km² (Mander *et al.* 2010). In the Langkloof, small towns include Joubertina, Louterwater, and Haarlem, with other small settlements including Heights, Twee Riviere, Krakeel, Misgund, and Avontuur. Loerie, Hankey, and Patensie are the most significant small towns in the Gamtoos. The high population densities in NMBMM contrast the low densities in the catchment. This points to potential pressure on water resources from the city.

3.3.4 Land Ownership, Use, and Management

Figure 3.13 illustrates the spatial distribution of land use in the study area and refers throughout this section. The majority of land cover in the catchment is natural, uncultivated veld. Topography determines the distribution of six main vegetation types in the area, namely (in order of decreasing incidence) Fynbos, Biome-Transitional vegetation, Subtropical Thicket, Savannah, Forest, and Grassland (Haigh 2004: 4; Skowno 2008 in Mander *et al.* 2010: 5). These host 47 International Union for Conservation of Nature (IUCN) protected plant species (Haigh 2004: 4–5). Thus, this area is important for conservation and various nature reserves have been established, specifically the Baviaanskloof Mega-Reserve (BMR) (Haigh 2004).

The BMR spans approximately 2,700 km², across nearly the entire Baviaanskloof and a substantial part of the Kouga (Boshoff 2008: 23; ECPTA 2015). It comprises state-owned protected areas within a network of private land (Boshoff 2008: 1). It is managed through Eastern Cape Parks (ECP) and was proclaimed a World Heritage Site by UNESCO in 2004 (Boshoff 2008: 9; Jansen 2008: 32–33). ECP is obligated to manage it in a manner befitting its international status, prioritising biodiversity and water conservation (Boshoff 2008). Falling primarily on mountainous areas, it accounts for approximately 62% of Baviaanskloof land, enclosing privately-owned land in the central portion of the valley (Jansen 2008: 32–33; Mander *et al.* 2010: 14). This privately-owned land is primarily uncultivated lands, drylands, and old cultivated fields used for livestock grazing (cattle, sheep, goats, and ostriches) (Jansen 2008; Mander *et al.* 2010). Intensive farming is limited, with only about 3–8 km² irrigated, producing crops such as maize, onion, alfalfa, pasture, vegetable seeds, and (more recently) lavender and olives (Jansen 2008; Mander *et al.* 2010). This reflects the marginal status of the Baviaanskloof (Figure 3.14). White-owned farms account for 36% of land, with only 2% owned by three small (coloured) communities (Mander *et al.* 2010: 5). Residents of the communities either find employment as farm labourers or migrate to regional towns; small-scale subsistence agriculture and pastoralism are also practiced (Mander *et al.* 2010: 6).

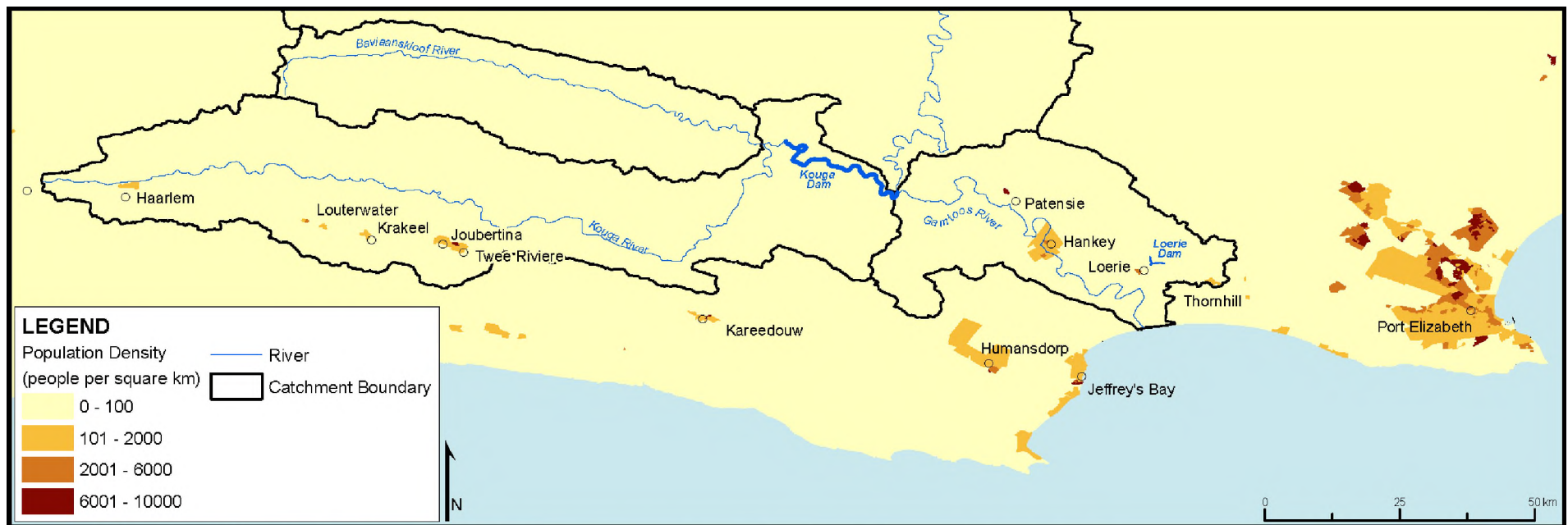


Figure 3.12: Spatial distribution of population in the study area (population density by enumerator area)

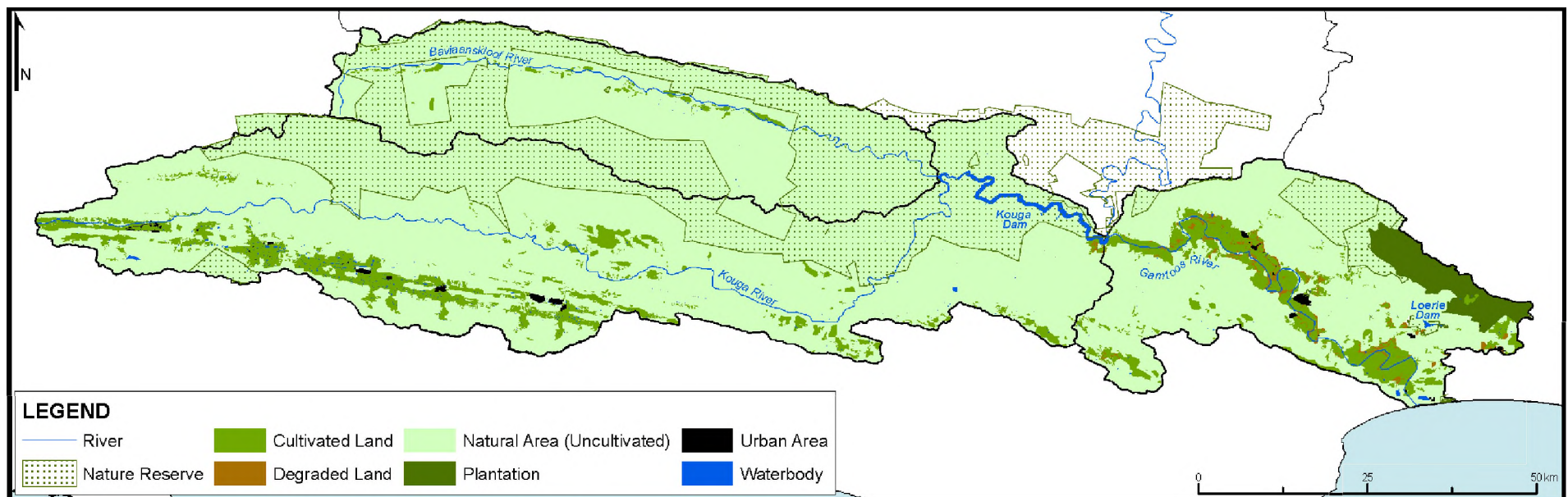


Figure 3.13: Spatial distribution of land use in the study area



Figure 3.14: Land use in the Baviaanskloof including (a) cultivated lands and (b) uncultivated, grazing land. Photo (a) is upstream looking east and photo (b) is downstream looking west.

The area experiences numerous land and water management challenges (Boshoff 2008; De Paoli 2008; Jansen 2008; Mander *et al.* 2010). As a result of periodic floods causing extensive, costly damage and loss to infrastructure (including roads, causeways, and telephone lines), numerous river and tributary modifications were made through time to protect cultivated areas from flooding and facilitate irrigation in and near the floodplain. Through time, land use and land cover changes placed increasing pressure on natural resources, resulting in overgrazing and denuded hillside vegetation (Figure 3.15). These resulted in low water retention capacity, increased speed of river discharge, erosion, river siltation, and degradation of floodplains and wetlands. Additionally, excessive water abstractions exacerbate water scarcity and reduce water quality.

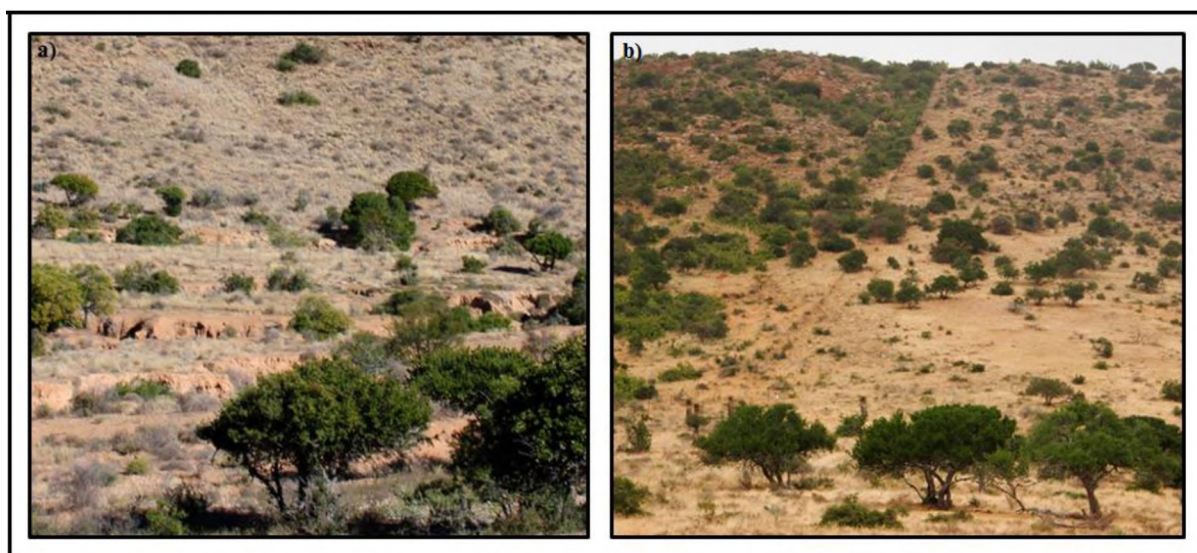


Figure 3.15: Degradation in the Baviaanskloof including (a) gully erosion and (b) overgrazing

Although agriculture remains the dominant economic activity in the Baviaanskloof, the extent of degradation means that conventional extensive agriculture has proven unsustainable, driving the pursuit of nature-based economic activities—such as conservation, tourism, carbon sequestration, and game farming—for socio-economic welfare (Boshoff 2008: 1; Mander *et al.* 2010: 1). The number of commercial farmers in the area has reduced in the past 15–20 years to 15 private farms and one communal farm (Jansen 2008: 32–33, 36–37).

Land use distribution in the Kouga shows a different pattern to the Baviaanskloof. The majority of land is privately owned (1,900 km²) uncultivated natural area, likely due to topography and inaccessibility. State-owned conservation areas (834 km²) are mainly restricted to the BMR in Kouga Mountains to the north (Mander *et al.* 2010: 5). Irrigated agriculture occurs primarily throughout the Langkloof ‘valley’ (Figure 3.16) with small pockets of cultivated land in the Bo-Kouga and Onder-Kouga valleys. Production focuses on deciduous fruit (apples, pears, apricots, and peaches), with lesser focus on livestock (goats, sheep, and cattle), lucerne, fodder, and citrus; vegetable crop production is limited (Haigh 2004; Jansen 2008; Mander *et al.* 2010). Small urban areas are also evident in the Langkloof valley. Under the government’s Land Reform Programme, by 2009 the state had redistributed approximately 41 km² of private (white-owned) farms to previously disadvantaged population groups (van der Merwe 2009 in Mander *et al.* 2010: 5).



Figure 3.16: Cultivated land in the Langkloof valley

Similar to the upstream sub-catchments, natural, uncultivated land cover dominates in the Gamtoos, consisting mainly of pristine Subtropical Thicket vegetation especially in rugged terrain (Haigh 2004). Intensive, irrigated agricultural activity is found along the Gamtoos River floodplain, in the hills above the Loerie Dam, and in the southwestern hills. Citrus and vegetables are the predominant crops produced, at over 120,000 tonnes and 250,000 tonnes per years respectively (Haigh 2004). Closer to the sea where temperature is moderated by the ocean, and fewer hills result in less protection from wind, citrus production decreases and vegetable and dairy farming predominate (see Figure 3.7b).

In all three sub-catchments, invasive alien plants (IAPs) are identified as an issue. The chief species of concern are black wattle (*Acacia mearnsii*), pine (*Pinus spp.*), silky hakea (*Hakea sericea*), red-eyed wattle (*Acacia Cyclops*), eucalyptus (*Eucalyptus spp.*), longleaf wattle (*acacia longifolia*) and prickly pear (*sesbaniapunicea*) (Haigh 2004: 17; Mander *et al.* 2010: 10). In the Baviaanskloof, IAPs are a minor problem; however, of note is prickly pear. In contrast, the Kouga faces a serious black wattle infestation (10 km²), particularly in channels and riparian zones of the Kouga River and its tributaries (Haigh 2004: 7; Mander *et al.* 2010: 10). Thus, parts of the Kouga were identified as urgently needing conservation attention (Boshoff 2008: 38). The Gamtoos experiences less of an IAP problem than the Kouga.

3.3.5 Water Use and Management

The study area falls under the Mzimvubu–Tsitsikamma Water Management Area (WMA). The Mzimvubu–Tsitsikamma Catchment Management Agency (CMA) was only gazetted by the Minister of the Department of Water and Sanitation (DWS) in January 2016 (DWS 2016).

Therefore, at the time of the field research, no CMA had yet been established for this area. With no irrigation board in the Baviaanskloof, water is managed privately on each farm. In the Kouga, water management differs for each tributary; Figure 3.17 differentiates between those tributary sub-catchments managed by irrigation boards (namely, Heights, Waboomsrivier, Louterwater, Aapiessrivier, Misgund, and Haarlem) from those with no formal water management institutions (namely, Tweek Riviere, Krakeel, Ongelegen, Bo-Kouga, and Avontuur).

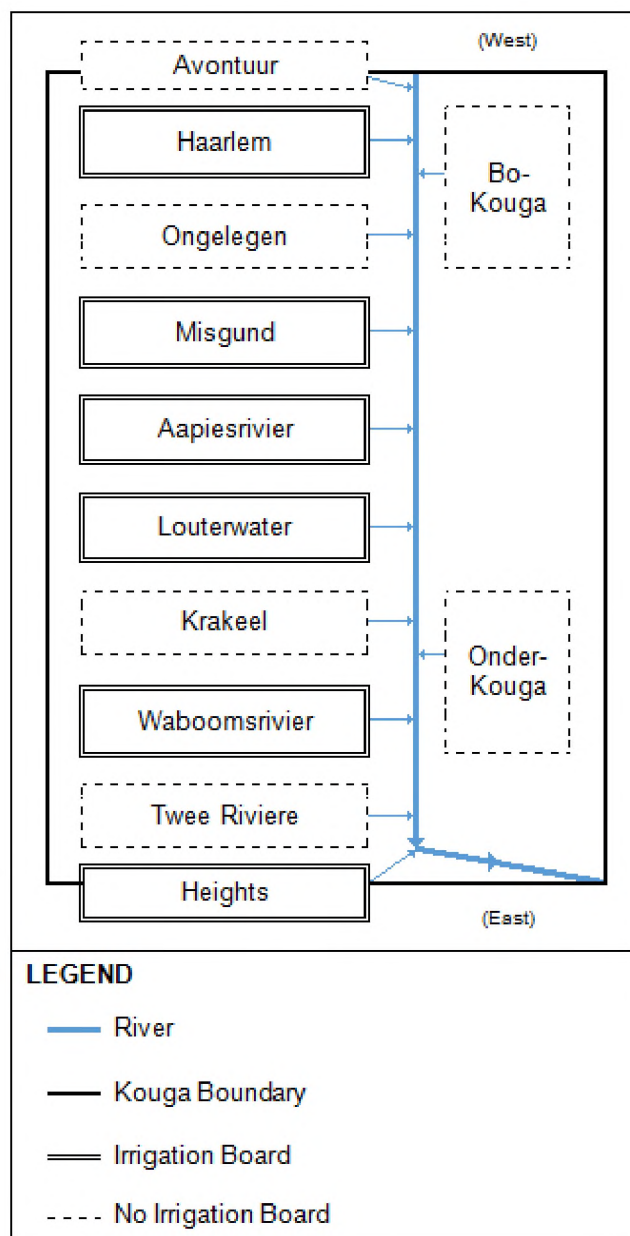


Figure 3.17: Irrigation boards in the tributary sub-catchments of the Kouga

As each tributary sub-catchment is subject to differing land and water management practices, it can be hypothesised that different issues will emerge in these basins. In the Gamtoos sub-catchment, water is managed by the Gamtoos Irrigation Board (GIB). At the time of the research, GIB and Haarlem Irrigation Boards were the only institutions that had started the process of transforming into water users' associations (WUAs).

Within the catchment, water is used in the domestic and agricultural sectors (DWA 2013; DWA 2014a). Additionally, the Algoa Water Supply System transfers water out of the catchment, supplying a significant amount of the total water used by urban, domestic, and industrial sectors in NMBMM (DWA 2013; DWA 2014a). Thus, the Gamtoos River catchment is of strategic importance in the Eastern Cape. Figure 3.18 and Table 3.4 illustrate water allocation and use in the study area by sector and location. While exact totals may vary through time, of significance is the relative proportion used by different sectors and locations as it reflects water demand and availability. The amounts in this table are referred to throughout this section.

In comparison to water use by other users, agriculture in the Baviaanskloof comprises a relatively insignificant amount (2 million m³/yr). This is unsurprising given the area's low mean annual runoff. Water is used primarily for irrigation of crops and grazing land (De Paoli 2008: 10). It is pumped directly from the alluvial aquifer—either from springs, the river itself, or from boreholes—and then redirected through furrows to small, on-farm storage dams (De Paoli 2008: 10; Jansen 2008: 29, 32). Irrigation methods include flood, pivot, and drip irrigation (De Paoli 2008: 10). Despite low water availability, water from the Baviaanskloof is touted as critically important for increasing agricultural and urban needs downstream (Boshoff 2008).

Agriculture in the Kouga is the second highest water user in the catchment (30–35 million m³/yr). Water is extracted from tributary rivers for irrigation and stored in privately-owned, on-farm storage dams and reservoirs, which have an estimated total capacity of 26 million m³ (Jansen 2008: 37). The Haarlem and Joubertina Dams together store approximately 5 million m³. This alters the rivers' natural flow regimes and reduces the volume contribution to the Kouga River (Haigh 2004: 5; Jansen 2008: 37). Most of the wetlands in the Langkloof have been drained and put under orchards (Haigh 2004). The area's topography confines agricultural activity to the parallel sub-catchments of the tributaries flowing across the Langkloof (from the Tsitsikamma Mountains to the Kouga River).

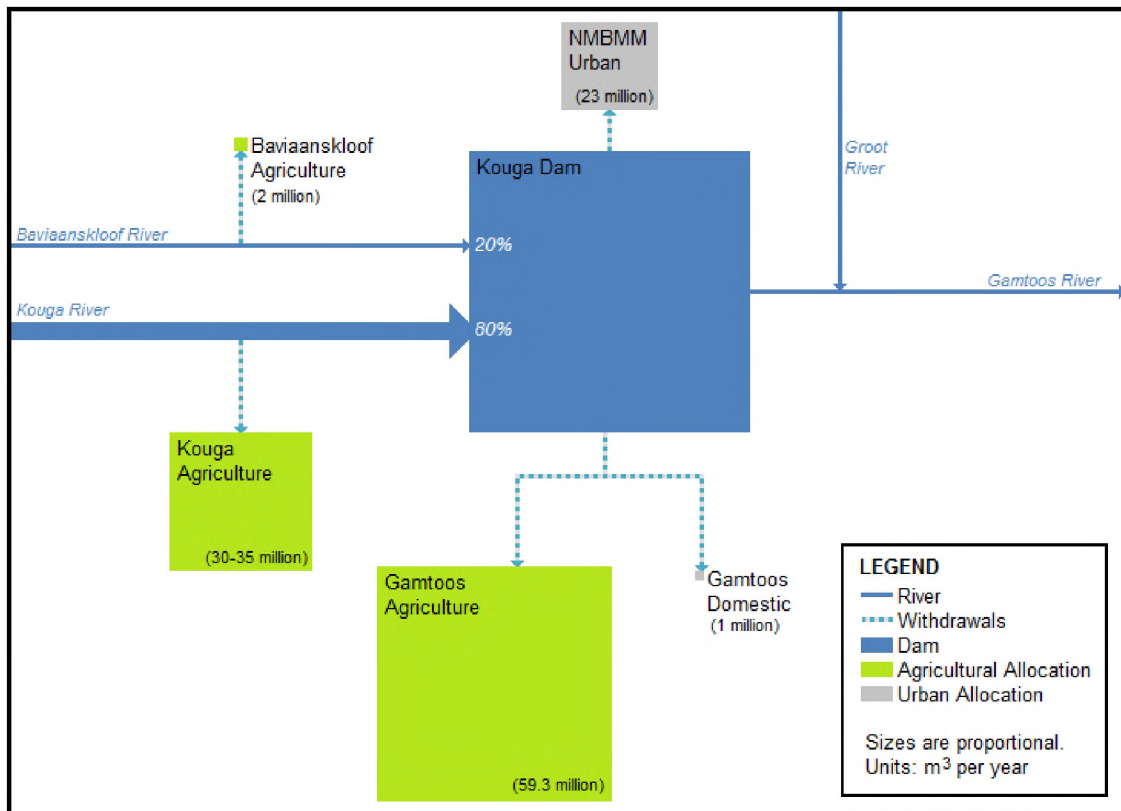


Figure 3.18: Water inputs and outputs by sector and location in the study area

Table 3.4: Water use in the study area by sector (2008) (adapted from Jansen 2008)

Location	Sector	Water Use (million m ³ /yr)	Water Allocation (million m ³ /yr)
Combined Study Area Sub-Catchments	Domestic	1	1
Baviaanskloof Sub-Catchment	Agriculture	2 (estimated)	N/A
Kouga Sub-Catchment	Agriculture	30–35 (estimated)	N/A
Gamtoos Sub-Catchment	Agriculture	45–47	59.3
NMBMM	Industry and domestic	20–23	23

Water management in the Gamtoos sub-catchment is characterised differently. Gamtoos farmers receive water from the Kouga Dam through the Gamtoos Irrigation Scheme, managed by GIB. The purpose of the irrigation scheme is to assure better quantity and quality of water supply for agriculture in the Gamtoos valley and for domestic and industrial use in NMBMM, particularly the city of Port Elizabeth (Haigh 2004). Figure 3.18 and Table 3.4 indicate that highest water use occurs in the Gamtoos (45–47 million m³/yr), where approximately 240

farmers are each allocated 8,000 m³ of water per original hectare irrigated when the allocation was set up (Haigh 2004). Thus, the scheme supplies almost 100% of irrigation water, with only a few farmers supplementing supply with water from tributary sub-catchments and boreholes (Haigh 2004; Boshoff 2008: 23). In addition, the scheme also supplies the domestic sector within the Gamtoos sub-catchment, as well as 20–30% of NMBMM's requirements (Haigh 2004; Boshoff 2008: 23), making NMBMM another significant water user in the study area (20–23 million m³/yr). The difference between water use and allocation in Table 3.4 points to water restrictions for different sectors and locations. Significantly, while agricultural users in the Gamtoos experience restrictions, urban users in NMBMM do not. Furthermore, upstream water users also do not experience restrictions due to a lack of formal water allocation and measurement. Domestic use in the catchment is small (1 million m³/yr).

The Kouga Dam (built in 1964) is located below the confluence of the Baviaanskloof and Kouga rivers (Haigh 2004). It has a catchment area of 3,850 km², a surface area at full capacity of 5.55 km², and a volume capacity of 129 million m³ (Haigh 2004; De Paoli 2008: 5). Importantly, the Kouga Dam loses about 2% capacity per year due to sedimentation. As indicated by Figure 3.18, the Baviaanskloof River supplies approximately 20% of the Kouga Dam's water (35–40 million m³/yr) while the Kouga River supplies approximately 80% (125–135 million m³/yr) (Jansen 2008: 48). These proportions reflect the proportions of total mean annual runoff for the two sub-catchments. A series of canals, tunnels, siphons, and five balancing dams transfer water 94 km from the Kouga Dam to the Loerie Dam, which also captures water from the low Elandsberg area and has a volume capacity of 3.4 million m³ (Haigh 2004).

The hydrological separation of the water in the Gamtoos River from the irrigation scheme water is due to high mineralisation from the Groot River tributary, making it poor quality for agricultural and domestic use (Haigh 2004). With no outlet valves on the dam wall, natural flow into the Gamtoos River is prevented except in wet years when water flows over the wall (Haigh 2004: 5). This points to the importance of overflows from the dam for sustaining the river's ecology. Figure 3.19 illustrates the Kouga Dam with no overflow (a) as well as in flood (b). High variability in rainfall in addition to low average rainfall amounts result in interchanging wet and dry years. In wet years water is 'lost' over the dam wall while water restrictions are put in place in dry years.

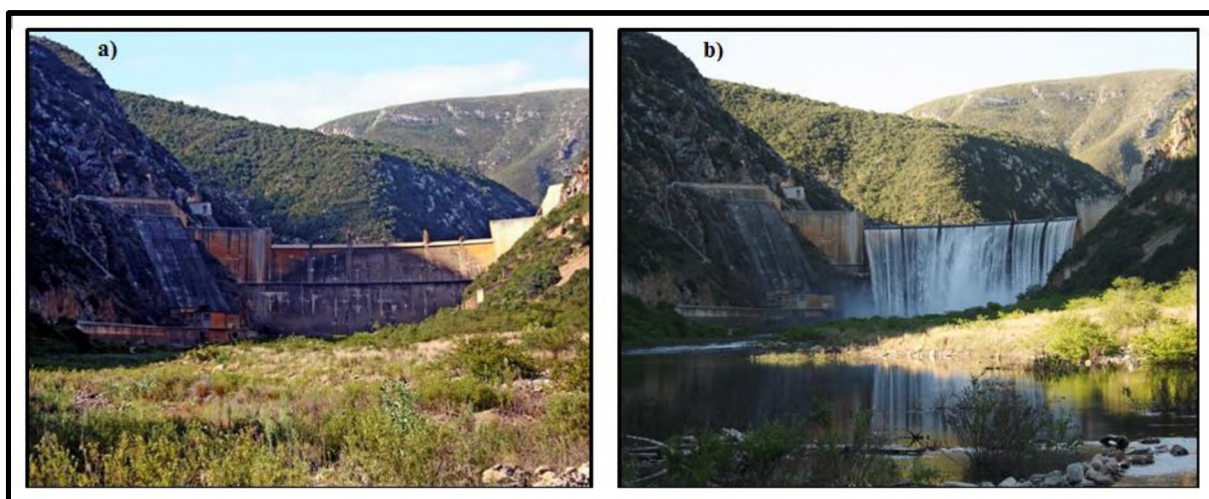


Figure 3.19: Kouga Dam at (a) 30% capacity with no overflow in January 2011 and (b) 100% capacity with overflow into the Gamtoos River in October 2011

3.3.6 Stakeholders Involved in Land and Water Management

There are numerous stakeholders and stakeholder groups involved in land and water management in the study area; some have already been mentioned in this chapter. Addressing Objective 2a, this section identifies those stakeholders relevant to this study and categorises them (under a political geocology approach) according to four socio-economic levels. Catchment boundaries are used to distinguish between stakeholders at local and regional levels and national boundaries separate stakeholders at national and international levels. Some stakeholders operate at multiple levels. Table 3.5 lists the 21 stakeholder groups according to the four levels. Commercial and emerging⁶ farmers, with their employees, are local level land and water managers. Towns, communities, and industries within the catchment boundaries are also important water users. Irrigation boards are the other main water managers at this level.

At the regional level there are the Baviaans, Kouga, Kou-Kamma, and George local municipalities. The city of Port Elizabeth (PE), although located outside the catchment boundaries, is also a regional level stakeholder as it receives part of its water supply from the Kouga Dam. Here, Nelson Mandela Bay Metropolitan Municipality (NMBMM) is the main political power-holder. ECP is a stakeholder, managing the BMR.

⁶ In South Africa the terms ‘emerging’ and ‘resource-poor’ are used to refer to previously disadvantaged (usually black or coloured) farmers who have acquired land since 1994 through land reform. While the descriptions ‘emerging’ and ‘resource-poor’ have differing connotations, for simplicity purposes this study uses the term ‘emerging’ to encompass all types of farmers coming from previously disadvantaged backgrounds. Note that ‘emerging’ does not imply subsistence farming.

National level stakeholders include a range of government departments (Water Affairs (DWA) (now DWS); Agriculture, Forestry and Fisheries (DAFF); Rural Development and Land Reform; Labour) and programmes (Working for Water (WfW), Working on Fire). These all influence land and water management, as do the operation of national energy markets and oil prices. Environmental NGOs and markets are categorised at both national and international levels. Environmental NGOs (such as Living Lands) are often funded by international bodies (e.g. the Dutch Government); Living Lands works towards restoration and conservation in the study area, and is the parent body for the PRESENCE Network. In order to maintain World Heritage Site status, BMR is influenced by UNESCO. Markets impact farmers' crop choices and management practices. Therefore, national chain stores such as PicknPay and buyers such as McCains are key stakeholders. International Standards Organisations' regulations impact on food safety, environment, biodiversity, and workers' health. For example, GlobalGAP specifies regulations that determine access to export markets or national chain stores.

Table 3.5: Stakeholders at local, regional, national, and international levels

Level	Stakeholders
Local	Commercial farmers Emerging farmers Employees (e.g. farm workers) Local population (residing in local towns, townships, and communities) Local industries (non-agriculture) Irrigation boards
Regional	Municipalities Eastern Cape Parks (ECP) Nelson Mandela Bay Metropolitan Municipality (NMBMM) City of Port Elizabeth (PE)
National	Government departments (e.g. Department of Water Affairs (DWA)) Governmental programmes (e.g. Working for Water (WfW)) National markets (including price regulators and buyers) Environmental NGOs Energy providers (e.g. Eskom and oil price)
International	International markets UNESCO Standards organisations (e.g. GlobalGAP, Fairtrade) International NGOs or NGOs funded internationally (e.g. Living Lands) International funding sources or organisations (e.g. Dutch government) Foreign labour

3.4 Results: Zones of the Study Area

This section delineates the study area into geomorphological (Schumm 1977) and water management zones (Molden *et al.* 2001) as outlined in Chapter 2. In doing so, it addresses Research Objective 1c: To delineate the catchment into zones to facilitate spatial analysis. The purpose of this is to facilitate spatial understanding of the study area and how different parts of the catchment are subject to differing characteristics, processes, and power relations. This section broadly classifies and describes the spatial extent of the zones but does not describe the distribution of resources, human productive activity, and power relations for each zone; this will be synthesised in Chapter 6.

Table 3.6 indicates the presence of the zones in each sub-catchment: four for the Baviaanskloof, six for the Kouga, and seven for the Gamtoos. Figure 3.20 illustrates the spatial manifestation of these zones. Note that that this diagram is intended to communicate the relative positions of the significant zones and does not illustrate accurate zone area proportions. The majority of land in the catchment is source zone; this corresponds with all natural, uncultivated, and non-irrigated land (see Figure 3.13). Transfer zones are indicated by rivers; these are limited to river beds and floodplain areas. Natural recapture, regulated recapture, and final use zones lie adjacent to transfer zones (along valley floors, floodplains, and areas with less harsh terrain) and correspond with irrigated, cultivated areas. Significantly, cultivated, irrigated areas in the upstream Baviaanskloof and Kouga sub-catchments are natural recapture zones, whereas similar areas in the Gamtoos are regulated recapture and final use zones. There are no regulated recapture or final use zones in the upstream sub-catchments. The only natural recapture zones in the Gamtoos are found in tributary sub-catchments, for example, upstream of the Loerie Dam. The Kouga Dam (as part of the Gamtoos Irrigation Scheme) qualifies as a regulated recapture zone, but is also an artificial sediment sink. Based on the available information about the area, no stagnation zones were identified. Ecologically sensitive zones include the BMR and the estuary (also classified as a modified sink zone as it now receives limited sediment contribution due to the existence of the Kouga Dam). Other ecologically sensitive zones do exist in the study area, although their specific locations were not identified for this study (for example, wetlands).

Of the three sub-catchments, the Baviaanskloof has the highest proportion of source zone to total area; only small pockets of cultivated land along the floodplain are classified as natural recapture zone. The Kouga has the second highest proportion of source zone; only the cultivated portions of the Langkloof, Bo-Kouga, and Onder-Kouga valleys are not classified as source zone, but instead as natural recapture zone. The Gamtoos has the lowest proportion of source zone due to widespread cultivation in the valley (regulated recapture and final use zone) and the southwestern and eastern parts of the sub-catchment (natural recapture zone).

Table 3.6: Presence of zones in each of the sub-catchments

Zone	Baviaanskloof	Kouga	Gamtoos
Source	Yes	Yes	Yes
Transfer	Floodplains	Limited floodplains	Floodplains
Natural Recapture	Yes	Yes	Tributary sub-catchments only
Regulated Recapture	No	No	Gamtoos Irrigation Scheme including transfer to NMBMM
Final Use	No	No	Yes
Stagnation	No	No	No
Ecologically Sensitive	Yes	Yes	Yes
Sink	No	Kouga Dam: artificial sediment sink	Estuary: modified sink

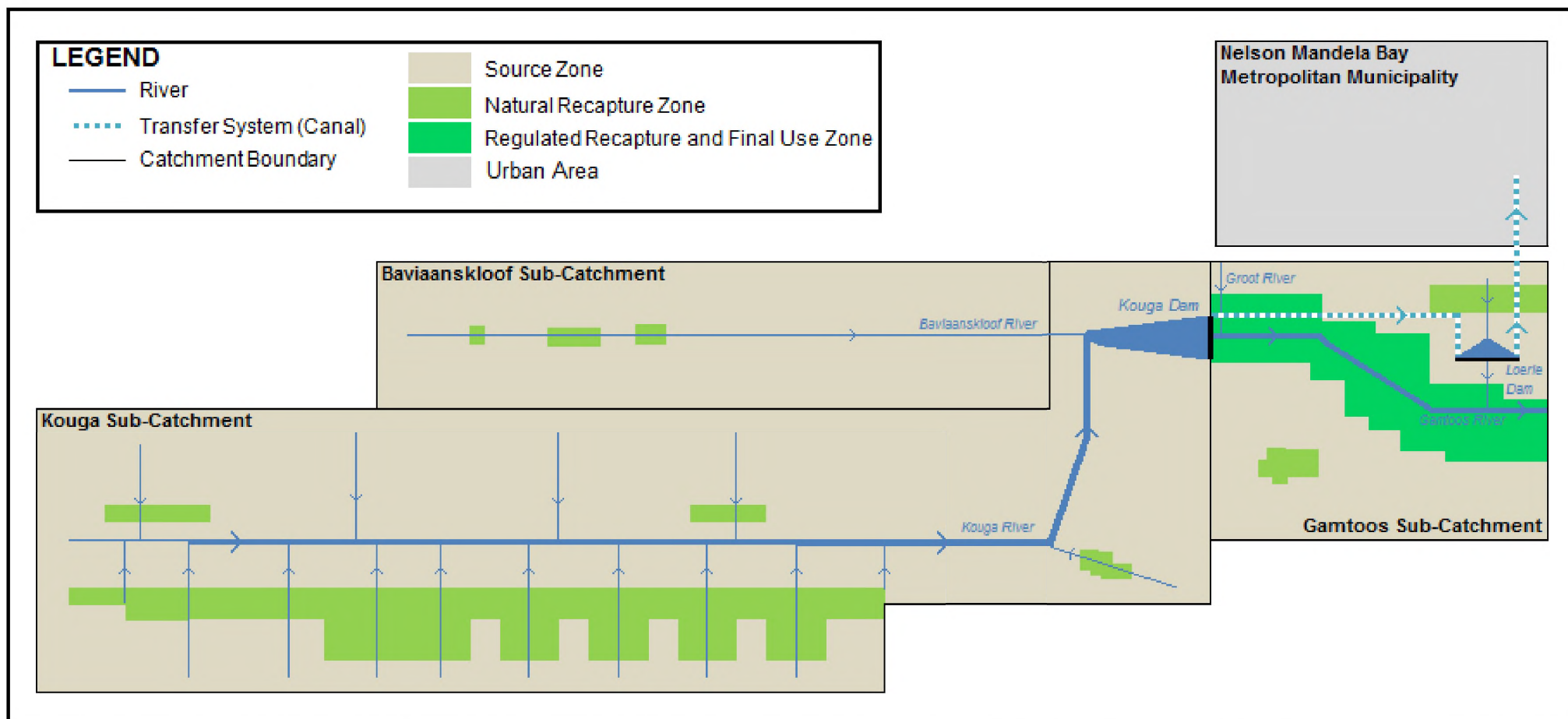


Figure 3.20: Diagrammatic representation of relative locations of water management zones in the study area. Zone area proportions are not accurate.

This section has delineated the spatial extent of the zones in the study area. Chapter 6 discusses the interrelationships between geophysical aspects (topography, rainfall, and hydrology), human productive activity (land use and water management), and how these shape and are shaped by power relations between stakeholders in different zones.

3.5 Summary of Findings

This chapter presented findings for Research Question 1, illustrating the spatial distribution of resources and human influences on the landscape in the study area. Each sub-catchment showed different characteristics in this regard. Importantly, the landscape's physical characteristics influence human productive activity. Primarily, the steep and rugged terrain restricts access to certain areas, determines those areas that can be cultivated, and influences what can be produced by determining the ease of transportation from each area. In addition, topography mediates rainfall, and shapes the area's hydrological characteristics.

The Baviaanskloof is characterised by marginal agricultural potential due to its insularity, low rainfall, low mean annual runoff, water scarcity, low capacity for water storage, and high levels of degradation. It thus has the lowest water use (2 million m³ per year) in the study area. Alternative land uses (e.g. tourism and conservation) assume increasing importance with the BMR as a prominent stakeholder.

In contrast, the Langkloof and Gamtoos valleys have thriving commercial farming industries. These are facilitated by ease of access, higher rainfall levels, higher runoff levels, good storage capacity for water, and higher population densities providing a convenient labour source. However, high rainfall variability necessitates careful water management. Agriculture in the Kouga uses 30–35 million m³ of water per year. This water use is managed separately in each of the parallel tributary sub-catchments; six have independent irrigation boards while the other four have no formal water management institutions. GIB manages water use downstream of the Kouga Dam. This water is shared between the Gamtoos' agricultural sector—which has an allocation of 59.3 million m³ per year but experiences frequent restrictions—and NMBMM's industrial and domestic sectors (which use 20–23 million m³ of water per year). NMBMM has much higher population densities than the catchment, potentially placing increasing pressure on water resources. It can be hypothesised that differing power relations will emerge in each sub-catchment due to the different water availability, demand, and management contexts.

Furthermore, there is limited direct access between sub-catchments; long routes around mountains need to be taken. Thus, minimal interaction for management activities—and therefore limited power relations—between sub-catchments can be expected. However, it can be anticipated that the downstream Gamtoos is vulnerable to upstream activities potentially leading to upstream–downstream power relations, despite the lack of direct linkages. Power relations can also be expected to manifest differently in each of the delineated zones, arising from different combinations of biophysical, geophysical, and human factors.

Overall, this chapter illustrated the structure and function of the landscape system in the study area, specifically the relationship between geophysical factors, biophysical factors, and human productive activity. It demonstrated how the landscape system's biotic and abiotic components influence one another, as well as the ramifications for resource management. Additionally, this chapter illustrated how these factors combine differently across space producing diverse contexts in different parts of the same catchment. This is important as different management approaches would be needed to tackle the varying circumstances. Furthermore, it can be hypothesised that power relations will similarly manifest differently across space. The following chapters outline the methods (Chapter 4) and results (Chapter 5) for Research Question 2 dealing with power relations. Chapter 6 draws together the political geocology approach and addresses Research Question 3 by integrating the two sets of results to spatially analyse the interrelationships between resource distribution and power relations in each of the zones in the study area.

Chapter 4: Methods and Methodology for Investigating Power Relations

Moving on from the previous chapter that presented the methods and results for Research Question 1 and Objective 2a, this chapter examines the methods and methodology used to address Research Objective 2b: “To identify issues surrounding access to, control, use, and management of land and water resources in the catchment on multiple levels” and Objective 2c: “To identify the extent to which power relations operate on an upstream-downstream level in the Gamtoos River catchment”. The chapter opens with a discussion of the qualitative methodology that informed the choice of methods (Section 4.1). Section 4.2 discusses data collection through semi-structured interviews and survey questionnaires administered to individuals representing selected stakeholder groups identified through Objective 2a. Section 4.3 briefly outlines data processing and organisation. Finally, Section 4.4 discusses qualitative content analysis of interview transcripts through Nvivo.

4.1 Qualitative Methodology

In developing a political geoeology approach, a descriptive–analytical, qualitative approach was followed to investigate power relations, influenced theoretically by political ecology. This approach potentially provides insight into: (i) the research participants’ social realities; (ii) the structure, function, and impact of human relationships and settings; and (iii) how people make sense of their surroundings (Berg 2007; Robinson 1998). It is appropriate for this study as it allows the researcher to share the subject’s perspective and describe how people structure their lives through the settings, actions, and meanings within their social context (Hakin in Robinson 1998; Berg 2001). Because it emphasises process while favouring relatively unstructured research designs, a qualitative approach allows for theory formulation to occur alongside data collection (Hakin in Robinson 1998), which is appropriate towards developing political geoeology. Furthermore, due to the small potential population sample in some sub-catchments (see Section 4.2.1: Sampling Strategy: Composition of the Sample) a qualitative approach was more suitable than a statistical, quantitative approach. Specifically, qualitative content analysis was chosen as the primary method to build a descriptive account of and analyse the prominent themes and types of power relations that occur on multiple levels within the study area over the use and management of land and water resources. Qualitative content analysis is discussed in detail in Section 4.4.

4.2 Data Collection

Data collection was administered by a single researcher from May to July 2012 in the Baviaanskloof, Kouga, and Gamtoos sub-catchments amongst local level participants directly involved in land and water management. Data was primarily collected through 34 semi-structured interviews, supplemented by 33 short survey questionnaires administered to the same participants. Berg (2007: 97) highlights that conducting interviews in preference over questionnaires provides maximum opportunity for thorough communication of ideas between researcher and participant. Used alone, questionnaires can be restrictive, denying participants the opportunity to challenge ideas on their own terms and thus masking a spectrum of attitudes (Robinson 1998: 390). While questionnaires enable formal statistical testing, full understanding of meanings, views, and beliefs can be lost (Robinson 1998: 389). In this study, these two methods were combined to yield the benefits of both. This section discusses the data collection methods, specifically, sampling strategy, pilot interview, semi-structured interviews, questionnaire surveys, and limitations of these methods.

4.2.1 Sampling Strategy

A Quasi-Random Sampling Strategy

Data collection was conducted with a population sample due to the limiting factors of time and cost (Robinson 1998: 385). In qualitative research, the perceptions, beliefs, and ideas of the sample should broadly reflect—rather than statistically represent—the wider population in the area (Berg 2007: 41, 43). This reduces bias and enables broad inferences to be made (without attributing causality) (Robinson 1998: 28; Berg 2007: 41). A quasi-random sample was selected using a non-probability sampling frame (Berg 2007: 41, 43). Participants were chosen for their geographical location, background, openness, level of knowledge, and ability to provide diverse perspectives on power relations over land and water resources. Furthermore, to ensure representativeness, participants were selected from different hierarchical levels (local level farmers and regional, national, and international level organisation representatives), functional areas, groups, and geographies. This is in line with methods advised by Eisenhardt and Graebner (2007: 28).

Three Considerations of the Sampling Strategy

The sampling strategy undertook three considerations to meet the abovementioned requirements. The first consideration was the need for participants located geographically in

each sub-catchment under investigation. A total of 34 participants were interviewed: 8 from the Baviaanskloof, 10 from the Kouga, and the remaining 16 from the Gamtoos.

The second consideration was the need to understand the perspectives of stakeholders directly involved in land and water management on a daily basis. Thus, individual interview participants did not come from all stakeholder groups identified in Chapter 3. Instead, farmers were identified as the primary stakeholder group to be interviewed; both commercial and emerging farmers were included as this is important in investigating power relations given the enduring inequities in South Africa.

The third consideration was to conduct at least one interview in each sub-catchment with a representative from an active organisation such as an irrigation board, environmental NGO, or government department. This was done in an attempt to represent alternative viewpoints from those of the farmers. Yin (2011: 12) describes these as ‘elite’ interviews involving key persons in communities who are chosen for their select roles and high value insights. One ‘elite’ interview was conducted in each of the Baviaanskloof and Gamtoos sub-catchments with organisation representatives from Living Lands and Gamtoos Irrigation Board (GIB) respectively. Living Lands (the parent body to PRESENCE) is an environmental NGO that has done extensive conservation and restoration work in the Baviaanskloof and the Kouga. GIB is the water management authority in the Gamtoos sub-catchment. In the Kouga, two ‘elite’ interviews were conducted with organisation representatives identified for their knowledge and involvement throughout the Langkloof valley: a representative from the Working on Fire programme and a representative from the Department of Agriculture, Forestry and Fisheries (DAFF). Working on Fire is a government programme (similar to Working for Water) that simultaneously tackles environmental and employment issues. DAFF is the government department responsible for agriculture-related issues nationally. Thus, all interviewed participants were directly involved in land and water management within the catchment.

Sampling Methods

In terms of specific methods, purposive and snowball sampling were followed (Robinson 1998: 29). Figure 4.1 illustrates the sampling strategy. The primary method used in the Baviaanskloof and Kouga was purposive sampling. It identified 20 participants through a database of contacts from the PRESENCE Network, of which 16 were interviewed. The database itself had more potential participants, however, the PRESENCE Network restricted who could be contacted

and interviewed. This was done to maintain positive relationships and prevent ‘stakeholder fatigue’ within their research network. Consequently, a few potentially valuable participants fell into this restricted group and were not interviewed.

In addition, Figure 4.1 shows two participants in the Kouga were identified through referrals. This sampling technique—known as snowball, chain-referral, or respondent-driven sampling (Berg 2007: 44)—was the primary method used in the Gamtoos due to the limited engagement of the PRESENCE Network there. The initial participant in the Gamtoos (Participant 019) was identified purposively through a supervisor of this research. As a key role-player in the area, Participant 019 was in a prime position to recommend suitable candidates. The sampling method then used the participants’ contact network; each was asked to refer others possessing the same attributes as themselves (Robinson 1998: 385; Berg 2007: 44). Snowball sampling yielded 35 more participants than purposive sampling, resulting in a higher number of participants in the Gamtoos than the upstream sub-catchments. Of the 32 potential participants identified through snowball sampling in the Gamtoos, 15 were interviewed.

Overall, ten potential participants declined interviews and 11 potential participants were not contacted. Reasons for declining or cancelling interviews included lack of interest, lack of willingness, scepticism of the research process, being too busy, not being located in the study area, and being away on holiday. There were a number of reasons for not contacting additional potential participants. Firstly, in some cases available contact details were incorrect. Secondly, time was a limiting factor in the Baviaanskloof and Kouga. Five days were spent for data collection in the Baviaanskloof which is an insular sub-catchment that is difficult to access. For this reason, PRESENCE coordinates time-bound field visits for multiple researchers, with shared transport and coordinated activities. Accommodation availability in the Kouga limited the field visit to four days. Data collection in the Gamtoos took place over a period of two weeks. A third reason for not contacting additional potential participants in the Gamtoos was having exceeded the number of participants interviewed in the other two sub-catchments. Additionally, themes were starting to recur with no new information arising over the last few interviews—despite these taking place with different types of farmers located in different positions in the valley.

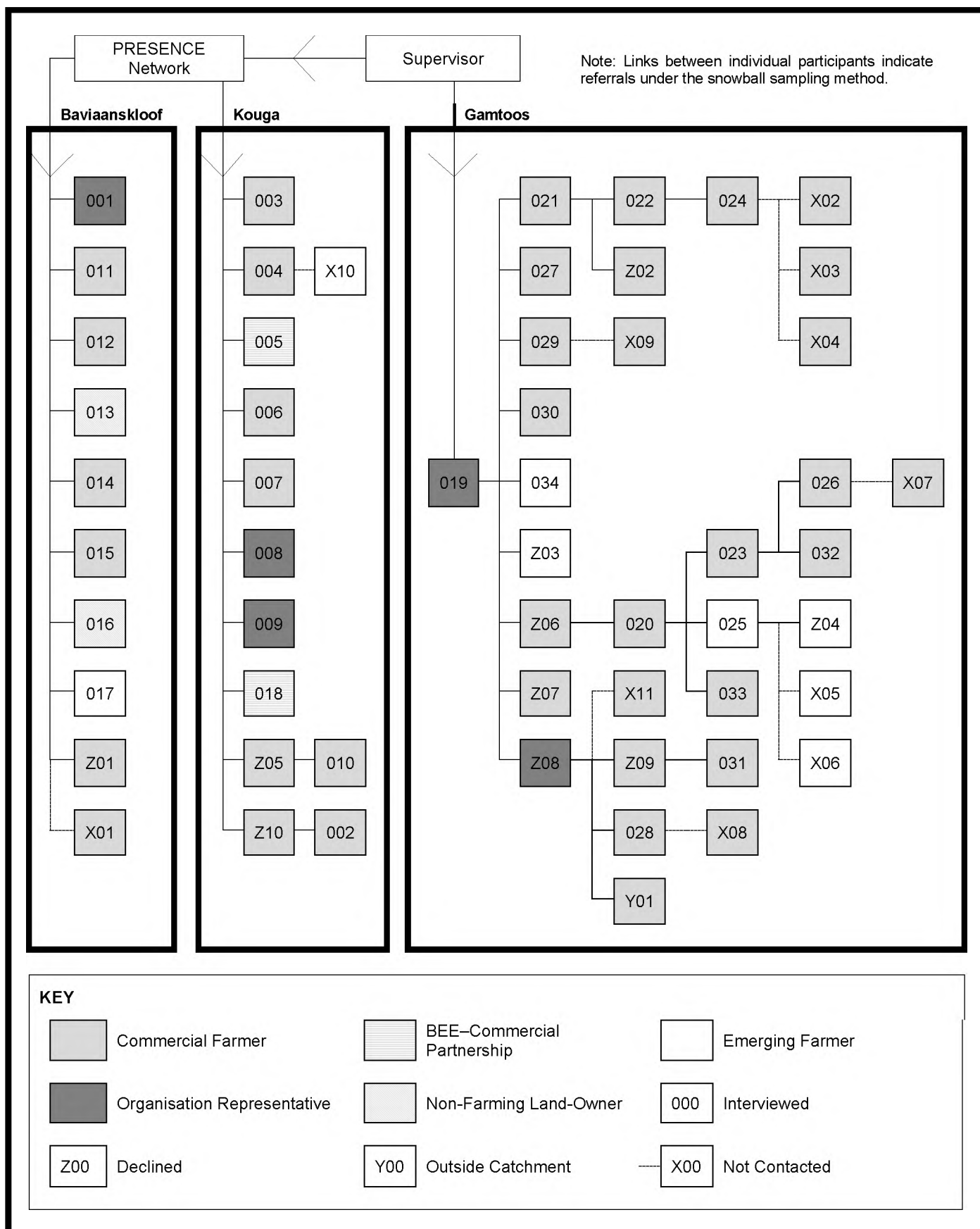


Figure 4.1: Sampling strategy by sub-catchment showing types of stakeholder

Composition of the Sample

Figure 4.1 illustrates the stakeholder groups to which the participants belong. In the Baviaanskloof, four participants were commercial farmers (out of a potential 12), and one participant was an emerging farmer representing a family trust (the only emerging farming community in the area). Additionally, two non-farming landowners were interviewed. In the Kouga, eight participants were interviewed out of approximately a potential 28 fruit exporters that are registered in the Langkloof valley. Of these participants, six were commercial farmers and two were representatives of black economic empowerment (BEE)–commercial farming partnerships. No emerging farmers were interviewed in the Kouga due to problems of gaining access; firstly, PRESENCE had limited contact details for emerging farmers in the Kouga, and secondly, commercial farmers were asked for referrals to emerging farmers but were either unwilling or unable to recommend individuals. One participant did provide the contact details for an emerging farmer, but the phone number received did not work. Using the snowball sampling strategy in the Gamtoos, 13 commercial farmers were interviewed out of a potential 203. Out of a potential 17 emerging farmers, three were contacted and two were interviewed.

Another important aspect to note is that the priority in the Kouga was to select participants from as many of the ten tributary sub-catchments as possible. Figure 4.2 illustrates that the sample represented (from downstream to upstream): Krakeel, Louterwater, Aapiessrivier, Misgund, Ongelegen, Haarlem, and Avontuur. A participant from the Suuranys Mountains region of the Kouga was also interviewed. The following sections outline the pilot interview, the semi-structured interviews and the survey questionnaires.

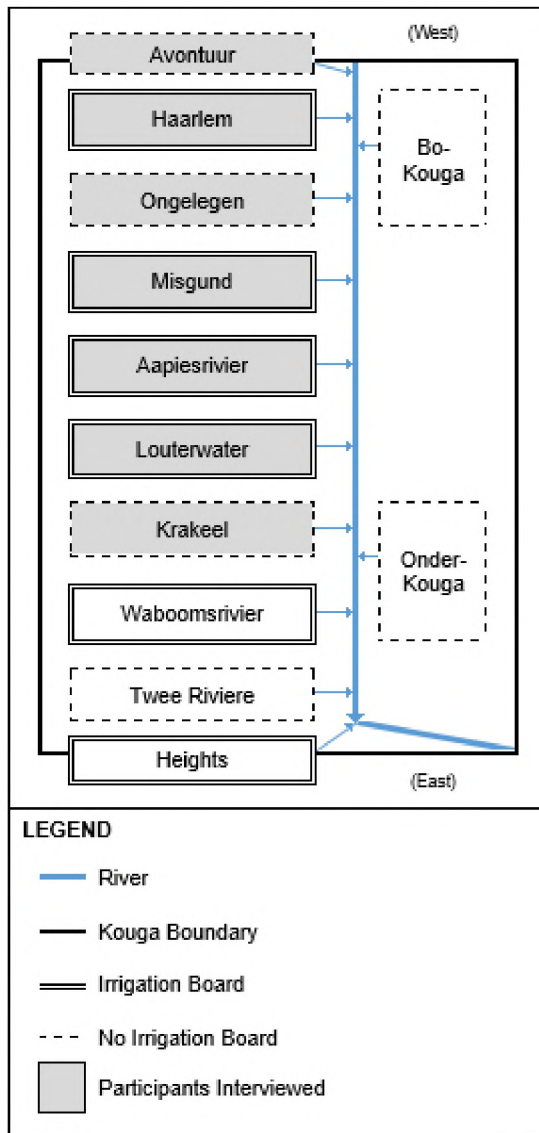


Figure 4.2: Composition of interview participant sample from Kouga tributary sub-catchments

4.2.2 Preparation: The Pilot Interview

Before conducting interviews with the population sample, it was first important to implement a pilot study. Robinson (1998: 382–384) advocates for the use of pilot interviews as they: provide field training for interviewers; help in skill and rapport development; allow questions to be tested; and allow for the interviewer to experiment with the interview schedule flow, order, length, and content. An extended pilot study was not possible due to time constraints and the limited number of available participants. However, a pilot interview was conducted with participant 001. This confirmed the viability of the semi-structured interview method, gave the researcher a feel for what to expect, and provided direction for the construction of the

survey questionnaire. For this reason, while the total number of participants was 34, only 33 questionnaires were administered. The questionnaire structure and content is discussed later in this section.

4.2.3 Semi-Structured Interviews

The purpose of the interviews was to discern participants' perceptions of land and water management and associated power relations. The researcher contacted potential participants telephonically, briefly introduced herself and the project, and requested an interview. If willing, a convenient time and location for the interview was arranged. Interviews were conducted at either the participants' houses or their offices.

During the interview itself, the researcher followed a semi-structured interview schedule. Figure 4.3 is an example of a typical schedule used during the interviews. It illustrates that interviews opened with the researcher introducing herself and the project, assuring anonymity and confidentiality, and requesting permission to digitally record the interviews for transcription purposes. Interviews then proceeded with participants being questioned on a number of topics, followed by the administration of the questionnaire. They were concluded with requests for participants' contact details (to provide feedback), and for referrals to other potential participants.

The semi-structured interview format was chosen as it benefits from the characteristics of both the structured and unstructured formats. Drawing on the structured interview format enabled the researcher to explore a framework of pre-set themes (namely access to, control, use, and management of land and water resources) with the aid of pre-determined topics and questions (Berg 2007: 94–95). As can be seen in the interview schedule, questions were not asked directly about the pre-set themes, nor about power issues. This was purposely done to avoid introducing bias and creating reluctance among participants. Instead, questions were designed to elicit information about these themes by asking questions on other relevant topics. For example, questions on employees, emerging farmers, water availability, water sources, and PE's demand on water were designed to elicit information about access. In the same manner, questions on types of farming, irrigation, influence of the market, and standards organisations were designed to elicit information on use and management issues. Relevant power issues brought up by participants were investigated through follow-up questioning.

Opening Statements ☐ Introduce yourself and the project. ☐ Explain confidentiality and anonymity. ☐ Request permission to record.
Topics to Cover: Ask questions around the following topics. ☐ Background information. ☐ Type of farming: Individually? Generally in the area? ☐ Size of farm: Total size? Size irrigated? ☐ Water source: River? Irrigation board? Boreholes? ☐ Number of people employed: Permanent? Temporary? ☐ Water availability? Rainfall reliability? Water issues? ☐ Irrigation board: role, benefits, water restrictions, perception, relationships, formation of. ☐ PE's demand for water? ☐ Government's role in the area (specifically pertaining to land and water): DWA, other government departments, municipalities. ☐ Water reform, formation of WUAs. ☐ Water legislation, payment for water, licensing, water rights. ☐ Emerging farmers. ☐ Influence of the market on land and water use: Local market? Export market? ☐ Influence of standards and standards organisations on land and water use.
Administer questionnaire.
Closing Statements ☐ Suggestions for future research? ☐ Request referrals to other farmers or stakeholders. ☐ Ask for contact details. Reassure confidentiality. ☐ Thank participant.

Figure 4.3: Example interview schedule used to guide researcher's questioning

The semi-structured format also maintained the freedom offered by the unstructured interview format, which operates from the assumptions that interviewers do not know all the potential questions in advance and that relevant questions tend to arise from interactions during the interview itself (Berg 2007: 94). Thus, the interview schedule given in Figure 4.3 was not followed rigidly; there were no set questions and the number and types of questions asked on each topic were guided by the development of the interview and the participant's previous

answers. Thus, by allowing for question development and adaptation during the interview, the semi-structured format allowed the interviewer to digress from the prepared questions and to probe for more information relevant to the investigation (Robinson 1998: 385, 413; Berg 2007: 94–95). Furthermore, nuances of meaning (potentially obliterated when sticking to a rigid interview schedule) were preserved (Robinson 1998: 413). The interview process, therefore, was flexible, tailored to specific individuals, and avoided the rigidity of the structured interview (Robinson 1998: 390). The interview style resembled a conversation between participant and interviewer, directed by the set themes for the research (Robinson 1998: 413; Berg 2007: 94). In addition, after each interview the process was reflected upon and the next interview incorporated new questions, topics, and themes.

Yin (2011: 12) points to the fact that this interviewing style is appropriate for case study research as it reveals the ways reality is constructed within the case study, rather than reflecting the researcher's version of reality. Furthermore, it allowed the researcher to efficiently gather rich, empirical data (Eisenhardt and Graebner 2007: 28). A record of the actual questions asked in interviews can be found in Appendix 4.1 which collates the questions sourced from the interview transcriptions according to the four themes around which they were designed to elicit information: access to, control of, use of, and management of land and water resources.

A digital recorder was used to obtain a record of the interview, reducing distraction inherent in note-taking, allowing the researcher to concentrate on the interview, and assisting with subsequent interpretation (Robinson 1998: 416–417). Only one participant declined the use of the digital recorder and in only one other (particularly long) interview did the recorder go flat. Less than five participants requested to go 'off the record'. Participants' availability and openness determined interview lengths, which ranged from fifteen minutes to over two hours. Where the participant was pressed for time, the questionnaire guided the interview structure and participants were probed for more detailed answers where relevant.

4.2.4 Survey Questionnaires

Interview data was supplemented through a survey questionnaire designed to establish participants' perceptions and attitudes regarding land and water management and other stakeholders. Robinson (1998: 378) indicates that survey questionnaires have been used widely in human geography research to obtain information from target groups within the population, especially when relatively small numbers of people are being questioned. The benefits of using

this method in this research are as follows: information was obtained in a simple, standard, and replicable format; both qualitative and quantitative data was yielded; findings were strengthened by adding a new line of sight; and the interview was structured by the questionnaire for those participants who were pressed for time (Robinson 1998: 378, 411).

While the interviews themselves were semi-structured, the questionnaire remained rigid throughout the data collection process. It was administered to participants during the semi-structured interviews and was filled-in by the researcher based on participants' answers. This was done to offer them the "opportunity for explanation and assistance with any difficulties the participants [had] in answering questions" (Robinson 1998: 378). Table 4.1 summarises the survey questionnaire questions; the questionnaire itself can be found in Appendix 4.2. It consisted of 16 questions. The table indicates that eight questions asked for responses on a 'Strongly Disagree–Strongly Agree' Likert-style continuum, four questions asked for responses on a 'Very Important–Really Unimportant' Likert-style continuum, two questions required 'Yes/No' answers, and the remaining seven questions were multiple choice, asking for participants' perceptions of various stakeholders.

Table 4.1: Summary of survey questionnaire: Question types and topics covered

Question Type	Questions	Topics Covered
Likert-Scale (Strongly disagree–Strongly agree)	1, 2, 3b, 4b, 5, 13, 15, and 16	Perception of water scarcity; need for collaboration between water users; importance of legislation implementation; need for alternative water sources for PE; impact of electricity cost to land and water management; and impact of future pricing of water.
Likert-Scale (Very important–Very unimportant)	11a, 11b, 12a, and 12b	Phrasing differed for each sub-catchment with the aim of gauging participants' perceptions of the importance of water for farmers either upstream or downstream of themselves, as well as for Port Elizabeth.
Dichotomous (Yes/No)	3a and 4a	Knowledge of National Water Act and the water reform process.
Multiple Choice	6a, 6b, 7, 8, 9, 10, and 14	Perception of: water management model; GIB; WfW; DWA; Living Lands; and standards organisations.

Graphs were generated from the results of the survey questionnaire and were used to support the content analysis findings. Figure 4.4 is an example of a graph illustrating results to survey questionnaire question 15 for each sub-catchment.

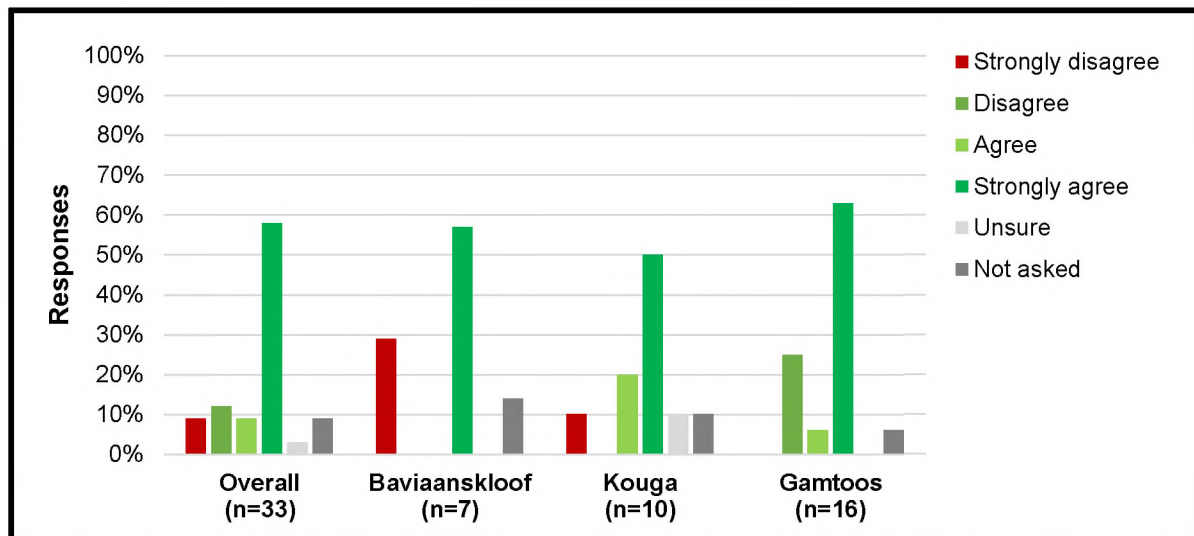


Figure 4.4: Example survey questionnaire results graph illustrating participants' perceptions of the impact of electricity costs on farming by sub-catchment (Q15. My farming, water use activities, or land management practices are affected by the price of electricity.)

4.2.5 Summary of Data Collection

This section has given a detailed account of the data collection process, including the sampling strategy, pilot study, semi-structured interviews, and survey questionnaires. Some problems and limitations were encountered with these methods. These will be examined in Chapter 6 (Section 6.6.1). The following section briefly outlines how the collected data was organised prior to content analysis.

4.3 Data Processing and Organisation

Following the semi-structured interviews, the digital recordings were used to create transcriptions of the interview data. These transcripts were then systematically organised and 'cleaned' to facilitate ease of reference, replication (if necessary), and a seamless analysis process (Mason 2002: 148; Berg 2007 45–46). This section briefly describes the data organisation and processing undertaken after data collection.

Interview and questionnaire recordings were transcribed to keep a record of the interview, prepare the data for further categorisation, and facilitate further interrogation and analytical coding (Robinson 1998: 427). Additionally, transcripts were edited to prepare the data for analysis. Edits included: correcting grammar and terminology (e.g. 'desalting plants' to

‘desalination plants’); replacing Afrikaans words with English ones (e.g. “ek wil say” – “I would say”); removing discourse markers (e.g. ‘actually’, ‘eventually’, ‘you know’, ‘you see’, ‘as a matter of fact’, ‘you understand’ etc.); completing hanging sentences (where meaning could be inferred from previous sentence); removing half-sentences (where the participant changed track and did not finish the thought); omitting identifying information (e.g. names, farm names etc.), irrelevant information (determined by research themes), anecdotes (e.g. about farming experiences outside the study area), tracts of conversation irrelevant to the interview (e.g. answering of phones), and researcher’s extensive explanations; removing hesitations (e.g. ‘umm’) unless indicative of reluctance to answer a sensitive question; and omitting repetitions (e.g. “I think, I think, ja I think that”) unless indicative of emphasis (e.g. “it is very bad, very bad”). Once the data had been processed, analysis began. The following section will discuss data analysis.

4.4 Data Analysis: Content Analysis

This section discusses content analysis of the transcribed interview data including the coding process, content analysis through Nvivo, and manual qualitative content analysis. Transcribed interview data was analysed through computer-assisted content analysis using Nvivo software. Content analysis involves the systematic analysis and interpretation of texts to identify patterns, themes, biases, and meanings in order to make objective inferences about the data (Berg 2001; Esterberg 2002; Berg 2007). The purpose of content analysis is to uncover patterns of human activity, action, and meaning (Berg 2007: 304).

Content analysis in this research followed a number of steps similar to the sequence of analytic activities outlined by Berg (2007: 36): (1) deductive development of codes; (2) application of deductive codes; alongside (3) open coding through inductive development and application of codes; (4) synthesis of final coding scheme for meaningful analysis of patterns and relationships; (5) identification of patterns through matrix coding; (6) critical analysis and interpretation of interview data located at intersecting codes; and (7) retrieval of examples to illustrate and corroborate emergent patterns and themes. This analysis process is described in detail in the following sections.

4.4.1 The Coding Process: Deductive and Inductive Coding

Deductive codes—derived from the literature and theoretical perspective—were developed prior to transcript analysis. Codes around similar themes were grouped into categories. Table 4.2 presents the deductive categories and codes according to four themes: land and water management, power, theoretical aspects, and local conditions and context. An example of a category under the ‘land and water management’ theme is ‘management’ (grouping codes relating to management activities). Examples of codes under this category are ‘protection’, ‘awareness’, and ‘development of resource’.

Table 4.2: Interview data content analysis: Deductive categories and codes derived from theoretical literature

Categories	Nvivo Codes
Theme 1: Land and Water Management	
Management	protection, allocation, awareness, demand, supply, quantity, quality, availability, coordination, planning, development of resource, needs
Governance	pricing, policy, NWA, NWRS, water reform process, the riparian principle, the prior rights principle, principle of subsidiarity
Use	food provision, basic needs, ecosystem function, industry
Adaptions	infrastructure, large-scale dams, inter-basin transfers, small on-farm dams
NWA requirements	water conservation strategies, demand management strategies, reallocation of water, licensing system, national tariffs for water services, financial assistance for water services institutions, accountability mechanisms, managing land and water together, ecological reserve, national government as custodian of water
IWRM activities	equitability, sustainability, efficiency, integration: institutions, integration: resources, coordination between sectors, recognition of interconnectivity, public–private sector partnership, stakeholder participation, conflict avoidance, conflict resolution, agreement of limits, involvement of women, water as an economic good, provision of safe water, natural disaster mitigation, capacity-building, building a knowledge base, institutional reform, ecosystem protection, increased agricultural productivity, improved urban delivery systems, demand management, optimised relationship between supply and demand, decentralisation/ centralisation (consolidation of institutions), decision-making at the lowest possible level, transparency, responsiveness to needs
Failures of water reform	failure to establish CMAs, failure to transform irrigation boards into WUAs, lack of successful water reallocation, enduring inequities in access to water, hampered processes of water licensing, failure to protect aquatic ecosystems, ongoing service problems in townships
Water reform challenges	resistance to institutional reform, reluctance to collaborate with new institutions, displacement of existing power structures, realignment of decision-making power, ideological and political divisions within government departments, bureaucratic in-fighting, financing issues, limited resources, reluctance to commit resources, lack of political will, overwhelming burden on officials, conflicting sector policies, lack of alignment between government departments, daily crises limiting ability to engage with IWRM concept, lack of buy-in by water managers ‘on the ground’ of the IWRM concept, lack of experience, lack of knowledge and technical capability, reluctance of stakeholders to participate, lack of effective stakeholder participation, lack of accountability for failure in target achievement, high rate of leadership change, high turnover of staff including ‘brain drain’ to the private sector
Challenges to management from within water sector	human resource capacity constraints, incompatibility between formal conflict resolution and traditional mechanisms, infrastructure problems, poor service delivery, reluctance to solve problems, preference to increase supply rather than manage demand, problems associated with attaching economic value to water

External challenges to water management	political instability, drought, flood, increasing water scarcity, increasing degradation and depletion of resources, declining quality, inequities in access which mirror historical inequalities, increased stakeholder conflict, cultural barriers, low levels of literacy, widespread poverty
Theme 2: Power	
Levels	global, international, national, regional, local, community, household, individual
Roles	land managers, decision-makers, influencers, institutional powers, power-holders
Circulation of power	struggle, conflict, marginalisation, exploitation, competition, segregation, discrimination, othering, collaboration, cooperation, negotiation, prevention, resolution, institutionalised knowledge, privileged knowledge, situated knowledge, produced knowledge, reproduced knowledge, institutionalised practice, privileged practice, situated practice
Type of power	access, influence, control, leadership, guidance, justice, constraining, enabling, driving
Structure	historical, political, economic
Ecological change	disturbance, degradation, pollution, restoration
Human–environment relationship	change as a result of human action, human action shaped by environmental conditions, factors that shape relations of power
Social relations	labour issues, job creation, job provision, cheap labour, poverty, livelihoods, apartheid, separate development, townships, homelands, inequality
Theme 3: Theoretical Aspects	
Theoretical	Structural, post-structural
Concept classification	Perception, representation, interpretation, explanation, discursive formation, symbolic contestation, discourse, meaning
Theme 4: Local Conditions and Context	
Stakeholders: Government	NMBMM (PE), DWA, Working for Water, Eskom
Stakeholders: End- Users	Commercial farmers, emerging farmers
Stakeholders: Private Sector	Living Lands, researchers, standards organisations
Stakeholders: Water Authority	CMAs, WUAs, irrigation boards, GIB
Environment: Land	Topography, soils, geology, vegetation
Environment: Water	Surface water, groundwater, dams, consumed
Environment: Climate	Rainfall, wind
Location: Sub-Catchment	Gamtoos (p), Baviaanskloof, Kouga, Groot, Gamtoos (s)
Location: Upstream–Downstream	Upstream: Kouga, upstream: Baviaanskloof, downstream: Gamtoos, internal upstream, internal downstream, external to catchment
Location: Ecological Concepts	Zones, upstream–downstream linkages, connectivity

This was not the final coding scheme used. Firstly, as can be seen in Table 4.2, the deductive codes were numerous. Secondly, because they were derived from the theoretical perspective many of the codes were not applicable to the case study (e.g. ‘NWRS’, ‘demand management strategies’, ‘homelands’). Thirdly, some themes emerged during the coding process that had not arisen deductively. Thus, an open coding process was followed whereby deductive codes were applied alongside the application and development of inductive codes. The coding scheme was therefore flexible and under continuous development. Using the ‘stakeholder’ categories, Table 4.3 provides an example of the evolution of the coding scheme during open coding; categories were developed for stakeholders at multiple levels from individual level through to international level. For a complete list of the categories and codes developed during open coding, please see Appendix 4.3.

Table 4.3: Interview data content analysis: Examples of categories and codes from open coding

Categories	Nvivo Codes
Stakeholder: individual level	individual A, individual B
Stakeholder: farm level (Baviaanskloof)	individual C, participant Z01, farm Z01, farm B, farm 011, farm 012, farm 014, farm 015, farm 017, farm level (general), individual D, individual E, farm 013, individual F
Stakeholder: farm level (Gamtoos)	stakeholder 020, stakeholder 022's (neighbour), stakeholder 025, stakeholder 033's father's farm
Stakeholder: local level	Baviaanskloof Farmers Association, BMR, CMA, commercial farmers (Baviaanskloof), commercial farmers (Gamtoos), commercial farmers (Kouga), community (Coleske Plaas), community (Zaaimanshoek), emerging farmers, emerging farmers (Gamtoos), employees, farmers (Gamtoos) applying for river pump, GIB, local municipality
Stakeholder: provincial level	ECP, municipality or urban centres, Port Elizabeth
Stakeholder: national level	Department of Agriculture, Department of Human Settlement, Department of Water Affairs, Eskom, financial institutions, Government, land market, markets (national), Angora and Mohair market, national market, Produce Buyers, Dairy, McCains, PicknPay, Shoprite-Checkers, Woolworths, SANBI, WfW, WfWetlands, Wilderness Foundation
Stakeholder: international level	outside organisations (other), Dutch Embassy, Eurepgap, funding organisations, GlobalGAP, HACCP, Living Lands PRESENCE, markets (international), standards organisations, UNESCO

Open coding resulted in a number of limitations. Firstly, as illustrated by Table 4.3 and Appendix 4.3, categories and codes were extensive (30 categories and over 500 codes). Secondly, these were applied at a very detailed level. Some codes, for example, were applied to only one sentence across all transcriptions and, as a result, low frequency counts occurred during content analysis that could mask meaningful relationships. Thirdly, some codes were too subjective in nature (e.g. those under the category ‘power: attitude’). Finally, some codes were duplicated (e.g. ‘increasing efficiency’ and ‘more efficient’).

The final coding scheme, as presented in Table 4.4, was reached through merging, refining, and grouping codes and categories. For example, the categories ‘individual level’, ‘farm level’, and ‘local level’ (Table 4.3) were merged under the category ‘local level’ (Table 4.4); likewise, the codes ‘individual A’ and ‘individual B’ were merged under the code ‘intra-community’. This streamlined the coding scheme and allowed for more meaningful relationships and themes to emerge. In Table 4.4, codes in **bold** indicate parent codes under which child codes were grouped⁷.

⁷ Parent codes are similar to categories—they group one or more other codes under them. These can either be aggregated or not aggregated. Aggregated codes mean that all coding to child codes is also included in the total frequency count for that code. Child codes are those codes occurring under parent codes.

Table 4.4: Interview data content analysis: Final Nvivo categories and codes

Category	Codes [with child codes]
Land use	commercial agriculture [cash crops, citrus, dairy, deciduous fruit, general, livestock [cattle, goats, ostriches, sheep], medicinal plants, olives, vegetable seeds], conservation-related land uses [conservation, game farming, restoration], tourism, degradation, inactive or unused land, land use change, permaculture, small-scale agriculture
Linkages	Baviaanskloof-Kouga, Kouga tributary sub-catchments, upstream–downstream [internal upstream–downstream, Baviaanskloof–Gamtoos, Kouga–Gamtoos, Groot–Gamtoos], linkages to PE [Baviaanskloof–PE, Kouga–PE, Gamtoos–PE]
Prevailing discourse	<i>standalone code</i>
Sentiment	positive, negative, neutral, mixed
Stakeholder by level	<i>See child categories below: local level, regional level, national level, international level</i>
Local level	commercial farmers [intra-community [farmers applying for permission to pump from the Gamtoos river], commercial farmers: general, commercial farmers: Baviaanskloof, commercial farmers: Kouga, commercial farmers: Gamtoos], emerging farmers, employees, irrigation boards [irrigation boards: general, Gamtoos Irrigation Board, Aapiesrivier Irrigation Board, Haarlem Irrigation Board, Joubertina Irrigation Board, Krakeel Steering Committee, Louterwater Irrigation Board, Misgund Irrigation Board, Waboomsrivier Irrigation Board], local urban centre [towns: general, Baviaanskloof communities, Haarlem township, Joubertina township, Krakeel township, Louterwater industry, Louterwater township, Misgund township, Patensie, Hankey]
Regional level	ECP, PE, WUA, municipalities
National level	government [DWA, government: other], energy, national markets, WWF
International level	Dutch embassy or government, foreign labour, funding organisations, Living Lands, international markets, standards organisations, UNESCO, Wilderness Foundation
Sub-catchment (secondary)	Gamtoos (primary), Baviaanskloof, Kouga, Gamtoos
Sub-catchment (tributary)	B: Studtispoort, G: Bergrivier, G: Klein River, K: Aapiesrivier, K: Avontuur, K: Bo-Kouga and Onder-Kouga, K: Haarlem, K: Joubertina, K: Krakeel, K: Louterwater, K: Misgund, K: Ongelegen, K: Twee Riviere, K: Waboomsrivier
Water	water availability, formation of WUAs or CMAs, water governance, water management, water on-farm management activities, water quality, water use

The final coding scheme was applied consistently across all interview transcripts, as advised by Berg (2007: 306). While Table 4.4 illustrates the salient features of the final coding scheme, the complete final coding scheme can be found in Appendix 4.5. It illustrates the criteria of selection by which content was either excluded or included (Berg 2001). For example, the code ‘intra-community’ was applied to any reference to individuals or groups of farmers within the same sub-catchment (other than the participants themselves). In addition, Appendix 4.5 identifies both latent and manifest codes. Manifest content focuses on surface structure (physically present and countable words) while latent content focuses on interpretation of the underlying meanings (Berg 2001; Esterberg 2002). Examples of codes coding manifest content are those under the category ‘land use’. Examples of codes coding latent content are those under the category ‘sentiment’. The application of codes from the final coding scheme was the

final step in the coding process. The following section deals with the production of results subsequent to the coding process.

4.4.2 Analysis: Frequency Cross-Tabulations

Following coding, matrix coding queries were run in Nvivo to produce frequency cross-tabulations of codes, revealing patterns within the data. A cross-tabulation is a type of frequency table that summarises the distribution of multiple variables (Colwell and Carter 2012: 49). Cross-tabulations allow observation of how “the frequency distribution of one variable relates to that of one or more other variables” (Colwell and Carter 2012: 49). Frequencies are thus compared by categories (Colwell and Carter 2012: 49). Table 4.5 is an example of a results cross-tabulation. It illustrates the frequencies that coding to each of the four codes in the ‘sentiments’ category (columns: ‘negative’, ‘positive’, ‘neutral’, and ‘mixed’) overlapped the ‘intra-community’ code for participants in different sub-catchments of the study area (rows: Baviaanskloof, Kouga, Gamtoos, and Study Area). Relative frequencies in the form of percentages for each sub-catchment have been calculated to facilitate comparison of the broad patterns.

Table 4.5: Example of Nvivo cross-tabulation of sentiments for intra-community relationships by sub-catchment

	Negative	Positive	Neutral	Mixed	Row Total
Baviaanskloof	67 (60%)	31 (28%)	10 (9%)	4 (4%)	112
Kouga	8 (33%)	10 (42%)	2 (8%)	4 (17%)	24
Gamtoos	11 (21%)	18 (35%)	8 (15%)	15 (29%)	52
Study Area	86 (46%)	59 (31%)	20 (11%)	23 (12%)	188

Cross-tabulation frequencies are potentially influenced by a number of factors. Firstly, they could be influenced by bias introduced during the interview process (i.e. by themes thought important by the researcher). Secondly, the number of interview participants in each sub-catchment could skew frequencies. For example, frequencies are likely to be higher in the Gamtoos due to the higher number of participants (16) compared to the Baviaanskloof (7) and Kouga (10). Thirdly, interview lengths have a bearing on frequencies; themes are likely to arise more frequently in a two-hour interview than a fifteen-minute interview. Thus, there is not necessarily any correlation or causality between cross-tabulation frequencies and the

importance of the issues underlying them. Therefore, frequencies do not point to actual power relations. In this research, where frequency cross-tabulations are presented as results, this is done to highlight broad patterns in the data. Primarily, however, frequency tables were used as an additional step in analysis through which to further investigate the underlying patterns of themes. Thus, they do not represent the central findings themselves.

4.4.3 Analysis: Qualitative Results

The central findings of this research emerged through manual exploration of the cross-tabulation intersections. That is, each frequency cell in an Nvivo frequency cross-tabulation represents a collection of all textual elements ('references') coded to those intersecting codes. As such, each cell gathers together all instances on similar topics in the qualitative data. These were further investigated manually by the researcher. Figure 4.5 provides an example: an excerpt of the qualitative data—as presented by Nvivo—underlying the [Study Area, negative] cell from Table 4.5. In this case, the 'references' shown are a sample of the collated textual elements that were coded to both 'negative' and 'intra-community'.

This qualitative data was manually explored, interpreted, and critically analysed by the researcher who read through, identified, and summarised the predominant themes. These themes are presented in Chapter 5 and supported by independent evidence from interview transcripts—in the form of detailed excerpts and selected quotes—to corroborate the researcher's interpretation and reduce bias (Berg 2001). In this way, a descriptive account was built detailing the views and experiences of the participants, which were represented through the researcher's interpretation and analysis (Robinson 1998: 431). This approach is known as qualitative content analysis.

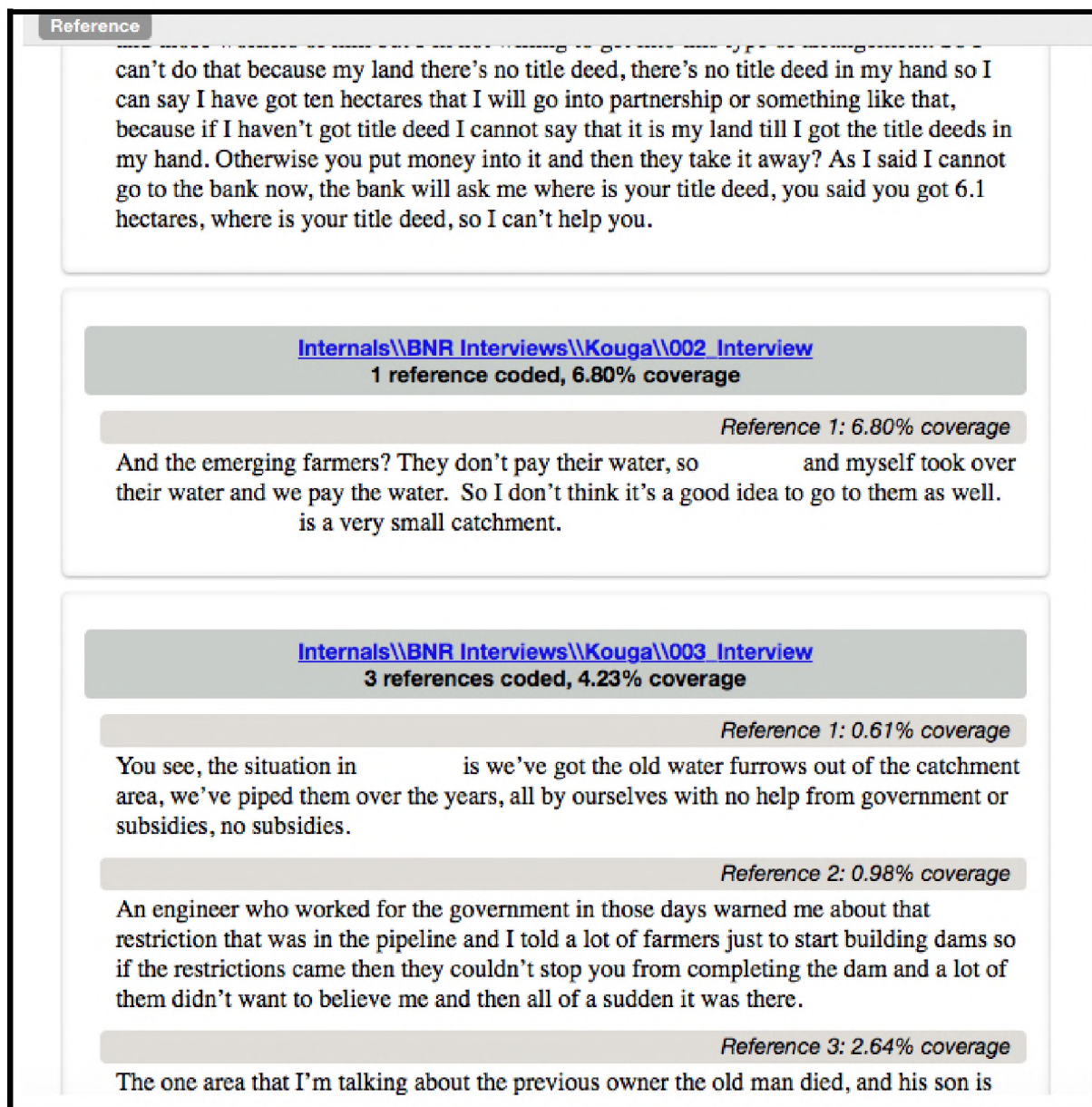


Figure 4.5: Screenshot of Nvivo for intra-community negative content

4.4.4 Summary: Qualitative Content Analysis

Qualitative content analysis focuses on meaning. It uses the counting of textual elements as a means to identify, organise, and retrieve data, after which literal words and meaning are considered (Berg 2001; Esterberg 2002; Berg 2007: 307). This form of analysis avoids the reductionist quantitative approach—which involves statistically analysing the frequency of specific words and themes (Esterberg 2002)—as it emphasises the importance of the words and meaning of the text and brings understanding of the participant's perspective (Berg 2001).

As this chapter has described, in this research, content analysis is primarily involved with the critical interpretation of the interview data identified through the frequency cross-tabulations of coding relationships (Robinson 1998: 431). In this way, a descriptive account was built of the prominent themes and the types of power relations that occur on multiple levels within the study area over the use and management of land and water resources, as well as how these are manifested in an upstream–downstream direction. An example of a power relationship is between emerging farmers (local level) and government departments (national level) that fail to provide adequate support after land redistribution. Further spatial analysis occurs in Chapter 6 where these power relations (Chapter 5) are interpreted alongside distribution of resources (Chapter 3) for each of the zones in the catchment.

4.5 Conclusion to Methods

This chapter has outlined the methods and methodology for this research. It has illustrated the way in which this research was carried out in order to build a descriptive, qualitative account of power relations surrounding land and water resources in the study area. Data was collected through a questionnaire survey and semi-structured interviews which were transcribed and analysed through qualitative content analysis. The following chapter presents the findings.

Chapter 5: Power Relations in the Gamtoos Catchment

This chapter presents the findings to Research Objectives 2b and 2c. It employs the political geocology approach, focussing on power relations among stakeholders at multiple levels of socio-economic organisation, including a limited focus on their spatial manifestation. Specifically, this chapter details power relations surrounding access to, control, use, and management of land and water at multiple levels, as well as upstream–downstream power relations. Power relations are presented for each of the levels at a catchment and sub-catchment scale; they will be interpreted according to zones in Chapter 6 alongside Chapter 3’s results.

Stakeholders were identified in Chapter 3 (addressing Objective 2a). As explained in Chapter 4, interview participants did not come from all stakeholder groups. As the primary focus was to understand the perspectives of stakeholders directly involved in land and water management, local level stakeholders in the form individual commercial farmers and emerging farmers were interviewed. Key organisation representatives were also interviewed from Gamtoos Irrigation Board (GIB) (local level), Working on Fire (regional level), DAFF (national level), and Living Lands (international level). Thus, all interviewed participants were directly involved in land and water management within the catchment.

Section 5.1 examines broad patterns in the coding, providing background to the central findings which are then analysed and presented as a descriptive account of qualitative themes arising from the interview transcripts. These are supported by participant quotations as well as graphs from the survey questionnaire where appropriate. Themes are examined in relation to stakeholders at four levels, namely local level (Section 5.2), regional level (Section 5.3), national level (Section 5.4), and international level (Section 5.5).

5.1 Broad Coding Patterns

This section highlights the overall quantitative coding patterns in the transcripts that are significant to understanding the qualitative results. For each of the sub-catchments, coding frequencies are identified for the four levels (Table 5.1) and for varying sentiments (Table 5.2). Table 5.1 illustrates that overall the local level was discussed the most ($f=658$), followed by national ($f=433$), then regional ($f=228$), with the international level discussed the least ($f=108$). All three sub-catchments reflect this pattern. With the most interview

participants, it would be expected that the Gamtoos sub-catchment would have higher frequencies than the other sub-catchments. This is the case for all levels except the international level, at which the Baviaanskloof has a higher frequency ($f=50$) than the Gamtoos ($f=36$). Therefore, it is expected that the Baviaanskloof will dominate international level themes. It is also interesting that the Baviaanskloof has a higher local level frequency ($f=195$) than the Kouga ($f=169$), despite having fewer participants. This possibly reflects the Baviaanskloof's insularity. Additionally, the Kouga's lower local level frequency could be attributed to, firstly, minimised intra-catchment water management interactions due to geographical non-linearity of water sharing resulting from the tributary sub-catchments' parallel arrangement or, secondly, to the sampling strategy's attempt to select participants from as many tributary sub-catchments as possible.

Table 5.1: Sub-catchment coding frequencies for socio-economic levels

	Local	Regional	National	International	Row Total
Baviaanskloof	195	54	96	50	395
Kouga	169	79	118	22	388
Gamtoos	294	95	219	36	644
Study Area	658	228	433	108	1427

Table 5.2 illustrates that across all levels negative sentiments were most prevalent for the overall study area ($f=632$), and neutral sentiments were least prevalent ($f=146$). Therefore, it is expected that negative themes will dominate the qualitative results. Each sub-catchment reflects this pattern for most (negative) and least (neutral) densely coded sentiments. For the overall study area, the Kouga, and the Gamtoos, mixed sentiments were second most prevalent, followed by positive sentiments. However, the pattern differs in the Baviaanskloof, where positive sentiments were more prevalent ($f=125$) than mixed sentiments ($f=62$). It is therefore expected that Baviaanskloof results will contain more positive themes.

Table 5.2: Sub-catchment coding frequencies for sentiments

	Negative	Positive	Neutral	Mixed	Row Total
Baviaanskloof	189	125	19	62	395
Kouga	177	65	52	94	388
Gamtoos	266	130	75	173	644
Study Area	632	320	146	329	1427

Again, based on the number of participants in each sub-catchment, the Gamtoos would be expected to have the highest frequencies, followed by the Kouga then the Baviaanskloof. This is the case for neutral and mixed sentiments. However, the Baviaanskloof has a slightly higher frequency ($f=189$) for negative sentiments than the Kouga ($f=177$). In addition, for positive sentiments, the Baviaanskloof ($f=125$) has much higher coding density than the Kouga ($f=65$), almost as high as the Gamtoos ($f=130$). While negative sentiments predominate across all sub-catchments, the characteristics of the Baviaanskloof's positive themes are worth further exploration in the qualitative results.

These results reflect that relationships between stakeholders exist at each level to different extents and are characterised differently (e.g. positive or negative) in each of the sub-catchments. The rest of this chapter will explore the thematic characteristics of these power relations.

5.2 Local Level

As already illustrated, participants discussed the local level the most. Table 5.3 illustrates the sentiments for local level themes. It illustrates that negative sentiments dominated in all sub-catchments. Significantly, relative to the number of participants, the Baviaanskloof had high frequency of negative sentiments (55%) at the local level.

Table 5.3: Sub-catchment coding frequencies for local level sentiments

	Negative	Positive	Neutral	Mixed	Row Total
Baviaanskloof	107 (55%)	54 (28%)	11 (6%)	23 (12%)	195
Kouga	64 (38%)	35 (21%)	26 (15%)	44 (26%)	169
Gamtoos	95 (32%)	77 (26%)	37 (13%)	85 (29%)	294
Study Area	266 (40%)	166 (25%)	74 (11%)	152 (23%)	658

This section presents the thematic results relating to local level power relations, specifically commercial farmers, emerging farmers, local population and employees, and local level water management.

5.2.1 Commercial Farmers

Commercial farmers are the primary land managers and water users operating at the local level. While commercial farmers experienced similar struggles in every sub-catchment, these were driven by different contexts. In the Baviaanskloof, commercial farmers experienced reduced income from farming through time and attributed this mainly to water scarcity, degradation (e.g. overgrazing, erosion, river channel cutting, and drained wetlands), and the marginal nature of agriculture in the area. They reported pressure to find viable alternative income sources other than farming. Although participants report progress and collaboration in this regard—such as tourism, restoration, conservation, and changes in crop type (e.g. olives)—they expressed frustration at the limited options for alternative income:

“But we also need money to replace that income... Big farms like [named farmer] ... if he can stop what he’s doing he’d do it tomorrow. If he could find another source of income, he would do it” (P-011).

In the Kouga’s thriving commercial agriculture context, pressure to find alternative sources of income was also reported but here attributed to lack of faith in South Africa’s political future, especially for white farmers. In the similar thriving commercial agricultural context of the Gamtoos, reduced income through time was also reported, but was attributed mainly to increasing input costs lowering profit margins (this theme will be explored in Section 5.5.4: Energy Providers).

Intra-sub-catchment power relations also arose as a significant finding at the local level. Within each sub-catchment, different upstream–downstream power relations arose. Themes surrounding intra-sub-catchment relationships arose more frequently in the Baviaanskloof than the other sub-catchments; this is possibly due to the insularity of the area as well as the small population. Here, upstream–downstream power struggles were driven by acute downstream water scarcity attributed to overuse of water and poor land management upstream:

“Some farmers jokingly complain that others are using too much water and they don’t get enough downstream” (P-012).

However, solutions were sought collaboratively with stakeholders deliberately and consciously avoiding outright power struggles over water in order to maintain good social relations within the small Baviaanskloof community. For example, this impacted the handling of water scarcity onset in the 1970s:

“...when water started becoming an issue I went to see advocates... [but] I would make so many farmers angry because of that... I understood that it would be one man who would cause many problems in the Baviaanskloof and we're a very small community” (P-011).

Instead of fighting over limited water, participants indicated that they collaboratively pursued restoration, which they viewed as a solution to water scarcity and reduced income:

“I think that is something that is working very well in the Baviaanskloof at this stage is that the people have taken ownership of this river system and seen how we can restore it to the benefit of a lot of people... a lot of people have been involved here so I prefer to talk about 'us', I don't talk about myself. I think this is a collaboration of people who are really interested” (P-011).

Power relations were also evident on this matter. For example, some participants expressed frustration with other farmers' attitudes to restoration:

“...sometimes it seems to be that they need to be forced to think in another way... if you are serious about something you must be serious about it... sometimes it seems... they are not serious enough... I was surprised to see [Angora goats grazing on land undergoing restoration]. It's not good. The problem is you can't do restoration on land if the farmer is not willing to do his part. Then it's a waste, a huge waste” (P-011).

However, participants displayed desire to assertively and amicably resolve these power struggles.

Other struggles over water in the Baviaanskloof were localised and focussed on infrastructure maintenance issues and related allocation concerns:

“[Named farm] has never helped us [maintain infrastructure]” (P-012).

“...as a farm, it cannot be that our quota of water is one 40 mm pipe” (P-016).

Despite ill-feelings stakeholders again displayed desire for cooperative and mutually beneficial solutions. Difficulties in communication were identified as a barrier to cooperation, driven by vast distances in the area, existence of only dirt roads, and lack of communications infrastructure:

“I think communication is the biggest problem. Ability to communicate and distances... Just to speak to some of these farmers in this area you have to travel long distances. We don’t have cell phones. Okay, we do have radios... Lack of communication slows processes down” (P-014).

In the Kouga’s tributary sub-catchments, cooperative and positive relationships between commercial farmers over water management were reported in all sub-catchments with formal irrigation boards:

“Last year, for instance, we had to replace a section of one of the pipelines and we got together and decided that we would do the job and every month one pays his part in comparison with his hours in attendance” (P-003).

Furthermore, participants expressed willingness to share water with other farmers in times of need (provided they had enough for themselves first):

“...if I see he got a problem and I have enough I will let the water through” (P-006).

The only internal upstream–downstream power struggle—in the form of a legal dispute over water rights—arose in a tributary sub-catchment with no formal water management arrangement. New upstream farmers failed to recognise longstanding sharing arrangements and rights of downstream users, complicated by lack of documentation making those rights official:

“So now these guys claim that it’s their water... because it’s going through their land... but the spring is not on their farm so there is a dispute... they take it, everything... They’ve got some sort of interdict where they divide it one day for them, one day downstream... But now the three guys downstream must divide that one day between themselves... That water never comes to the bottom, you take your turn again [and] before it’s here you stop it again at the top. So the inflow isn’t constant” (P-006).

No internal upstream–downstream power relations arose on the Gamtoos River. This can be attributed to the separation of water allocation from the river to the dam and the facilitation of this process formally through GIB. Thus, allocated supply is guaranteed regardless of usage by other farmers. The only example of a localised power struggle surrounding water in the Gamtoos is the high prices some farmers place on water when trading water rights during droughts.

5.2.2 Emerging Farmers

Power relations experienced by emerging farmers differ from those experienced by commercial farmers. This is significant given South Africa's context of enduring inequities. These can be classified into four broad groups: struggles experienced by emerging farmers; relationships with government; relationships with commercial farmers; and power in BEE programmes.

Struggles Experienced by Emerging Farmers

The most significant key constraint to success—a theme that came up in all sub-catchments—is the lack of resources (including financial), skills, and training required to run a successful commercial farming operation. Participants identified required skills as financial planning, long-term strategising, and knowledge of soils, crops, irrigation, and markets:

“The emerging guys who go into fruit farming really need the management skills... You've got to think about labour relationship. You've got to think about marketing. You've got to think about your resources that you don't plant a tree on shallow soil. You've got to think about your water supply... People can destroy a fruit farm in one year” (P-008).

“...first you must manage and then you can plant. You can't just plant. Because what are you going to plant? ...And which time of the year? And what's the yield going to be? You must know all of those things before you plant. So the pressure of the whole economy and all these GlobalGAPs and all these things are quite heavy these days on farmers. And I think that's also a problem why these things [emerging farms] don't get off the ground and don't work” (P-028).

Specifically, participants in all sub-catchments emphasised that emerging farmers lack monetary resources leading to a number of financial difficulties including: inability to financially invest; lack of assets to borrow against to establish farming operation; need to rent out land (instead of farming) to make an income; need to sell land to pay debts (before land reform regulations changed to prevent this); and need to annually sell water rights to other farmers due to inability to pay their accounts:

“But somewhere they must get the money and that's [the] biggest thing because they don't own the land—the land is still the Republic's land—they rent it from them for a five-year period and then after that if everything goes well then they will carry over the land to the people... [The] problem is where to get the production cost, because you can't go to a bank because the land isn't on your name” (P-006).

“Those people, my friends too, the government bought for them a farm in 2005... Their farm has been sold now... At the end of the day they are better off now because they [were able to] pay their debts...” (P-034).

This lack of required skills is linked to the idea that being a successful commercial farmer is not something you can ‘just do’, it is something you have to either be born and raised into, or passionate about:

“You don’t just get a farm and you farm. You don’t just become a farmer. You are born a farmer or not. And I think that’s a big problem” (P-028).

Emerging farmers also hold this perception:

“Farming is not a business where is anyone can come up and say, ‘I want to farm.’ It’s totally different... there is a big difference between a farm worker and a person who knows how to farm” (P-034).

Emerging Farmers’ Relationships with Government

Power imbalances between government and emerging farmers compound the struggles experienced by emerging farmers. Gamtoos participants pointed to inadequate support from government as a key constraint to emerging farmers’ success:

“...one of the problems is the assistance that is given by the government—by the Department of Agriculture—is not good enough” (P-019).

“...but still I think what happened is government, they give them the farm and they give them this and that and then they just left them so it was hard for them as well... No support, maybe a tractor in the beginning but no annually support or no mentor, nothing, just—. That’s also one of the big issues with this land reform, I mean it will hopefully eventually turn around” (P-020).

“...the government doesn’t want to give [us] money” (P-025).

“And I’m sad... the whole situation of land reform in this new government is totally wrong... because... Today: there’s your farm. Tomorrow: [government has] gone. After three days it’s a mess, nothing goes on, the farm is laying [inactive]... So that is totally nonsense, the way government is doing the thing” (P-034).

Participants also pointed to a lack of solutions offered by government to emerging farmers' problems, for example, with obtaining financial capital:

"We are busy [on behalf of emerging farmers] negotiating with Land Affairs to see what they can do because they [government] don't want to give money for production... but they [government] can't tell them [emerging farmers] otherwise how to get money" (P-006).

Kouga and Gamtoos participants pointed to poorly managed land redistribution, reporting problems with implementation of land ownership legislation and lack of land allocation planning:

"...about 8 years ago [government] bought land for the people... I asked [named government representative], 'What the hell are you doing? ...Where's the water?' He said, 'No, they can make a dam.' I said, 'We're not allowed to make dams!' So he said, 'Then they can pump from the river.' I said to him, 'Do you know that this river, sometimes for three to four months it is as dry as can be. There is no water to pump!' Until this day there is nothing happening on that property" (P-003).

Despite these problems, participants in the Baviaanskloof and Gamtoos pointed to the fact that the government has programmes in place to assist emerging farmers. Baviaanskloof participants reported that government had upgraded on-farm infrastructure for emerging farmers, and pointed to an example of government departments working together and meeting with landowners and farmers to cooperatively generate solutions to problems experienced. Gamtoos participants reported that government provided support through mentors, consultants, and training:

"But I see the government has now appointed a mentor... He's a consultant... he is supposed to look at all the resource-poor farmers' problems and make recommendations to government" (P-019).

"The only thing Department of Agriculture will do is they will take you to courses—Food Safety and Good Agricultural Practice—go sit at the desk and somebody else pays... I did Agricultural Leadership at University of Pretoria. That's got everything: Human Resources, Financial Management, Risk Management. Which is good, but it needs to be more practical" (P-025).

Relationships with Commercial Farmers

Lack of skills and resources combined with inadequate government support leaves emerging farmers dependent on commercial farmers for training and help:

“It is dependent on whether they [commercial farmers] are willing to help or not. Obviously they are willing because they can get something out of the deal, but at least they are willing... you will have to sacrifice him getting something and you learn in the process” (P-025).

As a result, emerging farmers are vulnerable to exploitation:

“They [emerging farmers] don’t pay their water, so [named commercial farmer] and myself took over their water and we pay the water. So I don’t think it’s a good idea to go [interview] them as well. [This] is a very small catchment” (P-002).

“When we came... a commercial farmer would come and say to you, ‘Sell me that equipment.’ You’ve got no clue how much it is worth... You sell it [for R3,000]. Down the line you discover, hey, that equipment is worth R14,000! Next time, you sell nothing” (P-025).

Generally, commercial farmers contemptuously viewed emerging farmers as inactive and unsuccessful:

“...you really can just laugh at some BEE projects... There’s one—there’s nothing happening there. They want to sell... I would like to see some of their business plans. It must be a joke!” (P-003).

An important finding regarding emerging farmers is the frequent use of ‘othering’ language by white commercial farmers when speaking of coloured or black emerging farmers:

“...they bought the land for the people...” (P-003).

“In this area we are four farmers. That one there: [named white farmer A], [named white farmer B] next door, [named white farmer C] at the top, and BEE group at the back next to our farm” (P-006).

In the first example, use of the term ‘the people’ strips the individual emerging farmers of their individuality and reduces them to a homogenous group. It also points to a lack of effort on the part of the commercial farmer to get to know the individuals on the surrounding farms.

Similarly, in the second example each white farmer is identified by name, but the ‘BEE group’ are reduced to a homogenised grouping of people. Othering language occurred alongside some overtly racist remarks:

“And then [that water] supplies the African gentlemen, or whatever you want to call your friends... Don’t get the blacks to run it because they just want to steal the money and that’s a fact. Because we don’t like these people getting money for nothing” (P-010).

“You know what the biggest problem is? In Africa? The greed of the African people” (P-023).

In response to a question about emerging dairy farmers: “<laughs emphatically> No! They are too lazy!” (P-030).

Understandably, there persists a lack of trust between emerging and commercial farmers:

“But [anyway] I can’t work with him because he doesn’t trust me. So if he doesn’t trust me I can’t trust him” (P-024).

Despite this, (cautious) positive relationships were reported, characterised by commercial farmers supporting emerging farmers through mentoring and resource lending. Baviaanskloof participants reported relationships based on agreement and mutual understanding. In the Gamtoos, emerging farmers reported positive working relationships with commercial farmers who fulfil roles of mentoring, partnership, and lending of resources (e.g. tractors). However, a particularly interesting finding was the gap in an emerging farmer’s knowledge about the role of standards organisations, despite having been mentored by a commercial farmer for several years:

“I have got no clue but I should have heard by now if there was. I don’t know” (P-025).

This gap in his knowledge (alongside his confidence that he would know about it if it was important) leads one to question how seriously commercial farmers take their mentoring roles.

Power in BEE Programmes

The Kouga was the only sub-catchment in which participants reported actively pursuing BEE programmes for the benefit of farm workers and local communities. These programmes were characterised by white management and seemed to have little real empowerment aside from increased salaries (profits) to ‘beneficiaries’ who continue to fulfil the role of farm labourers:

“It’s so tough to be a boss of 240 shareholders and to manage it and keep all the expectation in hand. If I were wealthy, I wouldn’t do it. It’s just not worthwhile. It’s very time-consuming. It’s tough on management” (P-005).

With little real control or power, beneficiaries remain vulnerable to exploitation at the hands of their white ‘bosses’. A Kouga participant described a poorly managed process with multiple people (including himself) exploiting beneficiaries through time:

“Then Land Affairs rented it [a BEE programme farm] out to an export company for three years. These people [beneficiaries] didn’t get anything... the export company farmed it. I managed it for them but there weren’t any involvement from the actual beneficiaries. They [export company] went off with the profits... Last year they get a [new] partner to farm with them... ‘til somewhere in December. And then the partner just vanished without paying any of the accounts, and leave them with everything [all the debts and problems] ... So in January my dad and myself went to them and said we would take it over until after the crop... harvest everything and pay all the bills and get the money in so that we can get back the money that we put in. So we are at that stage now” (P-006).

5.2.3 Local Populations and Employment Opportunities

The context of enduring inequities in South Africa also points to the importance of taking into account power relations for local populations, including opportunities for improving livelihoods. Water and sanitation services in communities and towns are provided by municipalities and are therefore examined at the regional level.

Themes relating to employment were characterised differently in different areas. In the marginal Baviaanskloof, limited income opportunities for local populations were reported especially for individuals from non-land-owning communities. This is likely driven by the marginal nature of agriculture and the insularity of the sub-catchment, a fact recognised by participants:

“I think Baviaans[kloof], just because of the road, has never had the potential to be like the Gamtoos Valley” (P-013).

Instead, government employment initiatives (e.g. WfW or municipality programmes) were highlighted as important in improving community members’ livelihoods and reducing social issues:

“It’s good that it creates jobs... [named community] had a very high unemployment rate, lots of dodgy kind of desperate people and it’s changed a lot with the work” (P-013).

This theme did not arise in either the Kouga or Gamtoos, where commercial farming was viewed as important for job provision regionally. Kouga participants indicated that a single farm potentially employs up to 300 people during peak season (approximately one worker per hectare or three per hectare if there is a pack shed), a role recognised as critically important for rural development:

“...if we don’t supply [job] opportunities all of them [farm workers] will run to Port Elizabeth and it will increase the problem [demand for water]. I think the major opportunity will be to keep them here... we can maintain low skilled workers on the farms that they can’t do in the towns. So if these people move to Port Elizabeth then the problem will be bigger. That’s why we’re contemplating saying, ‘Please let us improve the dam... and we can provide more jobs.’ That’s where the rural development strategic planning is involved” (P-005).

A Gamtoos participant linked this ability to provide employment in the commercial agriculture sector to the economy:

“We’ve [employed] about 100 people [in the past] but the economy at the moment—. PicknPay and those guys are a bit down... so we went down to about 50 [workers] now” (P-029).

An important finding in the commercial agriculture contexts of the Kouga and Gamtoos was the link between the ability to provide employment and water availability:

“Can you say if a storage dam is at 30% no more irrigation? ...and that would normally be at harvest time... where some type of fruit would need that last application, yes, to produce a nice, good quality fruit that can sell, that can pay a lot of workers. Now we had that experience during 2008, 2009, 2010. Some farmers had to lay off workers just because the amount of water available was less. It’s as easy as that” (P-008).

“...our normal water allocation is 8,000 m³/ha/year... for each farmer. When there is no restriction there is about 10,000 people employed in the [Gamtoos] valley which relates to agriculture. When you have 90% allocation, there is 9,000 people. It drops by 1,000 for

every 10%. The year before last, we had a restriction of 60% so we only have 40% water. So, in effect, 6,000 people were out of work” (P-019).

“...if we haven’t got water then we can’t produce, we can’t pay our staff, we can’t give work” (P-028).

These results highlight the link between land and water management and social issues, as well as the potential that power struggles over resources have to significantly impact local, rural livelihoods, not only of the land owners and power holders, but also for the wider population in general.

5.2.4 Local Level Water Management

While commercial and emerging farmers, along with their employees, comprise the primary land managers and water users in the study area, irrigation boards exist in some sub-catchments formalising access, control, management, and use of water. The water management contexts in each of the three sub-catchments displayed differing characteristics. The Baviaanskloof had no formal water management institution, with each farmer managing their own water according to their rights. The Kouga is characterised by five tributary sub-catchments with farmer-run irrigation boards, and five tributary sub-catchments with no official water management arrangement, although some of these had organised informally to create a ‘steering committee’. The Gamtoos has a formal irrigation board in the form of Gamtoos Irrigation Board (GIB) which is managed as its own entity separate from the farmers.

Preferred Water Management Model

Despite the different water management contexts in each sub-catchment, overall, participants viewed formal regulation of water management favourably with very few participants preferring no regulation or self-regulation. Figure 5.1 presents results to Question 6a regarding the perceived ideal level of regulation for water use. In both the Baviaanskloof and Kouga, the majority of participants preferred water use to be monitored by management boards. Interestingly, no Kouga participants chose self-regulated or completely unregulated, suggesting that they viewed formal water management positively. Similarly, only one Gamtoos participant indicated water use should be self-regulated for efficiency. Significantly, he was located in a tributary sub-catchment not linked to GIB, and thus was accustomed to self-

regulating water use. The majority of Gamtoos participants favoured heavy regulation by management boards, closely followed by monitoring.

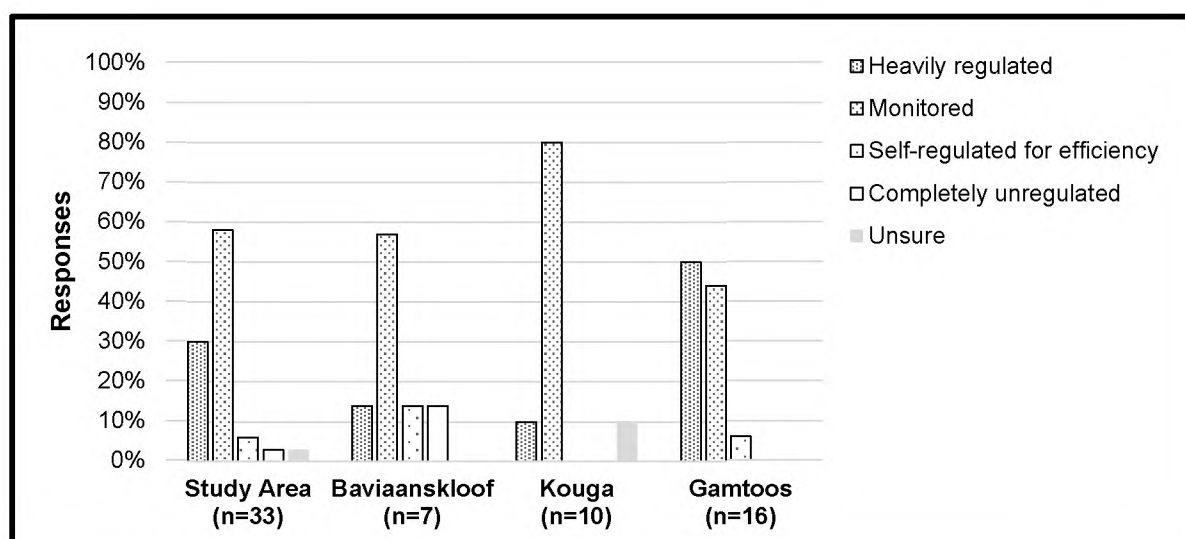


Figure 5.1: Participants' perceptions of preferred water management model by sub-catchment (Q6a. Water use should be)

Irrigation Boards and Power

Baviaanskloof participants expressed enthusiastic interest in the possibility of formalising water management. Kouga participants from tributary sub-catchments with irrigation boards reported positive relationships between irrigation boards and commercial farmers, as well as between irrigation boards and BEE programmes. Those Kouga sub-catchments with no formal water management institutions were characterised by negative power struggles, higher levels of distrust, and more water management challenges (as evidenced in Section 5.2.1: Commercial Farmers). Some tributary sub-catchments had a less formal 'steering committee' performing essentially the same functions as an irrigation board, as a result of difficulties experienced in establishing an irrigation board:

"We tried for years and then we submitted all the necessary documents and they send it back because at that stage every now and then there was a new minister or head of DWA because they're always shifting the goalpost. I think after the third one that we submitted we decided to do nothing more. We are still waiting. The last time we submitted was four or five years ago" (P-003).

Overall, Gamtoos participants viewed GIB favourably. Figure 5.2 presents the results to survey Question 7 for Gamtoos participants, regarding participants' perceptions of GIB's role in water management. No participants were dissatisfied with GIB and 75% indicated that GIB does a good job:

"I think [GIB] are excellent. I think it's the best in South Africa. We are very sure it's the best run irrigation board in the country. We're very sure about that" (P-024).

"Frankly if it wasn't for [GIB] we would have had a lot of troubles more than what we have. They are quite a good team and they are open-minded and they fight for the water, for the sustainable of the water, for the future. It's not good meeting short-term thingies, you must look long term" (P-028).

The 19% that chose 'room for improvement' indicated that while they were indeed satisfied with GIB, they believed there is always room for improvement. The only participant to answer 'unsure' was located in a tributary sub-catchment that is not linked to GIB.

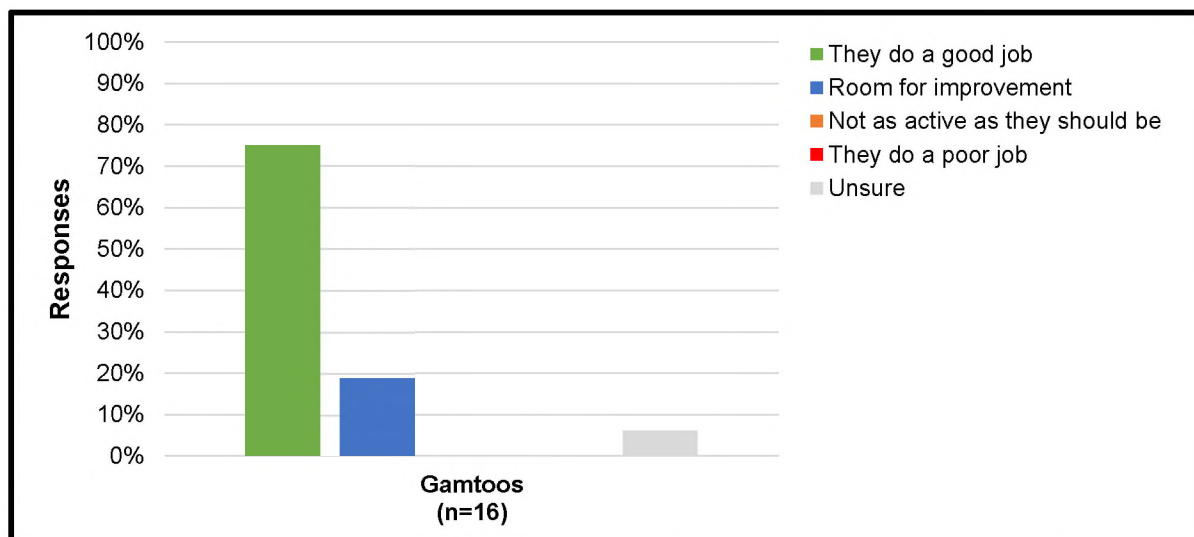


Figure 5.2: Gamtoos participants' perceptions of Gamtoos Irrigation Board (GIB) (Q7. What is your perception of the role Gamtoos Irrigation Board (GIB) plays in water management?)

GIB's numerous successes highlighted by Gamtoos participants included: accurate water measurement through the dam; installation of good quality water metres; low percentage of water losses through the system; strict management of water allocation; and efficient and

effective infrastructure maintenance. Positives such as these did not arise as explicitly in irrigation boards in the Kouga, possibly because they are run by farmers themselves.

The Haarlem tributary sub-catchment (in the Kouga), and the Gamtoos sub-catchment were the only two systems to pursue strict and accurate measurement of water use through the use of water metres at distribution points. This was viewed favourably:

“I think it’s more regulated due to the fact that water is piped and that there are water meters because I don’t think in the Langkloof that there is another irrigation board that has all its water by pipe and that has water meters at every distribution point” (P-018).

“And the important thing is we’ve got very, very sensitive water meters in. They are reacting if one drop, it reacts... that’s the important thing of GIB, they’ve put in quite, very, very good meters... It’s a good thing, it’s a good thing” (P-022).

“People who doesn’t pay, their water gets cut off. So it’s very well managed” (P-023).

Gamtoos participants specifically highlighted the low percentage (7.5%) of ‘unaccounted for’ water (losses through the system) as an example of the high quality of management, especially compared to urban areas which have ‘unaccounted for’ water upwards of 30%. An interesting finding was that what constitutes a ‘hectare of water’ differs in the Haarlem and Gamtoos systems. Through GIB allocation is measured as 8,000 m³ of water per hectare of land per year (therefore 1 ha=8,000 m³/ha/yr); through Haarlem Irrigation Board allocation is measured as 5,040 m³ of water per hectare per year (therefore 1 ha=5,040 m³/ha/yr).

Transformation in the Water Sector: Water Users’ Associations

A key aspect of the water reform in South Africa is the transformation of existing water management institutions into catchment management agencies (CMAs) and WUAs. Although no WUAs had been established in the catchment at the time of research, moves had been taken in this direction in both the Kouga and Gamtoos sub-catchments. Kouga participants pointed to discussions that had occurred in the past regarding the creation of one WUA for the entire Kouga. Additionally, Haarlem Irrigation Board had begun the process of independently transforming into a WUA. Participants recognised the importance of WUAs in broadening water management representation including the interests of urban areas, marginalised groups, and the environment. However, participants expressed frustration at the slow progress towards the establishment of a WUA:

“...they tried about two years ago to get one irrigation board on the table and nothing has happened since then. That’s why I’m saying it’s not going to happen” (P-002).

“At the moment it’s too quiet for me... especially when the government officials jump in, everything went a bit slow” (P-009).

Multiple challenges were highlighted in the process of transformation. For the Haarlem Irrigation Board these included: legal process of changing the name and tax associated with asset transfer (e.g. private Haarlem Dam) to new institution; ensuring corruption does not prevent loan repayment; including a wider area into the WUA than previously managed by irrigation board; and progress blocked by politics between the ANC (African National Congress) and DA (Democratic Alliance) political parties in Haarlem township. For GIB, challenges stalling the process included: dissatisfaction with the way GIB’s rights were being upheld and sought legal opinion; DWA facilitators were perceived to have agendas: *“the guys are trying to guide us in a certain direction”*; lack of capacity of DWA facilitators; high rate of facilitator turnover leading to lack of continuity in the process; facilitators emphasised that one emerging farmer on the committee was not enough and insisted that the process be started over; emerging farmers were asked to bring more representatives but some were not water users within the Gamtoos system; DWA refused to accept the Constitution presented; slow response times from DWA, such as it taking three years to receive a generic constitution for a WUA; conflict over choice of voting rights model: DWA is pushing for ‘one man, one vote’ while GIB is pushing for ‘votes relative to hectares of water allocated’.

Significantly in the Kouga, most irrigation boards expressed reluctance to form one WUA for the entire Kouga, preferring to remain independent. They cited the arrangement of the tributary sub-catchments as motivation for this:

“I don’t think that will really work because Twee Rivieren, for instance, has a catchment area; Joubertina, Krakeel, Louterwater, Misgund, Haarlem [each have their own catchment areas]; ...but it’s totally different situation from one to the other... Because the situation with Louterwater, for instance... they’ve got a dam in their catchment area. It’s a total different situation than Krakeel. The same with Joubertina and Misgund—all of them. So how can one association— ...now a guy from another board must decide what’s going to happen here? It doesn’t make sense” (P-003).

“...the thing is our water doesn't go to the other people. It run to the Kouga and then it run past to Port Elizabeth so there are no other farmers involved. So, for instance, the Louerwater [Irrigation Board] don't have any benefit to be part of the Misgund [Irrigation Board]” (P-005).

“That's what DWA wants us to do but the river is not running from west-to-east through the Langkloof. Most of them are going from south to north out of the Langkloof and then into the Kouga. And I don't want to be part of certain fights that are going to happen because they built, in Misgund, a township... they don't have water for that township. Now they must get water from the farmers, so there must be a new division of water in Misgund. The same with the Louerwater township. And I don't want to be a part of that fight. Our things have already been in place for the last twenty years... And then I don't want to be a part of their system to manage water use because they haven't got flow meters, they have nothing. Even in some place they only have open furrows; the water is not piped. So how do you manage that water? And I definitely don't want to be part of that. And if we are now one big water users' association what is going to happen if there is money available for upgrading systems? All that money is going to... the worst of the systems to upgrade that. So we will be last in line to get anything if there is [money] available” (P-018).

These examples highlight the influence of spatiality on water management and its associated power relations. This section has illustrated that power relations over water management take different forms for different local level stakeholders. Additionally, it has illustrated that the physical characteristics of sub-catchments, as well as their spatiality, have a role to play in shaping the types of power relations that exist.

5.3 Regional Level

This section presents the thematic results participants' perceptions of regional level stakeholders, specifically municipalities, the city of Port Elizabeth (PE), Nelson Mandela Bay Metropolitan Municipality (NMBMM), and Eastern Cape Parks (ECP). Similar to the local level, negative sentiments dominated at the regional level for all sub-catchments (Table 5.4). Significantly, in the downstream Gamtoos sub-catchment, negative sentiments dominated at the regional level compared to other levels (65%) with low prevalence for positive sentiments (9%). This is an interesting finding compared to the two upstream sub-catchments.

Table 5.4: Sub-catchment coding frequencies for regional level sentiments

	Negative	Positive	Neutral	Mixed	Row Total
Baviaanskloof	24 (44%)	15 (28%)	1 (2%)	14 (26%)	54
Kouga	39 (49%)	10 (13%)	7 (9%)	23 (29%)	79
Gamtoos	62 (65%)	9 (9%)	4 (4%)	20 (21%)	95
Study Area	125 (55%)	34 (15%)	12 (5%)	57 (25%)	228

5.3.1 Municipalities

Municipalities provide water and sanitation services to urban areas, impacting local livelihoods. Their jurisdiction crosses catchment boundaries. Thus, they are classified as regional level stakeholders. Different issues regarding municipalities arose in each sub-catchment. The only significant theme related to municipalities arising in the Baviaanskloof was the success of the Baviaans Municipality's employment programmes that had improved livelihoods in the community (see Section 5.2.3: Local Populations and Employment Opportunities).

It is interesting to note that more negative themes arose in the Kouga, where the interviewed participants reported (through their participation on irrigation boards) involvement in water and sanitation provision issues in the towns and townships as well as higher levels of involvement with municipalities, than the Gamtoos, where GIB mediates interactions with the municipality. In the Kouga, which has numerous small towns and townships, multiple water and sanitation problems were reported including: ageing infrastructure; water wastage; lack of water use regulation; population growth placing increasing pressure on infrastructure and resources; sewerage problems (risking ability to export fruit); and unreliable water supply. Municipalities in the Kouga were criticised for failing to address these problems as well as: inadequate service provision; lack of payment to irrigation boards; lack of follow through by officials; corruption; human resource capacity constraints; financial constraints; lack of adequate skills and knowledge; internal politics; and level of administration issues (district versus local municipalities):

“[Collecting money] is difficult because you have municipalities... about two years ago there was close to R500,000.00 outstanding” (P-018).

Despite this, irrigation boards reported cooperation with municipalities in other aspects, such as upgrading township infrastructure. Fewer issues with municipalities were expressed in the Gamtoos. The primary concerns raised by participants were water wastage and lack of water use regulation in urban areas. However, participants indicated that GIB and Kouga Municipality work together to solve water issues, and have a shared understanding of their water allocations.

5.3.2 The City of Port Elizabeth (PE)

Regional power relations between water users within the catchment and the city of Port Elizabeth (PE) came up as a significant finding in all sub-catchments.

Pressure from PE and Agricultural Water Restrictions

Participants in all three sub-catchments indicated that they felt pressure from PE for water. Baviaanskloof participants stated that this pressure had decreased compared to the past. Significantly, in the Haarlem and Gamtoos systems (where water use is strictly measured), participants expressed frustration at the frequent, official agricultural water restrictions:

“So we get 8,000 cubic meters per hectare... so if they cut it say to 50% you can only use 4,000 cubic meters that year” (P-021).

“It’s really a big thing for us because once the level of the dam reaches 70% and lower we feel it because... we are only going to get 60% or 70% of our water. We can’t actually afford it. We must plant each hectare just to have sustainable crops throughout the year. Like last year we had to... irrigate only the best orchards” (P-026).

While acknowledging that DWA controls decisions regarding restrictions (not NMBMM), restrictions were attributed to PE’s needs:

“We only feel that pressure... when they [DWA] decide what quota of our hectares we getting... So during the year it’s fine, you never hear from them [PE]. But by the time we need to get our new quota for the next year then they [PE] have a say. I’m not sure if they get first say, but they have a big say” (P-020).

“It’s unfair... I remember when this area was declared a drought area they had to cut a lot of water from us as farmers and then they push the water into PE” (P-025).

Significantly, Gamtoos participants expressed concern that restrictions are applied differently for urban and agricultural sectors:

“...the city itself has a water allocation of a certain quantity of water per year that they have to stay within... For example, when we were restricted by 60% they were only restricted by 15%. And all they do, they just raise the tariffs so everybody uses less water, industries use less water. But they still survive. It doesn't really affect their businesses. But in our case it affects us greatly” (P-019).

“...as soon as there is a shortage we get cut more than they get cut. We were cut down to 40% for a year and they were only cut—after 8 months—down to 70%” (P-021).

“[In PE] they don't restrict the water, or the use of water. They don't come and close your valves if you have overused this month and you haven't got water now. And that is what happens to the farmers: if you are over your quota they come and lock your valves. You haven't got any more water” (P-023).

In the Gamtoos, this regional fight for water constitutes a significant power struggle between DWA, NMBMM, and GIB:

“...at our last meeting I said to them, 'If next year comes... if your scheme is not finished we will fight with you. You will have to take the restriction in that case, more than us this time. Why do we always have to be punished more?'” (P-019).

In those sub-catchments without formal restrictions, Kouga participants explained their own conservative water use during droughts, also expressing resentment towards PE for not similarly restricting urban water use:

“And a lot of the times we have water restrictions on ourselves because it's dry. And then PE is still going 100% full blast with the water available because they've got other sources. We've only got this source. We're sitting on this source and that's the only opportunity we have so if we lose this and PE takes it then we've got nothing” (P-005).

Furthermore, participants viewed the legal restriction on building storage dams as a constraint to farming and attributed this to urban water needs:

“That is our biggest drawback now—there is no way we can expand” (P-003).

“We read all the stuff and we can see that there is pressure—the problem is we can see that there was a Law in 1993 I think, that we can’t expand. That’s one of the biggest problems, because we’ve got a lot of opportunities to expand and store more water. So that’s the biggest one by law” (P-005).

Relative Importance of Water

With the Kouga Dam as an important water source for PE, survey Questions 12a and 12b evaluated participants’ perceptions of, firstly, the importance of the water from the different areas to PE, and secondly, the impact of their own water use to PE. The majority of participants recognised the importance of water from their area to PE but viewed their own water use as either unimportant or very unimportant to PE, as illustrated by Figure 5.3 and Figure 5.4.

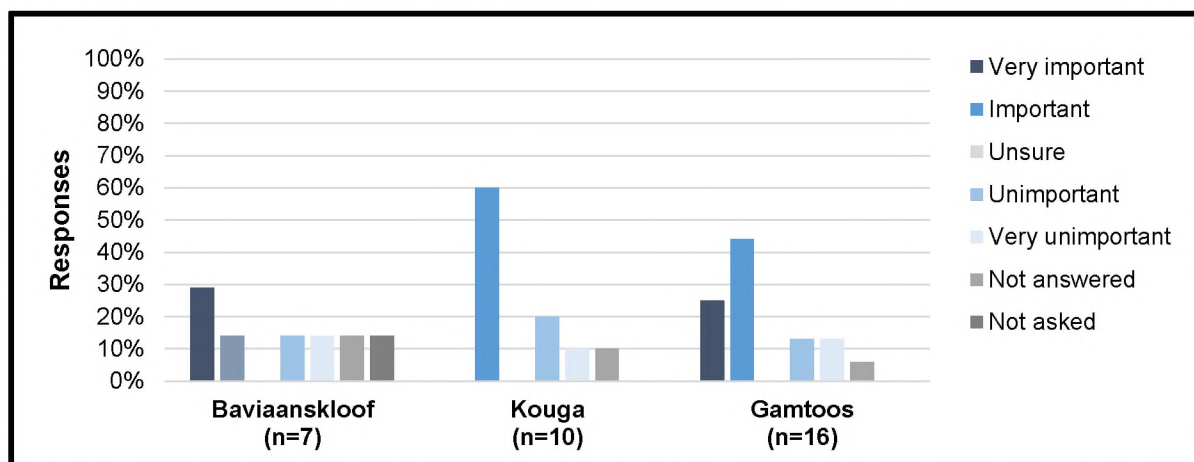


Figure 5.3: Participants’ perceptions of the importance of water to Port Elizabeth from their specific sub-catchment (Q12a. How important do you believe the water from [named area] is for Port Elizabeth?)

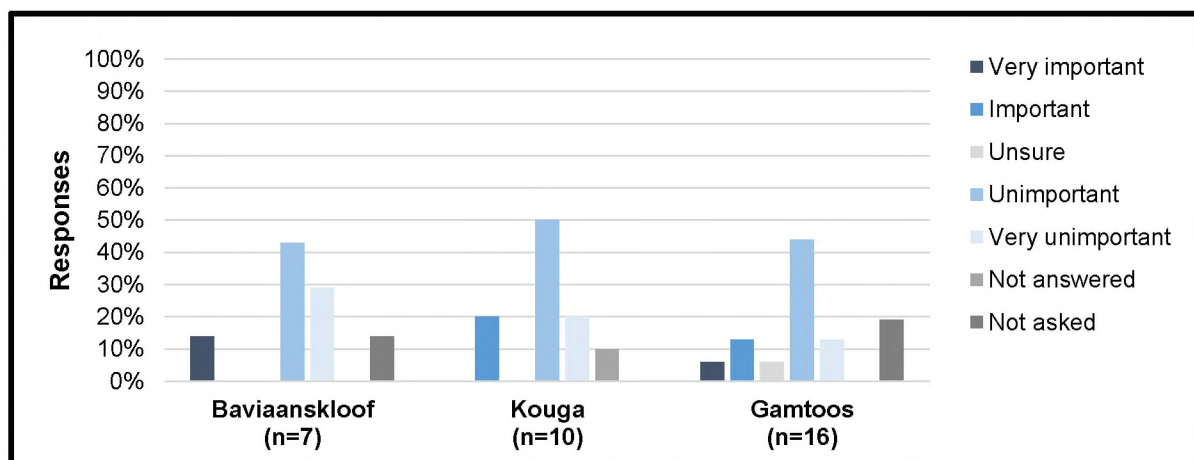


Figure 5.4: Participants’ perceptions of the potential impact of their water use to Port Elizabeth (Q12b. How important do you believe the water you use is for Port Elizabeth?)

Participants argued for the importance agricultural over urban use in terms of food provision:

“I think they [PE] are going after those water sources. I think they can do without it to be honest because if we don’t have water—no farmers, no food. You can’t just give everyone water for housing... if you take away all the farmers’ water then there is no food” (P-012).

“...we produce food for Port Elizabeth. They can’t live on water alone, they must eat. So the food production is very important” (P-024).

“And if the metro is wanting more and more water from the Kouga Dam, the less and less water we will get, the less and less food will be produced in the area” (P-027).

As illustrated earlier (in Section 5.2.3: Local Populations and Employment Opportunities), participants linked water availability to job provision. They also linked this to the importance of agricultural water use over urban use:

“I think during dry times you do feel the pressure, yes. Because then that’s all we’ve got as farmers and we’ve got the permanent people and so on so then you do feel it” (P-022).

“...so we sometimes just feel sometimes as if they can be more lenient to us farmers because if we haven’t got water then we can’t produce, we can’t pay our staff, we can’t give work. We give work to... a lot of workers in this valley” (P-028).

Importance of the Kouga Dam to Port Elizabeth

Despite acknowledging the importance of the Kouga Dam to PE, participants cited overflows as evidence that the dam’s storage capacity is too low to supply both the agricultural and urban sectors and argued that NMBMM needs to investigate and rely more heavily on alternative sources, such as Sundays River, Fish River, Orange River, and sea water desalinisation:

“So we feel that the whole extension [demand] for water in that area is not only our problem. It’s a much bigger problem and there are also a lot of water sources available to the east of PE... so they can use their sources as well so they don’t need to only look to this area for their water supplies” (P-004).

“And we were pressurising them to get that pipeline from the Orange River, to fix that, because in that dry time, obviously... we can use this water if they use more water from there” (P-020).

Participants also indicated that raising the height of the Kouga Dam was under investigation to increase storage capacity. Figure 5.5 presents the results to survey Question 13 regarding the need for PE to obtain water from sources other than the Kouga Dam. It illustrates that across all sub-catchments the majority of participants strongly agreed with the statement. No participants disagreed or strongly disagreed.

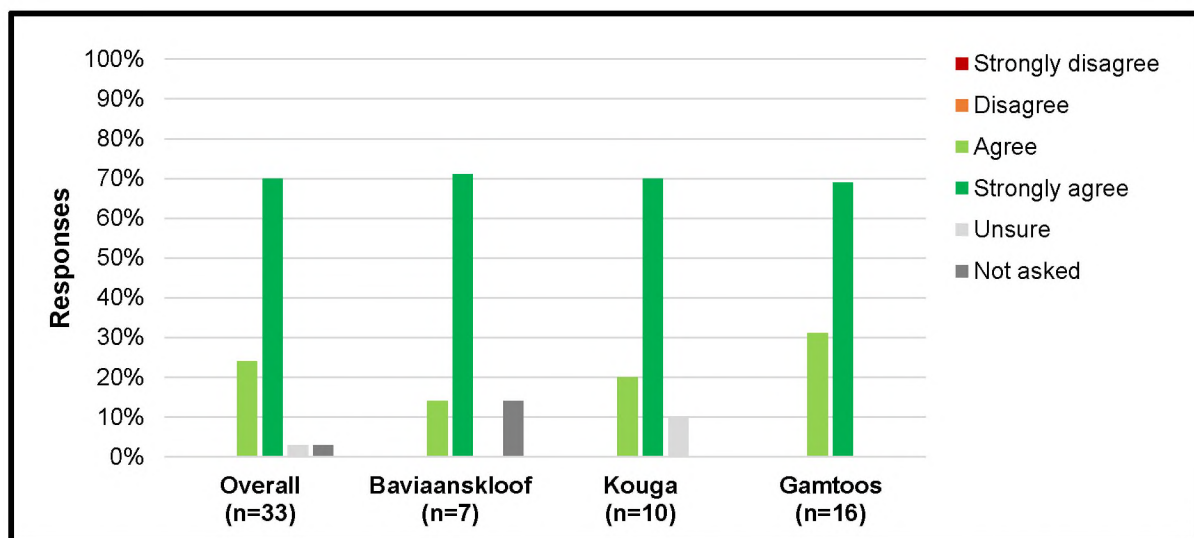


Figure 5.5: Participants' perceptions of the need for different sources of water for Port Elizabeth's water supply (Q13. Port Elizabeth should look into obtaining water from sources other than Kouga Dam.)

This section has illustrated the regional power relations between water users in the catchment (primarily commercial farmers) and the city of PE, illustrating that power relations do have a spatial manifestation in the study area. Nelson Mandela Bay Metropolitan Municipality (NMBMM) holds political power in PE and is in charge of service provision.

5.3.3 Nelson Mandela Bay Metropolitan Municipality (NMBMM)

Participants in all three sub-catchments cited high population growth and water wastage in PE as problematic. They attributed water wastage to: perceived unnecessary uses of water (e.g. lawns and golf courses); ignorance of water saving practices; and high water losses through the supply system:

“Even Port Elizabeth, they lose about 30% of their water; it's unaccounted for. And it's a closed system—it's purified water and everything—it's expensive!” (P-019).

“Did you know that the unaccounted for water from PE Municipality equals the amount of water that they get annually from the Kouga scheme? I’m not saying that’s all wasted, I’m saying it’s unaccounted for. They cannot tell you where it went. That’s ridiculous. It’s just insane” (P-023).

“...that loss worries our farmers because we are spending so much on measuring the soil content and like this irrigation system and applying the water with the right amount at the right time and not over-applying and whatever and there’s a lot of capital going into that and then you read in the paper that there is a loss... I think they can do better” (P-027).

Gamtoos participants linked these losses to capacity problems regarding infrastructure maintenance by NMBMM:

“There was a burst pipe from... one of the Port Elizabeth [supply] dams... the main supply pipe. It took them three months to fix it. How much water has gone down the river there? That’s the problem, that’s a big problem” (P-023).

Baviaanskloof and Gamtoos participants also highlighted financial capacity issues as limiting NMBMM’s ability to secure alternative supply sources:

“The other thing is the city also gets water from the Gariep Dam through the Fish-Sundays system and even more than a year ago the Gariep was overflowing... but their works were not big enough to purify the water. And we were so frustrated because they should have done that long ago but always they don’t have money. So the government gave them R450 million, I think they need R750 million, so it was with the intention that the municipality will have to repair the cost for the balance, but up ‘til now they say they haven’t got the money and also... nobody wants to give them a loan for that amount” (P-019).

Importantly, the Algoa Water Study Group—with representatives from both GIB as well as NMBMM and other stakeholders—was identified as having been formed to pursue solutions for water scarcity in the region. Power relations did not only have a spatial manifestation from the catchment to PE; significant upstream–downstream power relations also emerged.

5.3.4 Upstream–Downstream Linkages

This section examines the spatiality of power relations on an upstream–downstream basis. Participants in both upstream sub-catchments felt pressure to provide water downstream, although this finding did not arise as significantly as pressure from PE:

“[The pressure is] maybe not [from] PE but I think the farmers do feel it. You get the vibe that it feels like everybody wants the farmers to use less water and they want more water seeping in or more water running away... you feel as if they want us to use less water so that more water can go into the Kouga Dam so that they can have more water, or GIB can have more water irrigate and we have to get by with using less water. So I think it does definitely effect what is happening up here” (P-012).

“[GIB] want our water. But they’ll have to fight <in jest>” (P-018).

This section details the upstream–downstream linkages from the perspective of participants in each of the sub-catchments and concludes with an examination of water management differences upstream and downstream of the Kouga Dam.

Baviaanskloof Participants’ Perceptions of Upstream–Downstream Linkages

Figure 5.6 illustrates results to Questions 11a and 11b as asked to Baviaanskloof participants. Question 11a asked generally about water from the entire sub-catchment, while Question 11b explicitly pointed to water used by farmers themselves, thus gauging their perception of the impact of their water use to downstream farmers. The results show that participants perceived the importance of water from the Baviaanskloof differently to the impact of their own water use. The majority of participants perceived water from the Baviaanskloof as very important (57%) and important (14%) to downstream Gamtoos farmers (Section 5.3.5 discusses this sense of importance of Baviaanskloof water to downstream in more detail). However, some participants perceived water from the Baviaanskloof as unimportant (29%) to downstream farmers. As justification they argued that the Baviaanskloof sub-catchment inconsistently contributes water downstream, and also pointed to their own need for water:

“It is important because obviously that is where the main economy of farming is happening but... that water comes from us and we also need water here” (P-013)

Despite viewing water from the overall sub-catchment as important to downstream farmers, participants argued that their own water use was low due to marginal nature of farming, with the majority (57%) perceiving their own water use as unimportant for downstream farmers.

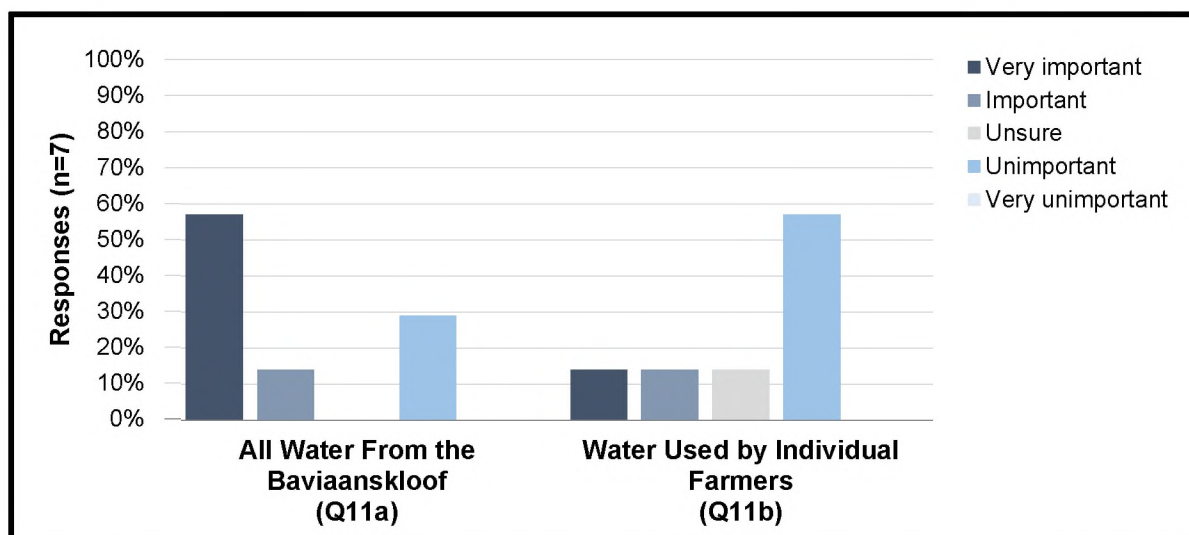


Figure 5.6: Baviaanskloof participants’ perceptions of the importance of water from the Baviaanskloof sub-catchment to downstream Gamtoos farmers (Q11a. How important do you believe the water from the Baviaanskloof sub-catchment is for farmers downstream in the Gamtoos valley? and Q11b. How important do you believe the water that you use in your farming is for farmers downstream in the Gamtoos valley?)

Kouga Participants’ Perceptions of Upstream–Downstream Linkages

Figure 5.7 illustrates similar patterns to the Baviaanskloof whereby the majority of participants perceived water from their specific tributary sub-catchment to be important (40%) and very important (20%) to downstream Gamtoos farmers, but their own water use to be unimportant (60%) and very unimportant (30%) to farmers downstream:

“...this [farm] is only a very small spot in this catchment area down to the Kouga Dam” (P-004).

“That is our water. They don’t have anything to say about that... The portion of water that we are using that is coming out of these mountains is maybe about a quarter or a fifth of the water that is annually going down this river... There are some years that there is going to be ten times more water out of this area than we are using and some years there’s going to be basically nothing out of there” (P-018).

Some participants perceived water from their tributary sub-catchment as unimportant (20%) and very unimportant (20%) to downstream farmers, arguing that the contribution from their sub-catchment is small relative to the Kouga total:

“Although this [specified tributary sub-catchment] area is only a small part of the total” (P-003).

“I would say of no importance actually because most of the years there don’t go anything downstream. It’s only in flood years that there will go water through. Mostly because this is so a small catchment that there’s no water going through” (P-006).

“Not important at all. It’s too little” (P-010).

Importantly, participants who viewed water from their sub-catchment as important qualified this by arguing that it is equally important for themselves as well as downstream, or by specifying that the overflow from their area was important.

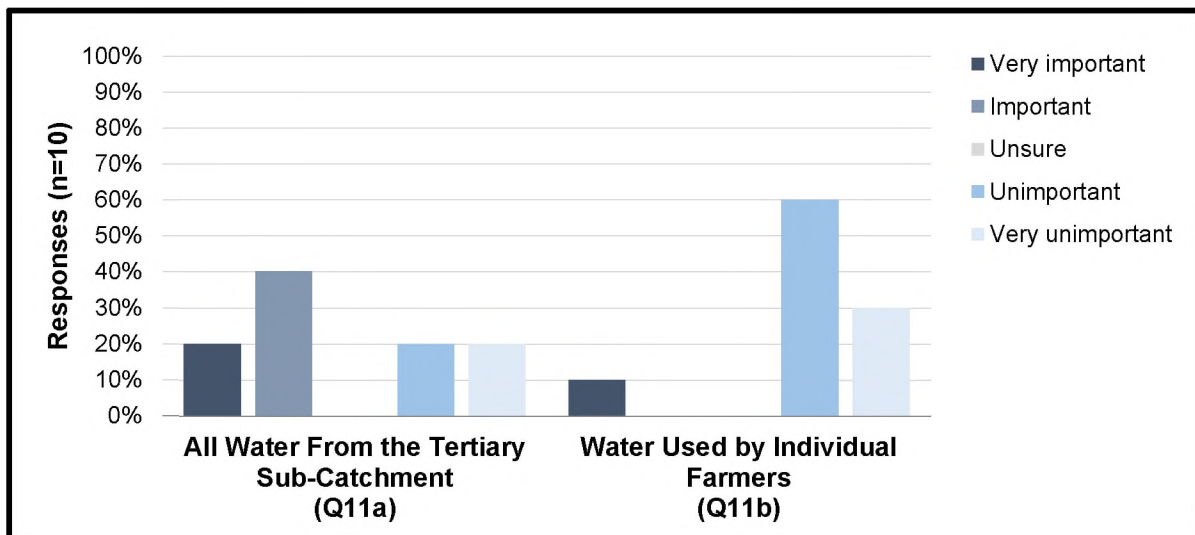


Figure 5.7: Kouga participants’ perceptions of the importance of water from the Kouga sub-catchment to downstream Gamtoos farmers (Q11a. How important do you believe the water from this [named tributary] sub-catchment is for farmers downstream in the Gamtoos valley? and Q11b. How important do you believe the water that you use in your farming is for farmers downstream?)

Gamtoos Participants’ Perceptions of Upstream–Downstream Linkages

Gamtoos participants emphasised their dependence on water from upstream, but recognised that farmers upstream also need water. Water from the Kouga was perceived as more important than from the Baviaanskloof, with one participant relating that GIB argued that buying out Baviaanskloof water rights would be unviable due to its negligible contribution to the Kouga Dam.

Figure 5.8 illustrates results to Questions 11a and 11b as asked to Gamtoos participants. Question 11a asked about all water from the upstream Baviaanskloof and Kouga sub-catchments, while Question 11b explicitly pointed to water used by farmers upstream, that is, water that was unavailable for use downstream.

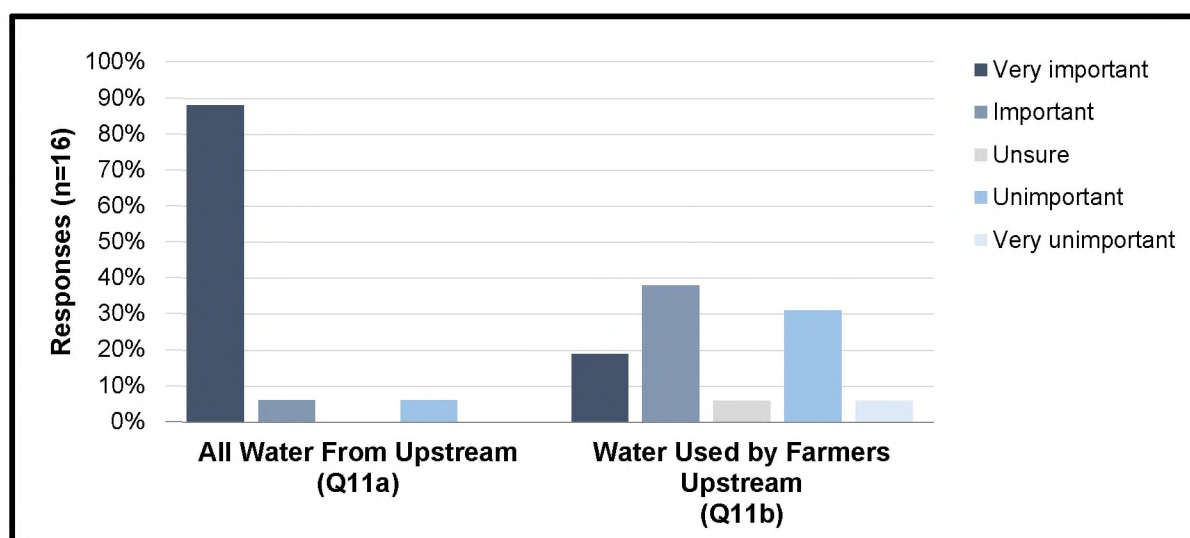


Figure 5.8: Gamtoos participants' perceptions of the importance of water from upstream sub-catchments to Gamtoos farmers (Q11a. How important do you believe the water from the upstream sub-catchments is for farmers here in the Gamtoos valley? and Q11b. How important do you believe the water that is currently being used by farmers upstream is for you farmers downstream?)

While the majority of participants (88%) perceived water from upstream to be very important to Gamtoos farmers, a more even distribution emerged across responses for water used upstream, with only 19% perceiving it to be very important, 38% perceiving it to be important, and 31% perceiving it to be unimportant. Those who perceived water used by farmers upstream as unimportant argued that water use upstream is stable and therefore not a threat, upstream users do not use that much water, or that farmers upstream also need water:

"...I think there is a spot for everybody and if they utilize it properly I don't mind because it's for everybody" (P-030).

"...let the sun shine over them too... I'm sure if there's enough regulation that they're not going to catch up all the water there and let nothing come down... let them also have enough water for their use" (P-032).

“...they have to use the water... they are in the same position as us... because they make out a living of that” (P-034).

Water Management Differences Upstream and Downstream

In addition to different perceptions of the importance of water use arising in the different sub-catchments, there are important water management differences upstream and downstream of the Kouga Dam. Significantly, water restrictions during drought are applied differently upstream and downstream:

“...especially in the drought the farmers in the Gamtoos Valley... had massive cuts on their water up to 70%... and the farmers in the Kouga could use as much as they wanted or as much as was available” (P-001).

This was attributed to the lack of water measurement in upstream sub-catchments:

“...when this committee decides about restrictions they say, ‘Gamtoos gets only 40% of their allocation. The catchment: no restriction because it can’t be measured.’ It’s pathetic! ...I always say to them, ‘...you only take from Gamtoos because we measure our water properly so it’s easy to take x million cubic meters from us because you know how much you’re going to get. It’s so easy!’ ...the other day I was a bit angry and when I told them that. And everybody was quiet and they said nothing” (P-019).

Furthermore, participants expressed concern that water use is not licensed (although it is registered) in upstream sub-catchments, leading to a concern that water is overused upstream:

“[GIB] is full [angry] and they want to get all the water licences [verified] in the Kouga and in the Baviaanskloof tomorrow [as soon as possible] ... [currently they] are not licensing those farmers and they can just use whatever they want and less water is getting into the Kouga [Dam]” (P-001).

“You see, that’s one of the things, they can’t measure it. And if they want to measure it, it is going to be a really expensive exercise because you need to measure each water point and there are hundreds of them. So I think that that is probably one of the reasons why the government hasn’t taken [licensing] further... That’s one of the shortfalls I see at the moment is that we’re not properly licenced water users. We’re only registered water

users... if you talk to [named expert] he will tell you that we use water illegally here because all the other users are licensed” (P-011).

“...in the catchment itself... the control is not done properly. After the new Water Act in 1998... everybody who used water for irrigation had to go and register his water use. So what the DWA then does afterwards, they go to everybody and they check his registration... But you know how farmers are they will fill in much more... and they think they have more water rights because they’ve filled it in. And since 1998 those in the Langkloof have not yet been verified so the government has to go... verify each of those water registrations and then they have to issue licenses and then they must oversee it that all the water is measured properly and then they must monitor it ...in our case each farmer has a water metre... and it can be done with all the farmers in the catchment [area] as well... it’s a bit more difficult but it is possible” (P-019).

Lack of measurement upstream was attributed to the cost of installing water metres:

“...people say but [measurement’s] going to cost lots of money. I say, ‘So what? Let the user pay.’ The government doesn’t have to pay for that... We have replaced our water metres over the last five years... It cost us about R6 million. We replace all of them, for each farmer... it was included in our water rates over a period of five years... [the farmers] didn’t even notice it. So it’s not an excuse not to measure it” (P-019).

Some participants in the Gamtoos perceived poor management in the Kouga as resulting in reduced availability of water downstream:

“...even where you have irrigation boards their infrastructure is not maintained properly... the problem is the irrigators themselves manage their own board and it’s pathetic, you know. They don’t maintain the systems” (P-019)

“...there is a lot of water being kept back by dams being built [up] there. They don’t come through to the Kouga Dam and that’s going to influence somehow how quickly the dam fills” (P-021)

“...in the Langkloof... Especially with the dams and everything I’m not sure if the control is that good over the new extensions and everything in connection with the dams and so on so that is a worrying factor” (P-022)

Thus, Gamtoos participants indicated that GIB and NMBMM pressure DWA to measure water use upstream:

“From our side (and also from the metro side) we have been putting lots of pressure on the Department to go and verify those water uses upstream. I know they are busy asking for consultants to tender to do the job” (P-019).

Lack of Inter-Sub-Catchment Social Linkages

Another important finding arose in the lack of themes arising related to inter-sub-catchment social linkages; that is, between Baviaanskloof and Gamtoos, Kouga and Gamtoos, or Baviaanskloof and Kouga. Overall, participants displayed only vague and incomplete knowledge of the conditions in the sub-catchments other than their own. Additionally, no participants provided evidence of significant social or economic interactions with stakeholders in those places.

Thus, regional power relations exist between upstream and downstream water users in the catchment. However, it is important to note that these power relations are characterised by subtle pressure with little overt interaction between upstream and downstream sub-catchments.

5.3.5 Eastern Cape Parks (ECP)

As the body responsible for the Baviaanskloof Mega-Reserve (BMR), ECP is responsible for the management of a vast swath of land in the study area and is therefore an important regional stakeholder. As already indicated, the Baviaanskloof’s marginal farming potential results in a higher focus on tourism, conservation, and restoration activities compared to the other two sub-catchments where intensive commercial farming activities occur. Thus, themes around conservation and ECP arose mainly in the Baviaanskloof where participants attributed land use change to water scarcity:

“They [farmers] are probably changing [land use] because of a lack of water on their land but as soon as they are capable of using more water they would use it” (P-001).

Significantly, participants indicated that ECP had in the past interfered with and pressured—or attempted to force—farmers to sell land for incorporation into the BMR:

“There was 15 years ago the idea to buy out all the farmers in the Baviaanskloof and make it one big reserve which is not really a good plan according to the farmers” (P-001).

“I don’t think that they really are involved in the sense that they are interfering with what is happening on private land at the moment... I don’t think they will in any way try to force the farmers to make any decisions” (P-011).

“Say 15 years back there was a couple of factors. There was a lot of pressure on farmers to sell land for conservation” (P-015).

This resulted in tensions and lack of trust between ECP and farmers, an uneasy relationship that still endures:

“I think they [farmers] feel pressure from nature conservation to change their land use” (P-001).

“Otherwise it’s a bit of a threat—you’ve got this big neighbour around you. Eastern Cape Parks is our biggest neighbour. It can be kind of scary” (P-014).

Overall, participants were reluctant to elaborate on these tensions with ECP; they gave vague answers and quickly changed the topic onto something else. In addition, a negative relationship between ECP and Coleske Plaas (a community living within the BMR) was hinted at, but participants were either unable or unwilling to elaborate:

“But they’re [ECP] trying to also push them [Coleske Plaas community] away but they really should be trying to keep them there” (P-014).

Furthermore, at the start of this research, the researcher was informed (during interactions through (not by) PRESENCE) that contacting the Coleske Plaas community during the research process was not allowed.

Despite the uneasy feelings towards ECP, Baviaanskloof participants indicated that relationships with ECP had improved:

“I don’t think that the past needs to be part of the future. In the past we had a few bad experiences but that is part of the history of this place ... so I don’t like the idea when people refer to the future and bring all the old stuff up again... I think [ECP] are actually bending over backwards to accommodate farmers now” (P-011).

“I think there’s better relationships over the years. I think we’re starting to talk... Not enough, but there’s a better relationship” (P-014).

Researcher: Do you have a good relationship with conservation now?

P-015: At the moment, yes.

This improvement was characterised by mutually beneficial, collaborative land management options between ECP and farmers (e.g. stewardships). These options exist both for farmers within the Baviaanskloof Valley as well as farmers in the Kouga whose land borders on the BMR:

“I think farmers used to be not very interested in the whole thing but now they see that a stewardship agreement with Eastern Cape Parks or some sort of conservation agreement can help them in some sort of way as well” (P-001).

In the Kouga, ECP-related themes arose only in marginal farming areas along the borders of the BMR and in the Gamtoos, ECP-related themes arose only in reference to the BMR.

Prevailing Discourse

A recurring theme was the pressure experienced by Baviaanskloof farmers to use less water, increase conservation activities, and decrease farming activities. This was a significant finding as it represents a prevailing discourse around the regional importance of water from the Baviaanskloof. Further investigation found that participants used sustainability and restoration discourse when discussing the pressure to change land use and decrease water use:

“I think what must happen is that it is an ecologically sensitive area that must be protected to serve other areas in the way of providing good quality water” (P-011).

“I think also over the years we could provide more water from this catchment area more consistently” (P-014)

Additionally, participants consistently linked the need for restoration to the idea that water is needed for downstream users and PE:

“I still see that as if you restore the Baviaanskloof in a more sustainable way and there is more water coming constantly in the Kouga [Dam] then there’s more farmers [in the Gamtoos] that can produce potatoes... and then a lot of people can eat those potatoes” (P-001).

Interestingly, Baviaanskloof participants consistently mentioned ECP within discussions about the need for Baviaanskloof water downstream and in PE:

“There’s talk at the moment with Eastern Cape Parks about Payment for Ecosystem Services. You can start restoration and providing better quality water for PE... [from] the Kouga Dam. We would play a part in providing better quality water, and more water, and also slowing down the water so that when it does fill up it provides good, clean drinking water for PE” (P-014).

“I think initially they thought, or I did, that Eastern Cape Park could come in, acquire land, it would be under their management... so, for example, they could go and say that they’re managing all this land and they could provide Port Elizabeth with so much water... and then the farmers, where would they benefit from that?” (P-014).

“...they can’t move farmers just because they think the water is needed in Port Elizabeth... So I think through the conservation that was one of the points they made to sort of pressurise farmers to sell land to [ECP] was the water is needed in Port Elizabeth” (P-015).

Furthermore, participants tended to have inflated perceptions of the importance of Baviaanskloof water to the Kouga Dam’s overall volume:

“You know, if the water dries up here [the farmers in the Gamtoos are] going to suffer. It’s an important water catchment area” (P-014).

While these perceptions were prevalent in the Baviaanskloof, they also arose amongst Kouga and Gamtoos participants. In a part of the Kouga sub-catchment bordering the BMR, interest was expressed in the potential for increased water provision to the Kouga Dam:

“...I think it will be good if [DWA] can come visit... the Farmers’ Association and tell us what programmes they can have in our area so that we can provide the water for them” (P-007).

Gamtoos participants (particularly those who had previously mentioned links with the Baviaanskloof) held the perception that water was used sparingly in the Baviaanskloof, providing good quality water downstream:

“...we got that—in the Baviaans—that Reserve that use water sparingly” (P-020).

“We are all members of Friends of the Baviaanskloof, and we are the only agricultural land below a dam like the Kouga Dam that is using the best quality of water to export fruit. We try to get this on our cartons exporting fruit because this is water out of a wilderness area—a World Heritage Area actually—and we make use of that water to grow our citrus” (P-026).

Contrasting this prevailing perception, a Baviaanskloof participant indicated that GIB asserted that buying out Baviaanskloof water rights would not be viable due to water scarcity:

“...as you know we are pushing for [Payment for] Ecosystem Services and that sort of thing but... the Gamtoos Irrigation Board would say, ‘Why would we pay for the water rights for the people in the Baviaanskloof when there is no water, so why would we pay for it?’” (P-001).

The contrast between the reality of the water scarcity situation in the Baviaanskloof, and the prevailing discourse that the water is important for downstream is a significant finding. Additionally, the link with ECP is important in characterising the types of power relations that exist. While participants themselves did not mention the role of researchers and Living Lands as a contributing source of this discourse, the researcher’s observations point to a link in this regard.

This section has illustrated that there are significant regional power relations over water management in the study area, and that these operate on multiple levels as well as spatially within the catchment. Power relations between the sub-catchments and PE were significant (particularly Gamtoos–PE power struggles), as well as upstream–downstream power struggles over water.

5.4 National Level

This section presents findings relating to national level stakeholders, specifically government departments, Working for Water (WfW), and energy providers. Markets and environmental NGOs are presented under international level. Table 5.5 illustrates that negative sentiments again dominated, specifically in the Kouga (59%). Interestingly, compared to the other two sub-catchments, positive sentiments for national level stakeholders were high in the Baviaanskloof (27%).

Table 5.5: Sub-catchment coding frequencies for national level sentiments

	Negative	Positive	Neutral	Mixed	Row Total
Baviaanskloof	49 (51%)	26 (27%)	3 (3%)	18 (19%)	96
Kouga	70 (59%)	14 (12%)	12 (10%)	22 (19%)	118
Gamtoos	101 (46%)	37 (17%)	22 (10%)	59 (27%)	219
Study Area	220 (51%)	77 (18%)	37 (9%)	99 (23%)	433

5.4.1 Government Departments (Other than DWA)

Other than Department of Water Affairs (DWA), participants mentioned: Department of Agriculture, Forestry and Fisheries (DAFF); Department of Rural Development and Land Reform; and Department of Labour. The most significant findings were the numerous barriers within government to the efficient implementation of processes. Significantly, these impact emerging farmers most.

Participants in all sub-catchments highlighted a lack of human resource capacity and lack of follow-through from government officials, specifically impacting emerging farmers who are often dependent on government feedback for their livelihoods:

“...we were dependent on the government and then the government was playing hide and seek with us... [Government is] not good [on coming through with what they promise]. They are definitely not good. Maybe if I can rate them out of five I would say two because they do come, it's not that they totally don't come... but I mean it takes a lot of work. You must dig, you must phone around, you must get upset, you must blame people, you must say 'so-and-so said this' and then the superior come down. Agh it's a lot! There was a stage where I had to phone the Minister himself. And then he come intervene” (P-025).

“...people came here and asked me what is the problem... and they write it down... after six, seven months or a year... another person [came] and asked me the same things ...there's a lot of people who come... and not one of them came back, not one of them came back, each and every one that came and interview... Some of them is people from the government come and ask what the problems I have got, from the Department of Agriculture, Land Affairs and so on... So they are totally useless, only mashing money. Not giving the help they promised... not in a position to do the jobs... white people, black people, coloured people, [they] work for government and... They don't come back, they

don't come back and it's still [me waiting] ... Up to now and in this time now the whole government is useless... up to now there is no field worker who has come to visit me [who has returned]" (P-034).

Participants expressed concern with the lack of coordination between government departments:

"Unfortunately, if I'm very honest, the communication and interaction can improve, definitely.... I know that... at real cabinet level ... they talk to each other. But they talk about policy, about broader guidelines or whatever. I think there is a need for more efficient communication, that if those two—Department of Water Affairs and Department of Agriculture—talk to each other they would also think about... the practical implications at grassroots level" (P-008).

Again, this particularly impacts emerging farmers' success. Related to this is a lack of clear understanding of the roles, functions, and responsibilities of different government departments and the officials within them. This leads to farmers (both commercial and emerging) being sent from one department to another:

"I battled with the municipality first... dating back to 2004 and 2002 regarding this sewerage problem [in the township] ... So I went to a woman who was an ANC member and I phoned her and she said she would help me. I had all the papers... [and] couriered it to her. I never heard from her again. I got hold of the Minister of Environmental and whatever and sent the whole lot to him. Three months later I had no answer. I asked somebody who had quite an influence in parliament. I received a letter saying they had to send my letter to Pretoria for somebody to translate it. And that was all I heard of that, never again. We tried everything... That's why these days I'm laughing at the people because nothing gets done" (P-003).

"[I was told,] 'You must go to the Department of Land Affairs.' [But then] they sent me to the Department of Agriculture. They sent me up and down up and down and up till now nothing happened" (P-034).

Another related issue is slow processes and response times from government, again, impacting emerging farmers the most:

"But the main reason is... it's long processes, it's different offices and it gets to that office and it sits two months just for one signature, and from there it moves to another office,

maybe they next to each other in the same building, and it goes to that office and it sits for a couple of months there... And then the minister changed and then he come with new policies and then now that programme is no longer in place and then you have to start the whole thing again. Your application must move again [through] all those hierarchical whatever up until it gets to the final stage and you don't know when it gets to the final stage who will be the minister then, so that is another problem on its own" (P-025).

"...told to me to put all this complaints on paper and give it to him... I think it was 2007 or 2006 and up to now they are still busy with it... the Department of Land Affairs" (P-034).

These issues could be related to the unwillingness of government officials to 'stick one's neck out' in case they 'step on someone else's toes':

"There is, unfortunately, a tendency in civil service that you've got your work, authorisation, your field of work, and [an] 'I'm the boss here' [attitude] especially amongst management. Maybe they're afraid that they can lose their jobs" (P-008).

Lack of adequate and practical knowledge among officials was also highlighted as mainly impacting the success of emerging farmers:

"And Department of Agriculture too with their Extension Officers: they are visible but some of them they are not knowledgeable. I think that they should spend a lot of money into their technical services. They need to upgrade that a little bit and get people that are knowledgeable—that are farmers—to form part of their technical team. Instead of getting guys that have degrees because... they don't have a practical knowledge of it and most of the things WE have to teach THEM" (P-025).

Related to this was a perceived lack of clear understanding of how to apply legislation amongst government officials. This has significant consequences, for example, blocking the successful implementation of land reform; an emerging farmer related how he had applied for a grant to increase the size of his farm by buying out other family members' land rights:

"But unfortunately the bad news came out that—those who want to sell their portions to me—we have not got any land because we are not owners of that land. This land belongs to our great-great-grandfather and this land was registered in his name in Bantu

Administration... and I ask them, 'You are the officials—the new government—now, what's going on now?' [but they responded], 'I don't know'” (P-034).

In the Baviaanskloof, government's lack of support to farmers was linked to degradation of the land:

“...it's not profitable to be ethical these days. There's no subsidies, there's no support for farmers. So they have to do that [degrade the land]—what are the other options?” (P-014).

Thus, these numerous barriers within government to the efficient implementation of processes were seen as pressing issues. However, no spatial pattern arose surrounding these themes in specific sub-catchments.

5.4.2 Department of Water Affairs (DWA)

Participants in all three sub-catchments perceived a number of failings of DWA and numerous barriers within it to the successful implementation of legislation. Baviaanskloof participants indicated that DWA have not had a role in the area since registering water rights, although some participants reported collaboration between DWA and DAFF in finding solutions to problems. In the Kouga, where farmer-run irrigation boards interact directly with DWA, the majority of participants stated that DWA poses some challenges and needs to be more active. Particularly, participants resented the restriction on building on-farm storage dams. In the Gamtoos where farmers rarely deal directly with DWA, the overall perception was more positive. However, participants expressed significant concerns at the regular water restrictions, the unbalanced implementation of these between urban and agricultural sectors, and the unbalanced implementation upstream and downstream of restrictions, usage measurement, and licensing.

Failings of DWA

Failings of DWA perceived by participants included lack of measurement and inadequate licensing of water use in upstream sub-catchments (addressed in Section 5.3.4: Upstream–Downstream Linkages). Additionally, Gamtoos participants mentioned using water from the Gamtoos River illegally, which suggests a possible lack of adequate policing:

“...every ten years we've got a drought that's causing us [to] making other plans—pumping out of the river without permission. We do it to survive only but if you are

desperate ... The irrigation board... they just close their eyes because they know ... I've got a pump station and everything... The Department of Water Affairs don't want it but what do they do in response? ...they ask the farmers to apply for permits to pump out of the river but we knew they not going to give it to us, these bastards, they're more clever than we think... a lot of farmers paid a lot of money for application forms and things but then they want your coordinates, they want to know where is your pump station so I told my son we are not going to give them any coordinates” (P-032).

Participants in all sub-catchments indicated DWA offers insufficient support to farmers in terms of advice, subsidies to upgrade infrastructure, and communication with (specifically) emerging farmers:

“For example—I'm going to look at our side, I'm not going to look at commercial farmers' side because they on top of the mountain, we still need to get there—we emerging farmers we've got a lot of problems with water. Some of our people they don't even know how to calculate the water they use. They don't even know the pricing of it, and how it goes, and also with this selling story when you're not going to use it you can give it to somebody who is going to use it, so that you don't pay the full amount of water that you're not going to use. And also [DWA could] come and visit us regularly just to find out, 'What is your problem? Where can we help?'” (P-025).

Participants in the Kouga and Gamtoos complained about slow implementation of processes, and slow response times. A previous example encountered is the slow implementation in transforming irrigation boards into WUAs. Additionally, as a result of slow processing of applications, participants reported they would rather upgrade infrastructure themselves than apply for assistance, or implement illegal practices rather than apply for permission:

“...we didn't apply [for assistance to upgrade infrastructure] because it normally takes months or years so in the end it's easier to just do it [ourselves] ... For instance, if you want to clean a dam then you have to apply for a permit to do the job because if you are going to remove more than 10 m³ they first want to do an Environmental Impact Study. Then you will never do that job... so we just do the job and keep quiet” (P-003).

“But we are struggling with DWA. We are not getting answers as quickly as was promised in the meetings... it's 6 months down the line and we've got no answers yet” (P-021).

Slow processes within DWA were seen particularly as a barrier to emerging farmers' success:

"the way the wheels of government turn is too slow. He will be dead before the water comes [the rights are allocated]" (P-024).

These failings of DWA were perceived to be driven by numerous barriers within DWA that prevent successful implementation of processes.

Barriers Within DWA to Successful Implementation of Legislation

Lack of human resource capacity within DWA was identified as a barrier:

"...the problem at the moment is again with the government is that they find it difficult to implement laws. I don't think that they have the capacity" (P-011).

In addition, participants expressed frustration at DWA's weak facilitation of processes:

"But I know [some other farmers] ... they paid a private guy in George that doing water stuff and they paid him to sort their [problems] out [with DWA]. They just got fed up with sickling" (P-006).

"You don't even deal with them because it's a bunch of [under-the-breath racial slur]. You don't even bother to phone them. You can't even sort your accounts out" (P-010).

"I actually acquired another 17 ha of water... it's taken seven years already... [it's] been approved provincially but now it's got to be approved by... somebody above the provinces probably in the national water board or whatever" (P-030).

Other examples of weak facilitation (from Kouga participants) relate to issues with government's records of dams. One participant reported an incorrectly spatially registered catchment dam. Another reported receiving an extremely high bill from DWA that precipitated a lengthy investigation which found that the entire Haarlem Dam had been incorrectly registered to his property:

"...at one stage we were getting a bill of... R47,000 per year. And then after numerous phone calls and faxes and talking to people they find out that the whole Haarlem Dam was registered on our farm! ...Then when they took that off they took everything off. So at the moment we're not registered for any water. Then they try and sort that out. So when it came back we had only 25 ha of water. So we're still battling with them for that" (P-006).

Participants also expressed concerns about a lack of visible DWA personnel ‘on the ground’, leading to lack of faith in DWA activities and decision-making:

“We last saw them when they did the registration of water rights. I wouldn’t know what they were supposed to do if they were around here” (P-015).

“The guys come here and you are telling him the situation. You have to take him and go and show him otherwise he doesn’t have a clue what’s happening. Now those are the people in the end making the decisions” (P-003).

P-008: *The closest representative is the guy in Port Elizabeth...*

Researcher: *Does he ever come into the area and see what’s happening?*

P-008: *Ja, if I shout loud enough.*

“I think they don’t always know what the needs of, say, this area is” (P-028).

Related to this, high turnover of staff was highlighted as an issue:

“They have a very high turnover of personnel. One year you are working with this one, the next year there is someone else, six months later there is another someone else. So there is no continuity” (P-018).

Kouga participants questioned the priorities of DWA officials. For example, participants witnessed DWA officials spending time, money, and resources investigating mineral water bottling within the sub-catchment yet they failed to respond to reports river channel modification that caused erosion and head-cuts:

“But sometimes they—funny, maybe I should watch what I’m saying—there is some[times] more political minor things and you see all of a sudden ZAP! [a representative of DWA] is here. I don’t understand their priority allocation! ... There was one landowner who went ahead and channelised a river... And I send them a picture and I told them what I saw. And maybe they’re a bit scared to tackle this situation but I’m disappointed. They should have responded much more actively” (P-008).

Interestingly, participants highlighted a need for legislation that is flexible to local conditions:

“You know, they tend to make a rule or regulation or a law and I think that situations differ so much from one place to another and you can’t just make a straight law for everywhere. You have all the different climates and things” (P-003).

Positive Relationships with DWA

Despite these failings and challenges, positive working relationships with DWA were also reported in each sub-catchment. Baviaanskloof participants appreciated DWA's involvement in restoration (through WfW) and the support provided to emerging farmers. Kouga participants pointed to the successful water rights registration in the past. Gamtoos participants highlighted low water rates, high dam safety standards, and DWA's commitment to improved water security by raising the dam wall. Participants in both the Kouga and Gamtoos highlighted positive relationships between irrigation boards and DWA as well as DWA's role in providing financial support to irrigation scheme maintenance:

“Actually, up ‘til now, we [Gamtoos farmers] have paid (I’m just guessing) about R15 million towards that levy but the government has spent over R200 million in replacing some of the infrastructure. You see, we have to do the normal maintenance but if something has reached the end of its life or it has to be replaced they have to do it... we can’t complain about that, we are very happy with them, as far as that is concerned, DWA, so we are very happy they have improved our infrastructure” (P-019).

5.4.3 Working for Water (WfW)

Working for Water (WfW) performed differing restoration activities in each sub-catchment. In the Baviaanskloof, WfW's involvement in restoration through planting of Spekboom was viewed positively. Significantly, however, restoration was not pursued to the same extent on all farms; commercial farms received preference over inactive farms despite similar levels of degradation and interest from landowners:

“We have a lot of land that we can offer for thicket restoration and we’re quite keen to do it” (P-013).

In the Kouga, WfW focussed on invasive alien plant (IAP) (black wattle) removal, with most participants indicating that there was room for improvement in the work done. Importantly, misalignment of administrative and catchment boundaries arose as an issue. Participants reported that WfW Eastern Cape argued the land beyond the provincial boundary (in the Western Cape) was outside their jurisdiction, while WfW Western Cape argued the same land was not their jurisdiction because the water flows to the Eastern Cape.

Baviaanskloof and Kouga participants criticised WfW's employment side for unreliable payment of workers, lack of real skills creation, and lack of true productivity. However, Baviaanskloof participants praised its contribution to job creation and mitigation of social problems associated with joblessness. Interestingly, in both upstream sub-catchments GIB's involvement was attributed to WfW's success.

In the Gamtoos, participants reported that WfW did not have much engagement but had done some IAP removal in tributary sub-catchments (black wattle) and in the Gamtoos River bed (reeds). Participants particularly viewed work done in upstream sub-catchments positively, pointing to increased base flow in rivers as evidence:

“So I think the best thing that could have happened was the Working for Water scheme. [It] is wonderful. My opinion is that Working for Water saved us from more severe drought because the runoff into the dam is much better after [it] started, especially in the Langkloof in the upstream areas” (P-024).

“Since Work for Water started you can see it on our rivers... I'm farming now next to this... Klein River... they took out all the alien trees [upstream]... and since then we have got a regular flow of water” (P-032).

The main criticisms of WfW targeted the efficacy and efficiency of implementation:

“‘Working for’ programmes are all based on employment, employment, employment, work, work, work. And it's not about using the resources effectively for restoration or land use change, or getting rid of the problem” (P-001).

“So I don't want to moan too much because I don't want them to leave our farm. But I think it could be done better. Especially the follow up work. They cut down the small stuff but they don't spray it always” (P-006).

Participants also linked WfW activities to increased soil erosion and fire risk. Thus, differences are evident in the type of land and water management activities performed in each sub-catchment and this is linked to their characteristics.

5.4.4 Energy Providers

Energy costs arose as a significant impact to farming in all sub-catchments. Figure 5.9 presents results for survey Question 15 regarding the impact on farming of the price of electricity. The pattern illustrates that the majority of participants across all sub-catchments strongly agreed. Significantly, the highest number of responses for strongly disagree was in the marginal Baviaanskloof. Additionally, not all farmers were equally affected by energy costs, depending on farming type and location relative to water source. Those Kouga participants that strongly disagreed were those practicing extensive land uses (e.g. livestock farming) that do not require irrigation. Similarly, those Gamtoos participants that disagreed were either small-scale emerging farmers or those with low-lying fields and benefiting from gravity-fed pressure for irrigation.

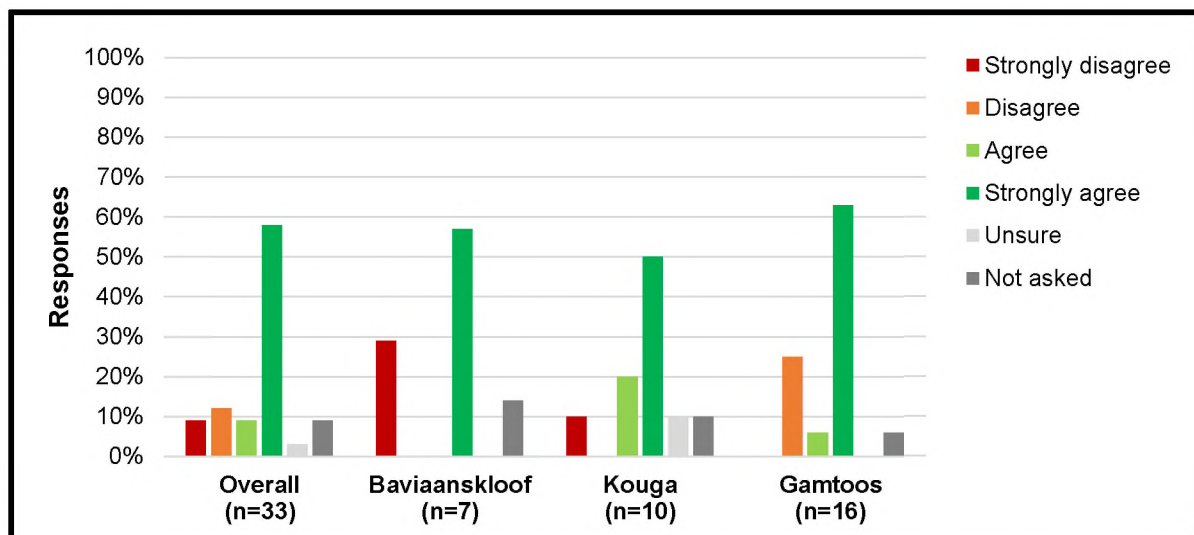


Figure 5.9: Participants’ perceptions of the impact of electricity costs on farming by sub-catchment (Q15. My farming, water use activities, or land management practices are affected by the price of electricity.)

Participants in all sub-catchments linked electricity costs with pumping for irrigation. Only Kouga and Gamtoos participants linked high energy costs to cold rooms and pack sheds (30% of the monthly electricity bill according to one participant). In all three sub-catchments, participants pointed to a rapid increase in energy costs in recent years—cited by multiple participants as 25% per year over three years—significantly impacting farming:

“...the total electricity... until 2008 for the one month... it was about R48,000... Last year it was... R97,000 a month. It is unbelievable what electricity costs us” (P-003).

“Diesel and electricity. When I started... you didn’t even put that on a budget it was such a small percentage of our [costs]... now it’s at least 10% or 15% of our budget... So that is a problem” (P-006).

“I think Eskom is strangling a lot of farmers in South Africa with these high prices of theirs!” (P-012).

“It is definitely getting serious now because four years back our electricity bill for the whole season was about R70,000. Now our electricity bill for the season is about R250,000... The price increase over the last five years of diesel is the same as electricity” (P-018).

These high input costs were linked to reduced profit margins, potentially making farming unviable in the future:

“[Farmers] cannot keep up with the production they used to have” (P-001).

“...very high cost. If you compare it to the produce, I don’t think it’s going to pay anymore” (P-011).

“And they’re making it harder and harder for farmers in this country. The electricity bill is going up. They want the water that we use. Where is the food going to come from?” (P-012).

“The problem is at the moment is that your cost went up so high, your electricity, your diesel... If you make your sums it’s not viable anymore” (P-029).

Baviaanskloof participants linked this to increased pressure on the environment:

“...it cuts [the farmer’s] line so fine. There’s now just that much more that he’s got to grow just to cover his costs. So it’s quite a vicious cycle and it’s also harsh on the surrounding area” (P-013).

This again illustrates a higher concern for environmental matters in this area, with participants perceiving this as driving land use change towards conservation, which they framed as positive. This theme did not arise in the other sub-catchments.

In all sub-catchments, participants reported attempts at increasing water use efficiency. However, interestingly, many attributed this to attempting to reduce pumping costs. Improved practices include: upgrading to higher efficiency pumps, practices such as mulching, and reducing evaporation loss by irrigating at night:

“...to get your production close to what your costs are so you have to irrigate as efficiently as possible with your water use just to save on electricity” (P-015).

“Mulching... makes up to a 40% difference. Not just in the water but in electricity as well. Because I have to pump all my water to the orchards and with mulching we use 40% less water and 40% less electricity as well... In the beginning I was not mulching because of the electricity price but now it's a side effect” (P-018).

“We are doing our utmost to use less electricity. More efficient systems... Better and different irrigation like drip irrigation and more efficient scheduling and no water loss and measuring with the probes, [making sure] never to over-water because the water is expensive and the electricity to pump the water is very expensive... Our efficiency the last 20 years at amounts of water to produce 1kg of food, we are 1/3 of what we used to be... So the price of electricity makes us more efficient” (P-024).

Despite the increasing costs, participants reported benefiting from lower rates by adapting irrigation practices to take advantage of Eskom's incentives to increase nocturnal irrigation. This section has illustrated that power relations with national level stakeholders tend not to manifest spatially, although they can be shaped by the physical characteristics of the area, as well as the context of the farmers, for example, with emerging farmers being most impacted by government failings.

5.5 International Level

The international level was spoken of least in all three sub-catchments. Additionally, it was the only level at which positive themes predominated, particularly in the Baviaanskloof (60%) (Table 5.6). A relatively even distribution emerged across all four sentiments for both the Kouga (range: 18–32%) and the Gamtoos (range: 19–33%). This section presents findings relating to international level stakeholders, specifically Living Lands, markets, and standards organisations.

Table 5.6: Sub-catchment coding frequencies for international level sentiments

	Negative	Positive	Neutral	Mixed	Row Total
Baviaanskloof	9 (18%)	30 (60%)	4 (8%)	7 (14%)	50
Kouga	4 (18%)	6 (27%)	7 (32%)	5 (23%)	22
Gamtoos	8 (22%)	7 (19%)	12 (33%)	9 (25%)	36
Study Area	21 (19%)	43 (40%)	23 (21%)	21 (19%)	108

5.5.1 NGOs: Living Lands and UNESCO

As an NGO focussed on improving sustainability and livelihoods, Living Lands had had minimal involvement in the Kouga and Gamtoos at the time of the research, thus findings were mainly from the Baviaanskloof. Here, perceptions were primarily positive, with participants stating that Living Lands had positively impacted farmers' mind-sets:

"I think they're doing wonderful work. They made a huge difference in the understanding and concept of the farmers and land use and water... and just general sustainable 'eco' issues. In the time that they have come to this valley they have made a big change and influence" (P-016).

Increased collaboration around restoration between multiple stakeholders was perceived as a positive outcome facilitated by Living Lands:

"And since that happened a lot of people have been involved here so I prefer to talk about 'us', I don't talk about myself. I think this is a collaboration of people who are really interested" (P-011).

Participants also pointed to improved decision-making processes amongst farmers:

"Even PRESENCE has played a major role in bringing information to the farmers which allows the farmers to make good decisions" (P-011).

Significantly, emerging farmers in both the Baviaanskloof and Gamtoos criticised Living Lands for lack of feedback.

"And as I said last year two students came and asked me the same thing... and they gone and no one came back and helped me. That's why I'm sad... last year it was the two girls... today it's [you], next year there will be another one. It's still [me sitting here] and nothing has happened from that time up to now, that is the problem" (P-034).

Living Lands, therefore, represents an example of the potential for positive outcomes of leveraging power in land and water management.

Unlike Living Lands which is directly involved in activities in the Baviaanskloof, UNESCO wields influence through setting guidelines to which the BMR needs to adhere in order to maintain World Heritage Site status. This status adds interest to the area, potentially influencing tourism. Participants only mentioned UNESCO within the context of the BMR and this added international interest.

5.5.2 Markets

Themes related to markets arose mainly in the thriving commercial farming industries of the Kouga and Gamtoos. Participants pointed to the influence of markets (national and international) on what farmers choose to plant as well as on land and water use. For example, Mohair and Angora wool demand in the 1980s resulted in overstocking of the veld and degradation in the Baviaanskloof. Farmers continue to plant based on potential income:

“It all depends on what we think the income is going to be because I must see that I get the maximum income per hectare” (P-021).

Chain stores (such as PicknPay and Woolworths) were also identified as influencing farming practices:

“[With chain stores] you must just show improvement [in practices]. There is no regulation to say I must give 2 kg per litre [of water] but if I used 2 litres to produce a kg last year I must try and use 1.8 litres. [If you don’t improve] you have to get reasons. Like now you’re getting a lot of natural rain you’re going to use less water from the system... You just have to give a report why you’ve used less or more or whatever” (P-021).

“So everything is important: how I fertilise, how I do my water, how I do my chemical spraying, how I lift them... So you must do everything right from the start to the end. You farm to get the best yield and the best price” (P-028).

Participants linked ability to provide jobs to demand from the market. Water scarcity was also identified as inflating market prices. Importantly, an emerging farmer participant lamented the fact that small-scale farmers are unable to compete with large-scale farmers:

“...but at the end of the day it became that the volume [produced] must be bigger and bigger and bigger and bigger. And they [chain stores] get in [buy from] white farmers, commercial farmers, and I’m out of there and I stop farming because if you haven’t got money unfortunately you can’t carry on. And I left it alone and I carry on with the cattle... and I’ve got some pigs... and that’s the income but it’s not so profitable that I can [be] come a rich man. It’s only for the love and the willing and the little money that came out it’s for my son so that he can carry on” (P-034).

5.5.3 Standards Organisations

Standards organisations provide accreditation to farmers thus regulating farming practices. Figure 5.10 presents the results to Question 14 regarding the degree of influence of standards organisations on farming activities. It illustrates that “influenced” had the highest responses across all sub-catchments with highest response rate in the Kouga (50%), followed by the Baviaanskloof (43%), and then the Gamtoos (31%). In the Gamtoos, 25% of participants felt it was heavily regulated and 25% felt it was slightly regulated. In the Kouga, 10% of participants felt it was heavily regulated. No participants in the Baviaanskloof perceived farming practices to be slightly or heavily regulated. The Kouga had the highest response rate for no influence (40%), followed by the Baviaanskloof (29%). No participants in the Gamtoos felt that standards organisations had no influence. The varied responses illustrate that overall there was no consensus on the extent of influence of standards organisations.

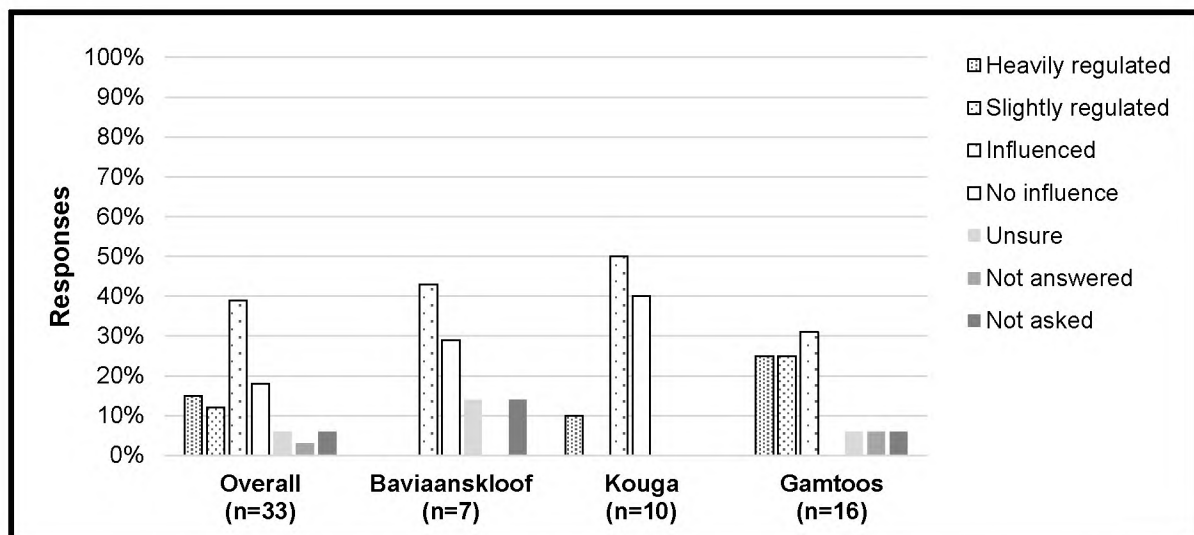


Figure 5.10: Participants’ perceptions of the influence of standards organisations on farming activities by sub-catchment (Q14. My farming and water use activities are influenced by standards organisations (e.g. GlobalGAP)).

Each participant perceived the level of influence on their farming practices differently. Some felt that standards organisations impose heavy regulations:

“You can’t export without certain accreditations... this is a system with a lot of strict regulations and rules that you have to attend to... And even the local supermarkets expect those accreditations... Otherwise they can’t handle your food” (P-004).

Others stated that they are monitoring their practices anyway, are already following best practice to produce the highest possible quality product, and that reporting these processes for accreditation is just a part of farming:

“I think most of the guys are on that standard. Because of the scarcity of water and the cost of electricity and fuel and stuff, you have to be efficient and effective” (P-023).

Some participants pointed to the benefits of adhering to standards:

“I mean initially it was a big hoo-hah when we started that. But it’s important so all of us—. I mean we’ve got Fairtrade so it’s even more with the people [beneficiaries] and it does influence it and sometimes it’s very difficult to keep to all the standards... but I think we passed that [stage]. I think we are very nature conservation [oriented]... It’s a problem if you don’t get a tick to get the certificate but... once you put it in place and like us with the Fairtrade you know so it’s a way of living and it’s a way of standard so it’s not a problem” (P-005).

“[It benefits you] by paying more for milk. It’s not a lot of money, you don’t have to adhere to it but there’s a cent or two per litre of milk... I would put it in anyhow because it is important for me to know how everything goes and how it’s used... But it’s not a bother. I like it. It makes sure that you are doing it [right]” (P-030).

However, type of farming did impact the degree of influence, with citrus, deciduous fruit, and cash crop farmers tending to perceive higher levels of regulation than livestock or marginal farming types.

This section has illustrated that the characteristics of the area impact the types of international level stakeholders that local level land managers interact with, and that power from the international level is wielded through influence and guidelines.

5.6 Summary of Findings

This chapter presented findings for Research Objectives 2b and 2c from the perspectives of those directly involved in local level land and water management. The findings illustrate that power relations among stakeholders occur at multiple levels of socio-economic organisation and are characterised differently at each level. Additionally, the characteristics of each sub-catchment influence the primary level at which power relations occur, with local and international level themes dominating in the Baviaanskloof, national level themes dominating in the Kouga, and regional level themes dominating in the Gamtoos. Themes differed according to sub-catchment characteristics, with more conservation-related themes (specifically associated with ECP and NGOs) arising in the marginal, dry Baviaanskloof, while themes relating to markets and standards organisations arose more prominently in the thriving commercial agriculture contexts of the Kouga and Gamtoos. Additionally, power relations were shown to manifest spatially at local and regional levels with upstream–downstream linkages and relations with the city of PE coming up as significant. Further spatial characteristics will be examined in Chapter 6 where power relations are interpreted alongside spatial distribution of resources for each of the zones in the catchment. Emerging farmers were found to face the most significant challenges to farming, with multiple barriers faced in their relations with commercial farmers, irrigation boards, and multiple government departments. The following chapter integrates these results with those to Research Question 1 (Chapter 3) and interprets them through a political geocology lens in the context of water management in South Africa.

Chapter 6: The Political Geoecology of the Gamtoos Catchment

Different spatial distribution patterns were observed for resources, human productive activity, and power relations in the study area. This chapter discusses these spatial patterns through the application of zonation concepts to address Research Question 3: What are the interrelationships between the spatial distribution of land and water resources and power relations in the area? It does this by integrating the spatial distribution of resources (Research Question 1, Chapter 3), how these resources are accessed, controlled, used, and managed (Research Question 2, Chapter 5), and how this shapes and is shaped by their distribution (Research Question 3, Chapter 6).

Specifically, Objective 3a (To spatially interpret resource distribution, human productive activity, and power relations according to zones in the catchment) is addressed through Table 6.1, Table 6.2, and Table 6.3, while Objective 3b (To describe the interrelationship between the biotic and abiotic landscape components and power on multiple levels) and Objective 3c (To analyse how the environment shapes power relations and how power relations in turn shape the environment) are simultaneously dealt with in the discussions for each zone. Existing literature is referred to, to situate findings within the present state of knowledge around water management in South Africa and power relations and the environment. The literature pointed to numerous power relations inherent in the South African water management sector. Significantly, the results reproduced many of these power relations that have been found before. Results indicated that, like the rest of South Africa, water management in the study area remains entrenched within the country's socio-political history.

The chapter discusses the political geoecology of the source zone, natural recapture zone, regulated recapture zone, and ecologically sensitive zone, as well as power relations in both the natural and regulated recapture zones. Finally, the political geoecology approach is evaluated, addressing Research Question 4.

6.1 Political Geoecology of the Source Zone

Table 6.1 uses a spatial framework to concisely present a portrait of the political geoecology of the source zone in the study area. This framework takes into account space by comparing characteristics of the source zone across the three sub-catchments. For each area, the key

environmental, human productive activity, and power relation characteristics are summarised according to findings already presented in previous chapters. This section discusses these interrelationships. Firstly, the overall source zone characteristics will be discussed. Secondly, an in-depth discussion of the political geoecology of the Baviaanskloof will be presented. Finally, due to the limited power relations arising in the Kouga and Gamtoos source zones, these two will be discussed together.

6.1.1 Characteristics of the Source Zone

The source zone encompasses all uncultivated, natural land and is characterised by steep, rugged, mountain terrain that is difficult to access, unsuitable for cultivation, has low population density, and limited water storage potential. With largely pristine vegetation, land is either left as natural veld (sometimes used for livestock grazing) or demarcated for conservation—the zone's primary human productive activity. Of the three sub-catchments, the Baviaanskloof has the highest total area dedicated to conservation, followed by the Kouga then the Gamtoos. The area's ecological importance is evidenced by its high biodiversity, protected plant species, vested national and international interests, and the creation of the Baviaanskloof Mega-Reserve (BMR). The only water extraction is for livestock drinking. The land and water management challenges experienced here are significant as management determines water and sediment yield to downstream zones, affecting catchment-wide use (Molden *et al.* 2001). Power relations primarily arose around restoration and conservation. The interrelationships in this zone between environmental components and power on multiple levels, as well as how they shape one another, will now be discussed in turn for each sub-catchment.

Table 6.1: Spatial framework illustrating the political geocology of the source zone

	Environment	Human Productive Activity	Power Relations		
			Access	Control	Use and Management
Overall	Natural area Steep, rugged mountainous terrain Variable rainfall Limited water storage potential	Uncultivated Conservation (BMR) Limited access roads Low population density Water extraction for livestock drinking only	Physical access: due to rugged, mountainous terrain, physical access to source zone areas is limited, with only gravel roads and dirt tracks of poor quality existing in some areas	No significant relations of control arose in the source zone	UNESCO World Heritage Site criteria influences ECP's management of BMR Prevailing discourse stemming from conservation interests lauds importance of water from Baviaanskloof to downstream and PE, encouraging farmers to use less water
Baviaanskloof	Low rainfall Shallow soils on slopes Extensive degradation	Largely state-owned, private ownership in valley Conservation on private land Tourism Restoration Stock grazing	Negative relationship between ECP and Coleske Plaas community living within BMR WfW provides jobs to and improves livelihoods of the local population	No significant relations of control	Cooperation between farmers pursuing alternative land uses Tension between farmers over restoration versus grazing land In the past, pressure from ECP to cease farming, trust issues persist Stewardship agreements between ECP and farmers Cooperation between Living Lands, WfW, and farmers towards restoration
Kouga	Moderate rainfall Fragile soil cover Some IAPs	Mainly private ownership with state-owned tracts in Kouga mountains Limited conservation on private land Stock grazing	No significant relations of access	No significant relations of control	Stewardship agreements between ECP and farmers bordering the BMR Clearance of IAPs by WfW on private farms
Gamtoos	Less mountainous than upstream Moderate rainfall Some degradation	Private ownership Limited conservation (due to small extent of BMR)	No significant relations of access	No significant relations of control	Clearance of IAPs by WfW on private farms

6.1.2 Political Geoecology of the Baviaanskloof Source Zone

Resource Distribution, Use, and Power Interrelationships

The Baviaanskloof source zone is a good example of the cyclical process through time whereby resource distribution has shaped human activity and human activity has shaped the bio-geo-physical environment. Topography, insularity, low rainfall, and water scarcity render intensive irrigated cultivation unviable for most of the Baviaanskloof meaning that it is classified mainly as source zone. Extensive overgrazing and degradation caused by economic pressure from market forces through time (for example, the 1980s Mohair and Angora goat boom) combined with water scarcity, worsened the area's marginality. This is an example of the lasting impact of external influences on the local biophysical environment. The combination of degradation, low agricultural potential, and high biodiversity value of the wider area drove regional, national, and international interest in conservation and restoration (through Working for Water (WfW), Eastern Cape Parks (ECP), and Living Lands). These activities shape natural resources by impacting runoff, infiltration, and water and sediment contribution downstream. This is an example of the mutual shaping interrelationships between resources and human activities. Power relations in the Baviaanskloof source zone are characterised by local, regional, national, and international level stakeholders cooperating towards mutual interests surrounding restoration, conservation, and tourism.

Restoration: Local, National, and International Power Relations

The focus on restoration, specifically the national level WfW, is an excellent example of a programme embodying IWRM ideals; efforts are coordinated towards sustainable, simultaneous management of soil, flora, and water resources alongside the pursuit of economic and social welfare, encompassing multiple aspects of GWP's IWRM definition (GWP 2000a: 22). However, it could be argued that WfW is an example of an isolated 'IWRM-activity'. Jonker's (2007) assertion that isolated IWRM activities do not equal holistic IWRM implementation is of relevance here. Power relations surrounding restoration can be summarised in three main thrusts.

Firstly, WfW has provided employment resulting in improved livelihoods for local communities and replicating findings by studies in other places (Binns *et al.* 2001; Buch and Dixon 2009). However, the finding that workers were not always reliably paid highlights the need for mechanisms ensuring that vulnerable communities participating in these initiatives are not disadvantaged through exploitation or bureaucratic backlog.

Secondly, the discord between local commercial farmers surrounding competing priorities—restoration versus continued livestock grazing—highlights the inherent difficulties in pursuing the IWRM ideal of sustainability without simultaneously assuring financial remuneration for lost income. This identifies a need for mutually agreed upon priorities, accountability mechanisms, and conflict resolution strategies to be in place before pursuing collaborative goals.

Thirdly, commercial (large-scale) farmers' land seemed to be prioritised for restoration despite similar levels of degradation and interest from non-farming landowners who indicated no restoration had yet been undertaken on their farm. In a similar fashion, the report on mediation in water management in the Baviaanskloof by Reijerkerk *et al.* (2012) focussed on the interests of white commercial farmers. This is evidence that—even in the pursuit of supposedly 'universal' environmental ideals—white commercial farmers have relative power compared to black and coloured communities and non-farming landowners. While it is likely that this marginalisation was unintentional and was actually a consequence of enduring racially skewed land ownership, it points to the need for implementers (for example, WfW and Living Lands) to reflect on the inherently political nature of the participatory process, as called for by Kemerink *et al.* (2013) in another area. The IWRM ideal of maximised, equitable social and economic welfare will not be achieved if white commercial farmers receive higher benefits from these initiatives to the exclusion of other societal groups.

Conservation: Regional and International Level Influence

Power relations surrounding conservation can also be summarised around three themes. Firstly, Living Lands (from the international level) successfully took a collaborative approach, working with farmers and earning their trust (see Reijerkerk *et al.* 2012). Secondly, ECP (from a regional level) initially aggressively pushed farmers to cease farming and sell land for conservation, an approach that was met with resistance and failed. Fifteen years on, trust issues with ECP remained despite improved relationships and opportunities for collaboration, pointing to the lasting influence that conflicting ideals can have in an area. Additionally, a concerning finding warranting further investigation was the suggestion that ECP was attempting to push the Coleske Plaas community (living within the BMR) out of the area. Marginalising the rights of local, vulnerable communities in pursuit of environmental ideals

contradicts the pursuit of social welfare and equity alongside sustainability in water management.

Thirdly, the use of discourse to influence resource use and management was evident in the area. A prevailing discourse emerged whereby participants repeatedly had an inflated sense of the importance of the Baviaanskloof River's water to downstream farmers and the city of Port Elizabeth (PE), contrasting reality of contributions to the Kouga Dam (Baviaanskloof: 20%; Kouga: 80%). Here, regional level discourse was used to lend legitimacy to arguments surrounding local level resource use and management, in a similar way to the use of prevailing global IWRM discourse legitimised water reform (Swatuk 2005; Swatuk 2010: 533). Again, echoing Kemerink *et al.* (2013), this points to the importance and need for researchers and organisations to be reflective of their own positions of power in an area.

6.1.3 Political Geocology of the Kouga and Gamtoos Source Zones

In the other two sub-catchments—where topography and rainfall allow for thriving agricultural sectors—restoration and conservation initiatives are less active and power relations are much less prominent in the source zone. In the Kouga's source zone, power relations surrounding restoration and conservation also arose in three main directions. Firstly, conservation opportunities were available for farmers to collaborate under stewardship agreements with ECP, similar to the opportunities in the Baviaanskloof. However, here these opportunities had a spatial manifestation, limited to areas with proximity to the BMR. Secondly, WfW deemed important in addressing extensive infestation of invasive alien plants (IAPs), particularly black wattle (*Acacia mearnsii*) which consumes a lot of water and impacts downstream water availability (Le Maitre *et al.* 2015; Rowntree and Beyers 1999). The importance of IAP removal was explicitly framed in terms of increasing water yield downstream (for further discussion on this, see Section 6.5). Thirdly, a power struggle emerged between WfW's provincial offices regarding the jurisdiction of clearing IAPs in the Kouga's Western Cape region when the water flows to the Eastern Cape. This points to challenges associated with misalignment of hydrological and administrative boundaries and highlights the importance of acknowledging the influence of space when designing resource management initiatives. This issue adds a dimension to those highlighted by Herrfahrdt-Pähle (2010a, 2010b). In the Gamtoos, source zone themes were much less evident. Here, the value of WfW was also referred to in terms of increasing water supply.

6.1.4 Summary

With very different issues arising in the marginal Baviaanskloof than the other two sub-catchments, the source zone clearly illustrates how resource distribution within a zone shapes power issues, how power issues in turn shape resources, and that these produce a clear spatial pattern. The following section examines the spatial interrelationship between resource distribution and power issues in the natural recapture zone.

6.2 Political Geoecology of the Natural Recapture Zone

Table 6.2 presents the political geoecology spatial framework of the natural recapture zone in the study area. For each sub-catchment, the key environmental, human productive activity, and power relation characteristics are summarised according to findings already presented in previous chapters. This section discusses these interrelationships, opening with a brief discussion of the characteristics for the overall natural recapture zone. Following this, each sub-catchment is discussed separately.

6.2.1 Characteristics of the Natural Recapture Zone

In the study area, the natural recapture zones correspond with cultivated, irrigated areas in the upstream sub-catchments; these are located along valley floors, floodplains, and areas with less harsh terrain. Water is diverted for agricultural and domestic use, and the small portion not depleted or lost as evapotranspiration is naturally recaptured by the same river system making it potentially available for reuse downstream (Molden *et al.* 2001). The primary factors determining distribution of this zone in the study area are topography, rainfall, and water storage capability. This zone across all three sub-catchments is characterised by variable rainfall with mild summers and cold winters. Land is either owned privately or by the state under the land reform programme.

Table 6.2: Spatial framework illustrating the political geocology of the natural recapture zone

	Environment	Human Productive Activity	Power Relations		
			Access	Control	Use and Management
Overall	Variable rainfall Mild summers, cold winters	Private ownership			Markets and standards influence management Energy costs result in water saving techniques
Baviaanskloof	Low rainfall Alluvial floodplain Stratified alluvial soils with clay Extensive degradation	Tourism and restoration Stock grazing Marginal agriculture (olives, vegetable seeds, maize) Water use: 2 million m ³ /yr Limited water storage potential	Physical access via gravel road and mountain passes Joint localised management resulting in allocation concerns Intra-catchment upstream use impacts downstream availability Limited job opportunities	No place-specific relations of control	In the past, pressure from ECP to cease farming Localised relations between farmers over infrastructure maintenance
Kouga	Moderate rainfall Bo-Kouga and Onder-Kouga valleys in Kouga mountains Langkloof valley divided into several smaller, hydrologically-divided tributary sub-catchments Fragile soil cover Extensive IAPs	Thriving commercial deciduous fruits industry Limited cash crops Stock grazing Water use: 30–35 million m ³ /yr Private on-farm total water storage capacity: 26 million m ³ Combined storage capacity of Joubertina and Haarlem Dams: 5 million m ³	Good physical access via tarred, regional road Upstream–downstream conflict over water in a sub-catchment with no irrigation board Irrigation boards restrict emerging farmers' access to water based on non-payment Government shortfalls as barriers to emerging farmers' success BEE beneficiaries have limited decision-making power Poor service provision by municipalities in towns Commercial farming important for job provision in the region	DWS sets legislation regarding governance of irrigation boards DWS legislation governs water management, e.g. restrictions against building on-farm storage dams	Township service provision and infrastructure maintenance: evidence of tensions and collaboration between irrigation boards and municipalities Commercial farmers collaborate towards water management and infrastructure maintenance within irrigation boards Pressure from downstream Gamtoos farmers and PE for water
Gamtoos	Moderate rainfall Upstream, hilly terrain in tributary sub-catchments Some IAPs	Limited dairy, citrus, and cash crops Limited water storage and extraction	Positive localised upstream–downstream relations in tributary sub-catchments	DWS legislation governs water management, e.g. restrictions against building on-farm storage dams	No place-specific relations of use and management

6.2.2 Political Geocology of the Baviaanskloof Natural Recapture Zone

Resource Distribution and Productive Activity

The Baviaanskloof's natural recapture zone is limited to pockets of irrigated, cultivated land adjacent to the river along the valley floor. A combination of topography, limited access, insularity, low rainfall, water scarcity, and limited options for water storage shape human productive activity, rendering intensive agriculture unviable. For example, large vehicles would have trouble manoeuvring the gravel roads, mountain passes, and vast distances to regularly transport vegetables or dairy products out the valley. Consequently, as seen in the previous section, land use activities are primarily focussed in the source zone. Irrigated agricultural activity in the natural recapture zone is marginal, using only 2 million m³ of water per year. It is focussed on crops such as vegetable seeds, olives, lucerne, and lavender; limited cash crops such as maize and other vegetables are produced. This illustrates how the bio-geo-physical characteristics of the area combine to shape productive activity.

Power Relations: Localised Issues of Access, Use, and Management

Three significant power relations emerged in this zone in the Baviaanskloof, significantly all existed at the local level. Firstly, reduction in water availability towards the downstream section of the sub-catchment produces tensions between upstream and downstream farmers. However, this is an example of conflict avoidance among local stakeholders; farmers chose to pursue alternative income opportunities rather than fight over limited resources. Secondly, localised tensions were evident over infrastructure maintenance and concerns over whether or not the correct allocations were being received in shared water management systems. However, these were normally resolved amicably. It is important to note that in an area with no formal water management institution there is potential for more powerful local landowners to exploit less powerful landowners when sharing water management responsibilities. Thirdly, the lack of job opportunities for local communities in the Baviaanskloof's agricultural sector is linked to water scarcity and marginal agriculture, illustrating how bio-geo-physical characteristics shape not only activities but also opportunities for improving livelihoods.

6.2.3 Political Geocology of the Kouga Natural Recapture Zone

Resource Distribution and Productive Activity

In the Kouga, natural recapture zone encompasses all irrigated, cultivated land in the Langkloof, Bo-Kouga, and Onder-Kouga valleys. More suitable topography, better roads, better access to labour, higher rainfall, and more opportunities for water storage (total capacity:

31 million m³) than the Baviaanskloof combine to produce a thriving commercial deciduous industry that uses 30–35 million m³ of water per year. The combination of environmental components produces a context of human productive activity in the Kouga that differs significantly to the Baviaanskloof. Cultivation is less prominent in the Bo-Kouga and Onder-Kouga valleys than the Langkloof.

The water management context in the Langkloof valley is shaped by the geophysical landscape; water is managed separately in each of the parallel tributary sub-catchments. This is an example of successful implementation of the principle of decentralisation whereby water is managed at the lowest possible level (GWP 2000a: 22). However, this example successfully highlights the paradox of simultaneously valuing decentralisation and integration under IWRM (Biswas 2004, 2008); water management is decentralised, yet simultaneously segmented and uncoordinated between tributary sub-catchments. Power relations relating to water management arose around four key themes: local level water management, competing levels of water governance, lack of resilience to drought, and equity issues.

The Importance of Formalised Local Level Water Management

The only case of intra-catchment upstream–downstream tensions was the legal conflict in a tributary sub-catchment with no irrigation board. Those areas with irrigation boards reported positive, collaborative relationships between farmers surrounding access, use, and management of water resources. Thus, upstream–downstream conflict emerged in two areas that lacked formal local water management institutions (here and the Baviaanskloof). This emphasises the value of formalising local water management institutions in preventing conflict.

Establishing WUAs: Competing Levels of Water Governance

Other studies identified competing levels of governance as an obstacle to the creation of CMAs (Bourblanc 2012; Bourblanc and Blanchon 2014). This obstacle was also evident in the creation of WUAs in the study area. Movement towards establishing WUAs reflects an attempt to coordinate development and management of water resources, a central part of IWRM (GWP 2000a: 22). However, a lack of coordination was evident in the move itself in the Kouga, with two parallel processes emerging towards establishing WUAs: one for the entire Langkloof valley, and one for Haarlem Irrigation Board.

Firstly, the process to create a single WUA for the entire valley had been proposed but stalled due to resistance from the multiple independent irrigation boards in the Kouga. These farmer-run irrigation boards are examples of the self-management of portions of catchments that arose historically, as identified by Schreiner and van Koppen (2002: 971). Resistance to the creation of a single WUA points to a desire to maintain existing power structures, remain independent, and retain control over decisions about access and use of local water resources. This echoes the difficulties identified by Swatuk (2005) and van der Zaag (2005) in creating new institutions with different jurisdictional boundaries to previous institutions and the associated reluctance of stakeholders to participate with new institutions. Van der Zaag (2005) and Bourblanc and Blanchon (2014) suggest that finding cooperative solutions within existing power structures or designing new agreed-upon institutional arrangements may be preferable to imposing structural change from outside. Indeed, if these difficulties continue to be felt in the study area, this may be a solution that needs to be explored. Furthermore, the proposal to merge irrigation boards and create one WUA contradicts the ideal of decentralisation and principle of subsidiarity. This reflects confusion surrounding the purpose, roles, benefits, and need for new institutions, how transformation can benefit existing institutions, and implementation of the NWA.

By initiating the process to independently transform Haarlem Irrigation Board into a WUA, the importance of maintaining autonomy from other sub-catchments in the Langkloof was emphasised. The numerous challenges experienced in this process point to firstly, problems with implementing water reform, and secondly, shifting power relations as institutions attempt to assert their control, ownership, and management of local systems. This was evidenced by the complications in the legal process of changing the name of Haarlem Irrigation Board and transferring ownership of the privately-owned Haarlem Dam to the ‘new’ institution. Kemerink *et al.* (2011: 593) similarly pointed to wealthier farmers’ attempts to retain power by continuing to assert the claims to water through ownership of permanent hydraulic infrastructure. These issues surrounding competing levels of governance in water reform emphasises the link between the geophysical reality of resource distribution, spatial management boundaries, and the socio-political challenges of transformation.

National Power Creating a Lack of Resilience

In the natural recapture zone of the Kouga, pressure for water downstream is manifested through the legislated restriction against building new storage dams that has been in place since the early 1990s. This is a significant constraint to farmers’ ability to build resilience against

recurrent droughts. Farmers' acute frustration in this regard possibly stems from the past when legislation facilitated storage capacity enhancement (Ashton and Haasbroek 2002: 188; Swatuk 2010: 530). This is evidence of how shifting social and political priorities through time respond to the geophysical realities of water distribution and shape water resources in different ways. Ashton and Haasbroek (2002: 197) previously indicated how coping with water scarcity shapes South Africa's water policies. Significantly, not only of the landowners and power-holders are impacted by a lack of resilience; participants in this study linked it to the need to lay off workers due to decreased production during droughts. This is significant because commercial farming is regionally important for job provision and rural development. This highlights how bio-geophysical realities have the potential to significantly impact local, rural livelihoods.

Equity Issues: Local, Regional, and National Power Relations

Issues relating to equity in the Kouga's natural recapture zone can be discussed in terms of five themes. Firstly, multiple participants mentioned the potential of using the livelihoods of local populations (either as a labour source or through BEE programmes) as leverage for gaining access to rural development programmes and funding for hydraulic infrastructure to enhance water storage capacity. This is an example of using legislation aimed at ensuring equity as a potential device to leverage power to serve their own interests. This illustrates that the central state (Swatuk 2010) is not the only level at which legislation can be used to leverage and harness power.

Secondly, the limited power of BEE beneficiaries in decision-making over resources leads to questions regarding the extent of true empowerment and whether the farmer-worker relationship is maintained under a different guise. This points to the need for mechanisms to ensure that beneficiaries are not exploited. Furthermore, the fact that BEE programmes are frequently managed by white commercial farmers points to a racial power disparity.

Thirdly, the example of commercial farmers appropriating an emerging farmer's water due to non-payment is a power relation of access. While irrigation boards have the right to discontinue supply to farmers who have not paid their rates, having the ability to appropriate and use the additional water means that the commercial farmers benefit from their position of relative power in the irrigation board. This example reflects findings by other studies is an example of underrepresentation by historically disadvantaged (black and coloured) individuals in water management institutions, the struggle they experience in asserting their rights, the

determination of the existing elite to preserve their relative advantage, and how power can be used to serve dominant interests (Swatuk 2010; Kemerink *et al.* 2011, 2013; Brown 2013).

Fourth, the failure of George and Kou-Kamma local municipalities to adequately provide water and sanitation services to towns and townships is an example of relations of access negatively impacting the livelihoods of local populations. This is an issue that is also found in other parts of South Africa (Herold 2009; Schreiner 2013). Here, irrigation boards reported providing these services themselves to ensure the livelihoods of the population, many of whom provide labour to farms in the area. These power struggles between municipalities and irrigation boards over infrastructure maintenance and water supply to townships reflect the continued inadequate access to safe water and sanitation for much of the population (Swatuk 2010: 523, 532–533). As a legacy of apartheid's separate development, these inequalities are usually distributed in explicit spatial, and racial, patterns with 'previously' disadvantaged black and coloured communities living in densely populated townships bearing the brunt of the problem.

Fifth, a key failure of water reform has been identified as a lack of water reallocation (Schreiner 2013). The case study highlighted an example where reallocated land did not come with the necessary water. This points to the failure to integrate land and water reform policies and ineffective inter-departmental collaboration (Ashton 2000a: 5; Merrey 2008; Pollard and du Toit 2008). Additionally, this example occurred in a tributary sub-catchment that did not have an irrigation board, pointing to the problems associated with national level government departments implementing local processes without adequate knowledge of local situations.

6.2.4 Political Geoecology of the Gamtoos Natural Recapture Zone

The natural recapture zone in the Gamtoos is relegated to upstream, highland areas of tributary sub-catchments (for example, above the Loerie Dam); the cultivated valley along the Gamtoos River is classified as regulated recapture zone. Agriculture is possible in some of these areas as terrain is less rugged than other mountainous upstream parts of the catchment. Significantly, Gamtoos Irrigation Board (GIB) only controls water from the Kouga Dam and has no power over water use and management in these tributary sub-catchments. Thus, Department of Water Affairs (DWA) (now DWS) performs functions alongside GIB for different parts of the same sub-catchment, pointing to segmentation and a lack of integration and contrasting the IWRM model put forward by the NWA.

6.2.5 Summary

This section illustrated that natural recapture zones are characterised differently in each sub-catchment, determined by a combination of factors influencing the amount of land and water suitable for productive agricultural activities. This section did not discuss power relations that are also applicable to the regulated recapture zone. These will be discussed in Section 6.4. Interestingly, these power relations exist at national and international levels (for example, markets, energy, and standards organisations, as well as between emerging farmers and government departments), whereas power relations at the local and regional level are dependent on the characteristics of the specific place. This contrasts the source zone, where power relations at the national and international levels were specific to the Baviaanskloof. The following section examines the spatial interrelationship between resource distribution and power issues in the regulated recapture zone.

6.3 Political Geoecology of the Regulated Recapture and Final Use Zones

Table 6.3 presents the political geoecology spatial framework of the regulated recapture and final use zones in the study area. As a significant user within the regulated recapture zone, the city of Port Elizabeth is included. However, as these zones only exist in the Gamtoos sub-catchment, the Baviaanskloof and Kouga sub-catchments are not included. The key environmental, human productive activity, and power relation characteristics are summarised according to findings already presented in previous chapters. This section discusses these interrelationships. Firstly, the extents of the zones are discussed. Secondly, power relations in the final use zone are briefly highlighted. Thirdly, regional relations of access are examined. Finally, competing levels of governance in transforming GIB to a WUA are discussed.

Table 6.3: Spatial framework illustrating the political geoecology of regulated recapture and final use zones

	Environment	Human Productive Activity	Power Relations		
			Access	Control	Use and Management
Gamtoos	Wide, winding floodplain surrounded by low hills Variable, moderate rainfall Mild summers, cold winters Alluvial loam and sandy loam soils Some IAPs Some degradation River water highly saline	Thriving commercial farming industry: citrus, cash crops, and dairy Storage capacity of Kouga Dam: 129 million m³ Water extraction for use from Kouga Dam only Water allocation agriculture: 59.3 million m³ per year	Good physical access: tarred roads Commercial farming important for job provision in the region Numerous shortfalls exist within government that act as barriers to the success of emerging farmers Frequent water restrictions, attributed to PE's water needs Water trading between farmers during restrictions Dependent on water availability from upstream	GIB controls water allocations, cutting off water use if allocation reached DWS makes final decisions regarding restrictions DWS sets legislation regarding governance of irrigation boards Illegal use of Gamtoos River water during restrictions to complement allocation	Positive relationships between municipality and GIB GIB praised for excellent water management and low unaccounted for water Some service provision issues in towns, but not to the extent of in the Kouga Commercial farmers exploit emerging farmers Commercial farmers mentor and assist emerging farmers Markets influence demand and crop choice Standards organisations set criteria, influence management Energy costs result in water saving techniques
Port Elizabeth	Topography allows for inter-basin transfer system from Kouga Dam via Loerie Dam out of the catchment	Industrial sector Domestic sector Water allocation from Kouga Dam: 23 million m³ per year	Dependent on water allocation from Kouga Dam City receives priority in water allocation over agricultural sector in times of drought	No significant relations of control	NMBMM criticised for high levels of water losses and inadequate infrastructure maintenance

6.3.1 Extents of Regulated Recapture and Final Use Zones

Regulated recapture and final use zones overlap in the Gamtoos; neither is found in the upstream sub-catchments. Firstly, the regulated recapture zone encompasses water supplied by the Gamtoos Irrigation Scheme to the agricultural sector in the Gamtoos valley (allocation: 59.3 million m³ per year), and to domestic and industrial sectors in Nelson Mandela Bay Metropolitan Municipality (NMBMM) outside the catchment boundaries (allocation: 23 million m³ per year). The area's topography made the construction of this system possible. In this zone, water is physically separated from the drainage network and has no opportunity to return naturally to the river (Molden *et al.* 2001). Secondly, the final use zone encompasses water contributed to the Gamtoos River by the Groot River and occasional overflow from the Kouga Dam which flows to the sea (Molden *et al.* 2001). High salinity precludes withdrawal from this zone for productive uses.

6.3.2 Power Relations in the Final Use Zone

Power relations in the final use zone are characterised by farmers' illegal extraction of river water to supplement irrigation water during times of drought and water restrictions, as well as farmers' applications to DWA for additional rights to Gamtoos River water on top of their existing rights to Kouga Dam water.

6.3.3 Characteristics of the Regulated Recapture Zone

The thriving, irrigated, commercial citrus, cash crop, and dairy industries in the valley are driven by a combination of suitable topography, good roads, access to labour from local towns, moderate rainfall, the sophisticated irrigation system, and the storage capacity of the Kouga and Loerie dams. Citrus and cash crop farming predominate in the upper valley closer to the Kouga Dam where hills protect citrus from wind damage. In the lower valley adjacent to the sea, dairy farming predominates; lack of protection from wind makes this part of the sub-catchment unsuitable for citrus and proximity to a national road provides the necessary daily access required by dairy farming. This is an example of how the spatial arrangement of human productive activity is shaped by the distribution of resources.

6.3.4 Regional Relations of Access

The most significant power relations in this zone occur at the regional level and are characterised by access issues. These exist, firstly, in an upstream–downstream direction; this zone relies on water received from upstream sub-catchments, particularly the Kouga which

supplies 80% of the Kouga Dam's water. Secondly, and more significantly, they exist between the Gamtoos valley's agricultural sector and the city of PE; urban allocation from the Kouga Dam is frequently prioritised over agricultural allocation.

Upstream–Downstream Power Relations

Upstream–downstream power relations stem from the significant differences in water management and control between the upstream natural recapture zones, and the downstream regulated recapture zone. Specifically, DWA's failure to implement water measurement, licensing, and restrictions upstream contrasts the strict management and control exerted by GIB in the Gamtoos. Interestingly, these regional upstream–downstream power relations are mediated through control (or lack of) at the national level, with minimal direct interactions between local land and water managers in the various sub-catchments. Here, topography, distance, and limited access routes result in operational separation of, and limited contact between, sub-catchments. Consequently, there is a lack of coordination in water management between the areas. Additionally, the interrelationship between geophysical landscape and power relations is evident: topography allows for the existence of the Kouga Dam, which in turn allows for accurate measurement of water, the implementation of licensing, and the ability to accurately control usage. Upstream—where water is pumped directly from rivers—these management functions have not been implemented as it is more difficult and more expensive to do so (although not impossible). The challenges faced in implementing these water management practices in the upstream natural recapture zones reflect similar challenges with DWA faced in other parts of the country as highlighted in numerous other studies (Funke *et al.* 2007b; Jonker 2007; Merrey 2008; Herold 2009; Swatuk 2010; Kemerink *et al.* 2011; Quinn 2012; Schreiner 2013)

Urban Versus Agricultural Priorities

The regional power relation arising more significantly in the results was between two regulated recapture zone user groups: the prioritisation of PE's demand for water over the Gamtoos agricultural sector. The transfer of water out of the catchment creates a 'false downstream' which is a significant user within the system. Thus, it is evident that—similar to the past—interests of dominant social groups (industrialists, companies, and cities) continue to be prioritised (Swatuk 2010: 532). However, whereas white farmers were historically prioritised (Swatuk 2010: 532), the agricultural sector (the majority of which is still comprised of white farmers) no longer seems to be a water allocation priority in the study area.

The link between job provision and water availability arose strongly in the Gamtoos. Thus, the legacy of disadvantaging the vulnerable continues; by restricting water allocation to agriculture, it is the labour force that suffers when jobs need to be cut due to decreased production. As Swatuk (2010: 532) indicated, the black majority were historically, systematically denied access to land and water, thereby restricting their livelihoods. Although water and land are not overtly being denied to the black and coloured majority in the study area, by starving the agricultural sector of the principal means of survival the population is denied access to the principal means of sustaining their livelihoods: employment. This is potentially an argument that the agricultural sector can use to leverage their power to argue against such stringent restrictions in the future.

Prioritising urban water use is another example of the shaping of South Africa's water policies to cope with water scarcity, uneven distribution of resources, and pressures of economic growth (Ashton and Haasbroek 2002: 197). While we saw that this manifested as restrictions against further storage of water in the natural recapture zone, actual usage in that zone is not restricted during times of drought, as it is in the regulated recapture zone of the Gamtoos. An important contrast is that while job losses in the Gamtoos are a direct consequence of DWA's decision-making in times of restrictions, in the upstream sub-catchments, job losses result from a lack of resilience in times of reduced water availability.

While the power struggle is between two regional stakeholders, it is DWA (now DWS) that has the final decision-making power regarding restrictions. This is reminiscent of the 'command and control' approach to water management whereby a central government body unilaterally imposes decisions (Ashton 2000a: 1). It is also an example of the use of central-state power to serve dominant interests (Swatuk 2010), and consistent with the finding by Mirumachi and van Wyk (2010) that the state continues to play a prominent role in decision-making and that other actors (such as business, civil society, and regional institutions) have limited power. This again emphasises the dominant power position obtained by DWA in water management, contrasting DWA's intended role of one characterised by leadership and guidance (Ashton 2000a: 1), as well as contrasting IWRM's decentralisation principle.

These regional power relations are exacerbated by the frustration felt at the high level of water losses and inadequate infrastructure maintenance in NMBMM in direct contrast to the low unaccounted for water under GIB's management. GIB's inability to successfully oppose or

renegotiate restriction decisions on the behalf of Gamtoos farmers points to a relative lack of power of local water management institutions when control is maintained by a national level department.

6.3.5 Transforming GIB into a WUA: Competing Levels of Water Governance

Swatuk (2010) pointed to the use of central-state power to marginalise and oppress the majority of the population. The same central-state power is now being used positively, through policy, to pursue transformation and address inequality. However, despite this strong policy foundation, vulnerable groups continue to be marginalised in many areas (Lévite *et al.* 2003; Funke *et al.* 2007b; Brown 2011, 2013; Kemerink *et al.* 2011, 2013). In the Gamtoos, a barrier to transformation to a WUA was GIB board members' distrust of the perceived agendas on behalf of emerging farmer representatives on the committee working towards transformation. These high levels of distrust are evidence of continuing barriers to achieving equity through the process of creating WUAs. This reflects continued dominance in water governance by (white) commercial farmers with underrepresentation by historically disadvantaged black and coloured individuals, resulting in high-volume water users' (i.e. white commercial farmers') trepidation towards changing power balances within formal water institutions. These were issues also identified by Schreiner and van Koppen (2002: 975), Merrey (2008), and Kemerink *et al.* (2011, 2013). Furthermore, this resistance reflects wariness towards the perceived risks involved with inclusive decision-making and increased interdependence of actors. However, this bolsters Brown's (2011) argument that perhaps increased state intervention is necessary in catchments with high heterogeneity to ensure equity and prevent marginalisation of vulnerable groups.

DWA's attempts to prescribe which voting option should be used under the new WUA in the Gamtoos is another illustration of the reversion back to a command and control approach, and contradicts the ideals of decentralisation. The ability of GIB to resist these changes and draw on legal help emphasises the competing levels of water governance identified by Bourblanc and Blanchon (2014). Other than being subject to decisions made at the national level, GIB largely retains autonomy in water management and is an example of how power is maintained by local level, large-scale, self-managed irrigation schemes that emerged historically in South Africa (Schreiner and van Koppen 2002: 971). These issues are similar to those highlighted by Mirumachi and van Wyk (2010) in the context of promoting stakeholder cooperation. Funke *et al.* (2007b) linked good governance to IWRM's successful implementation; unless the multiple

levels of water governance can be coordinated in the study area, progress towards IWRM is unlikely to be achieved. Thus far, the evidence suggests that IWRM has not been successfully implemented in the study area, despite evidence of isolated ‘IWRM activities’.

6.3.6 Summary

This section illustrated that the regulated recapture zone is characterised primarily by regional power relations, as well as problems associated with ensuring equity and transforming GIB into a WUA. The following section discusses power relations that arose in both the natural and regulated recapture zones.

6.4 Power Relations in Both Natural and Regulated Recapture Zones

Similar relations of power, management, and use of resources arose from national and international levels in the natural and regulated recapture zones. This section first discusses the influence of energy, markets, and standards organisations. Second, it highlights the barriers in government to efficient and effective land and water management. Third, it discusses issues arising in the pursuit of equitable access. Finally, it discusses the enduring supply phase of water management evident in the study area.

6.4.1 Indirect Power: Energy, Markets, and Standards Organisations

In all three sub-catchments, high energy costs forced farmers to pursue more efficient energy practices, which resulted in improved water use efficiency. This is an example of a national level relation shaping resource use. Similarly, national and international markets impact resource use and management through demand. This was most obvious in the Baviaanskloof where market pressure resulted in extensive degradation. Standards organisation are an example of international environmental, labour, and sustainability trends influencing local land and water management practices. Thus, power is not always leveraged directly to shape local level resource use and distribution, but is also manifested through indirect pressure and incentives.

6.4.2 Barriers in Government to Efficient and Effective Land and Water Management

Numerous challenges within government surrounding water management were identified in the literature (Ashton 2000; Allan 2003; Rahaman and Varis 2005; Swatuk 2005, 2008; Funke *et al.* 2007b; Jonker 2007; UN-Water and GWP 2007; Turton 2010b; Schreiner 2013).

Challenges highlighted by the literature that also arose in this case study were widespread financial and human resource capacity constraints; infrastructure problems; poor service delivery; lack of awareness of priorities; lack of political will and accountability in problem solving (evidenced by lack of response to issues reported by both emerging and commercial farmers); lack of experience and technical capability; failure to license and register water use (only done in Gamtoos not in the upstream sub-catchments); and preference to increase supply rather than manage demand (evidenced by pursuit of raising Kouga Dam wall, and removal of IAPs with the aim of increasing system yield). Thus, this case study reinforces the findings of other studies that solutions are needed to the numerous challenges in water management if the ideals of IWRM are to be realised. Importantly, these challenges are felt in all three sub-catchments in the study area, as well as in all zones.

6.4.3 Equitable Access Replaced by ‘Increased Access for Disadvantaged Groups’

Overall, power relations surrounding access were most significant for emerging farmers who face numerous barriers to success. Not only do they struggle to access the skills and resources necessary to compete with established commercial farmers, but government departments do not have the capacity to provide the level and type of support needed by emerging farmers. Unless government is able to rectify the numerous internal challenges and power issues within and between departments, transformation is unlikely to be achieved in water and land management as emerging farmers will continue to bear the brunt of government’s failures.

In the case study, the political, social, and economic reality of access to water remains skewed along racial lines, dominated by the actors and long-established institutional frameworks of the past (Brown 2011, 2013; Kemerink *et al.* 2011). Other studies have shown that water reform has failed to fully address apartheid’s legacy of inequality (Ashton and Haasbroek 2002: 191; Funke *et al.* 2007a: 12). The extent to which this has been achieved in the study area is mixed. While some emerging farmers have successfully applied for and received land and water, they are unable to fully utilise these resources as they do not have the necessary financial resources, practical knowledge base, or assets. The government’s slow implementation of processes and lack of adequate support leaves emerging farmers dependent on commercial farmers for mentoring and assistance, making them vulnerable to exploitation. Furthermore, the structurally entrenched racial inequalities that render low self-esteem and inhibit the ability of emerging farmers to challenge issues and claim their rights (Kemerink *et al.* 2011: 593) are evident in the example of the small-scale, emerging farmer who faced numerous barriers in

government to registering his land in his name, instead of his deceased great-grandfather's name. It could be argued that the IWRM goal of true equitable access is instead replaced by a goal of 'increased access for disadvantaged groups'. While commercial farmers are also impacted by shortfalls in government processes, their relative positions of power, wealth, and access to financial and other assets provides them with a resilience that is not experienced by emerging farmers. Consequently, previously disadvantaged black and coloured groups remain dependent on opportunities, employment, and support from more powerful groups in society (i.e. white commercial farmers, companies, and government).

6.4.4 Enduring Supply Phase of Water Management

Plans to raise the Kouga Dam alongside the prevailing viewpoint that PE needs to enhance supply through relying more heavily on sources other than the Kouga Dam (including inter-basin transfers from other catchments) reflects that the hydraulic mission and supply phase approach to water management is still actively pursued in the study area (Turton 1999; Ashton and Haasbroek 2002: 197). As seen previously, Ashton and Haasbroek (2002) argue that South Africa transitioned from a supply phase to an end-user efficiency phase. However, a significant paradox emerges in this case study whereby the supply phase approach is seemingly deemed acceptable for enhancing supply to the urban sector, yet the agricultural sector is subject to a demand management approach. This is evidenced by restrictions on building dams in the natural recapture zone, and regular usage restrictions in the regulated recapture zone. Additionally, while the private, agricultural sector seems to have achieved end-user efficiency, government has struggled to successfully implement demand management and end-user efficiency in urban areas, as evidenced by high levels of water losses through the supply system and ineffective restriction procedures. The following section examines the spatial interrelationship between resource distribution and power issues in the ecologically sensitive zone.

6.5 Political Geocology of the Ecologically Sensitive Zone

As both an ecologically sensitive zone and source zone, the BMR is subject to the power relations identified in Section 6.1. While no power relations arose explicitly surrounding wetlands, the ecological reserve, and the estuary, potential power relations could exist between environmental groups, those responsible for maintaining river health, and those extracting water from the system. The protection of river ecosystems is an important component of

IWRM, and is prioritised through the NWA as the 'Ecological Reserve'. Of particular concern is the lack of high quality water contributed to the Gamtoos River on a regular basis, possibly in breach of instream flow requirements. This echoes Schreiner's (2013: 240) assertion that despite successfully determining requirements for the protection of aquatic ecosystems, the NWA has failed to adequately implement protection measures. Other than interest in river restoration in the Baviaanskloof through Living Lands and removal of IAPs in the Kouga and Gamtoos through WfW, no themes arose relating to the protection of river ecosystems. It could be argued that the environmental reserve is marginalised in the study area, despite the legislated need to prioritise it. It is important to note that this responsibility lies with DWA (now DWS) as custodian of water (Ashton 2000a: 1; Schreiner and Van Koppen 2002: 969). Active intervention of the department was witnessed in the case study, but only where quantity of water was threatened (for example, illegal pumping from the Gamtoos River and rumoured bottling of mineral water in the Kouga) but not where quality of the system was threatened (for example, illegally modifying a river's channel in the Kouga). This points to water availability being prioritised in the study area over other aspects of water management, confirming Schreiner's (2013) observation that where reform does occur, a sectoral view of water management is often taken, narrowly focussing on one aspect. Even the only example of an IWRM activity, WfW's restoration and IAP clearance, was pursued with the goal of increasing yield downstream. Thus, other IWRM concerns such as social welfare are only pursued where they can contribute to other priorities simultaneously.

6.6 Evaluating the Political Geoecology Approach

This study aimed to further develop political geoecology (proposed by Rowntree 2008) as an approach for examining human–environment relations in geography, by its application to a case study of land and water management in the Gamtoos River catchment and its sub-catchments. Research Question 4 asked “To what extent does the political geoecology approach taken in this study explain the spatial interrelationships between physical resources and power relations over those resources in the Gamtoos catchment?” This section evaluates the political geoecology approach, firstly, as applied in this case study, secondly, to the context of land and water management, and thirdly, to the discipline of geography more broadly, therefore answering Research Question 4 and addressing Objective 4a.

6.6.1 Political Geoecology in This Case Study

This case study illustrated how the interrelationships between the landscape system's biotic and abiotic components and human productive activities produce unique characteristics of power relations in each of the zones. This has ramifications for how resources are accessed, used, controlled, and managed. Some power relations have a spatial manifestation, such as upstream–downstream relations and relations between agricultural water users in the catchment and the urban sector outside the catchment boundaries. Additionally, power relations are not only manifested differently across space, but are also manifested across different levels. Thus, this case study has presented a number of examples that illustrate that the geophysical distribution of resources shapes management and power relations, and simultaneously power relations and management shape physical distribution of resources. To do this, it undertook two theoretical stances to political geoecology, namely, structuralist and post-structuralist approaches.

Structural Political Geoecology

Under a structuralist approach, the case study contextualised local level productive activity within the broader historical, political, economic, and environmental context in a similar fashion to a chains-of explanation approach (Robbins and Bishop 2008; Rangan and Kull 2009). This was done in three main ways. Firstly, relations of access and control over resources were directly dealt with. Access issues occur in three main directions, (i) downstream users are subject to upstream activities, (ii) agricultural and urban sectors compete for limited water, and (iii) access to resources remains skewed along racial lines. Relations of control are primarily characterised by competing levels of governance. Through time, control over land and water resources has occurred on multiple levels. In areas with no local formal water management institutions, water resources are managed at an individual, local, farm level, or cooperatively by multiple farmers working together towards infrastructure installation and maintenance. Local level water management also occurs through multiple irrigation boards that exist in the area. ECP exerts control over land resources through the BMR at the regional level. At the national level, DWA gets involved both with individual farmers in areas with no irrigation board, as well as mediating their power through irrigation boards. As Ashton (2000a: 6) indicates, local authorities are expected to address local and regional issues and to take responsibility for local decisions, however, these local authorities do not exist in all places in the study area, placing the burden of responsibility for implementation upon DWA (now DWS). These competing levels of governance and control often result in power struggles.

Secondly, the case study employed a structural approach by dealing with shifting power balances between classes and groups within society, for example, between (i) urban and agricultural sectors, (ii) white commercial farmers and previously disadvantaged black and coloured communities, (iii) farming and conservation interests, (iv) emerging farmers and commercial farmers, (v) emerging farmers and government, and (vi) DWA and irrigation boards. Thirdly, the impact of external influences on those directly involved in land and water management was illustrated, for example, through (i) energy prices, (ii) national and international markets, (iii) standards organisations, (iv) regional and international conservation interests.

Post-Structural Political Geocology

The case study engaged a post-structural approach in two main ways. Firstly, it focussed on local level stakeholders' subjective representations of their day-to-day experiences of power struggles around land and water management. The power relations presented in the findings were therefore from the viewpoints of local level land and water managers. This was useful as it provided a description of the actual issues and struggles faced by those who use and manage resources on a daily basis. Secondly, and to a lesser extent, the reproduction of restoration and conservation discourse to influence local resource management activities was briefly highlighted.

Limitations of the Research

This section examines the limitations of the research, specifically it critically reflects on data collection, sampling strategy, marginalisation of the Groot sub-catchment, currency of the study and the degree to which results are location specific. These limitations were taken into account during the research process.

Limitations of Semi-Structured Interviews

The interview process had some limitations that could potentially impact the accuracy and validity of findings. Firstly, some participants were wary of the interview process, 'prickly' when asked about certain issues, and reluctant to expand on answers. Secondly, recording the interviews may have prevented the expression of true opinions (Robinson 1998: 416). Indeed, participants occasionally asked to go 'off the record' or declined to comment, furtively glancing at the recording device. Thirdly, overt questions about power and conflict were only asked to relaxed and open participants when appropriate, thus most participants were not asked

directly about power issues. While this approach successfully discerned power issues, overtly asking questions about experiences with conflict, cooperation, or power struggles might have yielded more explicit findings.

Limitations of Survey Questionnaires

Robinson (1998: 384) identifies a number of potential questionnaire design flaws. The questionnaire can be found in Appendix 4.2. When designing the questionnaire, flaws arising during the pilot study were taken into account and questions were adapted accordingly. However, some flaws only became apparent during data collection or analysis. Firstly, imprecise phrasing impacts whether results reflect the intended question meaning as opposed to the participant's interpretation (questions 2, 3a, 4a, 5). For example, Question 2 asked the extent to which participants agreed that there was a need for stakeholders to work together; many participants disagreed because they felt it was happening already, not because they were against collaboration. Similarly, Question 5 was intended to focus on the importance of sustainability, but due to phrasing, replicated Question 2. Additionally, questions 3a and 4a asked participants if they "knew of" the National Water Act and the water reform process respectively; phrasing did not differentiate between those who simply knew it existed and those who were familiar with its detail.

A second flaw is duplication of questions, for example, questions 2 and 5. Third, use of technical vocabulary can hamper participants' interpretation of questions; adding complexity in this case study, the majority of the participants were second language English speakers. Other flaws relating to questionnaire design identified by Robinson (1998: 385, 390) include inappropriate question style, lack of logical sequence, complex questions, lack of user-friendliness in a field environment, questionnaire length, and single questions dealing with sensitive topics. Another limitation in questionnaire surveys occurred when participants gave incomplete, vague or open-ended answers. Where possible, answers were inferred from their response, aided by listening to the interview recording during data processing. Alternatively, the answer was recorded as 'not answered'.

Limitations of the Sampling Strategy

The sampling process also potentially impacts findings. In this study, the number of participants interviewed was constrained by: restrictions placed by PRESENCE on who could be contacted, limited time available to stay in the Baviaanskloof and Kouga sub-catchments,

and the time-consuming nature of transcription. Selecting a larger sample from these two sub-catchments may have yielded a more complete understanding of struggles, allowed for inclusion of viewpoints from stakeholders at multiple levels, and reduced local level bias. Particularly, the blocked access to emerging farmers in the Kouga resulted in a dearth of data from this important perspective, marginalising these voices. Bias was also potentially introduced the snowball and purposive sampling methods.

Marginalisation of the Groot Sub-Catchment

The exclusion of the Groot sub-catchment is a power relation in itself. The Groot belongs to the same water management area (WMA) and will therefore be managed alongside the study area under the Mzimvubu–Tsitsikamma Catchment Management Agency (CMA). As part of the system, one cannot truly talk about coordinated, integrated, and equitable water management without considering the positions of stakeholders in the Groot. Furthermore, resource management processes in this area impact the quality of the ecological reserve in the final use zone of the Gamtoos River, an aspect that has also been marginalised within this study. The exclusion of the Groot sub-catchment thus illustrates how research has the power to marginalise an entire area.

Currency of the Study

As the field research was conducted in 2012, some of the findings could be outdated. However, the study does provide a snapshot of the types of power relations and challenges that existed at that point in time. Additionally, given that the findings replicated those in a number of other studies, it is likely that valuable lessons can still be learnt from the findings of this case study.

Degree to Which Results Are Location Specific

As a case study, many of the findings are specific to this catchment. However, the findings do shed light on the types of power relations existing at local, regional, national, and international levels. This provides insight into the types of issues that may arise from land and water management in a catchment, highlighting the need for management approaches that take into account these varying levels, types, and degrees of influence.

Summary

Despite these limitations, the political geoecology approach explained the spatial interrelationships between physical resources and power relations over those resources in the Gamtoos catchment. Space was taken into account through the use of maps as well as the spatial frameworks used in this chapter to identify the different areas where different characteristics and power relations are manifested. Thus, the political geoecology approach provided a lens through which to simultaneously examine the interrelationships between resource distribution, human productive activity, power relations over resources, and how these shape the ability of the landscape system to provide goods and services to those depending on them. This is in line with Rowntree's (2008) vision for political geoecology. Importantly, through the application of zonation concepts, the political geoecology approach undertaken in this case study successfully takes into account "the spatial connectivity within the geographic unit of study" (Rowntree 2008: 6). Additionally, political geoecology improved the understanding of the complex socio-ecological systems and associated power relations in the study area by spatially contextualising them (Rowntree 2008: 6). The following section contextualises political geoecology as an approach for studying land and water management.

6.6.2 Political Geoecology as an Approach for Studying Land and Water Management

By applying the political geoecology approach to the case study of the Gamtoos catchment, numerous relations of power within land and water management were elucidated and contextualised within broader processes. Additionally, the findings supported assertions made in literature about land and water management. Thus, the case study example illustrated how "water systems are not only shaped by, but also themselves shape and reinforce, social-political, and economic relations" (Kemerink *et al.* 2011: 593). As Bourblanc and Blanchon (2014: 2390) pointed out, vested interests result in numerous structural effects on South Africa's waterscape. This is evidenced by the variety of controls that the waterscape has been subjected to, from the strong encouragement for building of storage dams during apartheid, to the complete restriction of building such storage currently in place. Additionally, the case study has illustrated that water resources are manipulated to political ends, with urban use being prioritised over the agricultural sector, and users attempting to use equity issues as leverage to serve their own interests (such as increasing storage capacity). The case study has also highlighted numerous issues relating to ensuring equity through water management, as well as the enduring supply phase of water management witnessed in the study area.

Through the use of geomorphological (Schumm 1977) and water management (Molden *et al.* 2001) zonation concepts, the political geocology approach is tailored specifically to the study of water management. Additionally, concepts of ‘ecology’ are not dealt with in a purist fashion, with little focus on organisms and ecosystems (Chapman and Reiss 1999; Marten 2001). Rather, ecology in this study was engaged in the sense of studying the relationships between humans and their environment (as in human ecology) (Marten 2001). Of importance in this study was the focus on water systems. As such, perhaps a more suitable label for this approach that is tailored specifically to the study of water would be ‘political geo-hydrology’. However, by maintaining the label of political geocology, the potential for application to various other types of human–environment relations is upheld. This is discussed in the following section.

6.6.3 Political Geocology as an Approach for Studying Human–Environment Relations

While this case study has applied political geocology specifically to a water management context, political geocology is a flexible, adaptable approach that is not limited to water management studies and can be used to investigate any human–environment relations, taking into account the ‘political’, the ‘biophysical’, and the ‘geophysical’. In this study, catchment zonation concepts were used to provide the spatial framework, however, under the political geocology approach it is not necessary to apply catchment zonation concepts specifically. The approach can be employed to different contexts, adopting a suitable spatial framework from the wider discipline and adapting it to suit the specific needs of the study in question. Alternatively, a spatial framework could be created based on the needs of the particular study through the choice of an appropriate geographical unit of study. Here, the spatial frameworks used in this chapter (Tables 6.1–6.3) are useful. In this study they illustrated the different characteristics in each of the sub-catchments as well as how areas with different characteristics produce different relations of access, control, use, and management. The spatial unit used in the tables were therefore the sub-catchments. However, these could be replaced with a different geographical unit, for example, suburbs in a city, or different components within a landscape system (e.g. hillslope, wetlands, floodplain, and river).

Thus, political geocology has potential as a methodological approach, analytical framework, or explanatory tool. Additionally, with further development it has potential as a teaching tool to spatially explain the mutually causal interrelationships between resources, human activity, and power.

Potential limitations of political geoecology include, firstly, the overlap with political ecology. However, with many political ecology studies currently lacking an explicitly spatial focus, despite the field's centrality to the discipline of geography, by adding the 'geo' aspect and prioritising spatial concerns, political geoecology offers an explicitly spatial alternative to political ecology, adding new thought, direction, and innovation to the field. Secondly, the complexity of taking into account so many different factors under political geoecology could result in a diluted overview rather than in-depth findings of the specific issues in the area. It is important to recognise this limitation when choosing to utilise this approach. While the approach is useful for providing an overview of the interrelationships in an area, it would need some adjustment to provide more depth. Thirdly, the Gamtoos is a relatively small catchment and even within this only the most significant results and factors were included in the research to prevent the size of the study from becoming too extensive. Applying political geoecology to larger catchments or larger geographical areas could potentially increase the complexity and size of the study to the point that it would be unviable. In this context, the use of transcribed semi-structured interviews (as used in this study) would not be an appropriate method. However, the application of political geoecology is not limited to the methods used in this particular study; methods can be adapted to suit the specific context. With careful planning and ensuring the goals of a political geoecology study are thoroughly thought-out from the outset, these types of issues could be avoided.

6.7 Summary of Chapter

This chapter has provided a discussion of the findings and placed this within the context of the literature. It has done this through addressing Research Question 3. Findings were discussed according to the zones delineated in Chapter 3, namely, source zone, natural recapture zone, regulated recapture and final use zones, and the ecologically sensitive zone. Finally, the approach taken in this study was evaluated, thus addressing Research Question 4 and the aim of this thesis. The limitations of the research were also discussed. The following chapter highlights the conclusions of the study and makes recommendations for land and water management as well as future research.

Chapter 7: Conclusions and Recommendations

7.1 Research Goals

The aim of this research was to further develop political geocology as an approach for examining human–environment relations in geography through applying the approach to investigate land and water management in the Gamtoos River catchment and its sub-catchments. Four research questions were identified in Chapter 1 to achieve this aim, and are detailed again below in Table 7.1.

Table 7.1: The research questions and objectives of this study

Research Question 1	What is the spatial distribution of land and water resources and human influences on the landscape in the Gamtoos catchment?
Objective 1a	To map the spatial distribution of selected land and water resources.
Objective 1b	To identify human influences on the physical landscape through mapping of selected factors relating to human–environment interactions (such as land use).
Objective 1c	To delineate the catchment into zones to facilitate spatial analysis.
Research Question 2	What are the power relations between stakeholders regarding management of land and water resources in the catchment?
Objective 2a	To identify stakeholders at local, regional, national, and international levels.
Objective 2b	To identify issues surrounding access to, control, use, and management of land and water resources in the catchment on multiple levels.
Objective 2c	To identify the extent to which power relations operate in an upstream–downstream direction in the Gamtoos catchment.
Research Question 3	What are the interrelationships between the spatial distribution of land and water resources and power relations in the area?
Objective 3a	To spatially interpret resource distribution, human productive activity, and power relations according to zones in the catchment.
Objective 3b	To describe the interrelationship between the biotic and abiotic landscape components and power on multiple levels.
Objective 3c	To analyse how the environment shapes power relations and how power relations in turn shape the environment.
Research Question 4	To what extent does the political geocology approach taken in this study explain the spatial interrelationships between physical resources and power relations over those resources in the Gamtoos catchment?
Objective 4a	To critically evaluate the value of the political geocology approach in the context of land and water management, and to the discipline of geography more broadly.

As these research goals build on each other, conclusions are not presented according to research questions and objectives, but rather according to three themes. Thus, conclusions are presented relating to (i) the spatial interrelationships between resources, human productive activity, and power relations in the Gamtoos catchment (i.e. the political geoecology of the catchment), (ii) land and water management in the catchment specifically, and South Africa more broadly, and (iii) the value of political geoecology as an approach for examining human–environment relations in geography. While some conclusions are evident for more than one of these themes, they are only presented once in the place deemed most suitable.

7.2 Conclusions

7.2.1 Political Geoecology of the Gamtoos Catchment

- Topography is the key determinant of spatial interrelationships between factors in the catchment, influencing rainfall distribution, ease of access, degree of insularity, type of human productive activity (commercial irrigated agriculture versus conservation).
- At the catchment scale, changes in structure and function across the landscape produced changes in human productive activity across space, with different productive activities characterising each of the three sub-catchments. Insularity, water scarcity, limited access, and low rainfall combine, resulting in a focus on conservation and restoration in the Baviaanskloof, alongside marginal agriculture and livestock grazing. Contrasting this, thriving commercial farming industries exist in the Kouga and Gamtoos, focussing on deciduous fruits and citrus respectively. These are made possible by a combination of higher rainfall, good access, and adequate water storage capacity.
- At the sub-catchment scale, similar patterns could be found in the Gamtoos sub-catchment; citrus and cash crops are produced in the upper and middle sections of the valley where hills block wind, while the lower section of the valley adjacent to the coast is dominated by dairy farming, aided by the close proximity to a national road for daily access.
- The Kouga illustrates the implications of the geophysical structure of the landscape for water management, with management coordinated by local irrigation boards in each of the tributary sub-catchments.
- The spatiality of power relations was evident in the Gamtoos catchment. Physical factors and human productive activities combine in different areas to produce different zones; each zone was dominated by differing power relations.

- Power relations in the source zone were driven by regional, national, and international conservation interests. These were much more evident in the Baviaanskloof than the other two sub-catchments, likely as a result of its marginality and thus increased local interest in alternative land uses.
- Power relations in the marginal agriculture and water scarcity context of the natural recapture zone in the Baviaanskloof were characterised by:
 - localised power struggles over infrastructure maintenance and allocation concerns;
 - upstream–downstream relations resulting from reduced water availability towards the bottom of the sub-catchment; and
 - a lack of opportunities for improving livelihoods.
- Power relations in the thriving commercial irrigated agriculture context of the natural recapture zone in the Kouga were characterised by:
 - positive local relations over water in tributary sub-catchments with irrigation boards, with the only example of (legal) conflict emerging in a sub-catchment without an irrigation board;
 - municipalities failing to provide adequate water and sanitation services to towns, so irrigation boards end up performing these functions; and
 - shifting socio-political priorities through time in response to geophysical reality of water scarcity shaped water resources in different ways, initially encouraging storage and later restricting it.
- Water governance is separated in the natural and regulated recapture zones in the Gamtoos sub-catchment; Gamtoos Irrigation Board (GIB) controls water from the Kouga Dam, DWA (now DWS) controls water in the tributary sub-catchments.
- Power relations in the regulated recapture zone of the Gamtoos sub-catchment were characterised by regional power relations:
 - Department of Water Affairs' (DWA's) prioritisation of NMBMM's demand for water over the Gamtoos agricultural sector creating a 'false downstream' that significantly impacts farming and job provision in the valley;
 - reliance of regulated recapture zone water users on water received from upstream sub-catchments;

- GIB's strict water management contrasts poor implementation of functions upstream (lack of measurement and licensing by DWA) and in the city of PE (poor infrastructure maintenance and high water losses by NMBMM);
 - GIB's strict management is made possible by the geophysical landscape allowing for the existence of the Kouga Dam whereas these functions are not as easy upstream where water is extracted directly from rivers; and
 - minimal direct interactions between local land and water managers in upstream and downstream sub-catchments due to separation by topography, distance, and limited access routes.
- Power relations in the final use zone (in the Gamtoos sub-catchment) are characterised by farmers' illegal extraction of river water to supplement irrigation water during times of drought and water restrictions, as well as farmers' applications to DWA for additional rights to Gamtoos River water on top of their existing rights to Kouga Dam water.
 - In the ecologically sensitive zone, government interest in protecting water resources was linked to the goal of increasing water supply (for example, through IAP clearance or restoration), leading to questions regarding the motivations of government when activities promoting the protection of resources are carried out.
 - A number of similarities arose between the Kouga's natural recapture zone and the Gamtoos' regulated recapture zone, illustrating that similar characteristics can arise in different zones. Both zones were characterised by thriving commercial farming industries. Power relations that can be generalised to both these zones included:
 - exploitation of emerging farmers by commercial farmers;
 - assistance and mentoring provided by commercial farmers to emerging farmers;
 - power disparities in BEE programmes along racial lines including limited power of beneficiaries in decision-making, questions around how much true empowerment occurs, retained power by white managers replicating the farmer–worker relationship;
 - relationships between government and irrigation boards;
 - emerging farmers disadvantaged through government shortfalls;
 - markets and standards organisations influencing resource management practices; and

- a link between water availability and job provision highlighting the significant impact of geophysical realities on local, rural livelihoods.
- Patterns also emerged in the spatiality of the levels of socio-economic organisation.
 - Local level power relations tended to be more dominant in insular areas (e.g. the Baviaanskloof).
 - Negative local level power relations tended to be more dominant in areas with no formal water management institutions (e.g. the Baviaanskloof and sub-catchments in the Kouga). Positive local level power relations characterised areas with irrigation boards. This points to the importance of formalising water management.
 - Regional level power relations were more significant in the Gamtoos where water availability is not only determined by upstream use, but where farmers are also subject to restrictions from the 'false' downstream in the form of the allocation transferred out of the catchment to NMBMM.
 - National and international power relations can be generalised to other areas, that is, they are not location specific. For example, relations between farmers (both commercial and emerging) and government, or the influence of standards organisations on farming practices.
 - International level power relations were more prominent in the Baviaanskloof and source zone as a result of the higher focus on conservation among landowners than the other sub-catchments where the focus was on profit from farming.

7.2.2 Land and Water Management in the Gamtoos Catchment and South Africa

- The Baviaanskloof is a valuable example of how local actors can avoid conflict over limited resources by cooperatively pursuing mutually beneficial solutions to issues.
- Competing levels of water governance: There is a lack of coordination of water and land management between the Baviaanskloof, Kouga, and Gamtoos sub-catchments, with functions being implemented separately in each of the areas at different levels of water governance (individual local users, irrigation boards, and DWA). Water management is simultaneously uncoordinated and decentralised to the lowest possible management unit.
- Instead of embodying the role of leadership and guidance, DWA (now DWS) maintains a dominant power position, retaining decision-making power over certain water management decisions, such as those surrounding water restrictions, water storage capacity enhancement, and which WUA model should be implemented during transformation. This contrasts the IWRM principle of decentralisation. Furthermore, local authorities do not

exist in all areas, placing the burden on DWA (now DWS) to address local and regional issues and to take responsibility for local decisions.

- Local water management institutions have a relative lack of power and are subject to DWA's (now DWS) decisions.
- Simultaneously, DWA's (now DWS) intervention is important in protecting the rights of vulnerable population groups.
- Lack of ability to increase water storage capacity in upstream areas reduces resilience of the agricultural sector in times of drought.
- An important consequence of DWA's (now DWS) decision-making is the loss of jobs in the agricultural sector during droughts, significantly impacting local livelihoods of vulnerable communities.
- Although water and land is not overtly denied to the black and coloured majority in the study area, DWA's (now DWS) decisions surrounding restrictions in times of drought indirectly denies the population access to the principal means of sustaining their livelihoods: employment in the agricultural sector.
- Inequality in water management is not being addressed efficiently or effectively through current processes, despite the strong policy foundation for redress.
- Ensuring equity faces challenges of distrust between racial groups in society, relative lack of power and access to financial resources, knowledge, and skills of previously disadvantaged racial groups to successfully compete against commercial farmers, shortfalls within government exacerbating the challenges faced by emerging farmers.
- Transformations in water management (establishment of WUAs) face numerous challenges that inhibit and significantly stall the process, reflecting confusion surrounding the implementation of IWRM through the NWA as well as a lack of communication surrounding the purpose, roles, benefits, and need for new institutions and how transformation can benefit existing institutions.
- A paradox exists between the IWRM ideal of decentralisation, and the move towards increased integration evidenced by the resistance to creating new WUA institutions with different jurisdictional boundaries to previous institutions (irrigation boards).
- The need for decentralised water management at a local level is emphasised by the inadequate knowledge of local situations when DWA (now DWS) implements decisions from the national level.

- Local municipalities frequently fail to provide water and sanitation services in small towns. Black and coloured communities are most affected by this, again pointing to enduring inequities along racial lines.
- Water resources are manipulated to political ends, with urban use being prioritised over the agricultural sector, and local stakeholders attempting to use equity issues as leverage to serve their own interests (such as increasing storage capacity).
- Land and water management is also influenced by external influences in the form of energy prices, national and international markets, standards organisations, and regional and international conservation interests.

7.2.3 The Value of Political Geoecology

- The political geoecology approach taken in this study illustrated how the interrelationships between the landscape system's biotic and abiotic components and human productive activities produce unique characteristics of power relations in each of the zones.
- This was able to provide insight into how resources are accessed, used, controlled, and managed both in the study area and in South Africa.
- Furthermore, political geoecology has the potential to provide insight into power relations occurring at multiple levels of socio-economic organisation.
- Political geoecology provides an explicitly spatial alternative to political ecology, taking into account the 'political', the 'biophysical', and the 'geophysical'.
- The approach is flexible and adaptable and has potential application to studies investigating any human–environment relations, not just water management.

7.3 Recommendations

Based on the conclusions, this sections makes recommendations for future research, as well as for land and water management practice in the catchment specifically, and South Africa more generally.

7.3.1 Recommendations for Land and Water Management

- In those rural areas where local water management institutions (i.e. irrigation boards) are already successfully providing water and sanitation services that local municipalities have failed to implement, management models are needed that enhance, not disrupt, the status quo. Cooperative solutions between municipalities and irrigation boards would be worth

investigating as a viable solution in situations where municipalities do not have the capacity to take over these functions.

- The WUA transformation process needs to ensure that existing local institutions are not unnecessarily fiscally or otherwise disadvantaged by the change, for example, the tax associated with transferring assets to the newly created institution.
- For fair and equitable water management to exist in the study area, DWS needs to prioritise water measurement and licensing in upstream areas, similar to the downstream Gamtoos.
- Potential for competing levels of governance arises with the establishment of the Mzimvubu–Tsitsikamma CMA. Efforts need to be made to work alongside and find cooperative solutions to problems, rather than displacing existing power structures in the area. This also applies to the transformation of WUAs in the area. The slow process of transformation takes away from more important water management functions.
- Both equity and social welfare are important under IWRM. Mechanisms are needed to ensure BEE programme beneficiaries are not exploited, and to stimulate true empowerment. An example would be the establishment of monitoring groups.
- Mechanisms are needed to assist emerging farmers to access the financial capital needed to set up a successful commercial farming operation.
- There is a need for mechanisms to be built into policy to guide process implementation and clarify jurisdiction when social and ecological boundaries are misaligned.
- Decision-makers need to take into account the impacts on rural livelihoods of decisions to implement water restrictions to the agricultural sector.
- There is a need to establish local water management institutions in those areas that currently do not have one. This is evidenced by the fact that areas with formal governance at the local level reported fewer local power issues and higher levels of cooperation. However, within this framework it is important to ensure that more powerful local stakeholders do not exploit less powerful local stakeholders.
- Mechanisms need to be developed to achieve true equitable access to resources rather than simply increasing the access of previously disadvantaged groups without attaining true equitability.
- In conservation and restoration initiatives, there is a need to ensure that environmental concerns are not prioritised to the detriment of vulnerable social groups.
- With water management institutions existing on local, regional, and national levels, there is a need to align management functions to minimise competing levels of governance.

- There is a need for researchers need to be reflective in their use of discourse when it impacts actual management on the ground. Additionally, researchers need to make more of an effort to ensure that the participatory approach does not marginalise vulnerable communities, and that benefits accrue equally to all societal and racial groups.

7.3.2 Recommendations for Future Research

- Research participants are an essential part of the research process, as such, researchers need to make more of an effort to give feedback to stakeholders, especially emerging farmers and disadvantaged groups. This is particularly important in the study area where emerging farmers highlighted lack of feedback as a problem with participating in research.
- Research is needed into the economic and social impacts on local livelihoods of reduced water availability through droughts and water restrictions, as well as how resilience can be increased in these times.
- As climate change will potentially exacerbate droughts and pressure from the urban sector for water, research is needed into mechanisms for building resilience of the agricultural sector to protect both farmers and their employees from negative impacts.
- With the establishment of the Mzimvubu–Tsitsikamma CMA, there is potential for research to investigate the changing power relations and multiple levels of governance in the area.
- Thorough investigation is needed of the problems faced by emerging farmers as well as ways to increase their resilience and immunity to the shortfalls in government.
- The spatial framework used in this study was based on the zonation concepts promoted by Schumm (1977) and Molden *et al.* (2001). While these were adequate for the purposes of this study, there is potential for a spatial framework to be developed specific to political geoecology. This would improve the application and utility of the approach.
- Further case studies to determine the utility and viability of political geoecology and to further refine the concept are needed, for example, through a comparative study applying the framework to multiple catchments.
- The potential of the political geoecology approach as a teaching and explanatory tool could be investigated through further research.
- There is potential for a spatial framework specific to political geoecology to be developed that can be used across all types of studies and not limited to a water management context.

Appendices

Appendix 4.1: Interview Question Schedule

Appendix 4.1 collates the semi-structured interview questions as sourced from the transcriptions. Questions are grouped according to the broad theme into which they fit; some questions may fit into more than one theme but have only been represented once.

Access to Land and Water Resources

These questions were intended to elicit information about issues surrounding access to land and water resources.

Access and equity: Emerging farmers

- Are there any emerging farmers in this area?
- Are there any emerging farmers doing dairy/citrus farming?
- Could you tell me more about the efforts to increase the number of emerging farmers?
- Is there an Emerging Farmers Forum here?
- And how often does the Emerging Farmers Forum meet?
- And how many farmers are part of Emerging Farmers Forum?
- Who is 'us'?
- So you're managing it for the whole family?

Access and equity: Interrelationships between commercial and emerging farmers

- Who do you hire from?
- So how does that work, you hire the land and farm it?
- Then the ground that they rent out, do farmers then they farm that land and use that water, or do they just use that water on their own?
- Did you then pull out because of that?
- Are the emerging dairy farmers mentored?
- Are the emerging farmers contributing to the irrigation board?
- Are emerging farmers getting assistance from commercial farmers?
- So did your farm have a big role in helping set them up?
- And what about mentoring programmes where the emerging farmers can learn from commercial farmers?
- So then how does your partnership with this farmer work then? So you still farm your own land? But he will offer you resources?
- Would you say there's a good relationship there?
- How did you meet him in particular and get into a partnership with him?
- And why did that go sour?
- So you say you and other emerging farmers are largely dependent on the commercial farmers and whether they are willing to help you or not?

Access and equity: Interrelationships between emerging farmers and government

- Is it government-owned land?
- So you went to the government with the papers and everything that your great- great- grandfather had owned land?
- So then how does the process work, when they give you the farm, is it then yours completely?
- How good is the government about coming through with what they promise?
- And how many times have they changed since you started dealing with them?
- Would you say that not being able to talk to the same person is a problem with getting things done? The high turnover rate?

- Have you ever received any of the money?
- Would you say that's the main difference between applying through your great-grandfather for the land, and those emerging farmers who have just applied for land? Is the difference that when they get the land it's not theirs?
- Does that mean because the government owns the land, and not the people farming it, that it makes it harder for them to borrow money?
- Would you say that these services are needed then to help the emerging farmers? The people who don't have the experience and whose fathers haven't been farming so can't teach them?
- So they did send you on courses?
- And are they useful?
- Did that happen to you?
- So they haven't been able to sort out your title deeds up until now?
- And then what will be different once they're able to give you the title deeds, what will you be able to do that you can't do now?
- Saying that you're allowed to farm?
- Because they were told to by the apartheid government?
- Otherwise, you put money into it and then they take it away?
- They don't come back?

Access and equity: Commercial farmers' perceptions of emerging farmers

- And would you say they are successful?
- Are they learning and starting to do it on their own more?
- And paying their rates?
- How do they get an income [if they are not actively farming]?
- So it takes a while to start to get a regular profit?
- What would you say the biggest challenges faced by emerging farmers, like with the farm you're hiring, what are the biggest challenges they face?
- How do emerging farmers that aren't affiliated with commercial farmers, how do they do?
- So they've got no support?
- So then would you say that the main problems you face are that it is difficult to be a small scale farmer with no resources to draw on?

Access and equity: Black economic empowerment (BEE) programmes

- Could you tell me more about the relationship between the Black Economic Empowerment (BEE) farm that you manage and the other farmers in this area?
- How does that work?
- Can you tell me what the importance of having an Emerging Farmers' Trust is?
- As shareholders do they have an option if they would like to try to go run that?
- Do you think there is a need for more farmers to get into more empowerment programmes?
- Do the shareholders work on the farm?

Access and equity: Farm workers

- How many workers do you employ? Permanent? Temporary?
- Does that also impact the number of workers you can employ that year?
- Where do your farm workers live?
- And are they South African or do you also employ foreign workers?
- If people are working, how are they on the social grant system?
- So it's relatively low labour intensive running a dairy farm then?
- Okay, you try to keep permanent labour?
- Is that just because people need work?
- And those families have been living there for years?
- Are there alcohol problems with workers?
- And are the other workers okay with you employing people from outside the country?

Access and water governance: Water rights

- How do your water rights work, are they on your land?
- How are the water rights in this area distributed?
- Were there a lot of conflicts in the past that led to everyone getting water rights?

- Is that also signed in water rights?
- And when you hire land, does that come with the water rights?
- So when you got the land it came with the water rights?
- You were talking about the pumping and the hours you are allowed to pump, who sets that? So that is within the water rights?
- And that's just a matter of who has the rights to that water?
- So the different farms have been bought up because of water rights?
- And those are long-standing water rights that they've had for years from the beginning?
- Does that mean for the resource poor farmers, if they've now got land, but they weren't originally there when they registered the water rights, now they have no water?

Access and land: Ownership

- How big is your farm?
- Is that an average size of farms in this area?
- Is this one of the older farms in the area?
- How long have you been farming in the area?
- So a lot of buying-out has happened over the years?

Access and resources: Limits to expansion

- What would you say that your limits to expansion are?
- What are the factors that prevent you from planting more?
- Are you farming all the available land you have?
- Are you irrigating all the land that you can irrigate? How much more will you be able to irrigate with that?
- If there was more water available would you want to expand?
- And converting to drip irrigation, did that allow expansion?
- So if you had more storage capacity you would expand?

Access and water: Availability

- Does that mean that if you could get more water you would start doing more farming?
- Do you have enough water on your farm?
- So is everybody happy with how much water they are getting?
- How many hectares of water do you have?
- So you have got extra?
- So people really do find that it's a struggle to get more water?
- Could you tell me about water issues in the Baviaanskloof both at the moment and in the past and what caused the changes in water availability and how this has influenced changes in farming practices in the area?
- So the only impact then is that in dry times you don't get the water from the river?
- Because there is no water security?
- Do other farmers in the area struggle with water as well?
- Has it changed? Is it getting drier?
- So water has always been a problem in this area?
- So when farmers illegally pumped from the river in the past was it because they were desperate?

Access and water: Allocation

- How is your water allocated?
- Was it already allocated or did you have to fight for it when you bought the farm?
- So then basically, that water can't be used there so they are trying to get it reallocated?
- So is that why you were cut down to 40 percent of your water allocation?
- So does that mean they now get more than their allocation?
- So they haven't been getting their weekend share for years now?

Access: Perceptions of physical connectivity

- Do you think you need the same thing with farmers in the Kouga sub-catchment?
- Do you think that the main barrier to that is the distance and the mountains that need to be crossed to get to the other?

- I would assume the transport costs would be a lot higher than elsewhere, like the Kouga for example, because of the huge passes to get in and out?

Physical access to water: Water sources

- Where do you get your water from?
- What about the river water? Does anyone pump from that?
- Do you get water from that river?
- Is the river water good enough?
- And do you make use of boreholes?
- Why is the borehole water just a backup?
- Do you get all your water from the canals?
- Does the river run through your farm?
- Which river is it?
- Is there a difference between the water you get from the Kouga Dam and the water you get from the Klein River?
- So the water from the dam is more saline?
- Depending on how full the dam is?

Facilitating access: Water trading

- Is there any water trading between farmers?
- Is there ever trading, or would there be any trading of water, if it was really dry or a particularly bad drought?
- Is there any water trading between farmers within the irrigation board?
- So have you sold some of your water in the past?
- Do you ever buy from other farmers?
- If the neighbouring farm was willing to sell some of their water rights would you buy?
- Do you ever need to buy more rights from other people?
- Do you give him the water or sell it?
- Is that mediated well?

Facilitating access: Perceptions of payment for ecosystem services (PES)

- Would farmers, if payment for ecosystems services was implemented, do you think farmers would be willing to sell their water rights?
- If there was a system put in place where farmers could sell their water rights would you consider it or not really?
- There's talk of selling water rights. If it came to it and somebody downstream said they would buy your water rights would you sell them and stop farming?

Power and access: Upstream–downstream power relations between stakeholders

- What is your relationship with upstream farmers? Is it a good relationship? Are they willing to work together to sort out the water issues?
- Do you think there's a good relationship with the upstream-downstream farmers?
- What is the main problem you are experiencing at the moment as those of you living downstream?
- Do you think that the farmers at the bottom of the Baviaanskloof sub-catchment feel it worse?
- Is there a good relationship between yourself and upstream farmers? Are you able to talk things out when things like that happen?
- Do the downstream farmers in the Baviaanskloof put pressure for the upstream farmers to use less water?
- So what do you think of the farmers upstream above the Kouga Dam? In the Kouga sub-catchment and the Baviaanskloof sub-? Do you feel like there's a need for them to use less water so that more water comes downstream?
- Would you say that the way upstream farmers use water affects the amount of water you receive downstream?
- Do you have any interaction with upstream farmers at all?
- So then you're downstream from them? And then if they take too much it limits what you have?
- Are there any farmers downstream?
- Are you the last farm?

Power and access: Power relations between stakeholders

- Do you think that the other farmers in the area feel the same way?
- Is everyone fine with that arrangement?
- So when you put a plan together will the idea be to actively involve the communities?
- And in dry years, that doesn't cause conflict?
- Do you feel that pressure here?
- So within that signed agreement, if there is a drought and you end up with more water than next door do you just sort it out between yourselves and share it out?
- So as long as not everyone's using it before it gets to him?
- And do people respond well when there are restrictions?
- So you would say that in terms of the distribution of water in the area, the farmers are getting the water they need to grow their crops but it is the poor people that are suffering because of poor management?
- But does that drive to educate and improve the lives of people, does that extend to redistributing resources as well?
- It seems there have been a lot of smaller farms that are being merged together into bigger farms, when people are coming, possibly from outside, and buying new land, the people who have been living on that land for generations, do they get to keep living there or do they often have to move off?
- Could you tell me a bit about the interactions between the users, are they good or are there a lot of tensions?
- What do you think the main barriers to that happening is?
- Are you affected by that?
- Would you say that there are good relationships in the area between farmers?
- Are there any conflicts between farmers in the area over water?
- Have there been any significant conflicts that you know of in the area over water?
- And do the farmers feel the same way?

Control of Land and Water Resources

These questions were intended to elicit information about issues surrounding control of land and water resources.

Control and governance: Roles, functions, and responsibilities of the Department of Water Affairs (DWA)

- Do you have any interaction with the Department of Water Affairs?
- Does the Department of Water Affairs have any role in the area?
- Besides for receiving payments from the irrigation boards, do you feel that the government has any role in the area?
- What sort of things do you think the Department of Water Affairs should be doing more of?
- If those laws are broken do they then come in and do something about that?
- And is the way they influence that through their guidelines?
- Is there a representative on the ground here in this area from Department of Water Affairs? And then he's supposed to be for the whole of this municipality? Does he ever come into the area and see what's happening?
- Is it the Department of Water Affairs that you are applying for those grants through?
- Could you tell me a bit about the meeting with Department of Water Affairs a couple of weeks ago?
- But you can't use it until it has been approved?
- It was mentioned to me this morning that 35 farmers are applying for water use in difficult times to pump from the river, are you one of those?

Control and governance: Perceptions of the Department of Water Affairs (DWA)

- You mentioned just now that you need professional assistance, but do you feel like the people that Department of Water Affairs sends in have the knowledge?
- So that's why the Department of Water Affairs came in? And did that help?
- And the government is willing to look into that? Do you think the government is more willing to increase the storage capacity of dams where it benefits previously disadvantaged?

Control and governance: Creation of water users' associations (WUA)

- Could you tell me about the WUA?
- What's the difference between an irrigation board and a water users' association?
- And you think there's a need for one? Or a water users' association?
- I hear that Gamtoos Irrigation Board is trying to transform into one, what do you think of that process?
- Have you heard of the formation of a water users' association?
- So the Gamtoos Irrigation Board deals with the water from the Kouga Dam, will the water users' association then also manage the water from the other rivers like the Klein River? Will that be part of the management?
- Do you think that the formation of the water users' association is important?
- Do you think that would be useful? To have one irrigation board or do you think it would be better to have smaller ones?
- From what side are the people who keep changing things coming from?
- Could you tell me about the original plans for the water users' association and what is stopping it?
- And the viability of putting those control systems in place?
- Were you involved in it?
- Is it still happening?
- When was the last time anything was done about it?

Control issues: Implementation of legislation

- Do you think that it's necessary for the government to fully implement the Water Act?
- So you think the law is sound?
- Is that then registered?
- Do you think that licencing the water would change anything?
- Do you have to register your boreholes as well?
- So is that the only restriction—they don't restrict you from drilling boreholes for example?
- What does being a water controlled area mean?
- I've heard that during dry times they reduce at the beginning of the water year they reduce how much water you can use that year?
- What is that land tax?

Control and governance: Payment for water

- So nobody pays in the valley yet?
- And each farmer just pays directly?
- So had you paid that already?
- How does the payment for water in this area currently work?
- Downstream, is it actually measured and people pay for what they use rather than what they've got registered? How does it work down here?
- So you've been paying for water for a long time that you haven't been getting?
- How do they measure how much water you are using so that they know how to charge you?
- Do they charge you even if you're not using that water?
- Does that cost go to the irrigation board, or does each farmer pay for their own metre?
- You then pay your rates to them and they pay on the Department of Water Affairs?
- And are there any ever problems where somebody who is renting the land doesn't want to pay for the water? They're good about that?

Control and governance: Misaligned scales of management

- So you have to register your water with both the Eastern Cape and the Western Cape? And that's because your water flows to the Eastern Cape but is in the Western Cape? So the water that flows to the Eastern Cape is registered with the Eastern Cape? Does that cause problems?
- How does being in the Western Cape affect water management?
- What are the challenges that being in the Western Cape poses when all the water is flowing into the Eastern Cape?

Control issues: Interrelationships between institutions

- Is there a good working relationship between the irrigation board and the government?
- So the farmers pay the irrigation board and the irrigation board pays the Department of Water Affairs?

- What is the interaction between the Department of Agriculture and other government departments like the Department of Water Affairs? Is there any interaction?
- Do you find there is a difference between dealing with the irrigation board and dealing with the government?
- From what you know of this area, do you think that the irrigation boards have a good relationship with the government?

Use of Land and Water Resources

These questions were intended to elicit information about issues surrounding the use of land and water resources.

Water users: Port Elizabeth

- Could you tell me a bit more about Port Elizabeth and their demand on water?
- Do you feel like there is pressure from Port Elizabeth to use less water?
- How did that pressure come across to you?
- Do you think they will listen, do you think next time they will increase the water restrictions in Port Elizabeth and leave more water for the farmers here?
- Is there a chance that the Port Elizabeth quota will change?
- Then if Port Elizabeth could get water from somewhere else or if there was more storage, would that help during the dry times?

Water users: Urban use within the catchment

- What does that water supply, drinking water?
- Is any of the water in this area used to service any towns?
- So the town's water is managed by the irrigation board as well?
- And then who manages that pipeline afterwards?
- And the town doesn't pay anything to the farmers for the water?
- And do they pay to the municipality?
- And just like the farmers they also have to pay a certain amount for water?
- Do you know approximately how many people are living in the town?
- So if the community was to grow too much then the municipality would have to—?
- Does the township/ community get enough water?
- Are there any sewerage problems?
- Has the municipality come in and sorted it out? How did it eventually get sorted out?
- So there isn't enough water for the towns?
- Would you say the problem is that the townships don't have enough water allocated to them or that the infrastructure is not good enough?

Water Use

- How does the water use differ between veggies and citrus?
- Do you think that means that people will use 90 hectares rather than using less?
- Does that eat into the amount of hectares of water you get?
- Do you measure at all how much water you are using?
- So you irrigate more hectares than you have water?
- Could you tell me a bit about dairy farming and water use?
- Can you tell me a bit about water issues in the area?

Land Use

- What type of farming are you doing?
- What are the reasons for choosing those types of farming in this area?
- How many farmers in this catchment?
- What sort of cash crops?
- What is the ratio of citrus to cash crops?
- What are the reasons that it's not more citrus?

- What do you find is more profitable? The citrus or the vegetables?
- Why do you grow wheat?
- And do you choose based on the market?
- What would you say the main differences in terms of the land are between farming in this area and that area?
- So would you say it's riskier up there?
- How many hectares do you have for grazing?
- And you don't think that people would be interested in looking at other—for instance in the Baviaanskloof it has become a lot drier in the last few years and they have less water and some farmers are looking at different types of farming or tourism. You don't think that the same thing would happen in this area?
- What is the history of land use in this area, was it always livestock farming?
- So farmers are moving towards more restoration activities?
- Are they still relying a lot on farming as well?
- What are the main land use types?
- Do you think the land use will eventually change?

Physical Factors Influencing Use of Land and Water

- Is that also a factor to not planting citrus, like wind can be a factor?
- Does slope also affect the cash crop farming?
- What influence do the types of soils you have and the slope —?
- Besides that, are there any physical factors, such as the soil not being right for citrus?
- Is the rainfall different here from the rest of the Langkloof?
- And that effects when you harvest and all of that?
- So it has to have a specific climate?
- Is this one of the only areas in South Africa that has the right conditions?

Management of Land and Water Resources

These questions were intended to elicit information about issues surrounding the management of land and water resources.

Organisations influencing management: Gamtoos Irrigation Board (GIB)

Roles, functions, and responsibilities of GIB

- What role does Gamtoos Irrigation Board play in the management?
- Are you within the Gamtoos Irrigation Board scheme?
- And there's a metre on every property?
- So you went through the Gamtoos Irrigation Board to organise it?
- What authority does Gamtoos Irrigation Board have to collect rates and maintain pipes and things?
- But what if somebody is doing something that is against the law, does Gamtoos Irrigation Board have the authority to intervene?
- And you have the authority to remove the pump in the meantime?
- Could you tell me a bit about how the system below the dam works?
- How does Gamtoos Irrigation Board quantify losses on the system?
- So Gamtoos Irrigation Board immediately knows if there is a leak?
- And do you go through Gamtoos Irrigation Board to do that or do you go straight to Department of Water Affairs?
- Why do they turn the water off?
- So they turn off the water every year for two weeks?

Extent of influence of GIB

- Do Gamtoos Irrigation Board have much role in the area?
- What is the area of influence of Gamtoos Irrigation Board?
- And what area are you talking about when you talk about the Gamtoos Irrigation Board?

Attitudes towards GIB

- So you think there would be a lot more problems without an organisation like Gamtoos Irrigation Board to manage the water?
- Do you have a good relationship with Gamtoos Irrigation Board?
- And are they good about helping you, you know sending the bills and all that?
- Do you get good warning that they're going to do the maintenance?
- If there's a problem with the timing do you get a say?

Organisations influencing management: Other irrigation boards

Roles, functions, and responsibilities of other irrigation boards

- How many farmers are part of the irrigation board?
- Okay, so the role of the irrigation board is to?
- Okay, and is there anyone that the irrigation board has to answer to in terms of the irrigation board manages the water here, do they have to pay water to someone else?
- And it is run by the farmers in the board for the farmers in the board?
- You mentioned certain rules that the irrigation board has to follow, what does this involve?
- If there are any disputes over water, does the irrigation board sort that out as well?
- What are the benefits of having an irrigation board to the members?
- Do you think it is more regulated because of the presence of the dam than other sub-catchments?

Extent of influence of other irrigation boards

- So are you part of the Haarlem Irrigation Board?
- Does this area fall under the Haarlem Irrigation Board?

Attitudes towards other irrigation boards

- The Gamtoos Irrigation Board is very different to the irrigation boards here?
- Because here the irrigation boards are farmers on the committee, but Gamtoos Irrigation Board is its own entity?
- I know that there are a lot of farmers in sub-catchments in this area that aren't a part of irrigation boards, do you feel that it is a benefit being part of an irrigation board as opposed to not?
- And those irrigation boards are independent?
- When there are droughts, would you say that each of the sub-catchments and irrigation boards in each of those work together, or do conflicts then occur within them?

Water management in areas with no irrigation board

- So if you were to have an official irrigation board, would that help?
- So it's practically an irrigation board but it's just not registered?
- Do you think there would ever be a need to create an irrigation board for Ongelegen?

Organisations influencing management: Working for Water

- Are Working for Water doing work in this area?
- What is the role of Working for Water or similar projects in the Baviaanskloof?
- If they wanted to would you be willing to work with them?
- What sorts of things do you think they need to be doing more?

Organisations influencing management: Living Lands

- Do you think the other farmers in the area feel the same about PRESENCE and Living Lands?
- Are there certain things that Living Lands has to adhere to from the people they are getting the funding from to be able to do this work or is it just that there are outcomes?
- So Living Lands sets out those requirements that they're going to meet?

Organisations influencing management: Eskom

- Does the price of electricity affect your farming practices?
- So then your electricity costs are lower?
- Is electricity a big cost?
- Do you do a lot of pumping of water?
- Are you switching to cheaper electricity because the cost of electricity is so high because of pumping?

- So, have you cut down on the area of land that you irrigate since the price of electricity went up?
- Do you pump at night more than the day?
- And that is to do with the milking? This is per litre of milk?
- And is that just something that you do, do you have to give them free electricity?
- So as the price of electricity has gone up, the price of your goods go up?
- If electricity was cheaper would you be more active about bringing it here or not?

Organisations influencing management: Standards organisations

- Are there certain standards that you have to adhere to that affect the way you manage land and water?
- So any farmer who adheres to GlobalGAP has trained his workers in those sorts of things? And is that to make sure that the workers are well looked after?
- So you find if you meet Woolworths standards then you generally meet—?
- How would they trace it to the orchard?
- So it's on the box? So you have to hand in all those certificates?
- Where do they analyse that?
- So you send that report to them?
- And they come and check that? Once a year?
- And you have to have all your papers compiled to show them?
- What are the incentives? And over a year? And it's worth the extra money you put in?
- Do you think that Fairtrade is the way forward?

Organisations influencing management: Government departments

- So is that why you go to other departments like the Department of Rural Development?
- What about other government departments? Like Rural Development?
- And if someone does go ahead and do it without applications, are there disciplinary procedures through the Department of Agriculture?
- So the Department of Agriculture then monitors the area to make sure that people aren't expanding without applying?
- So if there isn't an effective Department of Agriculture in the area—?
- So that's the importance of the Department of Agriculture?
- So somebody wasn't reporting to Department of Agriculture before that?
- Where does the drive for this restoration come from? Does it come from yourself or did the government have any role in pushing it?

Organisations influencing management: Eastern Cape Parks

- Do Eastern Cape Parks and the BMR play any role in the way that farmers manage their land?
- Could you tell me a bit about the relationship with Eastern Cape Parks?
- And do you have a good relationship with conservation now?
- Is the pressure less or you work together more?
- So where it borders on the wilderness area, that's Eastern Cape Parks?
- Like a stewardship?

Organisations influencing management: Other organisations

- Are there organisations other than the Trust that influence?
- Are there any other organisations working in the Baviaanskloof that I should be aware of?

Organisations influencing management: Markets

- So is most of your citrus exported then?
- So your excess that you can't export, do you then sell locally?
- What makes those crops more profitable?
- So you notice the change in demand?
- Do you pack the lettuce or do PicknPay do that?
- So it is the government that sets the prices?
- What do you do with the fruit that you grow, do you export it?
- In terms of the export of apples and pears, is this area important to South Africa for that agricultural role?

Issues surrounding land management

- Does wheat have a different growing time then?
- What type of irrigation do you use with the wheat?
- Does that include things like mulching?
- So where do you put the probe?
- So does that affect the way that you grow them, the way that you water them and manage them?
- Can they graze while it has been composted? So this will all swap around at the different time of the year?
- Is that what, what is your reason for going organic rather than inorganic? So financial sustainability?
- And how do you then sustain through the months when they are not calving? Are they still producing milk?
- How does land management work with livestock farming?
- So mulching does make a difference then?
- How long does it take for a tree to reach maturity?
- Was the farm farmed heavily in the past? Was it degraded like the others?
- So for the last ten years, the livestock hasn't been grazing on the veld? Is that mainly because of the predators or is that also for the land?

Issues surrounding water management

- What are the main issues around water for the residents of this farm?
- So their main issue is infrastructure and the human resources to maintain and manage the infrastructure?
- Has the river been channelled in the past?
- Does that affect the way you use your water and manage your land?
- And you mentioned the risk of flooding, does it flood often?
- How do you manage that when you have restrictions and droughts?
- What type of irrigation do you use that helps to stretch that water? So are you irrigating any orchards at the moment?
- So you actually had to lay the pipeline yourself?
- So you always test the river water before you use it?
- Is that because of increased efficiency?
- Does that significantly impact the way you farm?
- Has it ever meant that you get less produce?
- So it's not measured like it's measured in the Gamtoos where they measure every drop?

Water management: Dams

- Do you know how many dams there are in this catchment?
- And then each farmer is in charge of maintaining their own dams?
- The water that you already have? You don't feel the need to build more dams to expand?
- And you're not allowed to build new dams?
- Has having those dams made a difference over the years?
- And do people feel that building a new dam would definitely help solve problems?

Power and Management: Power relations between stakeholders

- So are there more trustees living on the farm now?
- So it sounds like there is a lot of cooperation between farmers in this catchment?
- When those interactions happen, are they generally peaceful? There are no fights over it?
- Do you think that's a good thing?
- Does that influence the way you manage your water and your land and the way you farm?
- Do you find collecting the money difficult?
- And who is supposed to be looking after those needs? And are they?
- Is there any answerability for the farmers that are having things restored on their land or having Spekboom planted on their land? Do they have any commitments they have to adhere to? For example, if they are having Spekboom planted on their land, they can't immediately go and graze that land — is that written in an agreement?
- So there is initiative from the farmers that they want to work with these outside organisations because they can see the benefits so they're not going to get in the way of the restoration that's happening on their land because it's for them? So it's a good working relationship between the different organisations and the farmers?

Appendix 4.2: Survey Questionnaire

This appendix contains the survey questionnaire used in data collection.

Date of interview: _____
Interview code: _____
Interview location: _____
Affiliation of interviewee: _____

Participation is voluntary. Anonymity and confidentiality are guaranteed.

1. Water is a scarce resource.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

2. There is a need for farmers, government, communities, and organisations to work together to assure that the needs of all water users are met.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

3a. Do you know of the National Water Act?

No	Yes	Not answered	Not asked
1	2	6	7

3b. It is necessary to implement the National Water Act to assure that the needs of all water users are met.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

4a. Have you heard of the water reform process?

No	Yes	Not answered	Not asked
1	2	6	7

4b. The water reform process is a necessary step towards meeting the needs of all water users: upstream farmers, municipality, downstream farmers, and Port Elizabeth.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

5. There is a need for greater collaboration in the area to work towards sustainable land and water management.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

6a. Water use should be:

1	Completely unregulated
2	Self-regulated for efficiency
3	Unsure
4	Monitored by management boards
5	Heavily regulated by management boards
6	Not answered
7	Not asked

6b. At the moment, water use is:

1	Completely unregulated
2	Self-regulated for efficiency
3	Unsure
4	Monitored by management boards
5	Heavily regulated by management boards
6	Not answered
7	Not asked

7. What is your perception of the role Gamtoos Irrigation Board (GIB) plays in water management?

1	They do a good job
2	There is room for improvement
3	Unsure
4	They are not as active as they should be
5	They do a poor job
6	Not answered
7	Not asked

8. What is your perception of the role of Working for Water in the area, both in terms of creating jobs and the work they do in the environment?

	1	They do a good job
	2	There is room for improvement
	3	Unsure
	4	I have seen them around but I am not sure what they do
	5	They do a poor job
	6	Not answered
	7	Not asked

9. What is your perception of the role of Department of Water Affairs (DWA) locally in water-related management?

	1	They do a good job
	2	There is room for improvement
	3	Unsure
	4	They are not as active as they should be
	5	They do a poor job
	6	Not answered
	7	Not asked

10. What is your perception of Living Lands and the work they do in encouraging collaboration and sustainable landscapes?

	1	They make a difference
	2	They have the potential to make a difference
	3	Unsure
	4	I have not heard of them
	5	They do a poor job
	6	Not answered
	7	Not asked

Questions 11a, 11b, and 12a for the Baviaanskloof Sub-Catchment

11a. How important do you believe the water from the Baviaanskloof catchment is for farmers downstream in the Gamtoos valley?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

11b. How important do you believe the water that you use in your farming is for farmers downstream in the Gamtoos valley?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

12a. How important do you believe the water from the Baviaanskloof catchment is for Port Elizabeth?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

Questions 11a, 11b, and 12a for the Kouga Sub-Catchment

11a. How important do you believe the water from this [named tributary] sub-catchment is for farmers downstream in the Gamtoos valley?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

11b. How important do you believe the water that you use in your farming is for farmers downstream in the Gamtoos valley?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

12a. How important do you believe the water from this this [named tributary] sub-catchment is for Port Elizabeth?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

Questions 11a, 11b, and 12a for the Gamtoos Sub-Catchment

11a. How important do you believe the water from the upstream Baviaanskloof and Kouga sub-catchments is for farmers here in the Gamtoos valley?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

11b. How important do you believe water that is currently being used by farmers in the upstream Baviaanskloof and Kouga sub-catchments is for you farmers here in the Gamtoos valley?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

12a. How important do you believe water from the upstream Baviaanskloof and Kouga sub-catchments is for Port Elizabeth?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

Questions 12b-16 for All Participants

12b. How important do you believe the water you use is for Port Elizabeth?

Very important	Important	Unsure	Unimportant	Very unimportant	Not answered	Not asked
1	2	3	4	5	6	7

13. Port Elizabeth should look into obtaining water from sources other than Kouga Dam.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

14. My farming and water use activities are influenced by standards organisations (e.g. GlobalGAP).

1	Heavily regulated
2	Influenced
3	Unsure
4	Slightly regulated
5	No influence
6	Not answered
7	Not asked

15. My farming, water use activities, or land management practices are affected by the price of electricity.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

16. The future pricing of water will affect the way I use water, farm, or manage my land.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not answered	Not asked
1	2	3	4	5	6	7

Appendix 4.3: Codes Developed During Open Coding

Table A4.1 presents the codes and categories developed during open coding.

Table A4.1: Content analysis: Categories and codes from open coding

Categories	Codes
Catchment	Gamtoos (p), Baviaanskloof, Kouga, Gamtoos (s), Gamtoos (downstream), Gamtoos (middle), Gamtoos (upstream), Klein River, Studtispoort, Orange River, Tsitsikamma, Willowmore
Land use: agriculture	crop type (cash crop), citrus, fig trees, food production, fruit trees, lucerne, lucerne for feed, olive trees, pastures, tobacco, vegetable seeds, vegetables, mealies, potatoes, pumpkins, wheat, livestock, Angora goats, cattle, goats, grazing, Mohair goats, ostriches, sheep
Land use: conservation	conservation, game farming, medicinal plants, natural Spekboom veld, restoration, Spekboom, veld, land use change, tourism
Linkages	B&K-PE, Baviaanskloof-Gamtoos, Baviaanskloof-Kouga, Baviaanskloof-PE, farm-downstream internal, farm-Gamtoos, farm-PE, Gamtoos-PE, Gamtoos-upstream, Groot-Gamtoos, Kouga-Gamtoos, upstream-downstream linkages internal, physical aspects, communications infrastructure
Power: attitude	accepting, apprehension, concern, conditional, contempt, content, distrust, entitlement, fear, frustrated, hope, impatient, indifferent, making sure I understand, pride, relief, resentment, resigned, trust, uncertainty, understanding, entitlement, grateful, justifying actions, justifying in terms of the law, reluctant to talk about, sense of responsibility, standing aside, standing ground, entitled to water
Power: nature of interrelationship	accommodating, agreement, allowing (legally), applying for permission, arrangement agreed between stakeholders, conditions of arrangement, assisting, blocking access of another stakeholder, bringing people together, collaboration, communicating, competing, conflict avoidance, evidence of conflict, potential for conflict, contractual relationship, controlling allocation, controlling quality, controlling supply (source), cooperation, cost of electricity, decision-making, determining price, differing priorities, disagreement between stakeholders, driving, educating, enabling, enabling access of another stakeholder, exploitation, financial concerns, financial constraints, good relationship, improved relationship, influencing, influencing (not influencing), lack of communication, lack of involvement, lack of support, leading, less profitable, marginalisation, meeting, mentor relationship, moderating price fluctuations, moderating price fluctuations (not moderating), no issues experienced, no need to share, non-delivery on promises, not allocating more water rights, not upholding arrangement, othering (framing as less successful), othering (use of actually), othering language, overlooking, ownership, policing, advocates and court, power holding, pressure, pressure to sell, price influences, pricing, private arrangement, problem-solving, renting land, restricted water usage, self-sufficiency, service provision, sharing experience, suggestion that they illegally use river water, supplying water, tension, unreliable, using water that could be made available downstream, withholding information, withholding payment, withholding permission
Power: knowledge and discourse	discourse (conservation restoration), prevailing discourse, produced knowledge, reproduced knowledge
Power: perception	acknowledgement of influence of physical factors, adds legitimacy, desire for government to help with development of systems, difficult situation, improvement, indicates importance to farmers, inflated sense of importance, job opportunities, lack of implementation, lack of knowledge, lack of resources, need for, need for balanced benefit, need for improvement, need for increased collaboration, need to compensate, no alternatives, recognition of

	link between DWA and WfW, recognition of other stakeholders' point of view, reduced pressure, relative importance, there is a need for
Perception tone	mixed, negative, neutral, positive
Stakeholder: individual level	individual A, individual B
Stakeholder: farm level (Baviaanskloof)	individual C, participant Z01, farm Z01, farm B, farm 011, farm 012, farm 014, farm 015, farm 017, farm level (general), individual D, individual E, farm 013, individual F
Stakeholder: farm level (Gamtoos)	stakeholder 020, stakeholder 022's (neighbour), stakeholder 025, stakeholder 033's father's farm
Stakeholder: local level	Baviaanskloof Farmers Association, BMR, CMA, commercial farmers (Baviaanskloof), commercial farmers (Gamtoos), commercial farmers (Kouga), community (Coleske Plaas), community (Zaaimanshoek), emerging farmers, emerging farmers (Gamtoos), employees, farmers (Gamtoos) applying for river pump, GIB, local municipality
Stakeholder: provincial level	ECP, municipality or urban centres, Port Elizabeth
Stakeholder: national level	Department of Agriculture, Department of Human Settlement, Department of Water Affairs, Eskom, financial institutions, Government, land market, markets (national), Angora and Mohair market, national market, Produce Buyers, Dairy, McCains, PicknPay, Shoprite-Checkers, Woolworths, SANBI, WfW, WfWetlands, Wilderness Foundation
Stakeholder: international level	outside organisations (other), Dutch Embassy, Eurepgap, funding organisations, GlobalGAP, HACCP, Living Lands PRESENCE, markets (international), standards organisations, UNESCO
Temporal aspect	current situation, hypothetical situation, past situation, planned future situation, potential future situation
Water: allocation	amount received, land use expansion relative to quota, need for measurement, no quota - amount used, no quota - amount used - perception of importance, not measured, quota, quota - amount used - not using quota, quota - amount used - same as quota, quota reallocation, supplementing quota, urban priority over farming, yearly allocation process
Water: amount used	unknown, unimportant, increasing efficiency, increasing efficiency (motivation for), over-usage, over-usage (not over-usage), pressure to decrease use, pressure to decrease use (no pressure), allocation used up, crop variation, dependent on soil type, increased, increased efficiency, perception, seasonal variations, using the most, increasing irrigation
Water: availability	decreasing, dependent on rainfall, dry seasons, enough, enough (not enough), good, increased, link to conservation, shortage (adapting to - using less), shortage (adapting to), varies by place in catchment, lack of water, scarcity perception, security
Water: challenges	high costs, distribution, availability, balancing needs, degradation, DWA - lack of capacity, lack of finances, supply infrastructure problems, challenges to management, drivers of water issues, drought, floods, Kouga Dam - disturbed ecological system
Water: governance	activities, involvement (lack of), subsidies, payment for, payment to (not paying)
Water: infrastructure	funding (grants), maintenance, maintenance (challenges), need for transfer infrastructure, shared, upgrading or upgraded or need to upgrade, improving efficiency, off peak times, changing irrigation type, more efficient, pressure (water pressure), expensive, inadequate, unused, irrigation ceased, irrigation: expensive, irrigation: expensive to change, irrigation type: inefficient, irrigation type: low cost, infrastructure type, borehole, canal, filter, furrows, gabions, hydropower water wheel, Kouga Dam, metre, pipeline, pipes, probe (soil moisture), pump, storage dam (on farm), storage tanks, water metre, weir, irrigation type, sprinklers, central pivot, drip irrigation, flood irrigation, low sprinkling, micro jet, sprinklers, river adaptations, berms, channelling of river

Water: legislation	water hired with land, legislation, implementation challenges, licence, licenced (not licenced), NWA, NWA: implemented, NWA - lack of implementation, old water law, old water law (shortcomings), registered, registration of water rights, rights, rights (applied for), rights linked to land, rights linked to land (not linked to land), servitude, title deed, water reform, transforming to WUAs
Water: management	catchment area protection, climate appropriate crops, functions of IB, knowledge of, measurement (lack of), measurement (measured), moving to more efficient irrigation due to electricity, costs not water, PES, practice, practice change, pumping (activity), sharing, sharing (agreement), sharing (no need to share), trading, turns (distribution activity), consequences of management, floodplain (floods ceased), management model, (perception of), need for knowledge and experience, need for protection, poor, trading - pricing - too high, water management
Water: physical features	catchment area size perception, floodplain, infiltration, land and water linkages, rainfall, recharge fast, river cutting, river system change, river system change (degradation), surface runoff, surface runoff (faster), wetlands
Water: quality	quality (poor), saline, water quality, water quality (good), impacts of quality, standards organisations, testing
Water: source	Baviaanskloof River, Baviaanskloof River (tributaries), distance from fields, Gamtoos canal, Gamtoos River, groundwater, Klein River, Kouga Dam, Orange River, rain, Sewerfontein, upstream farm, water table
Water: supply	ceased, importance to PE, Kouga Dam (inadequate for supply), need for improvement, PE (utilising other sources), to downstream farmers, to PE, to PE (need to find alternatives)
Water: use	end user, end user efficiency, illegal use, related to issues, relative importance (for different uses), basic needs, big gardens, domestic (drinking water), ecological reserve, farming, food provision, gardening, irrigation (currently used), irrigation (purpose - not currently used), lawns and golf courses, other (not specified), permaculture, socio-economic use, livestock water, subsistence, sustain or restore water table, urban, water provision

Appendix 4.4: Final Coding Scheme

This appendix presents the final coding scheme. TableA4.2 illustrates the final categories, parent codes, and child codes that were applied during content analysis. It indicates whether they were derived deductively or inductively (column: D/I), whether they represent manifest or latent content (column: M/L)⁸, whether the category is aggregated or not aggregated (column: A/N)⁹, and the rules for application (column: Criteria of Selection).

Table A4.2: Final coding scheme

Category/Code	M/L	D/I	A/N	Criteria of Selection
land use	M	D	N	encompassing child codes related to land use types and activities; no coding directly to this parent code
commercial agriculture	M	I	A	encompassing child codes related to commercial agriculture activities and types; no coding directly to this parent code Rules for child codes: coded only when mentioned; not coded when not mentioned, even if it is known that the farmer grows specific type; not coded when talking about irrigation or water use in general; not coded when talking about upstream-downstream relationships unless farming is specifically mentioned; can be coded to more than one child code as farmers frequently engage in mixed farming
cash crops	M	I	—	encompasses references to cash crops as well as all vegetable crops such as mealies, wheat, potatoes, pumpkins, cauliflower etc.; only includes crops grown on a commercial scale even if the same crops are grown on a small or subsistence scale
citrus	M	I	—	encompasses references to citrus
dairy	M	I	—	encompasses references to dairy farming
deciduous fruit	M	I	—	encompasses references to deciduous fruits such as apples, pears etc.
general	M	I	—	encompasses references to commercial farming activities but where the type of farming is not specified, even if it is known
livestock	M	I	A	encompassing child codes related to livestock farming on a commercial basis including references to lucerne, pasture, and grazing; encompasses references to livestock other than cattle, goats, ostriches, or sheep; can be coded directly to this parent code; no overlaps between this code and child codes; encompasses references to livestock in general, or where more than one type of livestock is mentioned in close proximity
cattle	M	I	—	encompasses references to cattle or large livestock farming; does not include references to cattle on a small scale basis

⁸ Manifest content focuses on surface structure in the form of physically present and countable words in the data while latent content focuses on interpretation of the underlying meanings in the data.

⁹ Aggregated parent codes cumulatively count the frequencies of child codes into the total frequency. Parent codes that are not aggregated count into the frequency only the textual elements coded directly to the parent code but not the child codes.

goats	M	I	—	includes ordinary goats as well as angora and mohair goats
ostriches	M	I	—	coded when farmed; not coded when used as 'security'
sheep	M	I	—	encompasses references to sheep farming
medicinal plants	M	I	—	encompasses references to medicinal plants
olives	M	I	—	encompasses references to olives
vegetable seeds	M	I	—	encompasses references to vegetable seeds
conservation-related land uses	M	I	A	encompassing child codes related to conservation-related activities and land uses; no coding directly to this parent code Rules for child codes: can be coded to more than one child code
conservation	M	I	—	encompassing references related to conservation activities; coded when identified as the land use activity, even when not explicitly mentioned; can be coded at both Eastern Cape Parks and conservation, but not necessarily at both; can be coded at both restoration and conservation
game farming	M	I	—	encompassing references related to game farming activities; coded separately from conservation as game farming has a potentially financial motive; can be coded at both conservation and game farming
restoration	M	I	—	encompassing references related to restoration activities; can be coded at both restoration and conservation; mentions of Working for Water activities not coded at restoration unless those activities are explicitly identified as restoration within the interview context; includes both Spekboom restoration as well as restoration of rivers and alluvial fans etc.; coded when identified as the land use activity, even when not explicitly mentioned
tourism	M	I	—	encompassing references related to tourism activities
degradation	M	I	—	coded only if degradation or a similar aspect is mentioned; not coded if talking about restoration, even though restoration is needed because of degradation
inactive land	M	I	—	coded to refer to pristine, non-irrigable land that is left untouched; coded when referring to land that used to be farmed but that is no longer farmed; not coded if land is explicitly left for conservation purposes
land use change	M	I	—	coded where land use change has occurred or is occurring; coded where need for land use change is discussed
permaculture	M	I	—	encompassing references related to permaculture activities
small-scale agriculture	M	I	—	encompasses references to small scale farming activities and subsistence activities including vegetable gardens; includes livestock farming by resource-poor or emerging farmers
linkages	L	D	N	encompassing child codes related to linkages in the landscape, including perceptions of users in different parts of the catchment; no coding directly to this parent code; this code is used only for data organisation and grouping
Baviaanskloof–Kouga	L	D	—	encompasses references to connectivity between the Baviaanskloof and Kouga sub-catchments; does not represent an upstream-downstream relationship
Kouga tributary sub-catchments	L	D	—	encompasses references to connectivity between the Kouga tributary sub-catchments; does not represent an upstream-downstream relationship
upstream–downstream	L	D	A	encompassing child codes related to linkages in an upstream-downstream (or downstream-upstream) direction; no coding directly to this parent code

				Rules for child codes: coded when referring to upstream-downstream relationships, perceptions, or physical linkages; there is no code for both upstream catchments, therefore, can be coded to more than one child code; even if the question asks about both upstream sub-catchments, if the answer is only focussed on Kouga then it is only coded to the Kouga (likewise for Baviaanskloof); coded for both directions (i.e. in a downstream as well as upstream direction)
internal upstream-downstream	L	D	—	coded for references to upstream-downstream linkages within a catchment (i.e. within the Baviaanskloof, within a Kouga tributary sub-catchment, or within the Gamtoos sub-catchment)
Baviaanskloof-Gamtoos	L	D	—	coded for upstream-downstream linkages between the Baviaanskloof and Gamtoos sub-catchments
Kouga-Gamtoos	L	D	—	coded for upstream-downstream linkages between the Kouga and Gamtoos sub-catchments
Groot-Gamtoos	L	D	—	coded for upstream-downstream linkages between the Groot and Gamtoos sub-catchments
linkages to PE	L	D	A	encompassing child codes related to linkages externally to Nelson Mandela Bay Metropolitan Municipality; no coding directly to this parent code Rules for child codes: coded when referring to power relations, perceptions, or physical linkages; can be coded to more than one child code; even if the question asks about multiple sub-catchments, if the answer is only focussed on Kouga then it is only coded to the Kouga (likewise for Baviaanskloof and Gamtoos)
Baviaanskloof-PE	L	D	—	coded for Baviaanskloof participants where PE is mentioned; in other sub-catchments, coded when Baviaanskloof-PE linkage is explicitly mentioned
Kouga-PE	L	D	—	coded for Kouga participants where PE is mentioned; in other sub-catchments, coded when Kouga-PE linkage is explicitly mentioned
Gamtoos-PE	L	D	—	coded for Gamtoos participants where PE is mentioned; in other sub-catchments, coded when Gamtoos-PE linkage is explicitly mentioned
prevailing discourse	L	D	—	standalone code; identifies sections where prevailing discourse is evident, specifically in terms of restoration, carbon market, high importance of water from Baviaanskloof to PE and other related themes
sentiment	L	D	N	no coding directly to this parent code; this code is used only for data organisation and grouping Rules for child codes: encompass sentiment towards a topic in four directions: positive, negative, mixed, and neutral; can encompass either attitude towards a topic, perception of a topic or stakeholder, tone of answer, nature of experience, or power relationship between stakeholders; cannot be coded at multiple child codes
positive	L	D	—	coded where sentiment is predominantly positive
negative	L	D	—	coded where sentiment is predominantly negative
neutral	L	D	—	coded where neither positive nor negative sentiment is perceived
mixed	L	D	—	coded at mixed where participant relates multiple sentiments towards a topic, for example, “I think they are doing a good job but they could do more of x and y”
stakeholder by level	M&L	D	N	manifest codes (in latent groupings); encompassing child codes identifying stakeholders; no coding directly to this parent code; this code is used only for data organisation and grouping; stakeholders are

				actors who influence activities processes within study area; stakeholders are grouped according to the level at which they originate, operate, act, or have influence; stakeholders are not identified as individuals but rather as organisations (e.g. irrigation boards), places (e.g. the city of Port Elizabeth), or groupings of people (e.g. farmers)
local level	L	D	A	encompassing child codes identifying stakeholders at the local level, that is, originating within the catchment boundaries; no coding directly to this parent code
commercial farmers	M	D	A	no coding directly to this parent code; no overlaps between child codes
intra-community	M	D	A	reference made by participant to individuals or groups of farmers within the same sub-catchment (other than themselves); coded only for relationships not perceptions of others unless that perception is related to a relationship (e.g. observations of water use by others is not coded here unless it impacts the ability of others to access water); can be coded directly to this code; no overlaps between child code and parent code
application farmers	M	I	—	reference made by participant to application by group of farmers for permission to pump from Gamtoos River
commercial farmers: general	M	I	—	coded where reference is made to commercial farmers as a group in general (i.e. not within the catchment, but in the broader national or general context)
commercial farmers: Baviaanskloof	M	D	—	coded when commercial farmers from Baviaanskloof are explicitly referred to by participants from outside the sub-catchment (including participant 001); not coded when Baviaanskloof farmers talk in general about other Baviaanskloof farmers
commercial farmers: Kouga	M	D	—	coded when commercial farmers from Kouga are explicitly referred to by participants from outside the sub-catchment (including participants 008 and 009); not coded when Kouga farmers talk in general about other Kouga farmers
commercial farmers: Gamtoos	M	D	—	coded when commercial farmers from Gamtoos are explicitly referred to by participants from outside the sub-catchment (including participant 019); not coded when Gamtoos farmers talk in general about other Gamtoos farmers
emerging farmers	M	D	—	coded when resource-poor, or emerging, farmers are mentioned; also coded when BEE-partnerships or BEE programmes are mentioned
employees	M	D	—	coded when employees are mentioned, whether farm workers or employees of Working for Water; foreign labour is coded in addition to employees at international level; also coded when employees are not directly mentioned, but employment issues are mentioned
irrigation boards	M	D	A	no coding directly to this parent code; coding can overlap between child codes
irrigation boards: general	M	I	—	coded when not referring to a specific irrigation board; also coded when multiple irrigation boards are discussed together; also coded for sub-catchments that do not have irrigation boards
[irrigation board codes]	M	I	—	coded when mentioned or discussed GIB [deductive]; Aapiessrivier; Haarlem; Joubertina; Krakeel; Louterwater; Misgund; Waboomsriver

local urban centre	M	I	A	no coding directly to this parent code; coded when mentioned or discussed; coding can overlap between child codes
towns (general)	M	I	—	coded when multiple towns are spoken of together, or where a specific town is not identified
[urban centre codes]	M	I	—	coded when mentioned or discussed Baviaanskloof communities; Haarlem township; Joubertina township; Krakeel township; Louterwater township; Louterwater industry; Misgund township; Patensie; Hankey
regional level	L	D	A	encompassing child codes identifying stakeholders at the regional level, that is, originating from beyond the catchment boundaries, yet are still in proximity to the catchment; includes provincial level; no coding directly to this parent code; child codes can be coded at multiple codes
ECP	M	D	—	coded when mentioned or discussed; also coded for references to BMR, stewardships, or similar
PE	M	D	—	coded when mentioned or discussed; also coded for PE municipality or similar
WUA	M	D	—	coded when mentioned or discussed; although this is not yet a stakeholder that has been realised, coded at this level when discussed
municipalities	M	D	—	coded when any municipality is mentioned or discussed, even if specific municipality is identified
national level	L	D	A	encompassing child codes identifying stakeholders at the national level, that is, those stakeholder operating from a state level; no coding directly to this parent code; child codes can be coded at multiple codes
government	M	D	A	encompassing child codes identifying government departments; no coding directly to this parent code; child codes can be coded at multiple codes
DWA	M	D	—	coded when mentioned or discussed; also coded where 'government' is mentioned if context is about water management; also coded if not explicitly mentioned but implied; also coded when functions of DWA are mentioned including water rights, allocation, or payment; implementation of water act or water reform etc. even if DWA is not explicitly mentioned
government (other)	M	D	—	coded where reference is made to government departments that are not DWA; also coded where government is mentioned but a specific department is not identified
energy	M	D	—	coded when mentioned or discussed; also coded for mention of the cost of electricity without talking about Eskom specifically
national markets	M	D	—	coded when mentioned or discussed; coded even when market is not explicitly identified by participant as national, yet it is known; includes produce buyers such as McCains or chain stores such as Woolworths or Shoprite-Checkers; includes national price regulators
WfW	M	D	—	coded when mentioned or discussed; also coded for other 'Working for' programmes
international level	L	D	A	encompassing child codes identifying stakeholders at the international level, that is, those organisations or institutions who originate, or receive funding from, outside of South Africa; no coding directly to this parent code; child codes can be coded at multiple codes
Dutch government	M	I	—	coded when explicitly mentioned
foreign labour	M	I	—	coded when mentioned or discussed; those coded to this code are also coded to employees
funding organisations	M	I	—	coded when mentioned or discussed; general term encompassing any organisation that funds research or restoration or conservation activities
Living Lands	M	D	—	coded when mentioned or discussed

international markets	M	D	—	coded when mentioned or discussed; coded even when market is not explicitly identified by participant as international, yet it is known to be international
standards organisations	M	D	—	coded when mentioned or discussed; umbrella term encompassing any references to Eurepgap, GlobalGAP, HACCP etc.; where produce buyers also set standards this code applies
UNESCO	M	D	—	coded when mentioned or discussed; coded when directly referred to or when international conservation interest or world heritage site is mentioned
sub-catchment (secondary)	M	D	N	encompassing child codes related to sub-catchments; no coding directly to this parent code; this code is used only for data organisation and grouping Rules for child codes: refers to the catchment that is being spoken of; for farmers, only coded when talking about a catchment other than catchment they are in; for participant 001 coded according to the catchment spoken of
Gamtoos (primary)	M	D	—	only coded when participant specifically refers to the wider catchment
Baviaanskloof	M	D	—	only coded when participant is talking of a catchment other than the one they are in
Kouga	M	D	—	only coded when participant is talking of a catchment other than the one they are in
Gamtoos	M	D	—	only coded when participant is talking of a catchment other than the one they are in
sub-catchment (tributary)	M	D	N	encompassing child codes related to tributary sub-catchments; no coding directly to this parent code; this code is used only for data organisation and grouping Rules for child codes: refers to the catchment that is being spoken of; coded when participant speaks specifically about the tributary sub-catchment even if participant is in that sub-catchment; letter refers to secondary sub-catchment; not coded when the participant is talking generally
[list of child codes]	M	I	—	B: Studtspoort; G: Bergrivier; G: Klein River; K: Aapiesrivier; K: Avontuur; K: Bo-Kouga and Onder-Kouga; K: Haarlem; K: Joubertina; K: Krakeel; K: Louterwater; K: Misgund; K: Ongelegen; K: Twee Riviere; K: Waboomsrivier
water	M	D	N	encompassing child codes related to water; no coding directly to this parent code; this code is used only for data organisation and grouping
water availability	M	D	—	coded when referring explicitly to water availability; not coded when talking about supply, unless supply is directly related to availability of water (i.e. if supply is lacking because of an infrastructure issue it is not coded)
formation of WUA or CMA	M	D	—	coded when water reform process is discussed; coded when WUAs or CMAs are discussed
water governance	M	D	—	includes water legislation, rights, registration, allocation, pricing, payment for etc.; does not include physical access to water; does not include water reform; includes implementation of legislation
water management	M	D	—	coded when referring to management activities carried out by an irrigation board or similar; coded when referring to management model; not coded when referring to on-farm management activities
water on-farm management	M	I	—	refers specifically to management at the farm level; if it's related to use it is coded under 'water use'
water quality	M	D	—	coded anywhere water quality or similar is mentioned
water use	M	D	—	includes water efficiency; includes pumping water or electricity usage where it is related to water; includes any aspects related to water use; includes water users

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