RIVERS AS BORDERS, DIVIDING OR UNITING? THE EFFECT OF TOPOGRAPHY AND IMPLICATIONS FOR CATCHMENT MANAGEMENT IN SOUTH AFRICA

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ABSTRACT

South Africa‟s water resources are unequally distributed over space and time to a high degree and our already stressed water resources situation will only be exacerbated by climate change if current predictions are correct. The potential for conflict over increasingly strained water resources in South Africa is thus very real. In order to deal with these complex problems national legislation is demanding that water resource management be decentralized to the local level where active participation can take place in an integrated manner in accordance with the principles of IWRM. However, administrative and political boundaries rarely match those of catchments as, throughout South Africa, rivers have been employed extensively to delineate administrative and political boundaries at a number of spatial scales. The aim of this research is to determine if rivers act as dividing or uniting features in a socio-political landscape and whether topography will influence their role in this context. By considering sections of the Orange-Senqu River, some of which are employed as political or administrative boundaries, this project furthermore aims to consider the implications of this for catchment management in South Africa. South Africa‟s proposed form of decentralized water management will have to contend with the effects of different topographies on the way in which rivers are perceived and utilized. The ability of a river to act as a dividing or uniting feature is dependent on a number of interrelated factors, the effects of which are either reduced or enhanced by the topography surrounding the river. Factors such as the state of the resource, levels of utilization, local histories and the employment of the river as a political or administrative border are all factors that determine the extent to which a river unites or divides the communities along its banks, and are all influenced by topography. The implications of this for the management of catchments in South Africa are significant. Local water management institutions will have to contend with a mismatch in borders and in many cases bridge social divides that are

deeply entrenched along the banks of rivers. Importantly, the need for a context specific approach to catchment management is highlighted.

Keywords: Borders, Catchment management, Participation, Rivers, Topography,

CHAPTER 3: PARTICIPATION, POLICY, AND COOPERATIVE GOVERNANCE IN SOUTH AFRICA

CHAPTER 4: METHODOLOGY

LIST OF TABLES

LIST OF FIGURES

LIST OF ACCRONYMS

ANC - African National Congress

CBNRM - Community Based Natural Resource Management

CMA - Catchment Management Agency

CMS - Catchment Management Strategy

DEAT - Department of Environmental Affairs and Tourism

DWA - Department of Water Affairs

DWAF - Department of Water Affairs and Forestry

DWEA - Department of Water and Environmental Affairs

EU - European Union

FAO - Food and Agriculture Organisation of the United Nations

GIB	-	Gamtoos Irrigation Board
GIS	-	Geographic Information System
GNP	-	Gross National Product
IBT	-	Inter Basin Transfer
ICM	-	Integrated Catchment Management
IWRM	-	Integrated Water Resource Management
LHP	-	Lesotho Highlands Water Project
MAR	-	Mean Annual Runoff
NEMA	-	National Environmental Management Act
NWA	-	National Water Act
NWRS	-	National Water Resources Strategy
ORASECOM	-	Orange-Senqu River Commission
ORP	-	Orange River Project
OFS	-	Orange Free State
PRA	-	Participatory Rural Appraisal
SADC	-	Southern African Development Community
SAPS	-	South African Police Service
WFW	-	Working For Water
WMA	-	Water Management Area
WRC	-	Water Research Commission
WSA	-	Water Services Act
WUA	-	Water User Association

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CHAPTER 1: RESEARCH CONTEXT AND RATIONAL

1.1 INTRODUCTION

Throughout South Africa, rivers have been extensively employed to delineate administrative and political borders at a range of spatial scales from the international to the local. As the country initiates its decentralized water management strategy, which is based on the principles of IWRM (Integrated Water Resource Management) and stakeholder participation, the effects of using rivers as borders on the socio-political landscape will become apparent and have implications for the development of water management institutions. Furthermore the topographic effect or the nature of the physical landscape itself will also have an effect on the way in which that particular river forms a dividing or uniting feature amongst local stakeholders. In southern Africa a combination of increasing water scarcity and a situation where all major rivers are shared, often by more than two states, implies that conflicts over water resources are probable unless steps are taken to promote a culture of cooperative water resource management between stakeholders (Becker & Easter, 1999). At the local level the same is true, as increasing dependence on shared water resources accentuates the need for cooperative water governance.

Research context

Compared to many regions in the rest of the world, South and southern Africa‟s water resources are unequally distributed over space and time. Within South Africa itself a number of trends regarding inland water resources are surfacing such as: an increasing demand for water, decreasing freshwater flows, deteriorating fresh water quality, and a decline in the health of river ecosystems (DEAT, 2006). The effects of climate change are expected to exacerbate the situation if current predictions are correct; an expected decline in rainfall, particularly in the western part of the country, will cause already variable water supplies to become increasingly variable across the region (Ashton, 2002; Roberts, 2008). South Africa is regarded as a semi-arid water scarce region to the extent that, as a developing nation, water scarcity is seen as a key limiting factor in terms of both development and the eradication of poverty (DEAT, 2006; Lange *et al*, 2007; Turton 2008). The high utilitarian value of river basins has seen their widespread development for various economic sectors, most notably tourism, industry and irrigated agriculture

(Mbaiwa, 2004). According to Brouwer *et al* (2001), changes in land use and the increasing reliance of numerous stakeholder groups on a common water resource has resulted in river basins becoming the most threatened of all environmental resources and prone to disputes between those utilizing the resource. Increasing demand coupled with water scarcity has the potential to provoke conflict over water resources, not only in South Africa, but within the wider southern African context. The predicament posed by water scarcity has prompted researchers to discuss its implications in terms of either conflict or cooperation (Ashton & Turton, 2009). Considering this, in the South African context, managing water to a large extent requires managing potential conflict and engendering cooperation among riparian groups and stakeholders. Variable, vulnerable and scarce water resources create an environment where the potential for conflict over shared and often stressed water resources is very real as distinct groups of stakeholders utilise and often lay claim to the water available. However, as the literature will illustrate, in the case of shared water resources there is also a great deal of potential for the cooperative management of the resource in question when scarcity exists (Uitto & Duda, 2002).

In order to deal with the complex problems posed by South Africa"s current situation, national legislation is demanding that water resource management be decentralized to the local level where active participation can take place in an integrated manner in accordance with IWRM principles. The NWA (National Water Act) of 1998 has provided the means to achieve this as it "promotes integrated and decentralized water resource management in a new institutional environment where social development, economic growth, ecological integrity and equal access to water are key objectives" (Farolfi & Rowntree, 2005: 2). The NWA is implemented through the NWRS (National Water Resources Strategy) and the Department of Water Affairs. The strategy aims to balance water supply and demand in accordance with the objectives of the NWA. The need for a decentralized decision making process at the catchment scale has been facilitated by the NWA through the creation of CMAs (Catchment Management Agencies) (Woyessa *et al*, 2006). IWRM at the local scale is one of the key tools that have been endorsed by the NWRS to try to deal with the intense pressures on South Africa"s water resources. It is the focus on the local context, emphasized by IWRM thinking, that the NWRS has deemed as being crucial to the success of the strategy. The process of decentralizing water management begins with the nineteen WMAs (Water Management Areas) that have been identified across South Africa, each of which is expected to have a CMA in place by the end of 2011. Each WMA was demarcated

so as to include either a single primary drainage region or a group of primary or tertiary drainage regions (RSA, 1999).The variable nature of water resources and wide array of water users across South Africa has accentuated the need for these agencies to be instituted and empowered to manage water according to local contexts (Woyessa *et al*, 2006). The process is further decentralized by developing WUAs (Water User Associations) within local catchments often as replacements for former irrigation and water boards.

The implementation of water management at the local scale is, however, highly complex as it often requires that the water use demands of a range of stakeholders, from industry to agriculture, have to be considered while ensuring that the ecosystems, from which water is abstracted, are not damaged (Cessford & Burke, 2005). The themes of adaptive management, social learning and stakeholder participation are at the core of most strategies developed and employed to deal with this. Catchments, under the NWA, are defined as social ecological systems and therefore their management must involve the integration of all stakeholders. CMAs and WUAs aim to cater for this through the promotion of participation and the creation of conditions that allow for social learning and the formation of social capital to take place, amongst often diverse groups of stakeholders (Stringer *et al*, 2006). Social learning in particular has gained increased recognition as a participatory approach used in addressing environmental problems at the local level, including water management. One of the primary issues that has to be dealt with by these processes concerns conflict. Conflict between stakeholders with opposing attitudes and behaviors is a definite reality when dealing with a resource as scarce and variable as water. However through dialogue and the forging of new relationships, the possibility of integrated management in accordance with the objectives of CMAs is far more likely.

The decentralization of water governance has become a prevailing theme in water governance discourse as it promotes participation and accountability by bringing decision making closer to those affected (Lemos & Agrawal, 2006). It also allows decision makers to make use of precise time and place specific knowledge about water resources. In essence decentralization is about rearranging power relationships along the vertical axis within regional, national and local spatial scales (Mirumachi & van Wyk, 2010). This rearrangement aims to foster the broad based stakeholder dialogue and participation which has been absent from much of the southern African regions progress concerning transboundary water management and the development of river basin commissions (Swatuk, 2008).

South African water policies can be characterized as new, inclusive and progressive due to their focus on decentralization and adoption of participatory water management strategies (Mirumachi & van Wyk, 2010). These characteristics and their inclusion into policy importantly also dispense with, and effectively banish, the concept of neoliberalism in terms of water governance in South Africa as neoliberal policies pursue the enclosure of water commons and advocate the privatization of water resources (Perreault & Martin, 2003).This is precisely the opposite of what decentralized water governance aims to achieve.

In the South African scenario a significant challenge to the decentralized governance model is the lack of consistency between catchment boundaries and administrative and political borders as rivers themselves are frequently used as borders (Ashton, 2008). This pattern persists at international and sub-national scales as rivers are employed as administrative and political boundaries although their catchments traverse two, or multiple, political entities. Water governance literature considers management issues in the context of natural catchment borders and not in terms of political borders. Thus, when a river forms a political or administrative border, a mismatch in boundaries exists which has potentially complex implications for the management of that catchment (Norman & Bakker, 2009). Boundary demarcations are generally the result of either physical or functional criteria (Post *et al,* 2007) and, in the political sense, rivers provide an attractive physical landmark which bounds the functional processes of government or governance frameworks.

However, it is the catchment that is advocated as the natural unit for water management in South Africa. Using river basins and catchments as units for water management allows managers to govern an enclosed, individual system within an explicit physically defined area. Although developments such as ITBs (Inter Basin Transfers) disrupt this, the catchment is the logical unit for water management. It should be noted that the current discourse on IWRM has revealed this to be a point of contention as the main challenges to the implementation of IWRM in southern Africa have been described as „political" and therefore the use of the catchment as a unit for water management has been called into question (Swatuk, 2008). Catchment boundaries are derived from the topography of the landscape and therefore from physical criteria. A catchment can be defined as a topographically delineated area drained by a stream system. Watersheds, ridges of high land, form the boundaries of a catchment as beyond the watershed precipitation will drain into an adjacent basin (Brooks *et al*, 1997). A river basin can be defined in the same way,

but normally extends to include the entire river and its tributaries and thus can cover an extremely large area. For example the catchment of the Vaal River is part of the Orange River Basin (Gleditsch et al, 2006). South Africa has 22 primary river or drainage regions, although these are not always spatially consistent with the country"s drainage basins (DWAF, 2000b). The boundaries of the country"s nineteen WMAs, see Figure 2, resemble but do not match exactly those of the 22 drainage regions.

Research gap & motivation

An extensive array of literature exists which deals specifically with the management of transboundary or international water resources and the drivers of conflict and cooperation in such river basins (Toset *et al*, 2000; Giordano *et al*, 2002; Hensel *et al*, 2006). The causes of many water challenges develop at the regional level, hence the focus on international drivers of conflict and cooperation. However the effects are most acutely felt at the local level. The instituting of a river as a border may have been a decision made at regional level but the consequences of that decision are highly localized. The available literature dealing with participatory water governance at a local scale is substantial and the means through which it can be achieved have been widely researched and published (Farolfi & Rowntree, 2005; Stringer *et al*, 2006; Woyessa *et al*, 2006). However this literature does not investigate the fundamental drivers of conflict and cooperation to an extent comparable to that of those authors discussing the issue at the international scale. The research gap which this project aims to fill concerns marrying these two fields of research and introducing topography as a third element for consideration. This project aims to investigate if and how rivers act as borders and what the effects of this will be for catchment management process whose foundations lay in the participatory method. As catchment management, in its proposed form, is a local process, the impacts of local borders should be scrutinized as they will effect whether the river in question unites or divides local stakeholders. No South African study known to the author has explored the effect of the river itself, and its topographic setting, on the drivers that foster either conflict or cooperation, and allow for participatory management. This study therefore investigates stakeholder perceptions of, and responses to, rivers as dividing or uniting features. It examines the effects of employing a river as an administrative or political border on stakeholder cohesion. It determines if the different topographies through which a river flows have an effect on whether a river acts as a unifying or dividing feature, and considers the implications of the findings for the management of catchments in South Africa.

The importance of including the topographic factor stems from the form of South Africa‟s river systems. The physical nature of the South African landscape means that valley topography will have an important effect on whether or not a river engenders cooperation and therefore if a catchment is a suitable candidate for participatory catchment management. The current geomorphological features of the South African landscape represent a long history of igneous activity and earth movements (Christopher, 1982). Over the millennia a number of geomorphic cycles, most notably tectonic isostatic upliftment during the Miocene (15 million years ago) and Pliocene (2 million years ago), have shaped South Africa‟s highly variable landscape (Eriksson, 2000). As a result many of South Africa‟s rivers in their middle courses are deeply incised into a plateau like surface that is likely to hinder cross-river communication. Wide floodplains that enable riparian agriculture are the exception rather than the norm. Due to the variability of the South African landscape, within relatively small areas river systems and their tributaries can flow through highly contrasting topographies, most notably deeply incised valley types and flat landscapes with extensive floodplains. A question that this project endeavoured to answer was „do different topographies affect the capacity of local stakeholders to engage in the participatory management of their catchments?‟ If South Africa‟s proposed form of decentralized water management is to be successful in dealing with South Africa‟s precarious water situation, it is not only necessary to determine if rivers do in fact facilitate cooperation rather than conflict, but to also determine if this model of water management is universally applicable across different topographies.

The Orange-Senqu River scenario

The importance of water to human wellbeing implies that complex power relations often exist around the resource when it is shared by multiple stakeholders. Shared rivers in particular provide permanent linkages between different stakeholders (Turton, 2005). This often creates complex hydropolitical interactions which have a significant bearing on the development of cooperative water management relationships. The Orange-Senqu River provides an interesting system for research on rivers as borders as it flows through a number of highly varied environments and topographies over its 2300 km course. It acts as a provincial border between the Eastern Cape and the Free State, the Free State and the Northern Cape, and a national border between South Africa and Namibia. Water dependency also forms a fundamental element of the geo-political nature of the Orange-Senqu River as the headwaters of South Africa‟s largest river originate in Lesotho and

therefore water resources generated externally form a significant part of the country‟s total renewable water resources (Hoekstra & Chapagain, 2008). From a hydropolitical and catchment management sense the Orange River Basin also provides an unusual situation as thirteen IBTs link the basin to six other national and international river basins (Turton, 2003). All of the linkages are considered to be of strategic importance to South Africa. However the development of ITBs implies that the notion of the catchment and the basin as the primary units for water management is skewed. If catchments are linked across basin watersheds, the management of the affected catchments becomes more complex as strategic interests have to be factored into management strategies. Particularly with regard to international river basins, such as the Orange, ITBs complicate the issue of equitable and beneficial use of water (Pallett, 1997). The use of rivers as international borders adds a further complex dynamic to the management of international catchments and basins. Ten rivers form 2758km of South Africa‟s international borders which equates to 63.9% of the country‟s total terrestrial borders (see Figure 1). Within the Orange River basin the Caledon, Makhalenge, Molopo, Nossob, Ramatlabama, Orange-Senqu and Telle rivers form 1904km of international border. The Orange River basin thus illustrates the complexities that catchment management in South Africa has to contend with and the wider hydropolitical influences at play in the country.

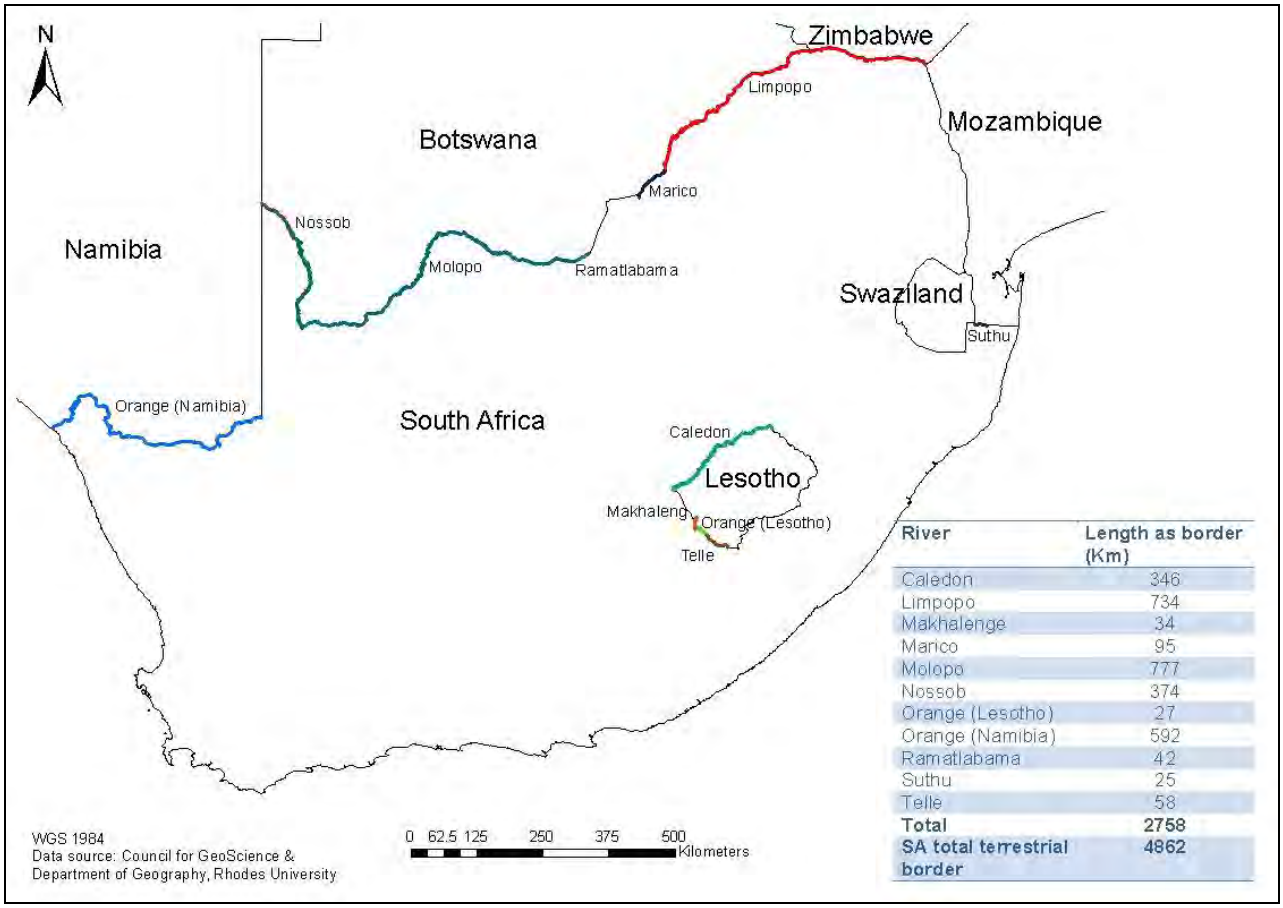

Figure 1: South Africa's international river borders

1.2 RESEARCH AIM & OBJECTIVES

Social interactions and politics, human relations organized by power, are "inherently spatial for they are both concerned with distributions of activities, authorities, functions, names, individuals or groups, and places" (Dikec, 2005: 186). Dikec (2005) contends that there have been significant developments in conceptualizing space politically and politics spatially over the last fifteen years. Consequently the geography of human relations has become an important issue orienting research. This research continues this trend in thinking as it investigates how physical geography and the use of rivers to bound institutions, affects the spatial distribution of human relations. It achieves this by considering how rivers divide or unite stakeholders, the effects of rivers as borders and the impact of the topographies surrounding them. The significance of investigating these phenomena becomes apparent when determining the implications of them for the management of catchments in South Africa.

The aims of this study are therefore:

1) To determine if rivers act as dividing or uniting features in a socio-political landscape and whether topography will influence their role in this context.
2) To consider the implications of this for catchment management in South Africa.

This study intends to achieve its aims by meeting the following objectives, using the Orange-Senqu River and tributaries as a case study:

1) To compare the study sites with respect to the nature of their water resources.
2) To investigate whether the river acts as a barrier to social networking and communication.
3) To compare the effect of site characteristics on social cohesion within the sites as a measure of potential for participatory water management.
4) To compare the effect of site characteristics on the degree of active cooperation within the study site.
5) To compare the effect of site characteristics on the potential for water based conflict within the study site.
6) To investigate the extent of knowledge of and engagement with water management institutions and policy.

1.3 THESIS OUTLINE AND STRUCTURE

This first chapter serves to provide a context within which the study has taken place and to explore the rationale behind this undertaking. This chapter introduces the nature of South Africa‟s water resources, its potential for water conflict and cooperation, and the steps that government is taking to manage the country‟s water resources. Chapters 2 and 3 expand on these elements by firstly reviewing literature relevant to the project and then by examining the structure of water governance in South Africa. Chapter 3 is specifically designed to illustrate why participation is critical from a legislative point of view and why it is so heavily emphasized. Chapter 4 provides a description of the the study area within in which

data was collected and then discusses the methodology behind the selection of the study sites, data collection and data analysis. Chapter 5 presents the results of the study which are relevant to the first aim of this project while chapter 6 presents those results which pertain to the second aim of this project. Each of the sections within these two chapters contains a specific discussion while chapter 7 provides a general discussion, the projects conclusion, as well as the limitations and recommendations of the project

CHAPTER 2: REVIEW OF LITERATURE

2.1 INTRODUCTION

Mohamed (2003) states that researchers have considered the geopolitics of shared water resources in two ways, these being in terms of either conflict or cooperation. The ability of a river to either divide or unite stakeholders will determine if a river fosters conflict or cooperation between those stakeholders; therefore it is important to identify what are the causes of conflict over shared water resources and what circumstances promote cooperation. The aim of this review, in part, is to analyze the current literature which discusses these two alternatives to shared water resource management and draw out the drivers of conflict and cooperation in this context. Although much of the literature reviewed deals with these concepts at a national and regional scale the principles derived from them will transcend the different spatial scales of investigation for this project. The issue of scale and the transferability of principles and strategies for water management across spatial scales are discussed as a separate topic within this review.

The status of a river as either a dividing or uniting feature will influence the effectiveness of water resource and catchment management initiatives and the way in which they are implemented. Water management policy in South Africa, as will be discussed in depth in chapter 3, is focused on decentralizing water management and incorporating local stakeholders into participatory processes with the mandate of designing integrated local water management strategies and action plans. Conceptualizing the importance of and challenges associated with, water management and public participation is a further aim of this review. The existence of conflict and cooperation within a catchment will heavily influence the success of participatory processes and the form of subsequent water management structures; it is with this in mind that these themes form the core of this literature review. Firstly, however, it is important that the nature of borders is discussed in order to draw out the key functions of a border that will need to be considered if an attempt is made to understand them as either dividing or uniting features.

2.2 THE NATURE OF GEOGRAPHIC BORDERS

The state must possess four characteristics in order to verify its sovereign status in the international community: a permanent population, a government, a capacity to enter into relations with other states, and a defined territory (Heater & Berridge, 1993). Borders mark the limit of sovereignty and state control and thus have to be mapped out in geographic space. Geographic borders therefore define a state or administrative entity in space. Employing a river, or a section of a river, as a border, is seemingly an attractive option as it provides a distinct physical boundary that is easily recognizable. However, according to Beckinsale (1969), the advantages of utilizing a river as a border are often offset by four key drawbacks. Firstly, most rivers naturally change their courses over time particularly when they are subject to extreme flood events. Secondly, floodplains and flat fertile riparian lands are highly attractive to settlers on both sides of the river and therefore competition over resources, particularly if water resources are scarce, can be fierce. Thirdly, withdrawals of water from the river or pollution discharged into the river affects stakeholders on both banks of the river. Finally, definitive legally binding demarcation of borders is complex and usually highly debated (Beckinsale, 1969). The use of rivers as borders therefore presents a number of issues and in South Africa these become apparent when considering the implementation of South Africa‟s water management policies.

In the South African context the use of rivers as political boundaries at national and provincial levels has presented a significant issue in terms of the implementation of catchment management policies as discussed by Pollard & du Toit (2005). Water management policies in South Africa use the catchment as the geographic unit for water management; however the provision of water services falls under the mandate of the municipality or province concerned. Therefore there is a definite mismatch between administrative and management boundaries, particularly when rivers are employed as a physical border between two administrative entities. Pollard & du Toit (2005) furthermore argue that this mismatch of boundaries undermines efforts to institute integrated and participatory water management practices in South Africa. This view is shared by Berkes (2006) who states that the mismatch between institutional and resource boundaries is one of the key issues that must be taken into account when considering any kind of resource management. Achieving the IWRM goals of the 1998 NWA is complicated considerably by this border issue as institutions dealing with either supply or management of water

operate within different spatial frameworks. IWRM thinking, however, dictates that water management and supply should be implemented and should operate in unison. In this case the use of rivers as borders is highly problematic as political borders in South Africa bear little resemblance to those of catchments. Managing catchments across such borders is further complicated by a need to understand the role of the border in socio-economic, socio-political and socio-cultural contexts and not just a geographical one.

Simply dealing with borders as geographical spaces is insufficient if the aim is to understand them comprehensively in the geo-political sense. Spatial borders exist as physical geographic objects which can be reinforced through their coexistence with non-spatial social borders. In order to understand borders fully, their study also needs to be about identities (Mol & Law, 2005). Turnbull (2005) expands greatly on this as the study discusses how difficult it is to define and disentangle borders from their histories. The issues associated with using rivers as borders, as explained above by Beckinsale (1969), extend beyond the geophysical as Turnbull (2005) argues that borders persist in a plethora of different roles. They exist, "spatially as geopolitical entities, temporally as historical periodicities, socially as national, natural and individual identifiers and epistemologically as knowledge limits" (Turnbull, 2005: 758). All of these individual yet deeply interconnected subject domains present themes that need to be considered when attempting to understand the role of borders. As this project determines if rivers act as dividing or uniting features, it considers the deeper meaning of the border in question to those on either side of it. According to Turnbull (2005), borders are essentially framing devices that find themselves thoroughly entrenched in modernist metaphysics, colonial ontologies and power politics and therefore need to be explored across all of these conceptual levels.

Coplan (2001) explores the way in which social interactions develop around a river when it is used as a border and how these interactions manifest themselves by enhancing cross border activity. Coplan (2001) argues that the river, by acting as a division, in effect unites communities on either bank as the border forces specific economics and social interactions to take place; however understanding this phenomenon requires an investigation of the specific region"s turbulent history. Donnan & Wilson (1999) share a similar point of view as they suggest that transnationalism in border regions allows for the integration of ideas, values and traditions and therefore borders can, in this sense, foster not only inter-state cooperation but also cross-cultural interaction. However this claim is made while considering only local communities. Experiences from the EU (European Union) illustrate

how national identities are in fact being strengthened as the role of borders as political barriers is being reduced. Importantly, Donnan & Wilson (1999) note that cultural landscapes often transcend political ones, especially in border regions. This is particularly relevant in the African context where many national borders are arbitrary relics of the colonial era and often bear no resemblance to cultural boundaries. It is however also recognized that rivers do exist in some cases, particularly in Africa, as natural borders between communities (Donnan & Wilson, 1999). The difficulties associated with crossing rivers can turn them into physical but non-official dividing features in the social landscape.

Donnan & Wilson (1999), state that the role of borders is changing due to the relentless pursuit of global neoliberal economic policy, globalization and the internationalization of politics. With these developments the role of borders may be reduced simply to geographic demarcations. Organizations such as the EU have implemented policies to remove the physical borders between states and erode borders to that of geographically bounded cultural borders. As free trade areas are promoted and strengthened throughout Africa the evidence already suggests that the SADC (Southern African Development Community) region in particular will eventually follow a similar course of action and witness the gradual erosion of international borders and a change in their meaning. Although this paragraph considers international borders and therefore issues operating at a different scale to that of this project, section 2.7 addresses the issues of scale and why discussions such as this are relevant.

2.3 DRIVERS OF CONFLICT

The nature of South Africa‟s water resources implies that conflict over increasingly scarce and variable water supplies is a probable eventuality unless steps are taken to avoid the development of conflict scenarios (Ashton & Turton, 2009). This is a key aim of South Africa‟s decentralized water management strategy. By discussing the drivers of conflict, this section identifies those relevant to borders. Although these are in the international context the same principles apply at the local scale.

Under international law individual states have the right to control territorial water resources and utilize them in an equitable and reasonable manner (Haftendorn 2000). However, according to Haftendorn (2000), it is the absence of consensus between the states involved

as to what constitutes equitable and reasonable use that drives the majority of water conflicts. Ashton (2008) describes the term „water conflict" as "any disagreement or dispute over or about water, where external social, economic, legal or military intervention is needed to resolve the problem" (Ashton, 2008: 3). However it is noted that water is seldom the primary cause of conflict and often serves as an incidental catalyst; pure water conflicts, or water wars, are extremely rare and only occur when armed conflict takes place in order to secure or gain access to a water source. Water supply is generally considered the primary cause of water conflict; however Toset *et al* (2000) state that water conflicts are often associated with broader issues and in fact water supply is often only one of a number of interacting variables that drive water conflicts. Giordano *et al* (2002) present a similar argument as they state that trans-boundary water conflicts, at any spatial scale, seldom exist in isolation from other international, national or local issues. Therefore there is a relationship between domestic geopolitics concerning water and broader national affairs and vice versa. Water based conflicts are thus not normally a simple function of geographic distribution but are often deeply immersed in a web of other geopolitical issues. The literature, however, does point out a number of geographic characteristics of water which contribute to conflict over the resource.

According to Ashton (2008) there are five key geographical and related geopolitical characteristics which can influence the probability of water conflict at a strategic level, these being: the degree of water scarcity that already exists in a region; the extent to which the water source is shared by one of more stakeholders; the relative power relationships that exist between water sharing stakeholders; the availability of alternative water sources and their accessibility; and the degree or extent to which a particular boundary is aligned with or located along a shared river system. Similarly Haftendorn (2000) identifies four water conflict types which relate to the relationship between the location of water and stakeholders: conflict through use; conflict though pollution; relative distribution conflict; and absolute distribution conflict. Hensel *et al* (2006), however, place substantial emphasis on the issue of water scarcity in particular, as the primary driver of conflict. Alternatively Toset *et al* (2000), discuss further how the supply of water as a resource may be associated with conflict either as an independent factor or interacting variable and therefore the geographical characteristics of water, in its role as a driver of conflict, cannot be viewed in isolation from the resources geopolitical context and importantly the region"s history. It

must also be noted that many of these possible drivers of conflict are relevant to upstream-downstream conflicts as well as cross river conflicts.

When attempting to understand the nature and root causes of water conflict, it is imperative that these conflicts, both national and international, are considered within their greater political and historical contexts (Giordano *et al*, 2002). Perreault (2008) states that historically constituted social identities, systems of meaning and livelihoods must be considered and integrated into new water governance efforts if water conflict is to be avoided. Incorporating this historical element into the analysis of water conflict dramatically increases the potential complexity of determining the causes of water conflict by presenting a new multi scalar political and historical dimension to the geographic dimensions already discussed (Ashton, 2002). By understanding the history surrounding a river system the reasons for current stakeholder relationships may become apparent. The importance of successful relationships between stakeholders is seen as paramount to the avoidance of conflict.

Haftendorn (2000) focuses on the importance of building trust and friendly relations between stakeholders and using this as the basis for constructing cooperative symmetrical institutional structures which facilitate water conflict resolution. Toset *et al* (2000) build on this claim by stating that as far as shared rivers are concerned the nature of the upstream/downstream relationship between stakeholders is one of the principal determinants of water conflict probability. The study by Toset *et al* (2000) further states that water conflicts are less probable when stakeholders enjoy shared values and cooperative relations regarding renewable resources and conflicts are likely only under special circumstances such as a high dependence on water, as a downstream riparian stakeholder, or when a history of antagonism exists between two stakeholders. Resources directly result in conflict when: the scarcity of the resource increases within a region; that resource is essential for human survival; the resource can be physically seized or controlled (Hensel *et al*, 2006). Water meets all three of these criteria and therefore creates an environment conducive for conflict of some kind, particularly when shared. Therefore relationships between stakeholders need to be developed and, once this takes place, agreements must be formulated and institutions put in place to equitable manage shared water resources.

Haftendorn (2000) introduces the concept that a spread of regional, international and local institutions to facilitate conflict resolution are of the upmost importance. According to the study it is the conversion of context specific conventions to regimes which have led to the most successful instances of conflict resolution. These regimes essentially formalize and embody in longevity the norms, principles and procedural rules of the initial convention (Haftendorn, 2000). This claim is supported by Hensel *et al* (2006) as their study investigates the probability of water conflict by assessing two factors, the availability of water and the prominence of institutions designed to control water resources shared by two or more states. The authors conclude that river institutions have been effective in reducing violent conflict over water resources and have consistently prompted successful negotiations between stakeholders over shared water resource related issues. They emphasize, however, the importance of river specific institutions as each shared river system will be unique in a variety of ways such as its geopolitical and historical settings. According to Perreault (2008) the development of such institutions and water management policies must include all stakeholders, specifically local water users, if conflict is to be avoided. Traditionally the governing and management of resources takes place through an ensemble of organizations, institutional frameworks, norms and practices which operate at a number of scales. Water conflict can however arise when a reorganization of these governance structures takes place without the inclusion of all stakeholders in the process (Perreault, 2008). Hensel *et al* (2006) nonetheless note that water scarcity is likely to negatively impact the effectiveness of water management institutions as will an absence of political democracy in any of the states involved. Therefore the ability of institutions to overcome obstacles to cooperation in anarchic river systems is subject, once again, to a complex mixture of geographic and geopolitical factors. The use of rivers as borders will hinder the development of institutions designed to remove the causes of water based conflict. Similarly if rivers act as dividing features it will be more challenging to mitigate these drivers of conflict.

2.4 FACILITATING COOPERATION

Facilitating and engendering cooperation is fundamental to the success of South Africa‟s decentralized water management strategy. Cooperation will have to be facilitated where rivers divide as well as when they unite stakeholders on either side of a river. This section

brings forward discussions about how cooperation can be facilitated and therefore how, in the context of this study, cooperation can be facilitated across borders.

Hydrological interdependency and the need to manage shared systems have served to erode the Wesphalian notion of sovereignty and reduce the autonomy of individual states (Alam *et al*, 2009). This movement has been termed the „greening" of sovereignty and is essentially a response to new notions of responsibility and the need for cooperation when resources are shared by multiple states (Liftin, 1997). Chenje (2003) describes two key concepts that need to be understood and differentiated from one another when dealing with cooperation concerning shared water resources. These concepts are hydropolitics and hydrodiplomacy. Firstly, hydropolitics is described as being about national and collective basin interests that concern benefits, self interest, security, cooperation, compromise, coercion and conflict. Alternatively hydrodiplomacy is a conscious process by the stakeholders involved to peruse either individual or collective interests without threatening each other (Chenje, 2003). The challenge lies in the latter as it needs to be integrated into the thinking of all stakeholders. Factors that need to be considered concurrently with these concepts are climate, social factors like population growth, poverty and development, pollution and the legal and institutional frameworks that are in place. All of these factors will substantially influence the probability of hydrodiplomatic effectiveness (Chenje, 2003). Four associated issues, which will be crucial to the success of any cooperative efforts, are the internationalization of the water resource, the levels of integrated management, transparency and public participation and the role of other organizations (Chenje, 2003). The success of hydrodiplomacy lies in the ability of stakeholders to jointly develop management policies that ensure equitable and sustainable use, and their ability to do so at a regional as well as local scale.

According to Mohamed (2003), the emergence of a water crisis amongst the arid and semi-arid states of southern Africa has left these nations with a single water management option due to their high dependency on shared water resources. Joint resource and policy development and cooperation is the only alternative available to such states if shared water resources are to be managed sustainably and water conflict avoided. The SADC contains 15 international shared river basins and already a number of states have signed a wide array of bilateral and basin wide agreements designed to facilitate collective management within them. This indicates that within southern Africa governments are committed to enhancing and strengthening levels of cooperation and thereby reducing the potential for water

conflicts (Turton & Ashton, 2008). The situation in southern Africa is, at least in principle, supporting the belief that growing dependence on international water resources will stimulate greater cooperation among co-riparians as they strive for the common goals of water security and peace (Mohamed, 2003). Uitto & Duda (2002) share this opinion as they emphasize the idea that instead of shared water resources being zones of conflict they can provide an opportunity and basis for cooperation and benefit sharing. The increasing number of treaties and agreements between co-riparian states is indicating that water conflict is not the inevitable outcome associated with shared water resources and in fact increasing scarcity in itself may drive cooperation at a regional scale. The study conducted by Becker & Easter (1999) can be used to further support this stance. Through the use of game theory, the study demonstrates that non-cooperation and conflict is not necessarily the inevitable outcome in the case of shared water resources. According to Becker & Easter (1999), once a minimum number of stakeholders decide to cooperate the remaining non-cooperative stakeholders will find it in their best interests to do so. Therefore stable and constant cooperation, regarding the management of shared water resources, initially relies on just a few of the total stakeholders involved (Becker & Easter, 1999). Although this would not be the ideal method for collaborative water management it may represent a viable alternative course of action which could be employed to force difficult or non-cooperative stakeholders into the management process. The preferred method for successful cooperation is centered on the joint development of water management policies.

Mohamed (2003) lays out the critical factors influencing joint development and management efforts concerning shared water resources. The factors which must be considered in a cooperative process are: river hydrology, political relations, economic capacity and geopolitical boundaries. By taking into account the physical, hydrological and economic situations of stakeholders in shared river basins, Mohamed (2003) argues that a more comprehensive explanation of the geopolitical situations can be formulated and from this point the most appropriate courses of action determined. Turton & Ashton (2008) are in agreement with Mohamed (2003) as they recognize the paramount importance of the deployment of collaborative institutional processes and structures to deal with threats to cooperation and peace. In the SADC context, however, shared water resource management is hampered due to a fragmented and weak institutional and legal framework as well as an absence of the inclusion of these three factors in the management process. The recurring theme of institutional approaches for facilitating cooperation persists throughout the

literature and in particular forms the basis of the study by Uitto & Duda (2002). Their study places specific emphasis on the need for collaborative decision making processes so as to ensure the sustainable development and equitable use of shared water resources. Ashton (2002) makes the key point that water management must be a collaborative affair regardless of scale. Likewise Uitto & Duda (2002) concluded that all stakeholders must be drawn together and forced to jointly develop water management policies which are equitable and enforced through an institution of some kind if water conflict is to be avoided. The overall point which is stressed throughout the literature is that joint decision making through multilaterally developed basin wide institutions must take place if conflict over shared water resources is to be avoided. To achieve this, stakeholders must align policy and strive for regional development.

Ashton (2002) stipulates that water allocation and distribution priorities within states must be closely aligned with national and regional development objectives. According to Ashton (2002) collaborative development and implementation of new water management policies must take place at a regional level. This is to ensure that neighbouring states do not employ potentially conflicting policies, but rather work collectively toward regional developmental goals and collectively cope with the pressures of economic growth with regards to water. The encouraging evidence within the SADC of a growing culture of cooperation and the development of joint institutions to manage shared water resources has, however, been overshadowed by an exceptionally slow rate of implementation (Turton & Ashton, 2008). States have yet to break away from traditional decision making processes that only apply within its sovereign territory. Discarding this ineffective way of thinking is crucial. Turton & Ashton (2008) agree with authors such as Haftendorn (2000) in that they state that measures designed to avoid water conflict must be based on joint decision-making processes that are based on suitable legislative and institutional frameworks developed at a regional scale. Regional agreements designed to help achieve the development of regional policies and goals consistently embody eight core elements that need to be adopted. These eight elements are: equitable use, avoidance of significant harm to other riparian stakeholders, sovereign equality and territorial integrity, information exchange, consultation with other stakeholders, prior notification, environmental protection, and peaceful resolution of disputes (Turton & Ashton, 2008). Regional polices must embody these elements and protocols while similarly recognizing that benefit sharing and equitable

use must be at the centre of any agreement if cooperative initiatives are to be successful (Uitto & Duda, 2002).

Cooperation is dependent on the ability of stakeholder‟s to find common ground with respect to norms and values concerning shared water resources. However (Uitto & Duda, 2002) state that if solid science and the factual analysis of problems and opportunities form the foundations of cooperative initiatives, the potential for mutually acceptable solutions and benefit sharing increase dramatically. Although the literature in this section discusses cooperation largely at an international scale, again the principles brought forward are applicable to the local scale. Concepts such as the deployment of collaborative institutional processes and the adoption of catchment wide policies that transcend borders are of fundamental importance to local as well as international efforts to facilitate cooperation.

2.5 WATER MANAGEMENT

IWRM aims to optimize social and economic welfare, without compromising environmental sustainability, by facilitating the coordinated development of water resources (van der Zaag & Savenije, 2000). It therefore recognizes the importance of integrating all stakeholders as well as environmental interests into the decision making and management process. Full integration must, in particular, lie at the foundation of management strategies for shared international water resources (van der Zaag & Savenije, 2000). The importance of these criteria is expanded by Sneddon & Fox (2006) who state that efforts to understand the complexities of shared river basins, and subsequent efforts to manage them, must embrace interdisciplinary perspectives and integrate them. Once this requirement is realized the „three pillars‟ of effective water management can be developed which strive for the balanced and equitable sharing of international water resources. Van der Zaag & Savenije (2000) explain that the first of these three pillars calls for technical or operational cooperation, the second is the political sphere which is “responsible for an enabling environment of political will and commitment to cooperation” (van der Zaag & Savenije, 2000:47), and the third pillar accounts for institutions responsible for law making, enforcement and management. It should be noted that these pillars are not mutually exclusive. For example, the institutional pillar is the result of political will and intense technical cooperation. Conley & van Niekerk (2000), by analyzing the Orange River basin, illustrate the difficulties in achieving balanced development of these three pillars. In the

case of the Orange-Senqu River the most significant, post 1994, advances have been made in the technical-operational field while the institutional and political realms have yet to reach the same level. Lopez-Gunn (2009) points out that although these principles or „pillars" may be universal, management regimes must be adaptive and designed to fit a particular situation. No two river basins are subject to identical circumstances and drivers and therefore management strategies must be tailored to suit each case. Van der Zaag & Savenije (2000) reach four conclusions pertinent to the management of shared water resources. Firstly, integrated management requires triggers to be identified and opportunities for enhancing cooperation taken; technical communication and cooperation is absolutely vital; the capacity for negotiation of stakeholders needs to be equal; and finally, free and unrestricted access to hydrological information is crucial.

Lopez-Gunn (2009) argues that for water management to be truly effective there needs to be a movement away from „government" to ‚governance" in the case of shared water resources. Lopez-Gunn (2009) presents two primary pieces of evidence to support this. Firstly, it cannot be assumed that the state will always act in the best interests of its people, and secondly, the state often lacks the capacity to effectively carry out its mandates and responsibilities. Building on this, Lopez-Gunn (2009) notes that the state is a bound institution whose influence ends at its geographic borders, whereas the sphere of public interest does not when catchments transcend international borders. International water management thus depends largely on the state"s ability to erode its own notion of independence and cooperate with its neighbors in an intensely integrated fashion. The difficulties associated with this are significant. Conley & van Niekerk (2000) show how in southern Africa mutual mistrust, inherent in the areas political situation, has severely hampered the growth of the legal and institutional infrastructure needed to support sustainable international water management. Fostering political conviction and sufficiently strengthening new regional institutions and legal frameworks is thus fundamental to achieving real and sustainable water management (Conley & van Niekerk, 2000).

Sneddon & Fox (2006) expand on the complexities associated with water management at a basin scale and specifically where basins are international. Sneddon & Fox (2006) argue that the complexity lies in that fact that many basins are simultaneously perceived as important stimulators of economic growth, the fundamental basis for local livelihoods, and as biodiversity hotspots. Balancing human and environmental needs is complex but as sustainable water management practices recognize that water resources are finite, human

needs must be calculated alongside the environmental requirements of freshwater ecosystems (Richter *et al*, 2003). Wallace *et al* (2003) suggest that IWRM is the most effective tool for finding the balance between human and environmental water needs within catchments. Sneddon & Fox (2006) go on to illustrate that cooperation, which in the third world is perceived as the basis for proceeding with water resource development in shared river basins, is underpinned by the principle of equitable utilization. However, such principles are often "far removed from the hydrological and ecological processes or river basins" (Sneddon & Fox, 2006: 191). Since, unlike South Africa, not all states have environmental requirements built into constitutions or national legislation, this is a key water management challenge further exacerbated by the lack of uniformity in legislation within shared river basins.

Integrated supply and demand management has until recently referred only to human needs with devastating cost to, largely neglected, fresh water ecosystems (Richter *et al*, 2003). Freshwater ecosystems provide an irreplaceable wealth of goods and services for human society, however the sustainability of these benefits, and the biodiversity of the systems that supply them, are constantly under threat from ever increasing appropriation of water by society. Part of this problem stems from a view that humans and natural systems are in competition with each other over available water resources (Richter *et al*, 2003). Richter *et al*(2003) state that the challenge of ecologically sustainable water management is ultimately to design and implement management programs that "store and divert water for human purposes in a manner that does not cause affected ecosystems to degrade or simplify" (Richter *et al*, 2003: 207). Wallace *et al* (2003) state that this can be achieved through water policies and laws, that make provision for the sustainable management of water resources by determining environmental flows, while simultaneously incorporating social factors into implementation strategies. It is also noted that South Africa has one of the world‟s most progressive policies for water management, the National Water Act of 1998, which includes ecological water requirements (Wallace *et al*, 2003). The limits of water use should therefore be defined by the requirements of affected ecosystems and not by human needs. Finding compatibility between differing user groups, including ecosystems as an equal stakeholder, implies a commitment from all stakeholders to continuous participation and active dialogue (Richter *et al*, 2003). The process for developing an ecologically sustainable water management program must, according to Richter *et al* (2003), include: determining the flow requirements necessary for sustaining

native species and natural ecosystem functions; account for both current and future human use and develop models for simulating human induced alterations to flow regimes; considering both temporal and spatial characteristics when assessing incompatibilities between human and environmental needs; collaboratively searching for solutions to incompatibilities; conducting experiments to resolve uncertainties in efforts to balance and integrate water needs; the designing and implementation of adaptive management programs to ensure long term sustainability. The growing recognition of ecosystem requirements implies that effective water management, at any spatial scale, must cater for the inclusion of environmental water needs and be given equal stakeholder status.

The definitive goal of water management policy within catchments is "to increase the beneficial utilization of rainwater falling in the catchment through the reduction of non-beneficial losses and water pollution" (Woyessa *et al*, 2006: 648). Achieving this goal requires incorporating a wide array of demands across the water use spectrum from irrigation to industrial needs. Accommodating these needs is further complicated, in the South African case, by the relative scarcity of water across the region (Woyessa *et al*, 2006). Furthermore the water management paradigm, within an IWRM framework, is shifting as increasing attention is being drawn to upstream influences on water use entities as well as the downstream impacts resulting from them. Woyessa *et al* (2006) argue that when taking into account all of these factors the need for wise decision making by catchment management authorities is accentuated significantly. This critical need is recognised by the NWA and has resulted in the establishment of CMAs as a legal requirement. Woyessa *et al* (2006) conclude by reiterating the point that IWRM must be part of a basin-wide effort, supported by effective institutions and policies, to ensure that upstream interventions do not take place at the expense of downstream users. Importantly Woyessa *et al* (2006) note that these principles are not scale specific, only practices and approaches change with spatial scale.

When discussing water management at reduced spatial scales, Leach *et al* (1999) suggest that a state of co-management should exist where responsibilities for resource management are appropriately shared between local stakeholder sectors. By doing this, sustainable development practices based on local level solutions, can be derived from community driven initiatives. Arafa *et al* (2005) agree but emphasize the point that successful local level water management necessitates close collaboration between government and local stakeholders. The combined involvement of interdisciplinary actors is also seen as crucial

to effective governance and the creation of institutions. Leach *et al* (1999) again refer to the importance of institutions in regulating local resource management. Yet in their study, institutions are seen as "regularized patterns of behaviour between individuals and groups in society" (Leach *et al*, 1999: 226). However the prevailing discourse on approaches to local resource management, particularly in IWRM and CBNRM (Community Based Natural Resource Management) literature, promotes formal community level organizations. The involvement of local stakeholders in governance structures and therefore the decision making process "promotes participation, ownership and dynamic management in water governance programmes and activities" (Arafa *et al*, 2005: 1). The theme of public participation now lies at the foundation of numerous water management philosophies and paradigms for these reasons.

2.6 PUBLIC PARTICIPATION IN WATER MANAGEMENT

Over the last 25 years there has been a remarkable shift in water management theory, from working for, to working with local stakeholders. The change in thinking is centered on a movement away from linear, positivistic and technology transfer models to philosophies that address the need for an integrated approach Schaap & Nandi (2005). Schaap & Nandi (2005) present a study in which PRA (Participatory Rural Appraisal) is discussed as one possible participatory method that can be used in developing water management strategies that account for the varying political, social, economic and technical dimensions of local water requirements. Their study emphasizes that successful intervention depends upon the inclusion of all these aspects. This shift in water governance philosophy furthermore allows for the incorporation of a range of political, social, economic and administrative systems which are responsible for the management and delivery of water at various levels of society and therefore essentially are a set of systems that control the water management decision making process (Zoubi *et al*, 2006). The aim of this new thinking is also to enable local stakeholders to strengthen their position in the decision making processes that will ultimately regulate their own activities (Schaap & Nandi, 2005). The widespread adoption of IWRM as a strategy for developing water resources further illustrates the change in thinking as it stresses the importance of the decision making element of the process. IWRM is usually implemented for the management of large geographic areas, however the study by Zoubi *et al* (2006) attempts to apply the same methodologies to a local scale. The reason

for this is that IWRM promotes, through stakeholder participation, collaboration and coordination among individual users in order to achieve transparent and effective local water management.

From the study by Zoubi *et al* (2006) a number of challenges are presented which need to be addressed in order to achieve local water resource management through a participatory framework, and the following studies in this section offer suggestions on how to address these. Firstly the need for local champions and stakeholder empowerment is paramount. Without a single leader from a stakeholder unit who can be relied upon, the interests of that unit are likely to be under represented, misunderstood or neglected altogether. Secondly the participatory approach cannot succeed unless skills including facilitation, negotiation and the promotion of dialogue and appreciation of information are present within the working group (Zoubi *et al*, 2006). Finally problems in communication between different units in the governing structure as well as between stakeholder units need to be dealt with. Often each department within an organization communicates only vertically within itself as opposed to horizontally with other units. Challenges associated with internal politics and issues of authority develop when poor communication exists. Zoubi *et al* (2006) conclude that local level water resource governance must include participation by all stakeholders and end users and to be successful capacity for communication and facilitation must be developed. This needs to take place to ensure full stakeholder participation and to reduce the gap between policy and practice.

The value of including public participation in water resource management lies in its ability to enhance the sustainability of management strategies and to introduce an adaptive management paradigm (Stringer *et al*, 2006). The strength of adaptive management is found in its cyclical approach to policy making where, as circumstances change and stakeholders learn, policy can be modified to suit the relevant environment. More over, participation fosters multidirectional flows of information and the formation of new relationships between stakeholders. The importance of information exchange and dialogue is further developed by Rabi *et al* (2005). Rabi *et al* (2005) discuss the importance of stakeholder dialogue in improving the success of local level water governance and the associated reduction in conflict. In many cases conflicts of interest regarding water resources result from different perceptions of the same issues and top-down management practices.

Rabi *et al* (2005) argue that public participation requires citizens to recognize their right to participate in managing local water resources and that achieving this often requires a major cultural change among the way the public acts and perceives their own position in society. Increasing and facilitating dialogue between stakeholders is central to causing a change in public thinking. The study by Rabi *et al* (2005) states, that the purpose of interactive dialogue is to enhance vertical and horizontal communication and coordination between all relevant stakeholders while simultaneously recognizing the differing perceptions of stakeholder units. Stringer *et al* (2006) state that as information exchange takes place in both dimensions, stakeholders learn from each other and collectively design flexible strategies to manage their environments, including water resources.

The process of social learning in particular helps policy reflect a range of values and viewpoints often unique to individuals or groups of stakeholders and it is by exposing these and then building them into management plans that participation proves its worth (Stringer *et al*, 2006). The theme of social learning has gained increasing recognition as a key participatory approach, especially when managing environments within a larger social context as it promotes increased interaction between stakeholders. This in turn can lead to the transformation of adversarial relationships, the building of new relationships and increased collaboration (Stringer *et al*, 2006). Importantly Stringer *et al* (2006) note that social learning does not necessarily imply that attitudes or patterns of behaviour will change but may contribute to an understanding of conflicting views. Similarly participation and social learning does not remove the possibility of conflict but it can help to appropriately control that conflict. The primary finding that emerges by the study by Stringer *et al* (2006) is that participation needs to be flexible and the institutional environment needs to be designed in such a way as to accommodate this. Finding acceptable solutions to problems and negotiating conflicting interests are only possible through effective, and often mediated, dialogue and information exchange. Rabi *et al* (2005) describe two potential sources of water conflict where an absence of dialogue is largely to blame. Firstly resource scarcity invites conflict in scenarios where the institutional environment is centralized and the problems associated with top-down management are compounded by a lack of stakeholder involvement and poor communication. Secondly conflicts can often arise when competing stakeholders have different interests that they try and defend or form differing perceptions of the issue in question (Rabi *et al*, 2005). In both of the cases conflict can be addressed by facilitating

meaningful dialogue which allows stakeholders to understand the perspectives of others and then negotiate an outcome. This process is complicated if dialogue needs to be facilitated across a river where that river already acts as a dividing feature.

Farolfi & Rowntree (2005) make the connection between access to information and the strengthening of the position of local stakeholders in the decision making process introduced by Schaap & Nandi (2005). The development of new decentralized water management institutions, as required by South African water law, implies managing complex socio-economic contexts "characterized by inequalities, lack of asymmetry of information and conflicting interests" (Farolfi & Rowntree, 2005: 1). The nature of such environments requires that clear decision support and negotiation tools be available for these new institutions. Furthermore Farolfi & Rowntree (2005) state that employing a participatory process to facilitate decision making and negotiation requires input from stakeholders with varying socio-economic backgrounds, unequal access to information and knowledge, and therefore differing capacities for effectively entering into the participatory process. In their paper Farolfi & Rowntree (2005) discuss the use of simulation models and role-playing games for participatory resource management in order to aid decision making and negotiation among stakeholders. Importantly the study reveals that decentralized governance strategies tend to be replaced by top-down centralized decision making when uncertainty exists. Thus processes of discussion, empowerment and negotiation need to be nurtured when uncertainty exists among stakeholders and so facilitate participatory bottom-up management (Farolfi & Rowntree, 2005). Notably the study concludes that asymmetry of information is a primary cause of unequal, ineffective, inefficient, conflict (Rabi *et al*, 2005) and environmentally unsustainable water resource management. Addressing this problem can be achieved by placing stakeholders in the same context and forcing them to negotiate towards a shared objective. This process can stimulate discussions and allow of the exchange of ideas and knowledge (Farolfi & Rowntree, 2005). Laban (2005) takes the idea of the importance of exchanges in knowledge and applies to the transfer of ownership of water management interventions.

The long term sustainability and effectiveness of participatory water resource initiatives depends substantially on the extent to which local stakeholders take ownership of the management process (Laban, 2005). Furthermore the impact of such initiatives, and local ownership, is intricately connected to the level of accountability assumed by those stakeholders involved. Laban (2005) argues that the degree of accountability assumed is an

important indicator of the extent to which local ownership of management has been achieved. Accountability, and consequently ownership, however, will be transferred only if a number of prerequisite conditions are in place. Laban (2005) states that local stakeholders must: be able to perceive the benefits of being accountable for the management of the resources; have access to and control over the resource; have the knowledge and capacity to implement management plans and policy; and finally have the organizational strength to fulfill and maintain these pre conditions. Laban (2005) concludes that without accountability at local and intermediary levels the success of sustainable water resources management interventions is doubtful. The pre conditions of existing economic and other benefits, appropriate skills and capacities, guaranteed property and usufruct rights, and claim making power must be in place for accountability and ultimately ownership to be transferred to the public (Laban, 2005). However ensuring that these conditions remain in place involves addressing one of the key challenges which participatory models are exposed to. Schaap & Nandi (2005) recognize the participatory process‟s characteristic of long term involvement. Facilitating effective local action and sustainable progress involves a long term commitment by the protagonist. The long term element is crucial as the success of the initiative is dependent on moving beyond sharing knowledge to developing conflict resolution skills, building confidence and supporting sustainable action groups (Schaap & Nandi, 2005).

According to Jonsson (2005), public participation leads to five primary benefits in the catchment management process. By involving the public in the development of management plans the public becomes better informed, remediation plans become legitimate, the implementation of management measures is more effective, the likelihood of conflict among stakeholders is lessened, and catchment management costs can be reduced as traditional enforcement activities are replaced by increased public participation (Jonsson, 2005). Jonsson (2005) argues, and agrees with Zoubi *et al* (2006), that by incorporating the public into the decision making procedure ownership of local resources, and therefore responsibility for them, is transferred from the state to the public. The advantage in this scenario is that the government‟s role becomes less about regulating and administering the resource and more about facilitating the collaborative management of that resource. This can lead to more effective and efficient management which targets the most important issues in the catchment while including all stakeholder needs. Underlying the entire process is guaranteed access to information by the public. Jonsson (2005) comes to a conclusion

supported by Farolfi & Rowntree (2005) and Stringer *et al* (2006) by clearly stating that access to information and efficient information transfer, between all participants, is vital to the success of any participatory effort. If access to information and consultation are guaranteed then the chances of active involvement, which is the end goal in participatory management, rise significantly.

Engendering participation across rivers is crucial if catchments are to be managed in the holistic manner which IWRM strives for. Guaranteeing access to information and facilitating social learning are but a few of the key elements of this which will need to take place across rivers. The need for these processes will be particularly acute where rivers divide communities.

2.7 THE ISSUE OF SCALE

According to Woyessa *et al* (2006) ensuring that water management interventions do not negatively affect upstream or downstream users is the fundamental principle which underpins integrated water management. Achieving this necessitates flexible and adaptive management structures. Such principles apply at all spatial scales from the local catchment to the primary basin. The associated actions, options and practices however require different approaches at different spatial scales (Woyessa *et al*, 2006). Similarly the generic principles of joint decision making, and suitable legislative and administrative frameworks underpin methods designed to avoid water conflict but the importance of issues of scale demands that processes, tools and institutions developed to achieve this are customized to be context specific (Turton & Ashton, 2008).

According to Stringer *et al* (2006) the issue of scale can complicate participatory approaches when stakeholders from across wide spatial scales are included in the process. This is because issues linked to transferability, comparability, time and expense are difficult to scale up. Confronting these problems requires facilitating participation of stakeholders at a range of scales using a variety of methods, which is often not feasible (Stringer *et al*, 2006). Berkes (2006) shares this concern by acknowledging that small systems transfer into larger systems in different ways and therefore the scaling up of research can either reduce or disproportionally increase complexity. More importantly Berkes (2006) states that there are four scale related issues that determine the sustainability

of resource management. These are complexity at the local level itself, the existence of external drivers of change, the problem of mismatch between resource and institutional boundaries, and the need for local level management to deal with cross scale issues (Berkes, 2006). Management across spatial scales implies realizing the cross-level linkages that exist between them, as well as the influences and drivers of change that act across scales. These drivers and linkages can range, for example, from ecological and geological forces to political and social dynamics. Because so many influences are pervasive and therefore systems so complicated, Berkes (2006) argues that it is therefore near impossible to find a resource management system that accounts for all cross-level linkages and multi-level drivers. Lulofs & Bressers (2010) importantly add that it must be recognized that some water managers will be active across more than one spatial scale while others will not. This has significant implications in terms of reaching across divides between stakeholders, whether they be social or spatial.

Turton & Ashton (2008) assess the issues of scale from a very different perspective by considering the different levels of scale at which political, economic and hydropolitical situations play out. Again the lack of consistency between catchment boundaries and administrative or political boundaries is brought forward. Their study refers to the southern African hydropolitical complex which exists at a scale above the basin level "but below the level of any regional political and economic cooperative structures" (Turton & Ashton, 2008: 305). This illustrates that even at relatively broad scales new variables are constantly added to the water management dynamic, often further complicating it.

2.8 CONCLUSION

Throughout the literature two key themes emerge in terms of the cooperative management of shared water resources. These are the pivotal importance of basin wide institutions which incorporate all stakeholders (Haftendorn, 2000; Uitto & Duda, 2002) and the collective management of these resources which aims for equitable benefit sharing (Ashton, 2002; Uitto & Duda, 2002; Turton & Ashton, 2008). In order to achieve these goals of shared water resource management the drivers of conflict need to be addressed when formulating cooperative management strategies. Shared water resources present a significant challenge in terms of avoiding conflict due to the diversity and number of possible drivers of conflict. The complexity of avoiding conflict over these resources lies in

the fact that all of these drivers will interact with varying intensity and influence depending on the context and scale of the situation in question. The recurring causes of conflict over shared water resources are scarcity (Hensel *et al*, 2006), water use and geographical distribution (Haftendorn, 2000), political and historical influencing factors (Giordano *et al*, 2002) (Mohamed, 2003), and the nature of relationships between stakeholders (Toset *et al*, 2000). All of these authors deal with a small number of these drivers in depth. However all fail to explain water conflict holistically by including elements of all of these drivers and drawing the links between them. Importantly the effect of landscape geography, other than in terms of resource distribution and scarcity, is largely neglected. To fully understand conflict over shared water resources all of these geographical, political, economic, historical, social and physical drivers of conflict need to be considered simultaneously, and a primary aim of this project is to determine if topography and landscape also act as determinants of conflict in conjunction with these drivers. It is imperative that the characteristics of borders and border regions are incorporated into the study and understood. Authors such as Coplan (2001) and Turnbull (2005) argue that social identities, specifically in border regions, are the result of complex historical and broader political interactions and must be carefully considered. It is highly probable that these identities will have a considerable effect on whether a river acts as a dividing and uniting feature and therefore must be considered in conjunction with the discussed drivers of conflict. There is also little evidence of investigations into the effects of utilizing rivers as borders and how this use of rivers may engender either conflict or cooperation. The employment of a river as a border may prove to be a further complicating factor that can either enhance or reduce the role of that river as a dividing or uniting feature. This project, therefore, also seeks to determine if the role of the river as a border will engender cooperation or foster conflict.

Water management literature consistently presents the two themes of integration and interdisciplinary involvement in developing policy. It is the recognition of the importance of these concepts in water resource management that has led to IWRM forming the basis for the world"s most progressive policy"s in the field (van der Zaag & Savenije, 2000; Wallace *et al*, 2003). Conflict avoidance and cooperation measures are essentially based on these very concepts and the literature on water management provides a foundation on which methods for facilitating cooperation are based. The water management literature most importantly exposes the elementary factors which much of the literature in this review reflects on or draws from. The issue of scale, integrating all stakeholders including the

environment, the individual nature of catchments, and the importance of institutions and interdisciplinary research, are all themes that fundamentally influence the way in which water is managed and their importance is reflected in their inclusion, in some way, in all other themes of this review. The emphasis on integration is what has led to the incorporation of public participation as a vital tool for developing sustainable water management strategies. Central to participatory initiatives are efforts to enhance dialogue and communication, ensure multi directional flows of information, foster local ownership, and facilitate social learning (Schaap & Nandi, 2005; Zoubi *et al*, 2006; Rabi *et al*, 2005). The goal of adaptive sustainable local institutions can result from encouraging these values (Stringer *et al*, 2006). The literature on public participation shows very clear parallels to the literature on facilitating cooperation although the two operate at very different spatial scales. Both, for example, advocate the importance of collaborative and empowered decision making and the value of institutions that recognize the rights and needs of all affected stakeholders. These similarities above all support the argument that, within the water management paradigm, principles transcend spatial scales although implementation techniques may not (Berkes, 2006). Complexity derived from multiple intrinsically interconnected and interacting forces and variables is consistently illustrated. This project will attempt to introduce the effect of topography and employment of rivers as borders as yet two more variables, and then determine the implications of these variables for the management of catchments in South Africa.

CHAPTER 3: PARTICIPATION, POLICY AND COOPERATIVE GOVERNANCE IN SOUTH AFRICA

3.1 INTRODUCTION

South African legislation recognizes that the state‟s water resources are scarce, unevenly distributed and occur in a variety of forms, all of which form a unitary, interdependent cycle (RSA, 1998a). Responsibility for the management of these resources falls to the National Government which has ultimate authority over all water use, although water is recognized as a public good. The NWA of 1998 is the primary piece of legislation that guides water management in this country and at its core are the themes of equitable and sustainable use. The act states that in order for water management to be equitable and sustainable, integrated management must take place and where appropriate, management functions can be delegated to a regional or catchment level so as to allow for public participation (RSA, 1998a).

The aim of this chapter is twofold. Firstly it is designed to give a brief overview of the legislation, and the associated requirements, which drives water management in South Africa. Secondly the chapter aims to illustrate how the concept of public participation in water management is intrinsic to South Africa‟s water management strategy and therefore why it should be determined how rivers act as borders, as this will affect the development of participatory water management institutions. It is expected that if a river acts as a border it will have an effect on participatory water management structures. The primary documents that this chapter is based on are the NWA of 1998 and a number of DWAF (Department of Water Affairs and Forestry) publications including; „Generic public participation guidelines‟ (2001), „Guidelines for catchment management strategies‟ (2007), „Guide to the national water act‟ (2006a) and, „Water management institutions overview‟ (2006b). It is not the aim of this chapter to provide a critique of DWAF/DWA‟s (Department of Water Affairs) policy but rather to provide a legislative context for this research.

The DWA is the official government department which replaced DWAF in 2009. However the enabling legislation, concerning water management in South Africa, was mostly

promoted by DWAF. Although Water Affairs forms an individual department within government the Minister oversees both the departments of Water Affairs and Environmental Affairs which in turn form the DWEA (Department of Water and Environmental Affairs). In terms of the DWA this gives the Minister executive authority over all fifteen water boards, the WRC (Water Research Commission), irrigation boards, WUAs and CMAs (DWA, 2011b).

Public participation, as interpreted by DWAF, refers to the continuous interaction between role players which aims to improve decision making during the planning, design, implementation and evaluation of DWAFs projects and processes (DWAF, 2001). Decision makers must then consider the views of stakeholders, often including marginalized stakeholders, during the decision making process. The term cooperative governance refers to collaboration between government, the private and public sectors and civil society on governing water resources in South Africa. The term also refers to cooperation between all spheres of government and elements of the state (DWAF, 2001).

Integrated Water Resource Management

Guiding the development of South Africa‟s water related legislation is the concept of IWRM (Integrated Water Resource Management). IWRM has become the dominant paradigm in water management as it recognizes that water resources are not independent of other issues such as those concerning global warming, biodiversity, health, food and energy. It emphasizes that each of these issues affects the next. IWRM promotes integrative, systems, sustainable, participative, partnership and managerial approaches to water resource management, as well as embracing multiple stakeholders within catchments (Schulze *et al*, 2004). It recognizes that social and ecological systems are intrinsically interconnected and therefore cannot be conceptualized or managed in isolation from each other (Jeffrey & Gearey, 2006). The philosophical reasoning which underpins the concept of IWRM is derived from ICM (Integrated Catchment Management) thinking which incorporates all social, economic and environmental elements operating within catchments (Ashton, 1999). The IWRM concept is founded on the Dublin Principles which initiated a movement away from traditional, engineering based, demand approaches to water management towards a more integrated planning approach which aims to reconcile water supply and demand, while simultaneously catering for water conservation and demand management (Funke *et al*, 2007). The four Dublin Principles state that:

- fresh water is a finite and vulnerable resource essential to sustain life, development and the environment
- water development and management should be based on a participatory approach involving users, planners and policy makers at all levels
- women play a central part in the provision, management and safeguarding of water
- water has economic value in all its competing uses and should be recognized as an economic good (Funke *et al*, 2007).

Although there are numerous definitions of IWRM it is widely accepted that these four principles are at the foundation of what IWRM aims to achieve. Within the South African context DWAF defined IWRM in its 2001 state of the environment report as a "philosophy of managing the water resources of a catchment in an integrated manner. It relies on the recognition that components of the hydrological cycle are intimately linked, and each component is affected by changes in other components. It is inherent in the concept of ICM" (DWAF, 2000). Therefore IWRM is a process which aims to develop water management strategies by considering the needs of multiple stakeholders which rely on, and govern, a particular water source through participatory processes with those stakeholders. These management plans must be informed by sufficient information about the nature of the local water resource and ensure that the resource is equitably, sustainably and effectively utilized. IWRM therefore requires cooperation and coordination between planners, institutions and individuals (DWAF, 2006b). In South Africa IWRM is enabled through the NWRS which is founded on the NWA and the WSA (Water Services Act). The factors that have forced the incorporation of IWRM into law and policy are: the constitution; the semi-arid nature of the country and the subsequently increasing stress on water resources; the need to address both social and environmental past inequalities in terms of water supply and allocation; the ability of water access to be an instrument for poverty alleviation; and the need to find a balance between socio-economic development and sustainability (Schulze *et al*, 2004).

As stated earlier in DWAF"s definition of IWRM, IWRM forms a central part of the concept of ICM. According to DWAF ICM is "A systems approach to the management of natural resources, particularly water resources, within the bounds of a geographical unit based on the catchment area of a river system. ICM recognizes the need to integrate all environmental, economic and social issues within a catchment into an overall management philosophy, process and plan" (DWAF, 2000a). ICM is thus a far more expansive and

complex concept than IWRM as it calls for catchments to be managed in a holistic manner where all elements of the catchment are considered. ICM proposes that all issues within a catchment related to water, even if not directly related to water, need to be considered and brought into a comprehensive management strategy. The enormous challenges in implementing ICM, due to its sheer complexity, render it as more of a vision for catchment management as it provides the philosophical backing for IWRM.

3.2 PRIMARY LEGISLATION

The Constitution

The South African constitution lays down a number of principles that guided the development of water law in South Africa. Referring to water the constitution states that: everyone has the right of access to water; everyone has the right to an environment that is not harmful to their health or wellbeing; the environment must be protected for the benefit of current and future generations; national government is the custodian of the nation‟s water resources (DWAF, 2006a). The Bill of Rights, chapter 2 of the constitution, in particular deals with the rights of every individual in South Africa concerning access to water (RSA, 1996). As a result of the provisions of the constitution DWAF produced three documents which have enabled government to protect the rights of the people and environment of South Africa with regards to water. The White Paper on National Water Policy for South Africa (1997), the Water Services Act (passed in 1997) and the National Water Act (passed in 1998) gave force to the constitutional mandates mentioned above (DWAF, n.d.). The development of these three documents involved consultation with an extensive range of stakeholders across the entire water sector and therefore the NWA itself is partially the result of a participatory initiative. The theme of participation is further promoted in other environmental legislation such as NEMA (National Environmental Management Act) (RSA, 1998b). The worldwide respect for South Africa‟s progressive water act is in part thanks to its collaborative development.

The National Water Act

The NWA is born of the mandates, concerning water, stated in the constitution and it provides the statutory basis for water management in South Africa. The primary objectives of the act are:

- the protection, use, development, conservation, management and control of the nation‟s water resources
- meeting basic human needs of present and future generations
- promoting equity, efficient, sustainable and beneficial use of water
- social and economic development
- the protection of aquatic ecosystems (RSA, 1998a)

The objectives of the act are achieved through establishing suitable institutions. The NWA is concerned with water resources such as rivers, streams, dams and ground water. The act contains all restrictions and requirements concerning the way in which these resources are protected, used, developed, conserved, managed and controlled (DWAF, 2006a). The act also defines the management of water resources as a national responsibility whereas the provision of water services, as discussed in the WSA, is the responsibility of local municipalities. Most importantly, in the context of this research, the NWA takes the opposite stance to the repealed 1956 Water Act in terms of management strategies. The 1956 act was based on the authoritarian, centralized approaches to water management in place in Europe. This form of water management was designed for countries with extensive water supplies and not the water scarce environment of South Africa. The new NWA states categorically that the citizens of South Africa must participate in water resource management at the lowest possible level (DWAF, 2006a). According to the NWA this is to be achieved through the development of representative institutions such as CMAs and WUAs. This approach corresponds with the international trend which recognizes IWRM as the strategy at the forefront of sustainable and effective water resources management. Since 2009 implementation of the NWA ultimately falls to the Minister of Water and Environmental Affairs who acts on behalf of the national government as the public trustee of South Africa‟s water resources.

The National Water Resources Strategy

The NWRS is the primary tool that is used to ensure that South Africa‟s water resources are protected, used, developed, conserved, managed and controlled (DWAF, 2006b). The strategy provides the framework within which water will be managed at a catchment or regional scale and binds together all water institutions and water users. The NWRS is reviewed at least every five years by the Minister and must be progressively developed through public consultation with all stakeholders and interested parties as public

participation in the development of the strategy is critical to the achievement of the strategy‟s goals (DWAF, 2006a). The purpose of the NWRS is to facilitate the proper management of the nation‟s water resources. It achieves this by making information available about all aspects of water management and providing a framework within which water can be managed at a regional or catchment scale. The NWA states that, in terms of institutional arrangements, the NWRS must:

- contain objectives for the establishment of institutions to undertake water resource management
- determine the inter-relationships between institutions involved in water resource management
- ensure that all water resource management institutions function in accordance with the NWRS

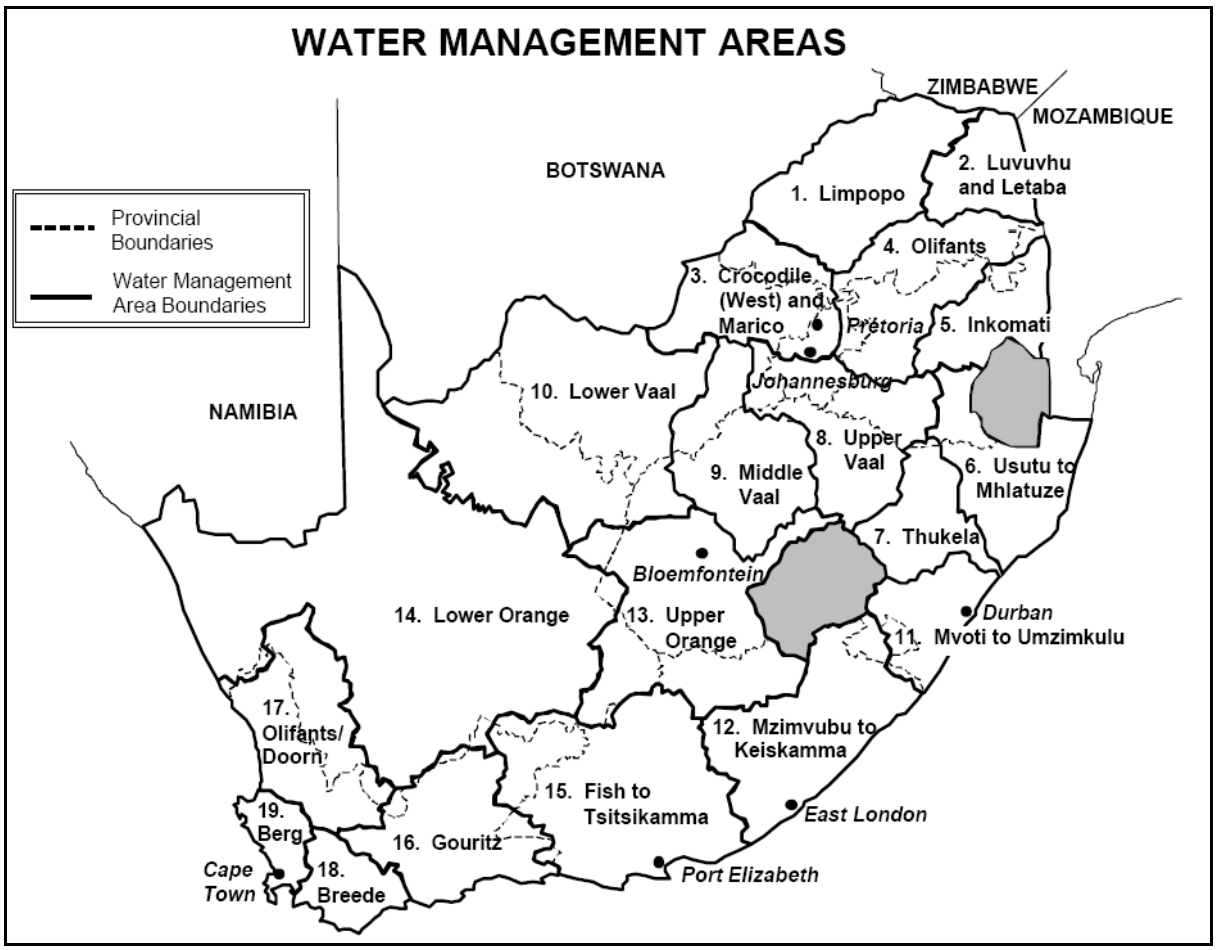

Figure 2: South Africa‟s Water Management Areas (RSA, 1999)

The NWRS has divided the country into its nineteen WMAs (Figure 2) and as per the NWA a CMA must be established in each WMA and then a CMS (Catchment Management Strategy) developed in each area. The establishment of these institutions is the primary way in which the NWRS is implemented (DWAF, 2006a). Figure 2 importantly illustrates the mismatch between WMA boundaries and provincial boundaries in South Africa.

3.3 THE STRUCTURE OF WATER GOVERNANCE IN SOUTH AFRICA: DEVOLVING POWER

The Minster

The Minister of Water and Environmental Affairs is entrusted with overall responsibility for water resources management in South Africa and acts as the public trustee of water resources on behalf of the National Government (DWA, 2011b). It is the responsibility of the Minister to ensure that: "water resources are protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all persons; and water is allocated equitably and used beneficially in the public interest, while promoting environmental values" (DWAF, 2006b:7). The general powers and duties of the Minister, as discussed in chapter 6 of the NWA, are divided into four parts:

- delegations, directives, expropriation and condonation
- general provisions regarding regulations
- powers relating to catchment management agencies
- powers of the Director General (RSA, 1998a)

Importantly the Minister may delegate power and duty, vested in the Minster by the NWA, to:

- an official of the Department by name
- the holder of an office in the Department
- a water management institution
- an advisory committee
- a water board, as defined in the WSA of 1997 (RSA, 1998a)

The Department of Water Affairs

The DWA, headed by the Director General, proceeds on the Minister‟s behalf and is therefore responsible for administering all aspects of the NWA. The Department‟s long term role is to develop national policy and regulatory frameworks which will govern the way subordinate institutions manage water resources and maintain general oversight of such institutions while also monitoring their performance (DWAF, 2006b). As CMAs and subsequent institutions are established the Department will devolve responsibility and power to them, allowing for the localized management of water resources.

Catchment management agencies

The purpose of establishing a CMA is to delegate water resources management to the WMA or catchment level, thereby allowing local stakeholders to become actively involved in the water management process (RSA, 1998a). Ultimately CMAs are to be established in all nineteen of the state‟s water management areas; however until a CMA comes into being the Minister through the DWA acts as the agency for that area. It must be noted that the DWA currently operates through provincial regions. A CMA is a statutory body and is the institution to which the Minister, through the DWA, delegates regional or catchment level water resource management.

Water user associations

A WUA is also a statutory body established by the Minister but operates at a restricted local scale. The purpose of a WUA differs from that of a CMA in that, although they are water management institutions, they are not designed to manage water but rather form co-operative associations of individual stakeholders undertaking mutually beneficial water related activities (RSA, 1998a). A WUA may extend its capacity and exercise management powers if they have been devolved or assigned to it by the Minister or relevant CMA, and if its constitution allows. All existing irrigation boards, water boards and water control boards will over time be transformed and restructured into WUAs (DWAF, 2006a). A number of WUAs will therefore be present within each WMA and under the supervision of a central CMA.

Figure 3 illustrates the basic structure of water governance in South Africa at present. It does not, however, include the structures in place which are responsible for international

water management & cooperation, finance, national water resource infrastructure, policy & regulation, and corporate service (DWA, 2011a).

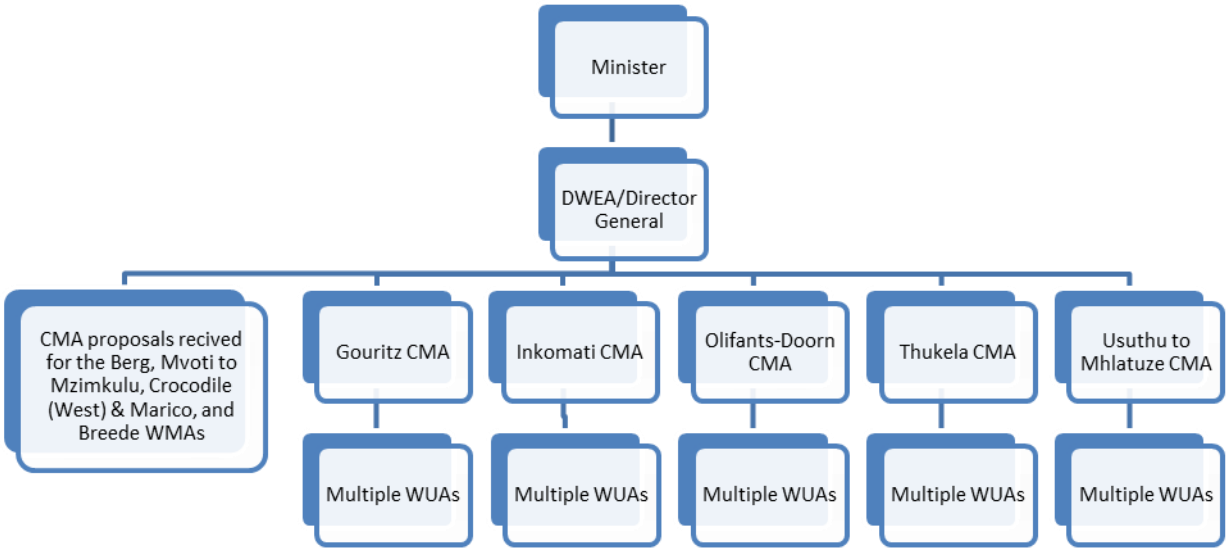

Figure 3: The basic structure of water governance in South Africa

3.4 WATER MANAGEMENT INSTITUTIONS

Catchment management agencies

CMAs form the primary management unit for water management in South Africa and are established to allow water management responsibilities to be delegated to a regional, basin or catchment level. The fundamental purpose of a CMA is to ensure the inclusion of local stakeholders in local water resource management and facilitate cooperation and agreement amongst stakeholders on water related issues (DWAF, 2006b). The CMA must promote stakeholder input, cooperation and agreement and develop a CMS so as to ensure community participation in water resources management, the sustainable use of water, cooperative governance, and coordinated activities (DWAF, 2006b). A CMA therefore has a mandate to:

- manage water resources within its WMA
- develop and implement a CMS

- ensure this strategy is in line with the NWRS, and
- contribute towards economic and social development (DWAF, 2006b).

The importance of public participation in South Africa‟s water management strategy is emphasized from the initial stages of CMA development. A CMA can only be established in a specific WMA after an extensive public participatory process has taken place and therefore contributed to the development of the CMA. The NWA itself stresses that the most critical factor in establishing a CMA is the public participation process with all stakeholders and their interests being adequately represented (DWAF, 2006a). Furthermore the CMA proposal itself must present a summary of the public participation process supporting the establishment of the CMA. The establishment of a CMA can take place in two possible ways. It can either be established on the initiative of local stakeholders or by the Minister in cases where such an initiative does not exist. This allowance recognizes the variation in the requirements of the various WMAs. The establishment of a CMA generally goes through four phases which again illustrate the importance of public participation. Phase one initiates participation by generating public awareness of the initiative and culminates in the formation of a Catchment Forum. This first phase is designed to facilitate the development of a common vision among stakeholders and assist in the development of trusting and constructive relationships (DWAF, 2006a). The second phase of the CMA establishment process formalizes participation. During this phase a non-statutory Catchment Steering Committee is established with the purpose of guiding the establishment process and the development of a CMA establishment proposal. The introduction of catchment forums and catchment steering committees are not a legislative requirement but are recognized as playing a vital role in the participatory aspect of the process (DWAF, 2006b). They are seen to provide important mechanisms for interaction with stakeholders and also play an advisory/consultative role. Phases three and four are concerned with interim management arrangement and the final establishment of the CMA. The evaluation of a CMA proposal is carried out by the DWA and, besides considering the financial and practical feasibility of the proposal, it closely evaluates the inclusiveness of the participatory process. During the establishment of a CMA, CMA functions can, as an interim arrangement, be delegated to advisory committees, catchment management committees and water user associations.

Once a CMA is established it has the inherent statutory powers "of a natural person of full capacity, except those powers which can only be that of a natural person or are inconsistent with the Act" (DWAF, 2006b: 17). Furthermore it has the following five initial functions:

- to investigate and advise interested persons on the protection, use, development, conservation, management and control of the water resources in its water management area
- to develop a catchment management strategy
- to coordinate the related activities of water users and of the water management institutions within its water management area
- to promote the coordination of its implementation with the implementation of any applicable development plan established in terms of the Water Services Act
- to promote community participation in the protection, use, development, conservation, management and control of the water resources in its water management area (DWAF, 2007)

If the CMA reaches a point where it can demonstrate it has the capacity to undertake additional functions, the Minister can delegate the following to the CMA:

- general management of water resources in the WMA
- acting as the responsible authority relating to water use and allocation (DWAF, 2006b)

An established CMA still falls directly under the control of the Minister who may under certain circumstances intervene in the functioning of a CMA. The Minister has the power to direct the CMA to take certain actions and make regulations relating to CMAs. Failure to comply with directives, ineffectiveness, and absence of need can lead to the disestablishment of a CMA by the Minister if the situation arises (DWAF, 2006b).

The development of a CMS and the implementation of that strategy is the most fundamental purpose of a CMA. The CMS for a given area specifies the intentions of the CMA in the area and the way in which water resources will be managed. A CMS sets the principles for allocating water within its WMA and provides the framework for managing water resources within that area. Importantly, CMSs must be in harmony with the NWRS and take into consideration relevant national or regional laws and development plans (DWAF, 2006a).

Water User Associations

WUAs are the most localized statutory institutions in the statutory South African water management structure as multiple associations will exist within each WMA under the control of a single CMA. The purpose of a WUA is to act as a mechanism through which the regional CMS can be implemented and facilitate the integration of stakeholders, which in turn allows for the pooling of resources and an enhancement of the effectiveness of water related activities DWAF, 2006a). WUAs can form as single sector or multiple sector associations. Single sector associations act in the interests of a group of similar stakeholders while a multi sector WUA will act in the interests of a combination of stakeholders involved in a range of activities. The establishment of a WUA is most likely to take place for four primary purposes:

- abstracting water for irrigation purposes on a commercial or subsistence scale
- activities involving the reduction of stream flow
- the treatment and disposal of effluent and waste
- control the use of water for recreational and/or environmental purposes (DWAF, 2006b).

The establishment of a WUA takes place according to a procedure laid out in the NWA and may be initiated by local stakeholder or by the Minister. Once a WUA is established its functions will depend on the provisions presented in its approved constitution. However the following functions are common:

- to prevent water resources from being wasted
- the protection of water resources
- to prevent unlawful use of water resources or acts that negatively impact water resources
- general supervision of water resources
- the regulation of water courses
- the investigation of water quality and water use
- to construct, maintain and operate water infrastructure (DWAF, 2006a)

A WUA may only exercise management of these functions once power has been delegated to it by the CMA or by the Minister. The establishment of a WUA allows for the simplification of the responsibilities of the CMA or the Minister as it groups stakeholders

into single entities which are more manageable (DWAF, 2006b). However a WUA is accountable to its parent CMA if that responsibility has been delegated to it by the Minister.

Throughout the WUA establishment process the theme of public participation and consultation is again very present. As in the case of a CMA, a WUA can only be established after public consultation has taken place (DWAF, 2006b). Even within a WUA proposal a detailed description of what public consultation has taken place as well as the outcomes of that consultation must be included. The proposal should also be consistent with the CMS of the regional CMA as well as with the NWA"s objectives. As stated earlier, all water, irrigation and water control boards that existed prior to the institution of the 1998 NWA must be converted to WUAs. This transformation of these boards requires a modification of their operation areas and management structures (DWAF, 2006b). The idea is to make established institutions more representative and include all stakeholders and move towards a more equitable distribution of water resources. The advantages of a WUA will depend on the purposes for which the WUA was established. In the context of this project it is noted that the primary advantages of a WUA are that firstly it facilitates the establishment of cooperative ventures on an economic scale amongst its stakeholders. Secondly it regulates the use of water within the system thereby ensuring an equitable and controlled distribution of water amongst its members. Finally it acts in the collective interest of its members in the wider water management context as each WUA is represented on the CMAs governing board.

3.5 PARTICIPATION AND COOPERATION IN THE SADC

The theme of participation in legislation extends beyond South Africa"s borders as it is mentioned in many of South Africa"s 59 international water-related agreements with other SADC states (Ashton & Turton, 2009). Over the past two decades southern Africa has established a strong record of water resource cooperation and the SADC itself has proved effective in negotiating transboundary water agreements between its member states (Giordano & Wolf, 2003). The signing of the SADC Protocol on Shared Water Courses in August 1995 marked the introduction of a new era of water management in southern Africa as it aligned water use in the region with the United Nations Convention on Non-Navigational Uses of International Waters. The key provisions of the protocol obligate

member states to establish close cooperation with their neighbors when undertaking projects that will affect shared water courses (Mbaiwa, 2004). At this regional level of cooperation the themes of sustainability and equitable use again form the core of these international treaties. Giordano & Wolf (2003) state that effective international treaties have four key characteristics all of which are equally applicable to local water agreements:

- an adaptable management structure which incorporates a level of flexibility and allows for public input
- clear and flexible allocation criteria
- equitable distribution of benefits
- detailed conflict resolution mechanisms (Giordano & Wolf, 2003).

The revised SADC protocol has two primary weaknesses which are of relevance and should be taken into account when developing local water management strategies. Firstly there are inconsistent applications of conflict resolution tools and secondly, there is a distinctive lack of public participation (Giordano & Wolf, 2003).

3.6 CONCLUSION

South Africa is home to a unique set of challenges facing water managers. These stem from the variable and scarce nature of water in the country coupled with the asymmetrical access to natural resources which are a product of the apartheid system of social segregation (Mirumachi & van Wyk, 2010). In order to meet such challenges, South Africa has reformed its water sector through both policy and implementation. The principles that underpin this reform are cooperative and participatory governance which aims to achieve equitable and sustainable water resource development and use. The water governance structure discussed in this chapter illustrates how water governance in South Africa has introduced new actors into the system and is redistributing the balance of power equitably between stakeholders (Mirumachi & van Wyk, 2010). Through its adoption of IWRM as the guiding discourse, policy has recognized that water needs to be managed in terms of the entire hydrological cycle and as one indivisible continuum (Conley & van Niekerk, 2000). The involvement of multiple stakeholders in the development and application of regional and local water management strategies and institutions is the path that has been chosen to achieve this holistic management form. This chapter has provided a detailed description of

how water management is structured in South Africa and why it takes this form. It has illustrated how cooperative governance and participation are built into this structure at almost every level and has described the rationale behind the inclusion of the principles. This in turn justifies and illustrates the relevance of this project. If the participatory method is to be successful in managing catchments and engendering cooperative governance, it must be determined if rivers, as water resources, act as dividing or uniting features within the social landscape, as this will have an intrinsic effect on the success of participatory water management initiatives. Rivers act not only as political and administrative borders, but also as borders between communities.

CHAPTER 4: METHODOLOGY

For the purposes of this project the term „stakeholder" or „interested and affected parties" refers to "individuals, groups and organizations that have an interest in and are affected by an initiative, and who may affect the outcome of an initiative" (DWAF, 2001: 7). Stakeholders are those who are affected directly or indirectly by an initiative. The term „role players" refers to those stakeholders who are then directly involved in the decision making process.

4.1 INTRODUCTION

This project took place under a realist research paradigm as it aimed to investigate if/how rivers act as dividing or uniting features by investigating the social structures and relations that exist between the stakeholders concerned. According to Wengraf (2001) realist research, one of the core „critical science" research philosophies importantly involves taking into account the social identities and real histories of those involved. The objectives illustrate this philosophical standpoint as they aim to investigate how, in this case, the Orange-Senqu River, divides or unites stakeholders by considering the underlying social structure and heritage of each study site. This is used as a method for explaining, in part, the current situation. As opposed to only investigating the communication and interaction that takes place between individuals, realism aims to explain the underlying mechanisms that dictate, drive or hinder interaction (Kitchin & Tate, 2000). Realism is concerned with explaining the causal mechanisms that exist and acknowledges that the social world does not exist independently of knowledge. To investigate how these particular phenomena occur, the project employed both quantitative and qualitative data generation techniques typical of realist research. Therefore the analysis techniques employed in this project were in nature both qualitative (a content analysis of primary data) and quantitative (the use of statistical analyses). This project also acted as much as possible within an inductive conceptual framework. An inductive or bottom up approach was adopted as the project aimed to start at a specific point and then develop general conclusions. Open ended and explanatory questions were asked in conjunction with closed ended questions so that, when

examining the data, patterns would emerge and theories could be constructed from these patterns.

The methods discussed in this chapter were adopted to allow this project to effectively meet its aims and objectives and draw some notable conclusions. The aim of the project is to determine if rivers act as dividing or uniting features in a socio-political landscape and whether topography will influence their role in this context, and then consider the implications of this for catchment management in South Africa. By working within an inductive conceptual framework this project will meet these aims through its objectives. The project‟s objectives involve investigating stakeholder perceptions, examining the effects of particular variables (principally topography), identifying factors which contribute towards the perceived role of the river, and understanding local conditions. The employment of the semi-structured interview format is a recognized method for achieving such objectives and generating qualitative and quantitative data will allow for the objectives to be met comprehensively. An understanding of the study sites within which this methodology will be applied is important and therefore this chapter will start by giving an overview of the general study area and then specifically describe each of the four study sites.

4.2 STUDY AREA

Introduction

Although this research was based on study sites located along the Orange-Senqu River it is important to discuss the nature of the entire catchment and developments on the Vaal River, its largest tributary, as these have significant downstream impacts due to their magnitude. The size and complexity of the catchment has forced ORASECOM (Orange-Senqu River Commission) to divide the Orange-Senqu River catchment into five primary sections: the Vaal River System, the Orange-Senqu River System, sub-systems in Namibia, sub-systems in Lesotho, and water demands in Botswana (ORASECOM, 2007b). Through its size and associated IBTs the catchment has stakes in all nine of South Africa‟s provinces; however this study will focus on sites where it forms the border between the provinces of the Free State and Eastern Cape and the Free State and Northern Cape.

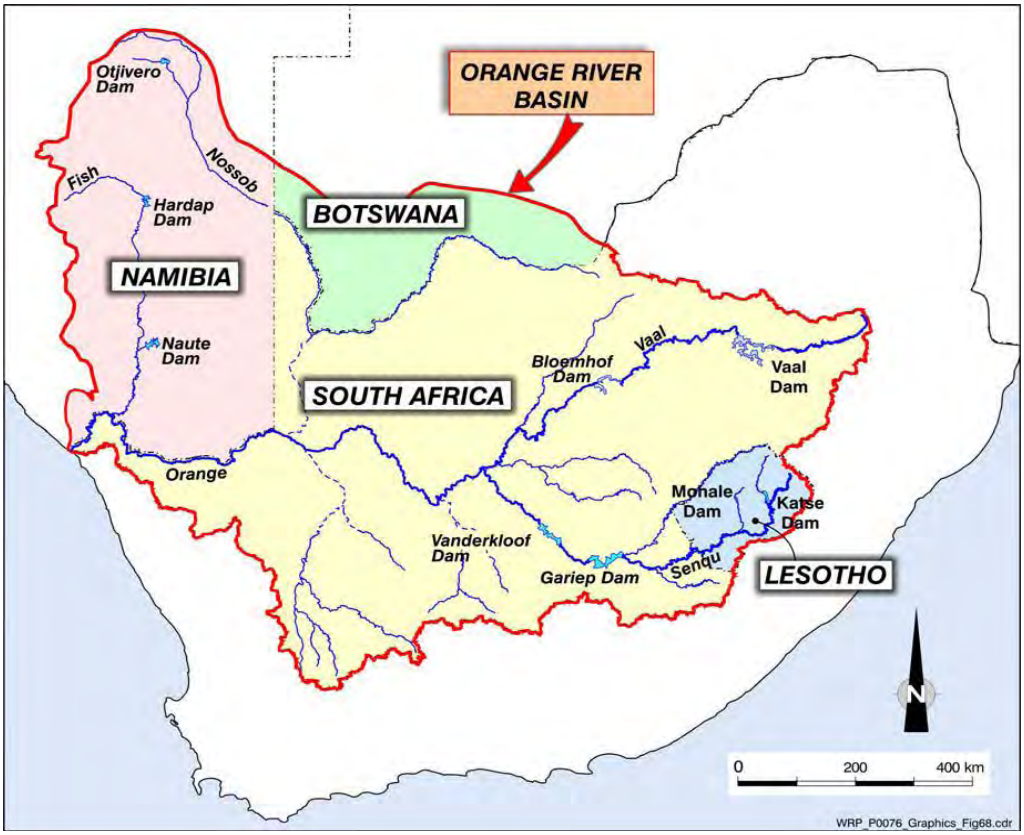

Figure 4: The Orange River Basin (ORASECOM, 2007a)

Geographic setting

The Orange-Senqu River rises in the Maluti mountain range in the eastern Lesotho highlands at an altitude of over 3000 m above sea level and flows westwards for 2,300 km across South Africa"s interior plateau before emptying into the Atlantic Ocean at Alexander Bay (Conley & van Niekerk, 2000). The Orange River basin (Figure 4) constitutes the largest African river catchment south of the Zambezi, covering an area of approximately 900,000 km^2 and traversing South Africa, Namibia, Lesotho and Botswana (Earl *et al*, 2005). South Africa is the chief stakeholder in the basin as 62% of the basin is located within its borders whereas only 25% is located in Namibia, 9% in Botswana and 4% in Lesotho (Turton, 2005); Lesotho, however, is located entirely within the basin. The catchment"s MAR (Mean Annual Runoff) has been estimated at approximately 11. 6 km^3 of water. However the contributions to this by each riparian state are highly unequal as South Africa contributes 55%, Lesotho 41%, Namibia 4% and Botswana 0% (ORASECOM, 2007a). The Orange-Senqu and its tributaries drain virtually the entire South African plateau south of the Witwatersrand, all of Lesotho and large areas of Namibia and Botswana (Bradley *et al*, 1980). The Orange-Senqu River"s largest tributaries

are the Vaal, Caledon, Fish and Molopo rivers. However the Molopo tributary in Botswana has not contributed surface flow to the system in living memory (Turton, 2005). The Vaal River is by far the most significant of these tributaries as it carries 4.27 km^3 of water per annum compared to the Senqu River itself (the name given to the Orange River is Lesotho) which transfers 4.73 km^3 per annum (Earl *et al*, 2005). Climate within the basin varies both spatially and temporally. The basin"s mean annual rainfall is 400 mm/a, but at the source in Lesotho rainfall can exceed 2000 mm/a, while as the river flows west, rainfall can decrease to as little as 25 mm/a (Mohamed, 2003). Similarly potential evaporation is highly variable as it stands at only 1200 mm/a in the source zone but at 3500 mm/a in the western reaches of the catchment. The different ecological zones through which the Orange-Senqu River flows vary significantly in alignment with changes in climate, from the mountainous source zone, the savanna grasslands of the central plateau and the hyper arid desert environments of the basins western extreme (Earl *et al*, 2005).

Development along the Orange-Senqu river

The Orange-Senqu River is South Africa"s longest and largest river as it carries approximately 20% of total river flow in SA and supports over 5000 km^2 of irrigated land along its course which consumes 64% of the water utilized in the system (Ashton *et al*, 2008). It is also the country"s most developed river system with some 31 dams and reservoirs with a combined storage capacity of over 12 km^3 (Turton, 2005). It is estimated that withdrawals from the systems and evaporation have reduced the natural flow of the river by half (Lange *et al*, 2007). Three massive projects have driven development within the catchment over the last 48 years. Firstly the ORP (Orange River Project) was developed to supply water for irrigation to large areas within the Cape and Orange Free State. This project included the construction of the Gariep Dam (1971) to create South Africa"s largest reservoir, the Vanderkloof Dam (1977) as well as the Orange-Fish Tunnel (1975), which was at the time the world longest continuous water tunnel (Conley & van Niekerk, 2000). Secondly the Vaal River Development, which included the construction of the Vaal dam (first completed in 1938 but raised in the early 1950s and again in 1985), was designed to supply South Africa"s industrial and metropolitan core with water, not only from the Vaal River, but from eight other catchments through a complex series of water transfer schemes (Conley & van Niekerk, 2000). The third, and most monumental of the three projects, is the LHWP (Lesotho Highlands Water Project). This colossal development thus far includes the 185 m high Katse dam (1998), the 145 m high Mohale dam (2002) and nearly 80 km of

transfer tunnels which transport water through Lesotho and into the Vaal river system (Mohamed, 2002). The ever increasing water requirements of the Vaal River complex, which produces more than half of the country‟s GDP and supports 40% of South Africa‟s population, has dictated that the LHWP will continue to be developed and grow. Furthermore Namibia in particular, has well established desert irrigation schemes along the lower reaches of the Orange-Senqu River which are completely dependent on the river. A number of nature reserves, most notably the Augrabies Falls Reserve, as well as local livelihoods are also dependent on the flow of the Orange-Senqu River, all of which are influenced by upstream activities in the Upper Orange and Vaal catchments.

The sheer size of the Orange River basin and the quantities of water which flow through it make it the most important international catchment south of the Zambezi, the most developed in terms of infrastructure, and the most studied. The strategic importance of the Orange-Senqu River to South Africa can be illustrated by the fact that Gauteng is now 100% reliant on IBT water, the majority of which is sourced from the catchment, it serves as a donor basin for three IBTs as well as a recipient basin for three IBTs, and is home to four intra-basin transfers (Turton, 2005). Through IBTs, the Orange is linked to the Limpopo and Maputo basins, both of which are also international river basins. These three basins, combined with the international Incomati basin, contribute approximately 32% of South Africa‟s MAR, support 70% of South Africa‟s GNP (Gross National Product), and contribute 90% of South Africa‟s electricity supply (Turton, 2003). The importance of this river extends beyond water provision for South Africa‟s industrial, urban and agricultural needs. The river forms a 450 km border between South Africa and Namibia; forms provincial borders within South Africa; supplies Namibia,in particular, with water for part of its agricultural and domestic needs; and the river‟s estuary is now an internationally protected trans-border Ramsar Wetland (Conley & van Niekerk, 2000). Managing such a complex and expansive system is an enormous task if South Africa is to follow its policy of bottom-up integrated water management. Given that the river forms borders between various national and international entities, it is important to determine if the river itself acts as a dividing or uniting physical feature, as it flows through a number of varied landscapes.

The history of the Orange-Senqu River as a regional border

The Orange-Senqu River has existed as a border in South Africa for over 178 years. Over this period it has become deeply intertwined into South Africa‟s history, primarily with

reference to the division between English and Afrikaans speaking South Africans. This brief examination of the history of the Orange-Senqu as a border reveals why cultural identities are so deeply attached to this river and, therefore, why considering local histories is crucial when attempting to understand why a river may unite or divide communities on either side of it.

Originally referred to as the *Grootriver* by terkboers from the Cape, the Orange-Senqu River region was in 1777 labeled Transorangia by Colonel Robert Gordon after the royal Dutch House of Orange (Oakes, 1989). By 1835 the British Cape Colony had expanded to include the Colesberg district which extended to the Orange-Senqu River from east of the rivers confluence with the Vaal River to the area of today‟s Gariep Dam. The lower reaches of the Orange-Senqu River formed the Cape Colony‟s northern border by 1847 (Oakes, 1989). Large scale expansion into the interior across the Orange-Senqu River was initiated by Louis Trichardt and Hans van Rensburg in 1835 as the Great Trek commenced. As the Great Trek gained momentum Voortrekker leaders such as Piet Retief and, Gert Maritz and Hendrick Potgieter follow routes across the Orange-Senqu River in the region of the river‟s confluence with the Caledon River in 1836 and 1837 into Griqua and Sotho territories. Although a Boer Republic was declared on the north bank of the Orange-Senqu River at Alleman‟s Drift in 1842, British control was swiftly reestablished over the transorangia region until their withdrawal in 1854 (Oakes, 1989). The Bloemfontein conference established the OFS (Orange Free State) Republic in 1854 employing the Orange -Senqu River as the boundary between the Cape Colony and the new republic. This would last until the 28th of May 1900 when, as the Boer War drew to a close, the OFS was formally annexed to Britain and renamed the Orange River Colony (Meredith, 2007). With the Union of South Africa coming into being in 1910, the OFS came back into existence as it became one of the new union‟s four provinces. The borders of the now Free State, including those along the Orange-Senqu River, have remained unchanged up to the present. The Orange-Senqu has acted as the dividing line between English speaking and Afrikaans South Africans for as long as Europeans have occupied the region. The Boer War so entrenched this divide that it is still visible at present.

The introduction of the Bantustan system and the Transkei homeland, which gained nominal autonomy in 1963, intensified the role of the Orange-Senqu River as a border with predominantly Afrikaners on the north bank and the Xhosa nation on the south bank. By

the time the Transkei was incorporated into the Eastern Cape Province in 1994 stark differences were obvious on either side of the now provincial border (Barber, 1999).

4.3 STUDY SITE SELECTION

The study sites for this project were identified within similar climatic and ecological zones but were specifically chosen to illustrate the extreme changes in topography that occur within the Orange River basin. Two of the study sites are located along highly incised and confined sections of the Orange-Senqu and Kraai Rivers, while two more sites are located along open unconfined sections of the Orange-Senqu and Caledon Rivers. The study area is positioned in a region where the source zone meets the plateau and therefore the study area contains sites that reflect both of these different areas.

Four study sites were chosen to represent a combination two conditions. First of these was topography and its influence on how the river can be accessed and utilized. The two topographic units that this study dealt with were either confined or unconfined sections of the Orange-Senqu River and its tributaries. Using the valley morphology characterization system laid out by Rosgen (1996) the confined sites (Sites B and D) fit into the type IV and type II valley classifications respectively. These confined types have a narrow valley floor lacking a significant floodplain and therefore the potential for irrigated agriculture is low. Figures 6 and 7 illustrate this valley type. Steep valley side slopes inhibit access to the valley floor and cross-valley communication. Using the same classification system the unconfined type (Sites A and C) fall into the type VIII classification. The unconfined sites have wide valley floors with considerable potential for irrigated agriculture. Figures 8 and 9 illustrate this classification. Access to the river is good and communication across the river is only inhibited by the difficulty of crossing the river itself.

The second condition pertains to the role of the river as an administrative/political boundary. Two study sites (A and B) are located where the Orange-Senqu River forms a provincial border firstly, between the Eastern Cape and the Free State and secondly, between the Free State and Northern Cape. Two more study sites (C and D) are located on the Caledon and Kraai Rivers. They are both tributaries of the Orange-Senqu River and join it above the Gariep Dam. The study sites located on the Caledon and Kraai Rivers are not located on provincial borders and have been chosen both to allow for a comparison to be

made with the two study sites which serve as provincial borders, and because they are tributaries of the Orange-Senqu.

All three of these rivers are perennial, although their flow rates differ significantly between the wet and dry seasons. Flooding occurs in all four sites although it affects the unconfined sites more acutely. The Gariep Dam does mitigate the extent of flooding to a degree in site A, but the high sedimentation rate of the Welbedacht Dam has reduced its capacity to contain flood waters and protect the lands of stakeholders below it. In site D low level bridges are frequently submerged during times of high rainfall. Within site A the Orange-Senqu is over 80 m wide at some points. At the time when field work was conducted for this research, the river was in full flow below the Gariep Dam, however above the dam it was less than 40 m wide and less than half a meter deep. In site B, the Orange-Senqu is at points, channeled into a section less than 10 m wide during the dry season but can reach an expanse of over 50m when in full flow. At the time of field work for this research the Caledon River was barely flowing. However it can reach an expanse of over 40m during the wet season. Finally, the Kraai River generally does not exceed 30m in width.

The primary reason for selecting sites along the Caledon and Kraai rivers is that these are the only two significant tributaries of the Orange-Senqu which occur close to the two sites on the Orange-Senqu River. Importantly all four study sites also fall within the Upper Orange WMA. The Kraai and Caledon also introduce interesting variables not directly brought out by situations along the Orange-Senqu. Firstly the Caledon is becoming increasingly stressed due to increasing demands in Lesotho and upstream urban areas. The rapid sedimentation, and therefore reduced capacity of the Welbedacht Dam, has further complicated the situation. Secondly the Kraai River is one of the last free flowing rivers left in South Africa and therefore brings forward a completely different water security and supply situation to those found in the other three sites. This research is thus based on four case studies that allow for an analysis based on comparing the different realities which exist within the individual sites.

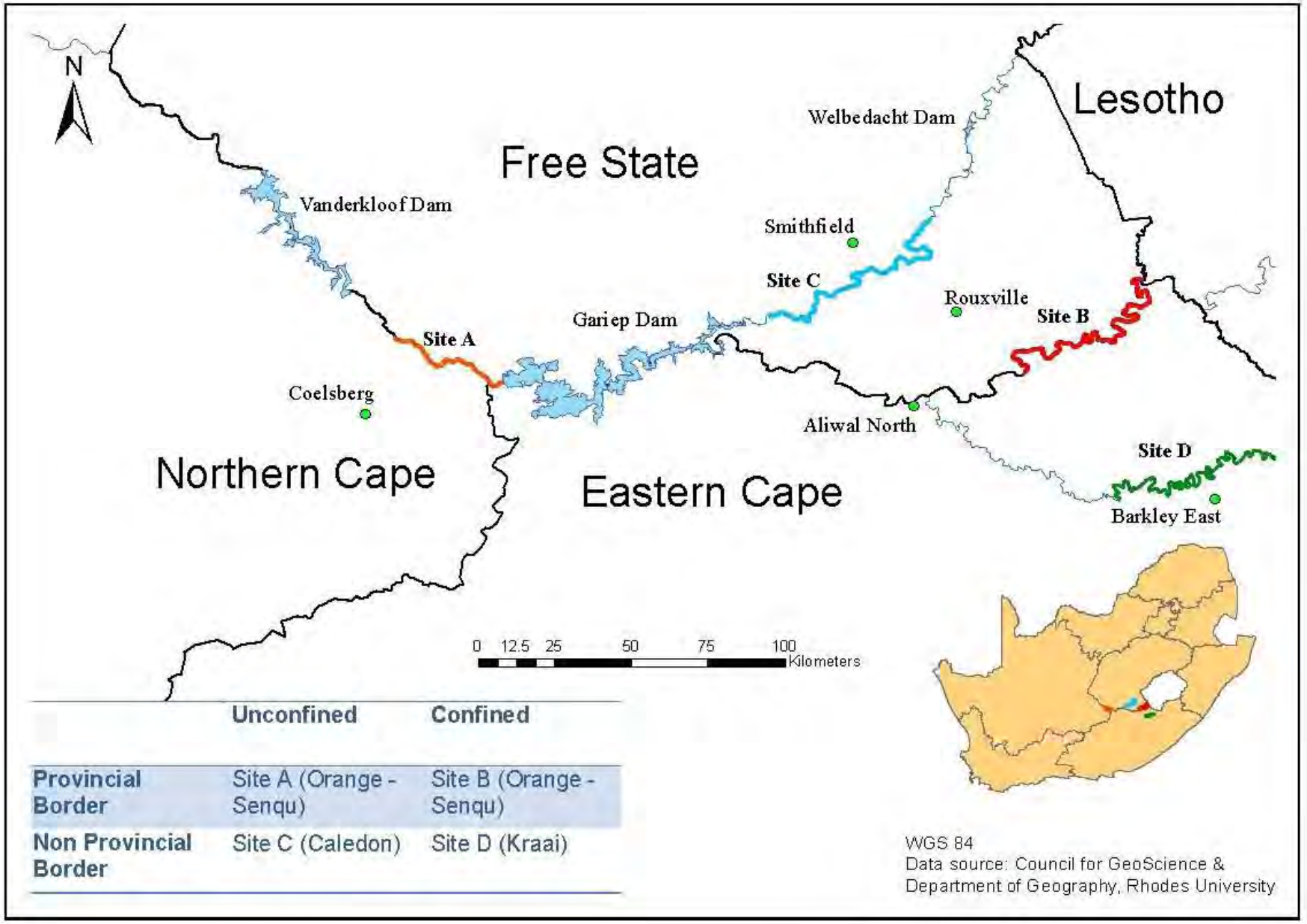

Figure 5: Study sites

The four study sites are, as indicated on Figure 5, as follows:

Study site A (orange) is located in an unconfined section of the Orange-Senqu between the Vanderkloof and Gariep Dams. Figure 6 is an image from this site.

Study site B (red) is located approximately 40-70km upstream of Aliwal North in a confined section of the Orange-Senqu. Figure 8 is an image from this site.

Study site C (blue) is located in an unconfined section of the Caledon River approximately 45km north west of Aliwal North. Figure 10 is an image from this site.

Study site D (green) is located in a confined section of the Kraai River approximately 10-40km west of Barkly East. Figure 11 is an image from this site.

Figure 6: Site A, unconfined section of the Orange-Senqu River

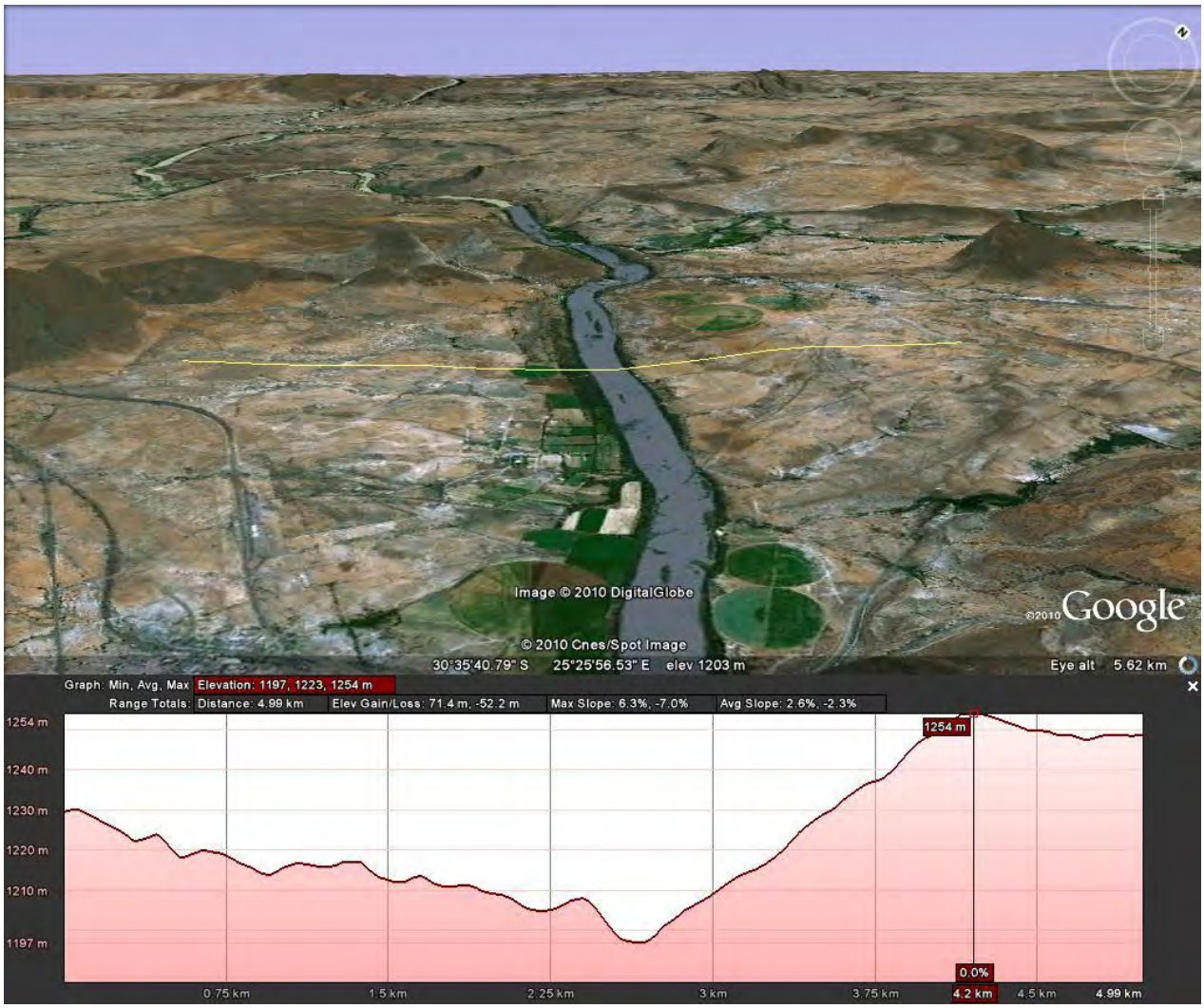

Figure 7: Site A, unconfined cross section of the Orange-Senqu River (Google Earth, 2010)

Figure 8: Site B, confined section of the Orange-Senqu River

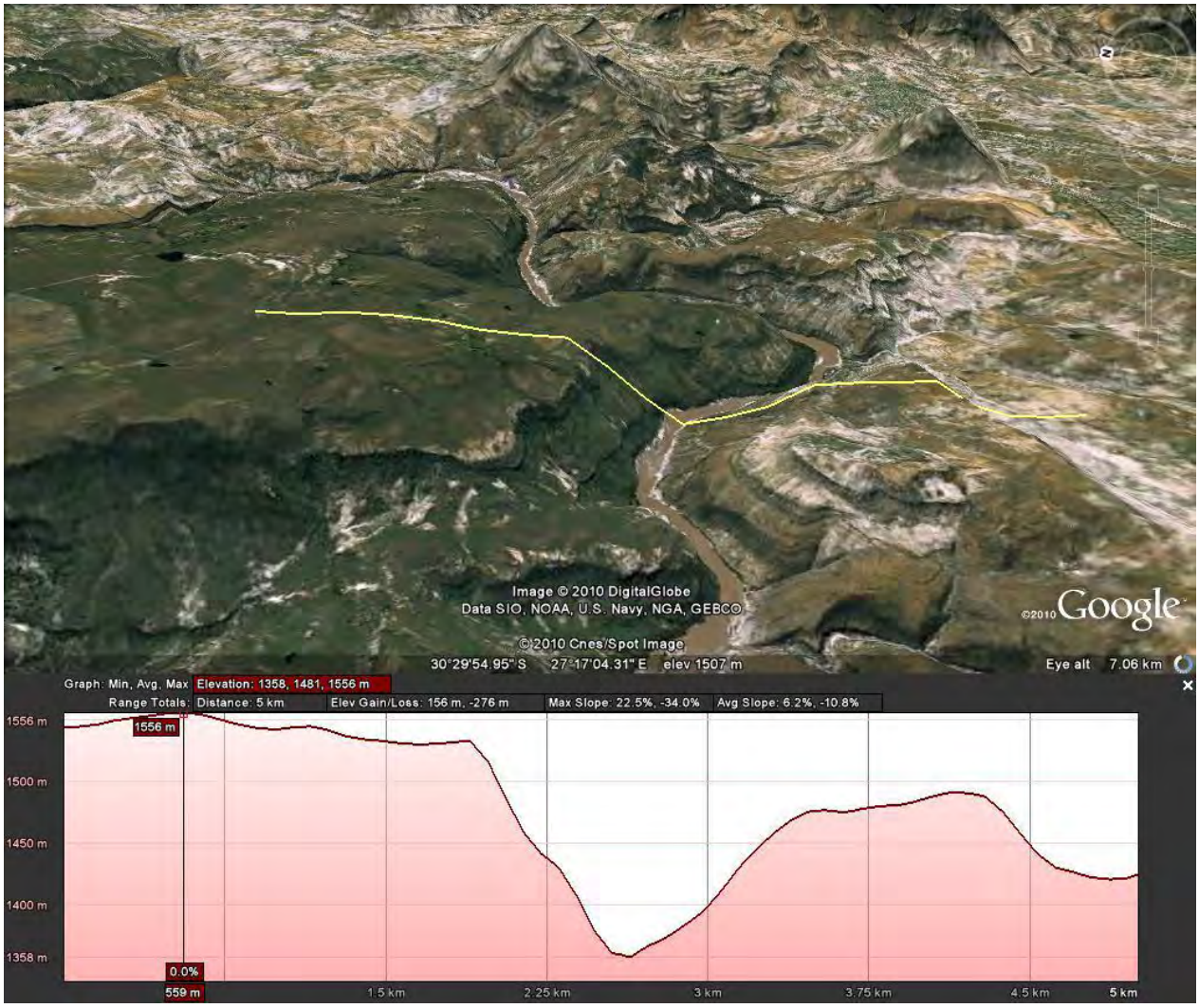

Figure 9: Site B, confined cross section of the Orange-Senqu River (Google Earth, 2010)

Figure 10: Site C, unconfined section of the Caledon River

Figure 11: Site C, confined section of the Kraai River

All four study sites are roughly the same size and where specifically limited in size so as to represent the size of a catchment containing a single WUA. This includes both the lateral and upstream-downstream extents of a stereotypical WUA in South Africa.

4.4 PILOT STUDY

On the 9th of June 2010, a pilot study was conducted in the Kat River valley in the Eastern Cape, South Africa. Three commercial farmers were interviewed using a preliminary interview format containing six themes. As a result of the pilot study, the interview format was revised to contain eight themes, discussed in the following section, as it needed to probe specifically the topics of communication and social cohesion more deeply. It furthermore indicated that stakeholders were very willing to discuss sensitive issues if confidentiality was ensured and thus the revised format contained questions which

investigated certain topics in more depth. The pilot study also brought forward the value of a mapping exercise explained in the following section. Subsequently the exercise was greatly refined and the scale of the maps used in the exercise decreased so that a broader range of social interactions could be plotted. Most importantly, the pilot study gave an indication of the time that would be needed to conduct the fieldwork component of this project.

4.5 DATA GENERATION

Semi-structured interviews

Primary data generation was conducted through 64 semi-structured interviews across the four study sites (16 in each). The data generated from those interviews was used to meet the project‟s objectives. Those targeted for interviews were commercial farmers whose properties bordered the banks of the Orange-Senqu, Caledon and Kraai rivers. Commercial farmers are the dominant water users in the entire Orange River basin as agriculture consumes 64% of all water utilized in the system (Ashton *et al*, 2008). They were therefore targeted exclusively as they constitute the stakeholder group that demands most water in the basin. If water is to be effectively managed in the manner proposed by government then farmers must be at the center of attention as they are the dominant water users in most of the basin‟s catchments.

The interviews, in term of time, ranged from 45 minutes to over two and a half hours in some cases. The numbers of appropriate stakeholders available for interviews was smaller than expected. Study site A was the first site visited during the field work period and only 16 stakeholders (out of a possible total of 20) were available to be interviewed. Initial interviewees were identified through local business contacts and at each interview the interviewee was asked to identify other stakeholders in the region who owned land adjacent to the river in question. In sites B, C and D a similar pattern emerged to that found in site A and so to ensure consistency 16 stakeholders were also interviewed in each of these three sites. Stakeholders interviewed in these three sites were not evenly distributed on each side of the river. This was because either an even number of stakeholders could not be contacted on each side of the river or an even number did not exist on either side. Figures 12 to 15 in chapter 5 display these distributions. It must be noted that in site B the south bank on of the

river is predominantly occupied by Xhosa speaking, non-commercial, farmers located in the former Transkei. It is only at the western end of the study site where a small number of commercial farms exist on the Eastern Cape side of the Orange-Senqu River.

As stated in section 4.2 commercial agriculture absorbs 64% of all the water utilized in the Orange River basin. Within the study sites this percentage would be expected to be higher as the only other water users in the areas are the small towns of Aliwal North, Barkley East, Colesberg, Rouxville and Smithfield, none of which contain any significant industry. With the exception of protected areas surrounding the Gariep dam and informal subsistence farming in the former Transkei region, the remainders of the study sites are dominated by commercial agriculture. No evidence was found of significant withdrawals by black subsistence famers in site B. Every effort was made to locate black commercial farmers within the study sites, unfortunately not a single operational black owned commercial farm could be found. It was not the intention of this study to limit the investigation to a single population group. The reality in the study sites is that all commercial farmers with land adjacent to the rivers in question were white and therefore only white stakeholders were suitable candidates for the interview process.

A semi-structured interview aims to explore a specific topic whilst trying to avoid asking specific questions. The interviewer has a number of themes that need to be covered but instead of asking a series of direct questions the interviewee is guided through a conversation where the questions are covered (Babbie, 1992). Semi-structured interviews are conducted within a moderately open framework that allows for focused yet conversational communication where board or general questions are used to gather primary data (FAO, 1990). This form of interview also allows for the generation of both quantitative and qualitative data as well as general information relevant to specific issues. For the purposes of qualitative research, the themes within the semi-structured interview were designed to elicit factual information as well as the opinions and attitudes of the interviewees (Punch, 2005). A semi-structured interview aims for a degree of flexibility, thereby allowing the interviewee to talk freely, while ensuring that the conversation remains on, or returns to the topic of the researcher (Saunders *et al*, 2003). This format of data collection suited research of this kind as it allowed interviewees, occasionally with a little encouragement, to be highly descriptive and detailed about the social and physical environments of which they are a part. By having a conversation with stakeholders, as opposed to simply asking direct questions, the respondents were also more relaxed,

accommodating and more willing to divulge potentially sensitive information. The semi-structured interview format also importantly avoids „testing" the interviewee which would otherwise lead them to be more reserved.

In order to generate quantitative data Lickert scales were included into the structure of the semi-structured interviews and often attached to open-ended question (see Appendix A which contains the entire interview format). Lickert scales are employed as a method of ascribing quantitative values to qualitative data and thereby making it possible for direct comparisons between responses to be made and making it possible for statistical analyses to take place (Babbie, 1992). As the structure and content of the semi-structured format was developed, relevant questions were accompanied by a Lickert scale with a ranking structure of 1 - 5. Lickert scaling is a uni-dimensional scaling method where the responses to a question are scored across a scale of 1 - 5 without, in this case, the interviewee necessarily being asked the question directly. As the interviewee answers the questions posed or proceeds with the conversation the interviewer makes the assessment. This form of scaling allows the interviewer to rank the subjects responses as the conversation proceeds without breaking the flow of the conversation as the exchange is guided from question to question. The data gathered from the Lickert scales can be analyzed by using the data to generate graphs and charts. Mogey (1999) suggests that parametric statistical tests can also be employed to analyze the data generated by Lickert scales in interview-based research. This is precisely what took place although non parametric test were also employed where appropriate. Three sets of statistical analyses were carried out on the quantitative data collected through the use of Lickert scales and other closed ended questions. The results of these tests form the basis of the quantitative results presented in the following two chapters.

The semi-structured interview format contained the following eight themes with a variation of open ended and closed questions in each: the nature of local water resources, communication and social networks, local sense of belonging, indications of cooperation, evidence of conflict, confidence in government, institutions, policy and water management, and local histories and wider geopolitics. Each of these themes, or a combination of them, was designed to specifically meet the objectives of the project (as illustrated in Table 1) and provide context to the discussion of the results.

Table 1: Linkages between research objectives and interview themes

Objective	Relevant interview themes
1) To compare the study sites with respect to the nature of their water resources	A) The nature of local water resources
2) To investigate whether the river acts as a barriers to social networking and communication	B) Communication and social networks H) Local histories and wider geopolitics
3) To compare the effect of site characteristics on social cohesion within the sites as a measure of potential for participatory water management	C) Local sense of belonging H) Local histories and wider geopolitics
4) To compare the effect of site characteristics on the degree of active cooperation within the study site	D) Indications of cooperation A) The nature of local water resources
5) To compare the effect of site characteristics on the potential for water based conflict within the study site	E) Evidence of conflict A) The nature of local water resources
6) To investigate the extent of knowledge of and engagement with water management institutions and policy	F) Confidence in government G) Policy and water management

Interviewee mapping

To determine if the river itself acts as a barrier to the development of social networks, stakeholder were asked to map out their most frequent contacts across the study site, either for social or work related purposes. Each interviewee was asked to mark on a map of the study site the other individuals in the farming community with whom they were most frequently in contact with. The interviewees marked between 4 and 8 frequent contacts

depending on the individual. The results are presented as maps in chapter 5. The maps of the study sites were generated by the author by merging the relevant 1:50 000 topographic map sheets available from the national geospatial information server. This was done using ArcMap, version 9.3.1. These maps were then laminated and after each interviewee marked off their frequent contacts on the map the results were captured by photographing the map. This exercise provided particularly useful data in terms of objectives 2 and 3.

The exercise provided a graphical representation of the relationships that were explained during the interview process and, although simplistic in nature, provided a clear indication of the distribution of social networks in each of the study sites. Further questions were built around this exercise so as to explain the mapped distributions.

4.6 ANALYSIS TECHNIQUES

Content analyses

A content analysis is a systematic method that is widely used within the social sciences to study the content of communications, such as interviews, and analyze them by placing specific elements of the data into explicit pre-determined categories (Stemler, 2001). This kind of qualitative analysis is described by Kitchin & Tate (2000) as an interpretive approach, the aim of the content analyses being to identify commonalities and trends that exist within the captured data and therefore to allow for conclusions to be drawn. It involves an in-depth analysis of the notes recorded during interviews with stakeholders and then the coding and classifying of that data in order to identify patterns or themes (Hsieh & Shannon, 2005). By scrutinizing and analyzing the responses, perspectives, experiences and ideas given by interviewees and by then placing them in specific categories, logical patterns emerge from the data. If, however, coherent patterns do not emerge this will be a finding in itself. Therefore the aim of this qualitative component of the data analysis process was to provide background information and meaning to support and explain the outcomes of the quantitative analyses. During this stage of analysis a key focus was to ensure that correlation within the data sets did not necessarily imply causation, therefore an important concern was to avoid making assumptions about causality. It was never assumed that because two variables correlated they were caused by the same reality or phenomenon. During this process and the writing of the following two chapters special efforts were made

to avoid bias towards positive evidence that supported the research hypothesis and not to over value confirmatory evidence.

Statistical analysis

The statistical analyses and tests used the quantitative data collected through Likert scales and closed ended questions. The statistical analysis employed both parametric and nonparametric statistical test using the software package Statistica© (StatSoft, 2011), and was comprised of four sections:

- Frequency tables (Table 2): frequency tables for each question displaying the distribution of responses across the relevant scale for each of the four study sites were calculated. A frequency table gives a neat and concise summation of the data and will reveal any distinctive or obvious patterns in a data set. Means and standard deviations of the continuous variables were calculated for four study sites. These tables were used to generate most of the percentages and ratios presented in text in results chapters as well as many of the graphs.

Table 2: Example of a frequency table form question A1 a

A1 a

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	14	21.9	21.9	21.9
	2	4	6.3	6.3	28.1
	3	1	1.6	1.6	29.7
	4	7	10.9	10.9	40.6
	5	38	59.4	59.4	100.0
	Total	64	100.0	100.0	

- Crosstabs and Chi square tests: these tests were run to determine if the four sites differed significantly from each other. A cross tab, essentially a two-way frequency table, was constructed for each question and illustrated the breakdown of responses across each of the study sites. Chi-square tests, using a 5% level of significance, were used to establish if the distribution of responses was significantly different

between the four study sites and thereby determine if there was any effect on the data due to location. The Chi-square statistic summarizes how far the observed cell counts fall from the expected cell counts under truth of the null hypothesis of equality of the distribution of responses between the sites (Agresti & Franklin, 2007). The results of the Chi-square tests are frequently presented in text throughout chapter 5 and 6.

- One-way ANOVA and post-hoc multiple comparisons: One-way ANOVA procedures, using a 5% level of significance, were used to test for the effect of location on the response scores. An „analysis of variance" or ANOVA is the inferential method for comparing the means of several groups in a data set while assuming homogeneity of variances and normality within the data set (Cohen, 1992). Where the ANOVA revealed significant differences between the sites Tukey post-hoc multiple comparison tests were used to indicate which of the sites differed from each other. Prior to analysis, homogeneity of variances and normality of the data were examined using Levene"s tests and Shapiro-Wilk"s tests, respectively (Johnson & Wichern, 2002). The results of the Tukey post-hoc multiple comparison tests are displayed as tables throughout chapters 5 and 6.

- T-tests: Finally independent t-tests, using a 5% level of significance, were used to test for significant differences between the combined sites of AB and CD, and then for AC and BD. A t-test assesses whether the means of two groups of data of statistically different from each other (Trochrim, 2006). These tests were, therefore, run in order to determine if there were topographical and provincial border effects on the response scores.

Structure of chapters 5 and 6

Chapters 5 and 6 present the qualitative and quantitative results obtained using the methodology described in the preceding chapter. Chapter 5 presents those relevant to the first aim of this project and chapter 6 presents those results relevant to the second aim of the study. Project aims:

1) To determine if rivers act as dividing or uniting features in a socio-political landscape and whether topography will influence their role in this context.

2) To consider the implications of this for catchment management in South Africa.

Chapter 5 is divided into six individual sections and chapter 6 is divided into three sections, all of which correspond to the discussion topics used in the interview format (see appendix A). Each of these sections presents the results specific to one aspect of this study and contains a discussion of those results at the end of each section. A general discussion is delivered in chapter 7 which brings together all of the findings of the nine sections in chapters 5 and 6. The analysis of data collected in each of the four study sites was carried out in two stages. Firstly a content analysis extracted patterns and significant data from the qualitative responses gathered. These are brought forward throughout chapters 5 and 6. Secondly the statistical analyses described in the methodology (4.5) were applied. These tests drew out the statistically significant elements of the data sets and exposed a number of quantitative patterns that either support or are explained by the qualitative results. The statistical tests that were run used the data gathered through the Lickert scales attached to specific questions and closed questions asked during the interview process. The results of these tests are presented either in tables or in text. The results of the qualitative and quantitative analyses are presented in tandem for each section and subsection so as to allow for a holistic understanding and correct interpretation of the gathered data. Emphasis will be placed on either the qualitative or quantitative results where necessary. These two chapters are not divided on the basis of either the qualitative or quantitative analyses but alternatively present complete results section by section. It must be noted that some sections are based more on the quantitative results while others rely more on the qualitative data gathered. It is the nature of the questions and issues discussed for that section during the interview process which dictate this.

4.7 CONCLUSION

This project has employed a methodology designed to effectively and efficiently meet the aims of the project and answer its research question. Conducting the research under a realist research paradigm and using a largely inductive conceptual framework has allowed for the collection and interpretation of both qualitative and quantitative data which answer the research question. The data collected across the four study sites, through semi-structured interviews, was subjected to a content analysis and a series of statistical tests which elicited the significant data sets and patterns presented in the following two chapters. The data collected through the use of Lickert scales and other closed ended questions provided the quantitative data used to run the statistical analyses and develop the tables presented in the results chapters. The quantitative data, drawn out by the content analyses, is used to reinforce, explain or support the results of these tests.

CHAPTER 5: RESULTS AND DISCUSSION FOR AIM 1

5.1 INTRODUCTION

Chapter 6 presents the results of six sections of questions which were designed to determine if rivers act as dividing or uniting features in a social-political landscape, and if the topography of the physical landscape influences the role of the river in this context. The six sections presented in this chapter are: the nature of local water resources; communication and social networks; local sense of belonging; local histories; indications of active cooperation; and evidence of conflict. Each of these topics is dealt with individually with reference to objectives 1 to 5 although their combined implications and meaning is brought forward in chapter 8. Table 3 serves to remind the reader of the nature of each of the four study sites.

Table 3: Study site characteristics

		Provincial border	
		Yes	**No**
Topographic unit	**Unconfined**	Site A	Site C
	Confined	Site B	Site D

Stakeholder summary

In total 64 white commercial famers were interviewed across the four study sites, the majority of which, 89%, were Afrikaans speaking while the remainder were English speaking. The farming experience of the interviewees ranged from 12 months to 65 years while similarly the period of individual/family ownership varied from under a year to 174 years over four generations. The average level of education of those interviewed was an agricultural diploma or degree; however the range extended from a master‟s degree to an incomplete matric. Agricultural activity across the four study areas was predominantly focused, 95%, on either sheep or cattle rearing or a combination of the two. Some 39% of interviewees were involved in irrigation activity in order to either generate fodder for livestock or as their sole source of income by cultivating cash crops. Other types of farms encountered were game, ostrich, dairy, poultry, goat and stud farms; however these were in

the minority. The sizes of these farms varied significantly from 235 ha to approximately 8000 ha although a single farm registered as a complete outlier at 19000 ha.

5.2 THE NATURE OF LOCAL WATER RESOURCES

The intention of this first section is to meet objective 1(see Table 1) and give an indication of stakeholder"s perceptions concerning their local water resources and associated issues. Congruencies or differences in opinions between the study sites gave an indication as to whether or not stakeholders across the region face similar challenges and share viewpoints with regard to their local water resources.

River importance as a water source

Revealing the perceived importance of the relevant river serves as an indicator of the degree to which stakeholders rely on that river as a water source and therefore how valuable it is to those stakeholders. The higher the value the more probable it is that local stakeholders will actively engage in the management of that water source. Establishing if topography affects the importance of the river will also give an indication of whether stakeholders in the different topographic units are more or less inclined to be involved in management structures.

The importance of the relevant river to agricultural activities in each site varied significantly. For question A1a, which asked stakeholders to indicate the importance of the relevant river to their farming activities, a Chi value of 27.564 ($x^2_{12} = 27.6$, p = 0.006) was found which verified that a significant locational variation exists within the data set. The ANOVA analysis confirmed this and through the associated multiple comparison test it was found that site B was significantly different to sites A and D. Site C was not significantly different to any of the other three sites due to a wide range of responses. The combined test for sites AC and BD produced a Chi value of 11.218 ($x^2_4 = 11.218$, p = 0.024), indicating that a significant difference existed between the two topographic units.

A content analysis showed that stakeholders in the confined site B were found to be far less dependent on the river as a water resource simply due to the topography of the region. It was stated that it was not viable, or even possible in some cases, to pump water from this section of the Orange-Senqu River to potential irrigation points. Importantly 100% of

respondents in the confined sites had access to alternative sources of water; however the accessibility of these alternative sources was significantly different between sites B and D particularly and sites B and A as Table 4 indicates. Stakeholders in site B indicated that alternative water sources were significantly less accessible, as alternative sources were either not present or physically difficult to access due to the topography of the area, than did those in sites A and D. Site C once again provided a wide spread of responses. The few respondents with no access to alternative water sources were pure cash crop farmers along the Orange-Senqu River below the Gariep dam. Alternative water sources were primarily boreholes and fountains/springs while some respondents did have access to ephemeral rivers and rain fed dams.

Table 4: Post Hoc Test: Significant Multiple Comparisons for question A4: „how accessible are alternative water sources?"

Dependent Variable	(I) Loc	(J) Loc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
A4	A	B	1.098*	.273	.001	.38	1.82
	B	A	-1.098*	.273	.001	-1.82	-.38
		D	-1.375*	.264	.000	-2.07	-.68
	C	D	-.813*	.264	.016	-1.51	-.12
	D	B	1.375*	.264	.000	.68	2.07
		C	.813*	.264	.016	.12	1.51

Tables 4, 8, 9, 10, and 11 present the significant results of the Post Hoc multiple comparison tests for specific questions. These tables compare a study site (I Loc) to the three remaining study sites (J Loc) and as a 5% level of significance was used, those comparisons with a significance level (column 4) of 0.05 of less are presented in bold. For

example, in Table 4 Site A is significantly different to site B as a significance level of 0.001 was calculated and in the second row site B is significantly different to Site A and Site D. In some of these tables only the significant comparisons are shown while in others the full results are displayed. Where the full results are displayed this is done to reinforce the differences between the study sites for that question. These tables neatly present the results of the comparison tests although they have only been used to present the results for a select number of questions.

Legal water use restrictions

Monitoring water use and withdrawals from river systems is crucial to the sustainability and equitability of water management schemes. This section illustrates the current state of regulation and therefore points to a key challenge that will have to be dealt with. The question of legal or customary restrictions on water use yielded a wide range of responses that were not constant within each study site, let alone between the different sites as illustrated by Table 5.

Table 5: Legal controls on water use within the study sites (Question A2)

	Water license mm/a	Water license mm/ha/a	Standard water levy	Metered withdrawals	No regulation
Site A	4	8	0	4	0
Site B	3	4	0	2	7
Site C	7	5	1	0	3
Site D	1	0	7	0	8
100%	23%	27%	13%	9%	28%

The range of methods used to regulate and bill stakeholders for the consumption of water for agricultural purposes were highly inconsistent and not altogether understood by most farmers. Amid much confusion the general consensus amongst those interviewed was that the first type of water licence was where fees were paid per an allocated amount of water per year irrespective of the actual quantity used; the second category of water licence was a standard fee based on the amount of scheduled land on the cadaster in question; water levies appeared to be seemingly random bills received by landowners at irregular intervals;

and finally a minority of stakeholder paid water bills based on meters attached to their pumps located on river banks. The fact that over a quarter of all respondents were not subject to any regulation at all by local or government authorities was the most significant and, for potential water managers, the most pertinent statistic produced by this question. It must be stressed that very few interviewees had a clear understanding of exactly how their water bills were calculated and which local authority was responsible for them. In Site D in particular the incapacity of the Eastern Cape authority was stated as the primary reason for virtually nonexistent water regulation. Temporal inconsistency of received water bills and checks on water meters was another common trend across all four study sites. Site A was the most regulated of the four sites, due to its position directly below the Gariep Dam; however even in this case communication between the local managing authority and downstream stakeholders was irregular.

Changes in water availability

Stakeholder views on changes in water availability also give an indication as to how necessary stakeholders feel it is to manage local water resources and how willing they would be to participate in the management of local resources. The next section on climate change and other environmental issues serves the same purpose.

Opinions regarding changes in the overall availability of water were fairly uniform across all four sites as a Chi value of 9.500 ($x^2_6 = 9.500$, p = 0.147) was produced when testing for locational differences in opinion. Sites A and C registered the highest number of respondents stating that no change in water availability had occurred during their time as farmers in the region. It must be noted that both of these sites are positioned below large storage reservoirs namely the Gariep and Welbedacht dams. Dropping ground water levels and declining rainfall were the most common indicators given for decreasing water availability. Although not a single respondent stated that water availability had increased, it was noted on occasion that due to better veld management practices, ground water in some areas was remaining constant even as withdrawals from the systems increase.

Climate change, water concerns and environmental issues

Discussions on climate change provoked a very repetitive range of responses across all for sites with no significant differences according to location ($x^2_{12} = 15.666$, p = 0.207). In total 64% of all interviewees stated that they had noticed absolute changes in local climate. The primary indicators of these changes were more isolated and intense rainfall patterns (33%),

the shifting of seasons and temperature changes (33%), and changes in biodiversity (7%). Importantly only two respondents stated that they did not believe in climate change as a phenomenon but rather changes in water availability was primarily due to natural variation and cyclical changes. However climate change or its affects, was rarely stated as a critical water related issue faced by stakeholders. As Figure 12 illustrates there is little similarity between responses to the question of water related issues across the four sites. This clearly indicates that each site faces a very context specific reality in terms of its water issues. Sites C and D in particular were faced with site specific problems. In site C the primary issue which affects scarcity and the variation of water supply, is sedimentation in the Welbedacht Dam upstream of the site. In site D the most substantial issue is that of declining water quality which stems from insufficient and poorly managed sewage infrastructure in the town of Barkley East. It must be noted that these are upstream downstream issues that affect stakeholders on both banks of the river as opposed to cross river concerns.

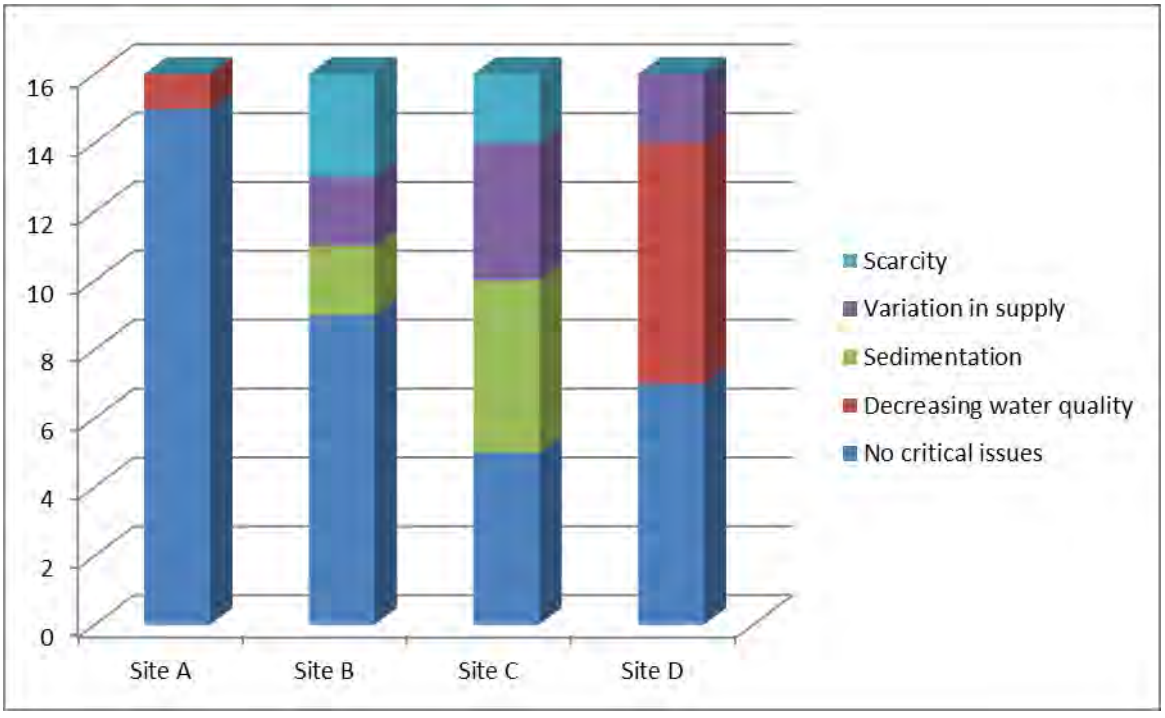

Figure 12: Most critical water related issues (Question A6)

The prevalence of other critical environmental issues was highest in Sites C and D as illustrated by Figure 13. The vermin problem was less frequent in sites A and B as these sites were predominantly occupied by crop and cattle farmers. Whereas in Site C, in particular, the high concentration of sheep farmers were suffering from staggering losses due to vermin. On seven of the ten sheep farms in Site C Black-backed Jackal (*Canis*

mesomelas) and Rooikat (*Caracal caracal)* were accounting for over 30 lost head of livestock per month per farm. In site D alien invasive species were the most significant issue with infestations of Grey Poplar (*Populus canescens*), and Black wattle (*Acacia mearnsii*) occurring frequently.

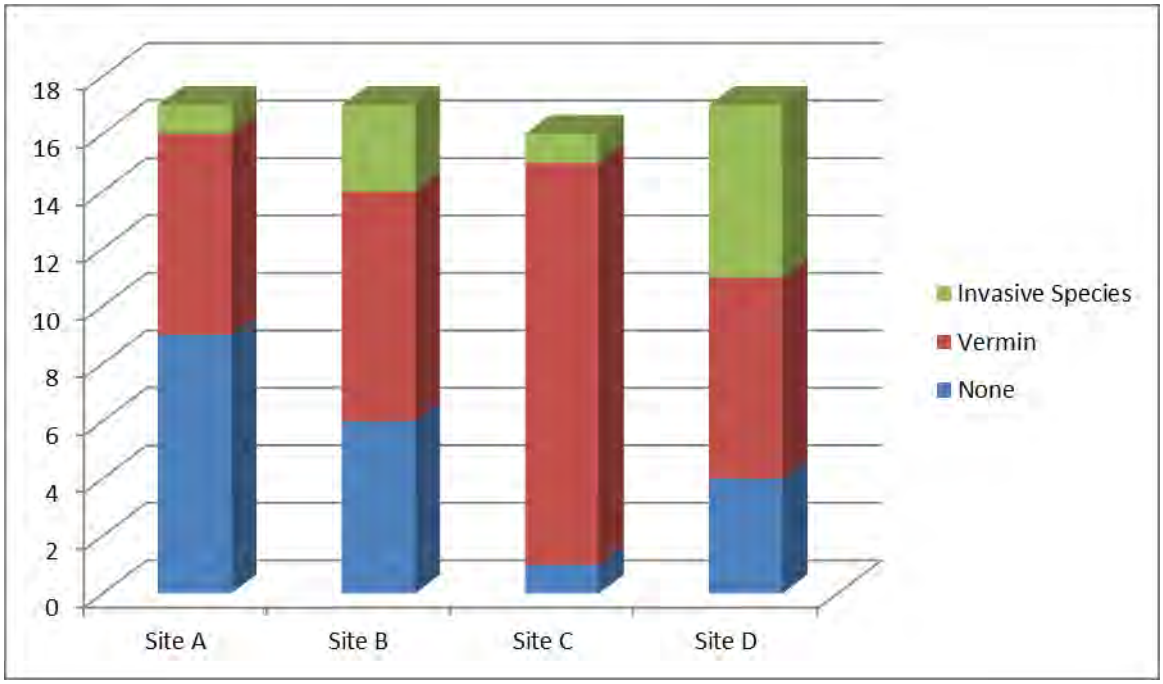

Figure 13: Other environmental issues (Question A8)

Discussion for section 5.2

The results indicate that the nature of local water resources and the topography surrounding the river in question does have an effect on whether a river divides or unites stakeholders on either side of it, in that the river may or may not act as a common point of interest for those stakeholders. The importance of the river to stakeholders indicates whether or not the river itself forms a common point of interest. If it does, issues concerning it will promote dialogue amongst stakeholders and thus the river will act as a unifying feature or as a source of conflict. Levels of river utilization and access to alternative water sources heavily influenced the perceived importance of the river while changes in water availability, legal or customary restrictions on water use, and the perceived impacts of climate change provided further insight into the characteristics of water resources within each study site.

The importance of the river as a water source to local stakeholders was heavily influenced by the topography surrounding the river. The results indicated that in the confined sites, the degree to which stakeholders could utilize the river was severely limited by the topography

of the region. A stakeholder in site B described the Orange-Senqu as a “complete non entity” as far his farming activities were concerned as the river was inaccessible due to the terrain of the area. Furthermore, in the confined sites, 100% of stakeholders had access to water resources other than the river while in the unconfined sites numerous stakeholders were completely reliant on the river as their sole source of water. The direct link between the perceived importance of a river and its level of utilization is obvious but the point that is being stressed here is that the topographic factor must be considered as a primary physical factor that will determine if a river serves as a common point of interest for local stakeholders. Stakeholder concerns about the health and reliability of their local water resources reinforce this point. The unconfined site C contained the highest occurrences of water related problems such as scarcity, variation in supply and sedimentation. The state of Caledon River in particular provided a common point of interest amongst those reliant on the river. In the confined sites these issues were less frequently stated simply due to the low levels of river water utilization. In sites B and D (confined) the effects of climate change on the consistency of alternative water resources became a far more significant issue as these issues pertained to individual water sources; however these issues did not appear to foster dialogue between stakeholders. The water security provided by the Gariep dam explains the lack of attention given to water related issues in site A. The one universally common characteristic across all four study sites was that restrictions on water withdrawals were chaotic and seemingly arbitrarily distributed. Particularly in parts of sites B and D, the monitoring of water abstraction was described as “non existent”.

The level of utilization of the river and the state of local water resources contributes to the river‟s perceived role as a dividing or uniting feature. Dependency on the river, the state of the river, and the availability of alternative water sources will determine if the river serves as a common feature uniting those stakeholders who share a common interest in it, while simultaneously alienating those who do not. The topography surrounding the river in question is the primary force that determines the importance of the river to local stakeholders and therefore determines if the river unites or divides stakeholders with regard to their dependency on that river. Based on this point, stakeholders in unconfined sites would be more inclined to participate in management initiatives than those in unconfined sites due to their mutual dependency and common interest in the shared water source.

5.3 COMMUNICATION AND SOCIAL NETWORKS

The purpose of Section B of the interview format was to identify the primary avenues through which formal communication occurs amongst stakeholders and the structure of local social networks. The results of this section give a clear indication of the importance of local organizations and the level of interest stakeholders have in local decision making processes. The second objective of this project is to investigate whether rivers act as a barrier to or catalyst for, social networking and communication. The results presented in this section meet this objective by demonstrating whether social networks are located primarily on one side of a river, and then providing explanations for this distribution.

Frequent contact patterns

Table 6 presents the results of question B1 which asked interviewees to point out on a map of the study site their most frequent contacts, either for social or work related purposes. The results clearly illustrate the degree to which stakeholders are in contact with other stakeholders on the opposite side of the river in question. 78% of all given frequent contacts were located on the same side of the river as the interviewee, which indicated a low level of communication across the river. Based on this, social networks appear to be specific to each side of the river. Particularly in sites B (confined) and C (unconfined), frequent communication with stakeholders on the alternative side of the river was rare.

Table 6: Location of frequent contacts (Question B1)

	Frequent contacts on home bank	Frequent contacts on opposite bank	Total frequent contacts per site	Ratio
Site A	53	17	70	3.12-1
Site B	61	13	74	4.85-1
Site C	59	10	69	5.9-1
Site D	58	26	84	2.23-1
Total	78%	22%	100%	

Difficulties associated with communication and river crossings

Identifying the difficulties associated with communication gives an indication of the state of infrastructure in each of the study sites. Participatory management cannot take place

without rapid and frequent communication between active stakeholders and therefore identifying obstacles to communication is important. This exercise also enables the identification of the most appropriate mediums for communication under the present conditions.

Across all four study sites communication was seen as problematic due to insufficient infrastructure. 69% of all interviewees stated that cellphone reception was erratic, insufficient or completely absent in their areas while 41% stated that Telkom (the national service provider) lines were seriously unreliable or non-existent. The lack of infrastructural development was particularly acute in the elements of sites B and C, which fall in the Rouxville region which still uses a telephone exchange system.

Across the four sites overall access of stakeholders to cellphone reception, land lines and internet connections was uniform with 70% stating that they had at least intermittent access to all three communication options. VHF two-way radio communication is still seen as the most reliable communication and is widely employed although the large size of farms in the study sites limits its effectiveness.

Only 16% of respondents stated that the quality of local roads were a major hindrance to communication. The distance by road to the nearest river crossing and the perceived regularity of crossing points provides insight into the results of question B1. Table 7 shows the average distance from the stakeholders homestead to the closest river crossing while Table 8 shows which sites differ statistically for questions B4 and B5. Sites B and C have the highest average distances between crossing points which corresponds to the highest ratios of frequent contacts in Table 6. Site B again proves to be significantly different to sites A and D for both questions. Figures 12, 13, 14 and 15 present local transport networks and clearly show that, particularly in sites B and C, river crossings are infrequent. In sites D it must be noted that the central river crossing shown on the map is often submerged during periods of high rainfall. Only in Site A do river crossings occur at regular intervals, although the majority of these occur upstream of the national road.

Table 7: Average distance to nearest river crossing

	Distance (Km)
Site A	10.1
Site B	26.9
Site C	16.8
Site D	8.7

Table 8: Post Hoc Tests: Significant Multiple Comparisons for questions B4: „how far is the closest crossing point over the river?" & B5: „would you say the river is easy to cross? (i.e. are there regular crossing points)"

Dependent Variable	(I) Loc	(J) Loc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
B4 (km)	A	B	-16.750*	4.226	.001	-27.92	-5.58
	B	A	16.750*	4.226	.001	5.58	27.92
		D	18.188*	4.226	.000	7.02	29.36
	D	B	-18.188*	4.226	.000	-29.36	-7.02
B5	A	B	-1.438*	.269	.000	-2.15	-.73
		C	-.813*	.269	.019	-1.52	-.10
	B	A	1.438*	.269	.000	.73	2.15
		D	.813*	.269	.019	.10	1.52
	C	A	.813*	.269	.019	.10	1.52
	D	B	-.813*	.269	.019	-1.52	-.10

Membership of organizations

Investigating levels of stakeholder involvement in local organization serves a double purpose. Firstly it gives a clear representation of the levels of cross river communication and the degree to which the relevant river acts as a border for local institutions. Secondly it indicates the degree to which local stakeholders are already involved in organizations that effect their agricultural practices.

Membership of farmers associations was high with no significant difference between the locations as a Chi value of 3.678 was determined ($x^2_4 = 3.678$, p = 0.298). Overall 91% of interviewees were affiliated with a specific farmers‟ association. The 9% who were not members of any farmers association stated that they were either uninterested or believed that the system was ineffective. Of this 9% the majority were pure irrigation farmers who stated that the farmers associations were only interested in the needs of livestock farmers and not irrigation needs. In terms of membership of other organizations 42% were active members of one other organization of some kind while only 11% were members of two or more other organizations. Additional organizations were either provincial agricultural organizations, specific interest organizations or industry specific organizations such as the National Wool Growers Association. Stakeholders in sites C and D proved to be significantly more active in other organizations that those in sites A and B as a Chi value of 12.935($x^2_2 = 12.935$, p = 0.002) was calculated for the combined sites. With regard to farmers association meetings, 78% agreed that it was important to attend meetings of their respective districts. However 77% of all interviewees also agreed that time constraints often effected their ability to attend such meetings. No significant difference between the different locations was found in this case as a Chi value of 9.482 ($x^2_{12} = 9.482$, p = 0.661) was calculated. It must be noted that not all stakeholders in each study site are affiliated with the same farmers association as Figures 14,15,16 and 17 illustrate. The maps clearly show that the farmers associations are specific to one side of the relevant river. Only one case was found, outside of site D, where a stakeholder was a member of an association on the other side of the river. It should also be noted that site D did contain highest number of contacts located on the opposite side of the river to the interviewee.

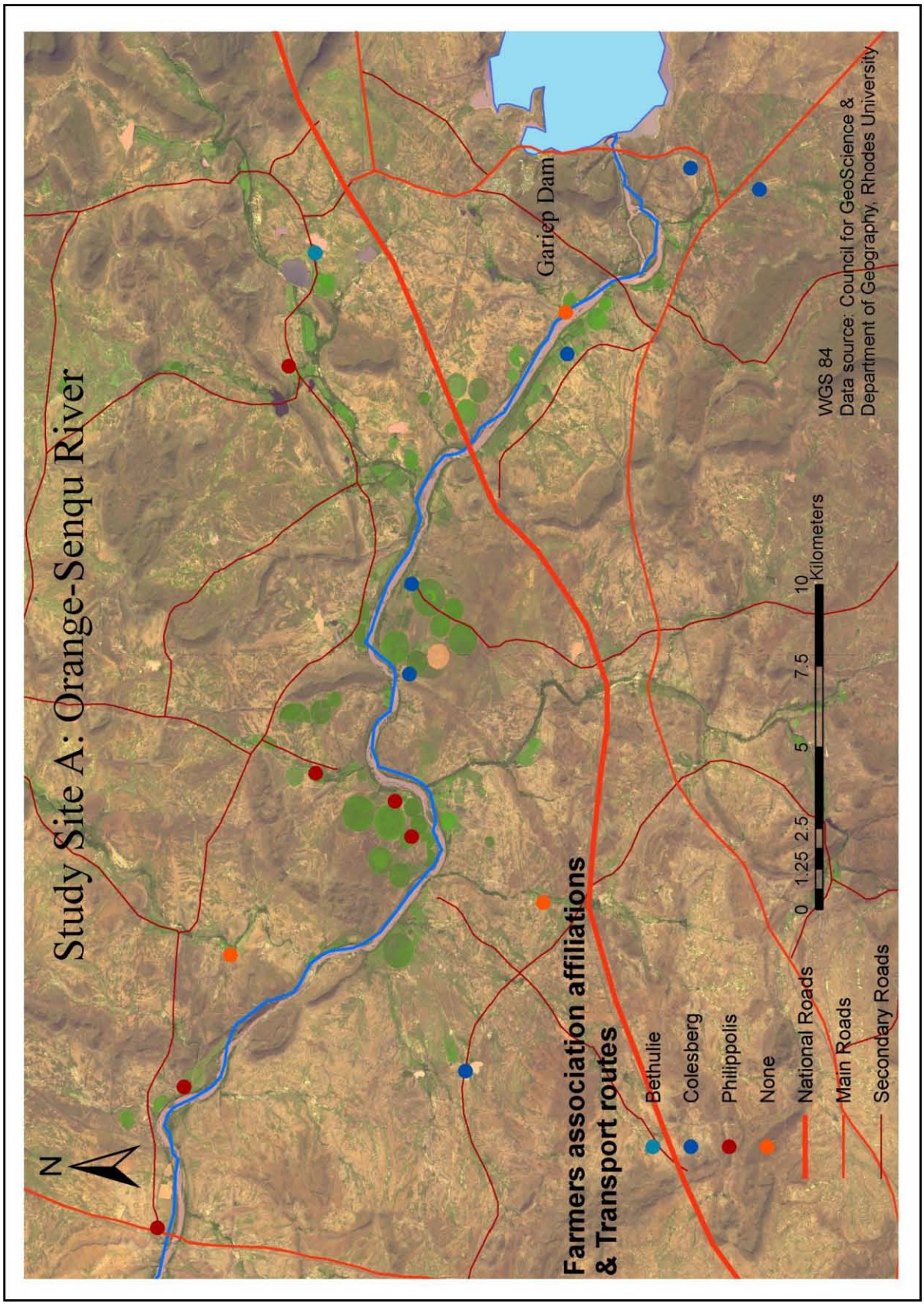

Figure 14: Site A, location of interviewed stakeholders, their affiliations to local farmers‟ associations, and local transport routes

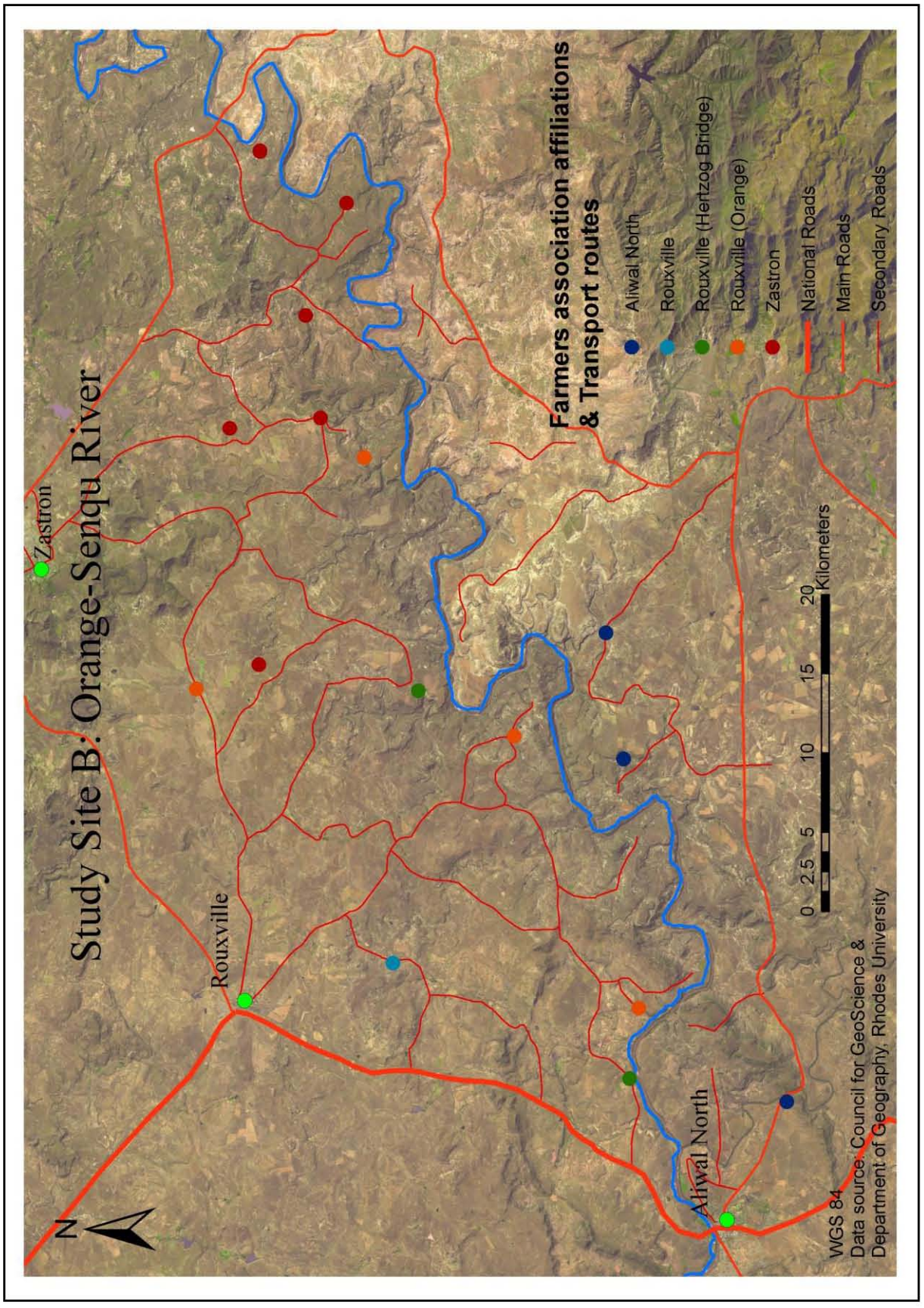

Figure 15: Site B, location of interviewed stakeholders, their affiliations to local farmers‟ associations, and local transport routes

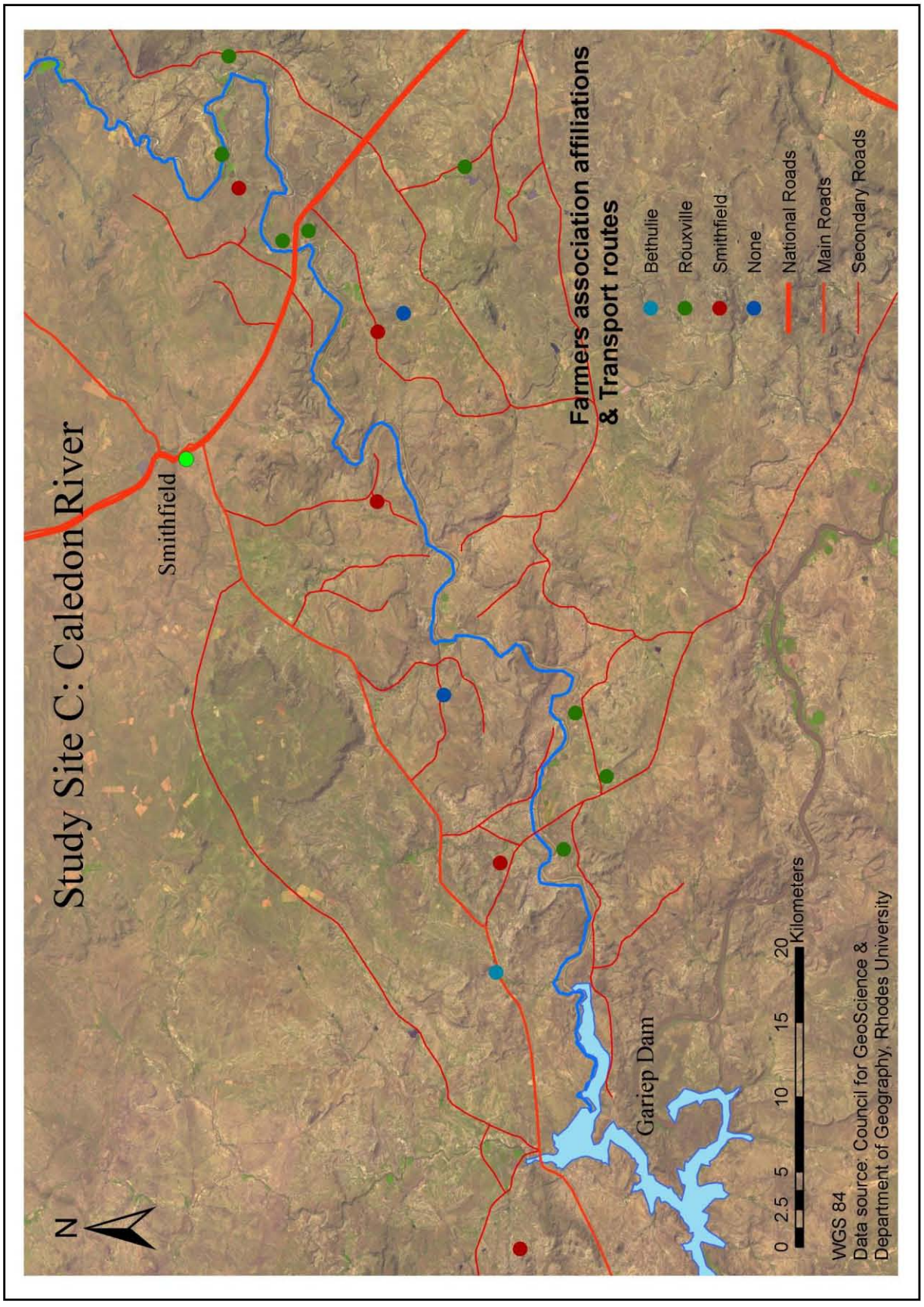

Figure 16: Site C, location of interviewed stakeholders, their affiliations to local farmers‟ associations, and local transport routes

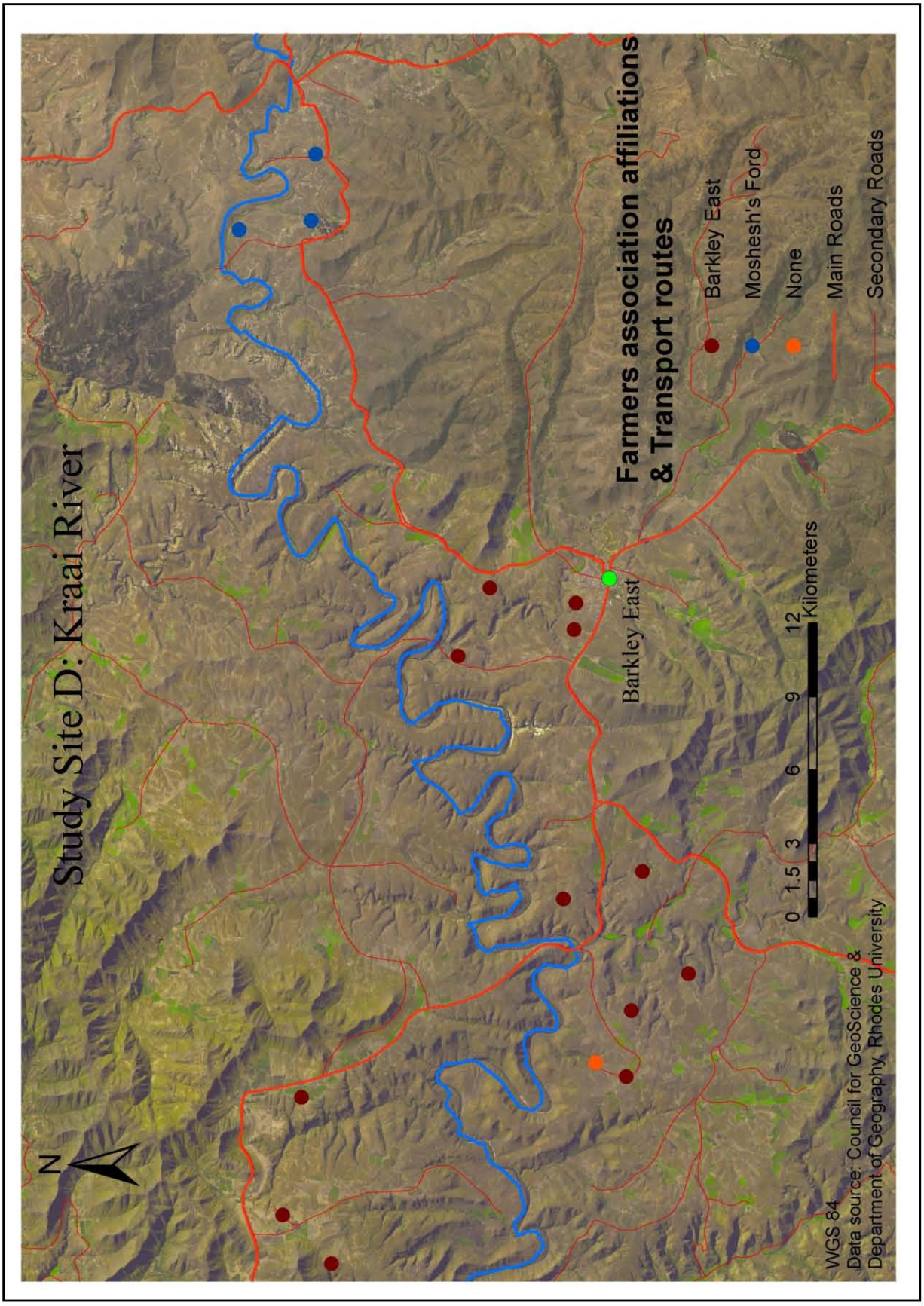

Figure 17: Site D, location of interviewed stakeholders, their affiliations to local farmers‟ associations, and local transport routes

Discussion for section 5.3

The frequent contact patterns brought out by the mapping exercise, produced results that clearly show that regular contact between stakeholders does not take place across the rivers in the majority (78%) of cases. According to research findings this takes place for three reasons. Firstly poor communication infrastructure and long distances between river crossings makes cross river communication difficult and/or tedious; secondly social networks form within the boundaries of local institutions such as farmers associations which frequently employ rivers as administrative borders; thirdly past events have had a great effect on the nature of social landscapes which have often resulted in communities being split along the lines of the river. This last point will be discussed later in this chapter. It also noted that farmers associations are provincial institutions.

The state of telecommunication infrastructure across all four sites is cause for concern as the serious shortfalls in infrastructure will act as a limiting factor in terms of the development of water management initiatives. The data suggests that the majority of stakeholders have already dispensed with the use of landlines for both telecommunication and internet access due to the unreliability and limited access to such infrastructure. Instead stakeholders have opted to rely on cellular connections for these services although these have also proven to be erratic, often as a result of weather, and limited in terms of coverage. It is recognized that cellphone coverage is obviously not limited to a particular side of the river. However obtaining cellphone numbers only takes place through existing contacts. The simple fact that two-way VHF radio is still the most effective form of communication speaks volumes about the state of communication infrastructure. The implications of this situation are that the ease with which information can be transferred to and amongst stakeholders is extremely low. Communication in this way also is entirely dependent on existing lines of communication.

Turton & Ashton (2008), Stringer *et al* (2006), Rabi *et al* (2005), and van der Zaag & Savenije (2000) all categorically state that information exchange is fundamental to any cooperative water management strategy. Another result of this situation is that communities, excluding broader family ties, are highly localized. If communication is challenging, stakeholders develop relationships with those who are most accessible. This would be with neighbors and those who reside in close proximity. The communication element may therefore partially explain why the majority of frequent contacts do not extend

across the river and will be a further contributing factor to the development of communities that are specific to one side of the river. This reality presents another significant challenge as catchment management strategies rely heavily on integration, reflection and learning as essential elements of IRWM and the attainment of its goal (Pollard & du Toit, 2008). The poor state of communication infrastructure is therefore a significant obstacle that will have to be overcome in order for collaborative water management to take place. The fact that the state of road networks were not seen as a significant problem by the majority of stakeholder is however encouraging in this regard. The state of communication infrastructure may not directly cause a river to act as a dividing feature, but where the topography of the region highlights shortfalls in infrastructure and accentuates difficulties in communication, the state of communication infrastructure may enhance the role of the river as a dividing feature.

Membership of local organizations was high across all four study sites as 91% of all interviewees were affiliated with a farmers‟ association in a particular district. Farmers associations are province specific so it is not surprising that the Orange-Senqu River forms an administrative border for these institutions. The fact that at a sub provincial scale, rivers are employed as boundaries for farmers associations is a key finding in terms of this project‟s aims. The employment of the river as an administrative border for local farmers associations proved to be the most significant factor affecting a river‟s role as a dividing or uniting feature. These associations, which act at a very local spatial scale, were all specific to one side of the river in question with the exception of site D on the Kraai River. The role of the farmers‟ association in the development of social relationships is fundamental. In all four sites quarterly meetings of the local farmers association concurrently serve as the highlight of the social calendar and provide one of the few formats for broad social interaction amongst farming communities. Most stakeholders shared the view that these meetings were often “the only chance we have to socialize with our community”. The result of this is that close social networks tend to develop within the community attached to that farmers association. If the farmers‟ association is confined to only on side of a river, as in sites A, B and C, the role of the river as a dividing feature is inadvertently enhanced. The results, as shows in Table 6, confirm this. Regular communication across the river, most notably in sites B and C, is very low as the majority of regular social and work related contacts do not extend to the opposite side of the river. In site A the ratio is only lower due to the integration of irrigation farmers on both sides of the river. In site D, where the rivers

form no boundary at either level (provincial or for local farmers associations) the frequency of contact across the river is more than double that of sites B and C and nearly 50% higher than in site A. The study does recognize that this is probably not the only explanation as to why cross river contacts were more frequent in site D but it is likely to be a contributing factor. The rates of farmers‟ association membership further reinforce these divides although the fact that just under half of all stakeholders are members of more than one organization may limit this effect to a minor degree. Clearly a definite divide exists between stakeholder groups on either side of the river where the river forms an administrative border for farmers associations. The role of topography is not clear in this case although it is likely to again be a factor that enhances or reduces the role of the river as a dividing feature. It is recognized that the nature of farmers associations may enable them to overcome topographic constraints.

5.4 LOCAL SENSE OF BELONGING

The following section, based on section C of the interview format, provides an indication of the degree to which the community in question is unified and mutually supportive. The results for this section signal which groups of stakeholders form close social networks and therefore which are more likely to support collaborative or cooperative initiatives. The sections concerning the local sense of community, security and voting interest all contribute to understanding this particular dynamic within the stakeholder communities. The results of this section provide an indication of the levels of community cohesiveness and strength that exist within the study sites and together with section 6.3 aims to meet objective 3.

Local sense of community

Across all four study sites, 95% of stakeholders felt a strong or very strong sense of belonging to their respective communities where they also felt they could, in general, trust the members of that community. Site A was the only site to register stakeholders who did not share this sentiment. Notably 100% of all interviewees stated that when problems occur there are community members outside of the family who they can turn to for help. Reciprocity, in terms of assistance, was seen as the norm in all but two cases across the four sites. Both of these were located in site A. These communities in sites A, B and C

were specific to one side of the river with the exception of irrigators in site A. In site D these communities stretched across the Kraai River.

Security

In terms of security, responses across all four sites were relatively consistent as no statistical differences between the locations were found. In total 73% of interviewees did not consider house breaking and safety to be a serious issue. However concerns regarding stock and produce theft were not as positive. 39% of stakeholders were concerned or highly concerned about this kind of theft, although many recognized that it was only a problem at particular festive times of the year. Stakeholders in site C proved to be the least concerned with stock theft while farmers in site A suffered most from this problem. The spatial relationship between urban areas and the degree to which stock theft is problem was, surprisingly, not significant.

Voting interest

Section 7.2 deals with confidence in government in detail while the degree to which stakeholders were enthusiastic to vote in local elections gives a further indication of community cohesiveness. For this question a Chi value of 27.378 was calculated indicating a locational difference within the data set ($x^2_{12} = 27.378$, $p = 0.007$). Site A again proved to be a significant outlier in this section as the ANOVA analysis and subsequent post hoc multiple comparison test confirmed that site A was significantly different to sites B, C and D. None of the other sites differed significantly from each other. Among sites B, C and D 88% of interviewees stated that they were eager to participate in local elections. In Site A 50% of stakeholders were uninterested in taking part in such elections.

An average score for section C, which contained eight questions all with Likert scales attached, was generated by totaling the responses for all eight questions in the section. The ANOVA analysis, based on the average score, indicated highly significant differences within the data set. As Table 9 illustrates, site A was significantly different from the remaining three study sites. This difference is a result of the consistently lower scores provided by site A throughout the section. This indicates that site A supports weaker and less cohesive community/communities than site B, C and D. Stakeholders in site A stated that the reasons behind the fractured state of their communities were twofold. Firstly traditional differences between long established families in the former OFS and those in the old Cape Colony stem from the Boer War, and secondly the building of the Gariep Dam

allowed for a new generation of irrigation farmers to enter their communities. Livestock farmers stated that they had little in common with the new landowners involved in irrigation, and as the new irrigators did not attend farmers‟ association meetings, there was little opportunity or reason to socialize with or contact them. Due to the lack of opportunities for integration with the established farmers of the region, stakeholders involved in irrigation stated that they alternatively developed ties with other irrigators in the area on both sides of the river. These stakeholders chose not to attend the meetings of local farmers associations as they were dominated by livestock farmers and therefore had little relevance for those involved in extensive irrigation.

Table 9: Post Hoc Tests: Significant Multiple Comparisons for the average scores for section C: „local sense of belonging"

Dependent Variable	(I) Loc	(J) Loc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Ave C	A	B	-.38281*	.14220	**.044**	-.7586	-.0070
		C	-.56250*	.14220	**.001**	-.9383	-.1867
		D	-.43750*	.14220	**.016**	-.8133	-.0617
	B	A	.38281*	.14220	**.044**	.0070	.7586
		C	-.17969	.14220	.589	-.5555	.1961
		D	-.05469	.14220	.980	-.4305	.3211
	C	A	.56250*	.14220	**.001**	.1867	.9383
		B	.17969	.14220	.589	-.1961	.5555
		D	.12500	.14220	.816	-.2508	.5008
	D	A	.43750*	.14220	**.016**	.0617	.8133
		B	.05469	.14220	.980	-.3211	.4305
		C	-.12500	.14220	.816	-.5008	.2508

Discussion for section 5.4

Communities which are cohesive and contain strong social ties, albeit not necessarily across the river, are likely to be more receptive and open to cooperative and participatory water management initiatives than those which do not contain such levels of solidarity. The results of this section, which investigated these social dynamics by assessing the local

sense of belonging that stakeholders felt, show that in all but site A strong local, closely knit communities exist.

The strength of these communities is very high in all but site A. In sites B and C strong, mutually supportive communities have developed although they are in alignment with farmers‟ association membership patterns and are therefore specific to one side of the river. As previously discussed in section 6.3 the farmers‟ association has a central role to play in the development of social networks and communities. In site D the same is true except the communities spread across the Kraai River. Site A recorded significantly lower indices of social cohesiveness than the remaining sites due to the numerous divisions and splits evident in the region. These are displayed below in Figure 8. In site A there is strong evidence to suggest that past events and differences in agricultural activities can have a significant influence on the orientation of relationship development. Furthermore the results for site A reiterate the importance of farmers associations in the development of social relations. In terms of sites B and C the results of this section indicate that although communities in these sites are divided along the lines of the river, these individual communities are strong and highly integrated. In the case of site C this would suggest that efforts to instigate collaboration could be achieved fairly easily if the community is receptive to the proposed water management strategy. Purely from this perspective the same could be said of the confined sites although the findings of section 6.1 would have to be taken into account which indicates that stakeholders in these sites do not share the same level of dependency and interest in the river as those in the unconfined sites.

5.5 LOCAL HISTORIES

An in depth assessment of how rivers act as dividing or uniting features entails exploring how local histories have shaped the social dynamics of each study site. Section H also explored past historical events that may have helped shape the region into its current social form. The results of this section reveal how past events have forged the social landscapes for particularly sites A and B. The relevance of local histories becomes acutely apparent when investigating how the river in question divides the communities on either side of it.

The perceived impacts of significant past events differed substantially between the border sites (A and B) and the remaining two sites. Within sites C and D 98% of stakeholders

stated that no significant historical events had shaped, to a large degree, the areas in which they lived. While over 50% of stakeholders in sites A and B shared this opinion it was clearly stated by other members of each community that Apartheid policies, the Boer War and the construction of the Gariep Dam had all radically changed the social structure of the two sites. Those stakeholders in sites A whom did not note the importance of past events were all landowners who had become established in the region post the completion of the Gariep Dam. In site B the effects of Apartheid were most obvious as the southern bank of the river formed the border of an element of the former Transkei homeland. In site A the legacy of the Boer War is still at the center of grievances between long established farming families on either side of the Orange-Senqu River. One stakeholder on the north bank or the Orange-Senqu in site A stated that "there are some farmers around here still fighting the Boer War". The building of the Gariep Dam, however, did much to unite the downstream region as it brought new farming families into the community and acted as a central feature vital to all livelihoods. Historical divisions were most present in sites A and B although the general feeling is that these divisions are steadily being eroded. The old divide between Afrikaans and English farmers within site A has all but disappeared, the reasons for this will be discussed later. Only in site B are the effects of Apartheid still active. Virtually no commercial farming takes place in the former Transkei within this site and there is still a very blunt separation between the Afrikaans and Xhosa speakers on each side of the river. The attitudes of stakeholders in much of site B resembled those cultivated under the Apartheid system. There was very much a „them" and „us" attitude amongst the majority of the stakeholders referring to those on the Eastern Cape side of the river and those on the Free State side of the river.

Importantly it was noted that as the old divisions wither, new divisions develop. Stakeholders across all four sites stated that their farmer"s associations were specific to one side of the river in question and since the meetings of these associations are major social events they do break the regions up into factions to a degree. In site D this was stated as being the only divide that existed within the region. The influx of new farmers to particularly areas of sites A and C has also created a division between the old established farming families and new stakeholders entering the region. The recent expansion of large scale irrigation in sites A and C has allowed for this and has also generated another divide between livestock and irrigation farmers as their needs differ substantially.

Discussion for section 5.5

The portion of the Orange-Senqu River which runs through sites A and B contains a very rich and lengthy history as a border which is still relevant today as social identities, and therefore relationships, are intrinsically attached to that history. The effect of using the Orange-Senqu River as a border since the early 19th century has been the generation of divides amongst the relevant communities that are simply not present in sites C and D. Site B contains the most blatant evidence of the social implications of the rivers use as a border. The employment of the Orange-Senqu River during the Apartheid era as a border between the former OFS and the Transkei homeland has left a significant mark on the social landscape of the region. Attitudes cultivated pre 1994 are still very much in existence at present and the use of the same stretch of river today as a provincial border simply fosters a continuation of those attitudes amongst farming communities. The extensive use of this stretch of river firstly as a border between the old OFS and the Cape Colony and then as a border between the OFS and the Transkei has entrenched an attitude of „them" and „us" referring to communities on the opposite side of the river. The end of the Bantustan era has not brought about a change in this attitude for three reasons. Firstly communication between communities on either side of the river is difficult due to the nature of the landscape and the extensive road distances between stakeholders on either side. Secondly new commercial farmers on the south, Eastern Cape, side of the river have found it impossible to break into the tight and seemingly guarded Boer communities on the north side of the river. A stakeholder new to the region and located on the south bank in site B stated that farmers on the north bank "are not interested in the Eastern Cape". The commercial farms on the south bank are located west of the former Transkei but upstream of Aliwal North. As a result of this they have opted to form their own closely knit communities. Thirdly the continued use of the Orange-Senqu River as a provincial border has meant that local farmers associations have remained specific to one side of the river and this has reinforced the division between the Afrikaans Free State and the predominantly Xhosa Eastern Cape (the traditional stronghold of the ANC and home to the greater Transkei). In particular stakeholders on the north bank have attached an identity to those on the opposite side that is purely a product of the river"s employment as a historical and racial divide, and its use as a provincial border. The result of this is a stark divide between communities on either side of the river which is unlikely to be altered in the foreseeable future. In the former Transkei no evidence of a change from traditional

subsistence and communal agriculture was visible. The lack of agricultural development in this area is a further factor that allows for the continuation of divides between communities along the river.

In site A the Boer War still lies at the center of grievances between the long established families in the region, with predominantly English speakers on the south bank (old Cape Colony) and Afrikaans speakers on the north bank (former OFS). During the conflict, the region around Colesberg, witnessed continuous and bitter fighting during the first year of the war and it is for this reason, hostility between some families still remains (Bradley *et al*, 1980). These hostilities are manifested in deliberate non-cooperation between particular stakeholders. However the construction of the Gariep Dam has radically changed the social dynamics of the region and has largely removed the legacy of the Boer War. The construction of the dam allowed for the introduction of large scale irrigation to be developed below it which in turn attracted an entirely new generation of famers to the region. As a new generation of stakeholders moved into the area, the old divides were no longer of relevance to an increasing portion of the community. The importance of old divides in site A has thus been largely negated due to infrastructural development. However the importance of local histories cannot be neglected in this case as it is still highly relevant to particular stakeholders in the area who, as a result of the introduction of new stakeholders, have become even stauncher in the protection and proliferation of their own identities. This feeling of their identity being threatened is partially to blame for the cultivation of the new divides between livestock and irrigation farmers. A social identity is an individual‟s conception and expression of their group affiliations (Haviland *et al*, 2005) and, as in this case, as these are tested, they appear to be strengthened. This social development in itself poses a challenge to any kind of integrated resource management.

Local histories can be intrinsically connected to the role of a river as a uniting or dividing feature. The results of the section very clearly illustrate how, as a result of past events, the Orange-Senqu River has persisted as a dividing feature in the landscape separating the communities on either side of it. Particularly in site B the past employment of the river as a border during the Apartheid era continues to separate the communities on either side of it. The topography of the region seems to aggravate the situation and entrench the role of the river as a dividing feature. In site A, it is interesting to note how the construction of the Gariep Dam has done much to reduce the effects of the river‟s use as a border. Past events

have forced stakeholders to attach identities to the Orange-Senqu River which has morphed it into a dividing feature.

5.6 INDICATIONS OF ACTIVE COOPERATION

Section D of the interview format extracted evidence of active cooperation amongst stakeholders with regard to their agricultural activities and water use. The results give an indication of the levels of cooperation within the four study sites and the reasons as to why cooperation does or does not occur. This section provides the results which meet objective 4, which was to compare the effect of site characteristics on the degree of active cooperation.

Evidence of collaborative agreements

The purpose of this section is to determine if stakeholders have experience in cooperative projects, if they have a tendency towards cooperation, and if the topography of their region affects their ability and inclination to cooperate. The results of this section will again add insight into the suitability of different topographies to management projects which require widespread and often intensive cooperation.

Across all four study sites 81% of interviewees were not involved in collaborative projects of any kind and were not subject to collaborative agreements with other farmers in their region. Of the 19% who were involved in agreements of some kind, 13% of the total was located in site A. The majority of collaborative agreements were informal with only two cases of formal contractual agreements. The sharing of equipment and/or labor between farmers differed from site to site as Figure 18 illustrates. The sharing of agricultural assets and human resources was most common in the unconfined sites while the confined sites of B and D indicated very low levels of this type of cooperation between farmers. The only instances of cross river cooperation were found in site A where many of the large irrigators share expensive cropping equipment.

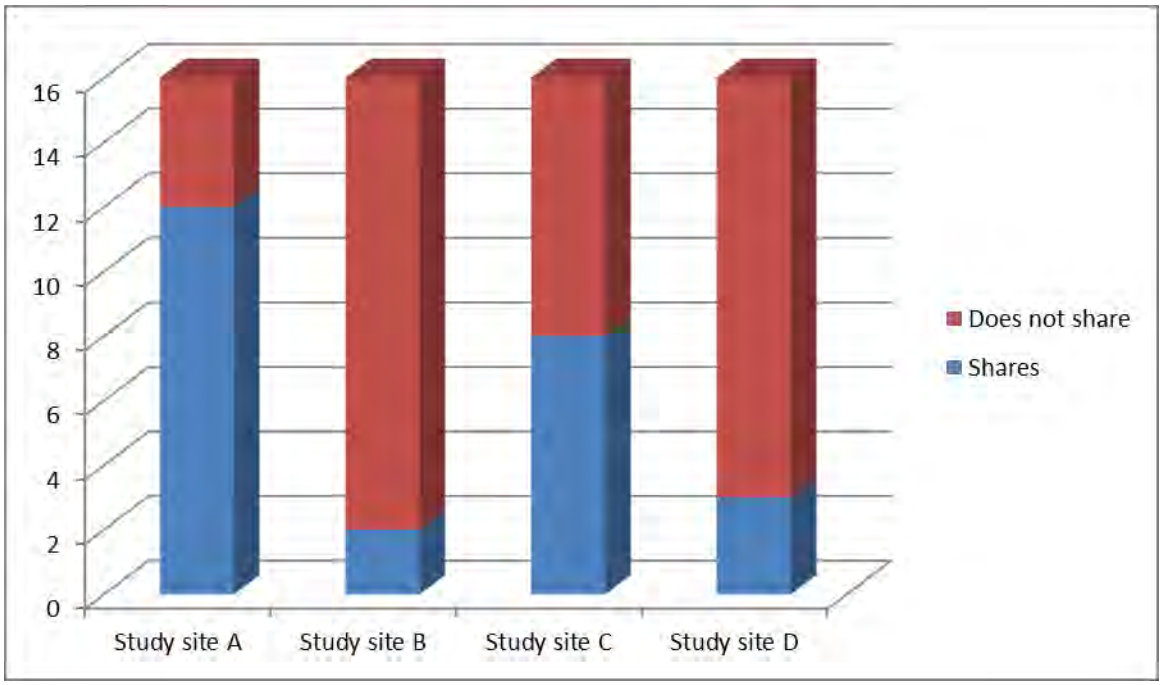

Figure 18: Sharing of equipment and labor (Question D3)

The reasons for and against the sharing of resources was highly varied although within sites B and D the most common reason given for not cooperating in this way was “the distances are simply too great”. The need for sharing in these two sites was also highly diminished in comparison to sites A and C. In the unconfined sites, particularly amongst the heavy irrigators, stakeholders often stated that equipment was too expensive to be owned individually and therefore they had no choice but to share the cost. Of the 61% of stakeholders who were not engaged in the sharing of equipment, most stated that besides distance, most farmers were either self-sufficient or preferred not to share except in cases or emergency. No evidence of large scale cooperation amongst groups of stakeholders was found in any of the four study sites.

Discussion for section 5.6

The results concerning cooperation are an extension of the limits imposed by topography on water use as discussed in section 6.1. In the confined sites the physical limitations on water use infer that the potential for cooperation is limited as the topography of the areas reduces water use. Evidence of cooperation was scarce across all four sites. However the unconfined sites were home to virtually all instances of cooperative arrangements amongst stakeholders. The nature of the landscape and the agricultural activities allowed for by the topography of the area are the reason for this. The majority of cooperative agreements were

amongst irrigators due to the sheer expense of individually owning cropping equipment and due to the fact that distances between them were small.

The results clearly indicate that a clear connection exists between topography and the frequency of cooperation among stakeholders. In the unconfined sites the topography of the area allows for irrigated agriculture to take place and mobility is only restricted by the river itself. In the confined sites cooperative agreements are almost nonexistent because the landscape does not allow for extensive utilization of the river. Levels of cooperation and utilization therefore correlate and utilization, as discussed in section 6.1, is greatly determined by the topography of the area. The results show that stakeholders in the unconfined sites have a higher tendency towards cooperative projects and those in the unconfined sites than those in the confined sites. Therefore site characteristics and the types of agriculture they allow for, with reference to topography, do have an impact on levels of levels of active cooperation between stakeholders.

5.7 EVIDENCE OF CONFLICT

A history of water conflict within each study site was compiled through section E of the interview format with the associated methods of conflict resolution used being provided by the interviewees. An indication of the perceived likelihood of future water conflict, assuming present conditions prevail, was also determined as were the stakeholder explanations for futures containing either conflict or non-conflict scenarios. Identifying episodes of water conflict highlights potential scenarios that should be avoided, prevented or preemptively handled. By bringing forward stakeholders concerns over future water conflict, this section also draws attention to the types of challenges that future water managers will have to contend with and plan for, and provides the results to meet objective 5.

Cases of past water conflict and resolution methods

Only eight cases of water related conflict were identified in the entire study, all of which occurred at highly infrequent intervals. Site A recorded three cases and site C recorded four cases. Although water conflict appears to be a rare occurrence regionally, the unconfined sites are more susceptible to such instances. Causes of water conflict fitted into two categories. The first contained cases regarding the building of structures, such as weirs, in

either tributaries to the primary river or in the primary river itself (i.e. the Caledon). These scenarios occurred most regularly in site C where the Caledon River is frequently reduced to small channels in the river bed where construction of small weirs and diversion channels is easy. Disputes of this nature were successfully dealt with by DWA. Stakeholders stated that they were prepared to involve DWA in the resolution of such disputes and abide by the ruling of the department rather than open a legal case. The second category contained legal disputes over access to water sources and servitudes on neighboring properties. These sources could be the primary rivers itself or springs and fountains. Conflicts in this category were resolved either in court or informally between the parties involved.

The likelihood of future conflict

Opinions regarding the possibility of future water based conflict differed between the confined and unconfined sites although overall a common trend prevailed. In sites B and D 100% of interviewees stated that conflict over water resources was extremely unlikely while in sites A and C 31% of stakeholders believed that water conflict was a probable eventuality. The combined results of AC and BD produced a Chi value of 11.852 (x^2_4 = 11.852, p = 0.018) which indicated that a significant difference existed between the two topographic groups of study sites. Overall 84% of stakeholders did not foresee water conflict as being a significant problem.

The reasons given for the improbability of water based conflict were uniform across the four sites. The most commonly cited reasons were:

- A sufficient supply or water is available to meet current needs
- Farmers know the limits of the available water resources and are responsible in terms of water use
- Each stakeholder has rights to a range of water resources and knows what they are entitled to and will not exceed their allotted amount
- At present water conflict is either extremely rare or non-existent and the situation is unlikely to change

Those stakeholders who stated that water conflict is a probable eventuality gave the following reasons in support of their claim:

- The declining reliability of ground water and changes in rainfall patterns will lead to conflict

- Mismanagement of water resources and upstream dams will lead to scarcity (referring to the high sedimentation rate of the Welbedacht Dam)
- Increasing demand in urban areas will mean less water available for farmers
- The general demand for water will increase while supply decreases

Discussion for section 5.7

Although instances of water conflict were rare, the unconfined sites were more susceptible. The most common disputes were based around the construction of impediments in tributaries or within the main channel of the river in question. Such issues were exclusive to the unconfined sites as a result of topography. The confined site would physically not allow for this kind of small scale local interference in stream flow. The link between utilization and conflict is therefore very obvious. Where a water resource is accessible and utilized by more than one stakeholder, competition and conflict over that resource is inevitable if the resource is limited and unregulated. The impact of topography on water conflict can also be demonstrated by the responses to the question of future water conflict in each topographic unit. Stakeholders in the confined sites categorically stated that water conflict was extremely improbable due to their limited water needs and the inaccessibility of the river. In the unconfined sites almost a third of stakeholders foresaw water conflict as inevitable due to their reliance on declining shared water sources. Importantly no mention was made of the LHWP as a source of water conflict at this point. The effect of topography on conflict, as was the case concerning cooperation, go hand in hand with the effect topography has on the utilization of the river as a water resource.

CHAPTER 6: RESULTS AND DISCUSSION FOR AIM 2

6.1 INTRODUCTION

The second aim of this project was to determine the implications of the outcome of the first aim for the management of catchments in South Africa. As discussed in chapter 5, rivers do act as dividing and uniting features and the topography of the landscape does effect this. This chapter presents results relevant to the management of catchments in South Africa. These will be discussed in conjunction with the findings of the previous chapter, in chapter 7. Stakeholder confidence in government; attitudes towards and awareness of institutions, policy and collaborative water management; and wider geopolitics will all influence the ease with which catchment management initiatives can be implemented and the style that such initiatives should take. The results and discussions presented here illustrate the current situation, with reference to catchment management, that exists on the ground in the study sites. It thus provides an indication of the many challenges that implementers of South Africa‟s catchment management policies will face as well as the opportunities that exist.

6.2 CONFIDENCE IN GOVERNMENT

The results displayed in this section present the varying attitudes towards local and national government both in terms of government performance and the stakeholder‟s role in the governance system. Importantly the results give a clear indication of the stakeholders‟ perceived level of influence, their perceived level of support from government, and the prevalence of local champions within local communities. This section aims to lay a foundation on which the results that meet objective 6 can be placed. By assessing stakeholders perceptions of government, the reasons as to why stakeholders are or are not engaging with management institutions, may become apparent. This section begins by presenting the most pressing concerns faced by stakeholders regarding government as illustrated by Figure 19 below.

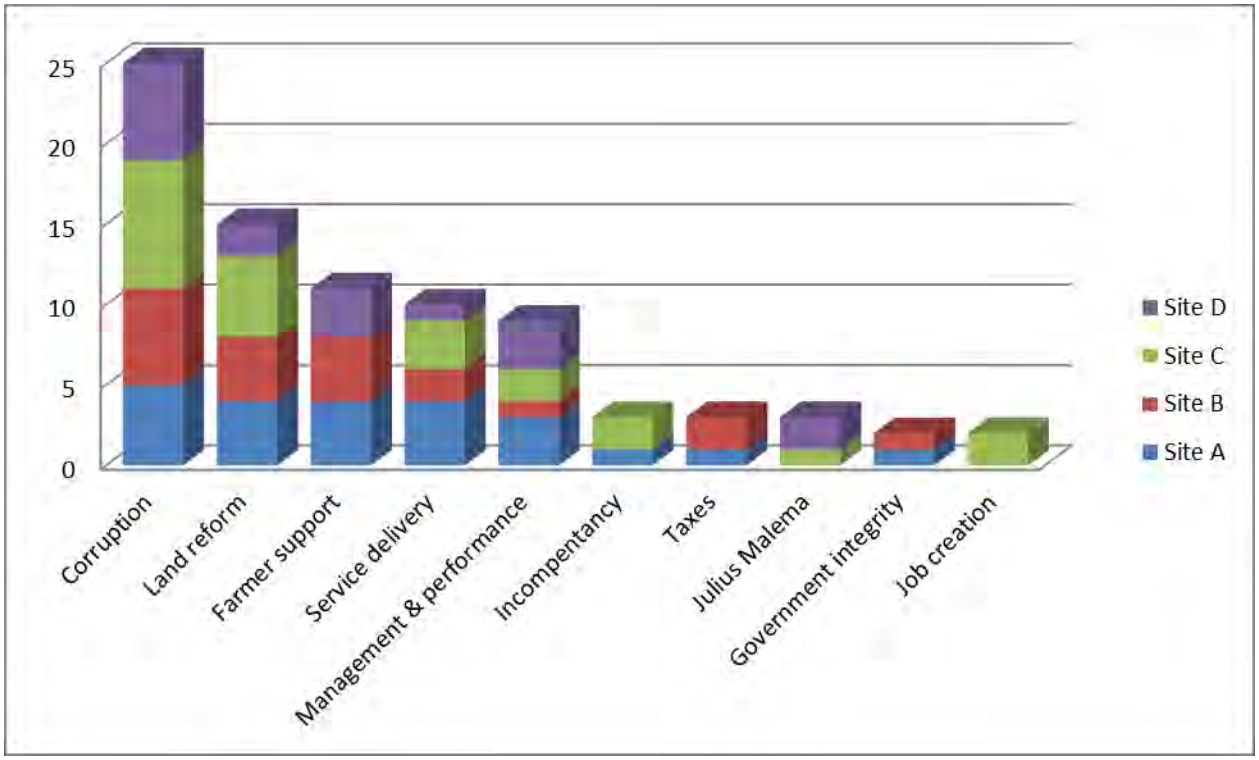

Figure 19: Primary concerns regarding government (Question F1)

Opinions of government performance

The decentralization of water management is a government driven process and therefore determining the opinions of stakeholders towards government will give an indication of the probable reception that new initiatives will have. Stakeholder attitudes regarding government support and their ability to influence change will also effect the degree of enthusiasm that stakeholders will show towards government driven water management programs.

Opinions of local government (municipal level) were uniform across sites A, B and C with 90% of stakeholders expressing an extremely poor opinion of government performance at this level. Stakeholders in site D however conveyed highly mixed responses ranging from extremely poor opinions to mild satisfaction in the performance of their municipality. Perceptions of provincial and national government were far more constant as 69% of interviewees in total expressed a very negative opinion of government performance at these larger scales. Confidence in respective SAPS (South African Police Service) stations was significantly higher with 45% of all stakeholders stating that they were either impartial or satisfied with SAPS performance. The ANOVA analysis for this question revealed that

stakeholders in site D expressed a significantly higher opinion of the SAPS than those in sites A and B. The issues of taxes and government expenditure as relevant to farmers provoked extremely negative responses. 97% of stakeholders felt that they received nothing in return for the paid taxes and that the government was not spending their money correctly or wisely. Overall opinions of government, over the last 10 years, had declined amongst 98% of stakeholders.

Support from government

The perceived level of support received by farmers from government was exceedingly low across all four sites. In total 86% of stakeholders felt they had been all but completely abandoned by government and in many cases it was felt that government was deliberately undermining their way of life. Throughout the study sites the statement of "our government does not care about the farmers any more" was frequently repeated. It was stated that all past forms of government support, such as drought relief and subsidized veterinary services, had dissipated while land taxes had increased and therefore the government was no longer concerned with the plight of commercial farmers. These sentiments were most intensely felt in sites B and C. Question F 6 asked stakeholders if they felt that government listens when they voice a concern or comment. Within sites A, B and C 88% of interviewees strongly disagreed as they stated that government rarely if ever reacts to their concerns. However a Chi value of 23.251 ($x^2_6 = 23.251$, p = 0.001) was determined for this question. The ANOVA analysis confirmed that again stakeholders in site D had a significantly higher opinion of their local municipality than those in the other three sites and that their municipality was far more likely to act on concerns voiced. The generally negative responses regarding government support are closely linked to the land reform process which greatly concerned 80% of all interviewees. However, it must be noted that it was the process through which land reform is taking place that concerns landowners rather than the concept itself.

Ability to influence change

Stakeholders in all four sites stated that they had a seemingly insignificant ability to influence decisions affecting their communities. 86% stated that as individuals they held absolutely no power in the decision making process while the balance claimed they had a very limited or negligible amount of influence. Perspectives on the ability of the community as a collective to influence change were marginally more positive. For this question a Chi value of 29.952 ($x^2_9 = 25.952$, p = 0.000) was calculated indicating a

difference in responses based on location although the ANOVA analysis was inconclusive. Once again site D registered the most positive score while site B registered the most negative. Overall 34% of stakeholders believed that as a community they could effect change and the decisions governing their regions. Confidence in the electoral process was however still high as 83% if stakeholders across all four sites still believed it was either important or vitally important to vote in national elections.

Leadership and local champions

Questions 12 and 13 of section B looked for evidence of leadership amongst farmers within each of the sites. Incorporating local champions into participatory management structures is seen as particularly important during the initial stages of any initiative and crucial to their success. Identifying local champions and leaders is therefore a priority.

Sites C and D displayed encouraging results as 59% of those interviewed in these two sites had in the past held or currently held positions of leadership within the farming community. The majority of these were within the local farmers association. In standard farmers associations the key positions of chairman and secretary rotate amongst the members every two years. It was noted that some members had also sat on provincial agricultural boards or had held positions in organizations relevant to their agricultural activities. In site B only 31% of stakeholders could state that they were either in a position of leadership or had been in the past, while in site A not a single interviewee could claim this. The combined results of AB and CD yielded a Chi value of 13.4 ($x^2_2 = 13.4$, $p = 0.001$) indicating a highly significant difference between the two groups of sites with regard to the question of local leadership. The prevalence of local champions was extremely low as in sites A, B and C with only 21% of stakeholders in these four sites stating that there were well respected and influential farmers in their communities. In site D however 75% of stakeholders stated that there was at least one individual in their farming community who they would describe as a local champion.

Discussion for section 6.2

Gauging stakeholder opinions of government performance and support, as well as the current perceived ability of stakeholders to influence change, gives a useful indication of some of the initial challenges that will be faced by those attempting to implement any water management strategy. It can be argued that low opinions of government will hamper any intervention as from the outset stakeholders will have little faith in the ability of

government to effectively carry out a mandate. Across all four study sites opinions regarding government in general, with the exception of site D in some instances, were extremely negative, particularly when it came to the question of support from government. Similarly the perceived ability of stakeholders to influence change was low. Based on this stakeholder reactions to a water management system based on participation could be one of distinct apprehension and disinterest.

The low prevalence of local champions across sites A, B and C is also cause for concern. Only site D provides positive results in this regard. The unexpectedly low incidence of identified local champions may imply that there are no highly regarded senior farmers in the areas, which is highly unusual, or that the communities are more fractured and less cohesive than initially realized. A manifestation of these possible realities is the extremely low perceived ability to influence change. 86% of stakeholders felt that as individuals they were unable to influence change in their communities while 66% stated that even when presenting a united front as a stakeholder group, they would be unlikely to cause change. These highly negative views may be a response to the acute sense of abandonment by government that the majority of stakeholders feel. The repercussions are that, from this point of view, a major challenge will be restoring stakeholder confidence in their own ability to influence change and thereby motivate stakeholders to become involved in participatory water management initiatives.

6.3 INSTITUTIONS, POLICY AND COLLABORATIIVE WATER MANAGEMENT

The results of section G of the interview format give an indication of the prevalence of local water management institutions, awareness of water management policy and government strategy, and stakeholder‟s perceptions of water management practices in their respective regions. The primary purpose of this section is to illustrate the degree to which national water management policy is currently being implemented or simply known of by the stakeholders which it will most intimately affect. The purpose of objective 6 is to assess the extent to which water management is already taking place and the level of knowledge that stakeholder‟s posses with regards to changes in the way water will be managed. The results of this section meet this objective.

Water management institutions

Membership of WUAs was extremely low with only 9% of stakeholders claiming to be affiliated with an organization by this name or of this nature. Of the 9% all but one farmer was located in site A. The location of site A directly below the Gariep Dam is the reason for the partial involvement of stakeholders in a quasi WUA as authorities at the dam are responsible for the organization of meetings and any resulting action. The WUA in site A, extended along both the north and south banks of the Orange-Senqu River between the Gariep and Vanderkloof Dams. Awareness of the drive for the development of WUAs was significantly different across the four study sites as a Chi value of 26.352 was calculated ($x^2_{12} = 26.352$, $p = 0.010$). Site A proved to have a significantly higher consciousness of the WUA program than stakeholders in the confined sites of B and D. Site C gave a mixed set of responses to this question, but also scored higher, on average than the confined sites.

Knowledge of policy

In order to gain an understanding of the level to which stakeholders could appreciate current national water management policy four questions (G10-11, see Appendix A) were asked, the results of which are cause for concern. 77% of stakeholders could not state which WMA they resided in. The unconfined sites again scored marginally better than the confined sites in terms of awareness in this regard. In total 92% of stakeholders did not know if a CMA was in place in their region and in most cases the concept of a CMA and/or how it would assists farmers was completely foreign. In site D not a single stakeholder could recall ever having come across the term at any point in time. Interviewees where then asked if they ever received information regarding the regional water situation or changes in government policy, to which 77% replied „not at all". Relevant information was only gathered occasionally and sporadically with water bills or through personal contacts. A small minority of stakeholders stated that they occasionally received information through their respective farmers associations. However these responses were not consistent within farming districts. The final question asked stakeholders where their local water institution was based, i.e. where they get their water license, and who they answer to in terms of water use. In the unconfined sites of A and C 97% of stakeholders could state that they could direct water related to queries to Bloemfontein where they received their water licenses from the DWA. In site B the question did not apply to 25% of the stakeholders interviewed and a further 25% could not state where their respective DWA office was based. A similar set of results were found in site D where again the question did not apply to 25% of

stakeholders while a further 31% could not state whether their DWA office was based in Bloemfontein or Bisho.

Collaborative water management

The question on the perceived current state of water management produced results which showed a definitive difference between the confined and unconfined sites. Within sites B and D 97% of stakeholders stated that water was currently being managed effectively while in the unconfined sites only 56% of stakeholders shared this opinion. The reasons given for the more negative attitude in site A and C can be attributed to the management of the Gariep and Welbedacht Dams. Those stakeholders in site A stated that there is frequent miscommunication between dam managers and those farming downstream about the timing and extent of releases from the Gariep Dam. The result of this miss communication is often severe damage to equipment, most notably pumps, that operates on the banks of the Orange-Senqu River. In site C it is again the high sedimentation rates of the Welbedacht Dam, and the consequent inconsistency in water flow down the Caledon River, which prompt the negative responses towards current water managers.

The idea of collaborative water management was received with varying degrees of enthusiasm across the four study sites. A Chi value of 28.374 ($x^2_{12} = 28.374$, $p = 0.005$) was calculated and the subsequent ANOVA revealed that the two confined sites differed significantly from site A while site C produced mixed responses, although 37% believed collaborative water management to be necessary. The confined sites clearly demonstrated that collaborative water management was either not necessary or the current way in which water was being managed was sufficiently effective. The results for site A registered at the opposite extreme as 69% of stakeholders stated that collaborative management was either important of crucial importance to the future of farming in the region. When the results of sites AC and BD were combined a Chi value of 21.519 ($x^2_4 = 21.519$, $p = 0.000$) was produced which reinforces that significant differences exist between the confined and unconfined sites with regard to the question of collaborative water management. Suggestions as to how a collaborative effort should be structured were varied. Within the confined sites the overwhelming consensus was that the current situation should continue without interference from government unless a situation develops where serious competition for water occurs which in turn promotes conflict of some nature. The feeling in the unconfined sites was significantly more variable as Figure 20 illustrates.

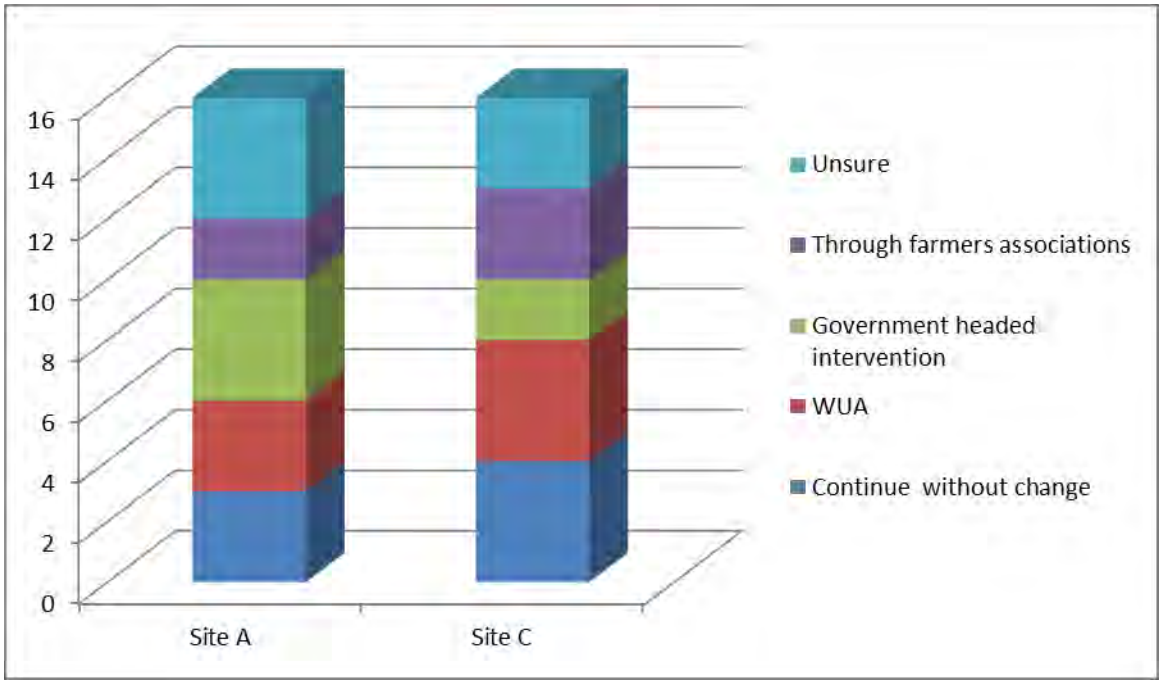

Figure 20: Stakeholder ideas for the structure of water management (Question G6)

Within site A and C only 22% of stakeholders believed that the current form of water management should remain in place. The remainder was in favor of change although through what institution was unclear. Importantly it must be noted that those in favor of government intervention were concerned about the capacity of government to effectively carry out a mandate. It was also widely felt that the voice of the farming community needs to be heard within a water management structure but this role should be filled by the local farmers association.

In order to further illustrate the differing attitudes towards collaboration within the sites question G7 asked if the interviewee thought the river concerned was a common resource that brought stakeholders together. Table 10 clearly shows that while the confined sites once again share a common opinion there are significant differences between these sites and sites A and C.

Table 10: Post Hoc Tests: Significant Multiple Comparisons for question G7: „would you say the river is a common resource that brings people together?"

Dependent Variable	(I) Loc	(J) Loc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
G7	A	B	1.875*	.265	**.000**	1.17	2.58
		C	.750*	.265	**.031**	.05	1.45
		D	2.250*	.265	**.000**	1.55	2.95
	B	A	-1.875*	.265	**.000**	-2.58	-1.17
		C	-1.125*	.265	**.000**	-1.83	-.42
		D	.375	.265	.496	-.33	1.08
	C	A	-.750*	.265	**.031**	-1.45	-.05
		B	1.125*	.265	**.000**	.42	1.83
		D	1.500*	.265	**.000**	.80	2.20
	D	A	-2.250*	.265	**.000**	-2.95	-1.55
		B	-.375	.265	.496	-1.08	.33
		C	-1.500*	.265	**.000**	-2.20	-.80

Stakeholders in the confined sites clearly state that the river did not act as a unifying feature at all between stakeholders in the region. Site A produced results that showed particularly amongst the irrigation farmers the Orange-Senqu River was indeed a common resource which brought farmers in the area together. In site C the results were again variable. The heavy irrigation farmers shared the attitude of those in site A; however the average opinion in site C was one of indifference.

Discussion for section 6.3

As the results clearly show water management institutions are all but absent from the unconfined sites while they are completely absent from the confined sites. Awareness of the drive for WUAs replicates this pattern. Warning of releases from the Gariep Dam are often, although not always, communicated to immediate stakeholders lying downstream of the dam and in the past there have been irregular meetings between managers of the dam and those farmers who draw directly from the Orange-Senqu River just below the dam. It is due to these meetings that a minority of stakeholders in site A stated that they were involved in a water management institution of some kind. However it did not appear that stakeholders had any actual influence on the nature and timing of releases. The proximity of site A to the Gariep dam is the sole reason for the increased consciousness amongst stakeholders of the WUA program as some information regarding policy has been transferred to stakeholders during these meetings. In the remaining three sites, particularly the confined sites, knowledge of WUAs was extremely limited and this can be attributed to a total absence of communication between water authorities and individual water users. The results regarding knowledge of general policy, such as CMAs, are even more worrying. A foundation of any water management initiative must be an understanding amongst stakeholders of why, and by what authority that initiative is being implemented. This cannot be achieved if stakeholders are completely unaware of policy and its implications for their livelihoods. Individual stakeholders will not be receptive to something they do not understand and therefore, as stated earlier, information exchange must take place and preferably take place well in advance. The farmers‟ association is the most obvious medium through which to do this however it must be remembered that, for example in site A, not all affected stakeholders are active members of their local farmers associations. The lack of institutions and, more importantly, the complete lack of understanding amongst stakeholders, infer that any attempt to create a water management institution will have to begin at the most fundamental level which is creating awareness. The challenge will be most acute in the confined sites where knowledge of policy is lowest and no institutions currently exist. It will not be possible to implement a strategy for water management when, for example, 77% of stakeholders do not receive information regarding government policy.

The results of this section further highlight the stark differences in opinion between the confined and unconfined sites. The opinions of stakeholders in the confined sites towards

collaborative management are again the results of the limited utilization of any common water sources, which is determined by the topography of their regions. As stakeholders in the confined sites make little or no use of rivers as water sources, it is not surprising that they do not see a need for the current state of water management to change. The lack of river utilization in the confined sites also partially explains the extremely poor level of knowledge about WUAs, CMAs and water management policy in general. Taking all of this into account it is understandable as to why stakeholders in the confined sites do not see the need for collaborative water management. The rivers in these sites simply do not act as the unifying and common interest resources as they do in the unconfined sites. In the unconfined sites, although knowledge of policy was poor, the need for collaborative management was appreciated. A sentiment brought forward by a number of stakeholders in site C was that "we cannot continue without managing our water collectively". Although opinions as to how it should take place varied significantly between stakeholders in both sites A and C, there was a general consensus that it needed to take place. High levels of river utilization and mutual dependence on a common resource are the explanations for this. The topography of the region again demonstrates its effect.

In terms of the second aim of this project it is clear that the topography of a region does appear to have an effect on levels of policy awareness, enthusiasm towards collaborative water management, and current water management situations. This rather concisely and strongly demonstrates the need for context specific catchment management policies. The same strategies for initiating participatory catchment management would not, in the context of this study, be appropriate for both the confined and unconfined sites as each has carrying, and often opposing, views towards the concept. It is clear the knowledge of policy is poor and current water management almost nonexistent. However resolving these issues will require different strategies depending on the nature of the catchment.

6.4 WIDER GEOPOLITICS

The results of this final section give an indication of how the stakeholders concerned view their position within the wider catchments and river basin of which they are a part. It is crucial that stakeholders understand their role and place in the countries wider water systems and can appreciate the affects that their activities have in the wider spatial context.

This section aims to explore stakeholders‟ perspectives in this regard and provide a different range of information that will be useful in the answering of the second aim of this project.

The supply of water

The Orange-Senqu River was stated as being highly important at a regional level by 84% of interviewees many of whom commented on the importance of the Gariep Dam and the supply of water to the Eastern Cape through the ORP (Orange River Project). However, only a small number of interviewees noted the Orange-Senqu River‟s importance at a national scale through its connection to Gauteng, through the LHWP. The only commonality amongst those who did not recognize the importance of the Orange-Senqu River at a national scale was that those stakeholders were not at all involved in irrigation activities.

Attitudes with regards to the effects of upstream activates on water supply were significantly different between sites A and D, and sites B and C as Table 10 illustrates. Stakeholders in Site B stated that the LHWP was indeed effecting the supply of water flowing down the Orange-Senqu River, although at this point in time it was not having a detrimental effect. Of greater concern was the quality of water flowing out of Lesotho. A number of stakeholders stated that after intense rainfall high quantities of rubbish, originating in Lesotho, were often deposited on the banks of the river. In site C upstream industrial and urban development as well as increasing demands in Lesotho was stated as effecting the supply of water flowing down the Caledon River.

Table 11: Post Hoc Tests: Significant Multiple Comparisons for question H2.1 „Do upstream activities effect water supply?"

Dependent Variable	(I) Loc	(J) Loc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
H2.01	A	B	-1.500*	.466	**.011**	-2.73	-.27
		C	-1.563*	.466	**.007**	-2.79	-.33
		D	-.250	.466	.950	-1.48	.98
	B	A	1.500*	.466	**.011**	.27	2.73
		C	-.063	.466	.999	-1.29	1.17
		D	1.250*	.466	**.045**	.02	2.48
	C	A	1.563*	.466	**.007**	.33	2.79
		B	.063	.466	.999	-1.17	1.29
		D	1.313*	.466	**.032**	.08	2.54
	D	A	.250	.466	.950	-.98	1.48
		B	-1.250*	.466	**.045**	-2.48	-.02
		C	-1.313*	.466	**.032**	-2.54	-.08

Stakeholders in site A did not feel that upstream activates had any effect on them thanks to the water security supplied by the Gariep Dam. It was however stated that their water supply could only be affected, with the exception of natural disasters, if the LHWP expanded significantly. As the Kraai River is in no way affected by the LHWP stakeholders in site D stated that the only upstream threat to their water supply was alien plant infestations but at this stage WFW projects were in control of the situation.

In terms of downstream water users 98% of stakeholders stated that activities downstream did not affect the way in which they conduct their farming activates. Similarly 94% of stakeholders stated that they did not in any way affect those farming downstream of them. The standard reason given for these responses was that the systems in which they operated contained such large amounts of water that their extractions were of no significance. The only four (6%) interviewees who did state that their activities affected those downstream were all in site C where the Caledon River on occasion runs dry.

Question H2.4 asked if, as water users, the stakeholders felt threatened by other water users either upstream or downstream. Sites A and D unanimously stated that they did not feel at all threatened in any way. The reasons for this were again the location of site D and the water security provided by the Gariep Dam. Half of the farmers in site B stated that the LHWP and its planned expansion were a major threat to the water security of the region particularly those upstream of the Gariep Dam. It was claimed that in the long term too much water will be sent to the Vaal system and the needs of those in the upper Orange will be forgotten. The larger irrigation farmers in site B stated that the Gariep Dam already gives those below it a financial advantage over those above it and developments in Lesotho will only put them at a further disadvantage. In site C responses varied between the extremes. 75% of stakeholders in this site did not feel threatened in any way but the remaining 25% stated that upstream developments were an extreme threat to the viability of irrigation in the lower reaches of the Caledon.

Discussion for section 6.4

The results of this section indicate that the majority of stakeholders have a generally poor appreciation or understanding of where they fit, in terms for the larger water networks of which they are a part. It was only a number of stakeholders in sites B and C that recognized the impacts of upstream activities on the quantities of water flowing through the Orange-Senqu and Caledon rivers. In sites B and C stakeholders stated that upstream impacts in the form of the LHWP and development upstream of the Welbedacht Dam were, or had the potential to, severely threaten their the supply of water. The security provided by the Gariep Dam and the lack of development in the upper reaches of the Kraai is partially responsible for the lack of understanding found among stakeholders in sites A and D.

Stakeholders need to have a clear understanding as to where they fit into larger systems and be aware of their impact on other groups of stakeholders. The primary reason why this

needs to take place is so that they can appreciate why certain decisions are taken and if they are in a position to affect the decision making process, and make informed decisions. For example, awareness of the rationale behind the LHWP was extremely limited. Particularly in site B stakeholders simply were not aware of the critical importance of the project to Gauteng. Similarly the expansion of irrigated agriculture in the Lower Orange was unknown to most stakeholders who could not understand why so much water was being allowed to flow past them and therefore, as they perceived it, wasted. The results indicated that the majority of stakeholders were unaware of the larger systems to which they were connected or why certain decisions concerning water management were made. Also their impacts on downstream users were underestimated. It is therefore necessary to generate an appreciation of the position of local stakeholders in far larger systems so that certain decisions can be rationalized and appropriate decisions made. Upstream downstream links appear to be equally as weak as cross river linkages in most of the study sites.

CHAPTER 7: GENERAL DISCUSSION & CONCLUSION

7.1 INTRODUCTION

The final chapter of this thesis brings together the results and discussions presented in chapters 5 and 6 as it examines stakeholder perceptions of rivers as dividing or uniting features and the implications of this for catchment management in South Africa. The use of rivers as borders is central to much of the discussion, as the results illustrated that this use of rivers has important implications for the nature of affected social landscapes. The role of topography is brought into the equation throughout the discussion as it tends to enhance of reduce the effects of other factors on stakeholder perceptions and on the implications of those perceptions for catchment management. This chapter aims to systematically discuss and elucidate the inferences and ramifications of the results and lay a basis from which conclusions can be drawn and recommendations made. This chapter closes with a conclusion including recommendations for future research and an acknowledgement of the limitations of this project.

7.2 INTERPRETING STAKEHOLDER VIEWS OF RIVERS AS DIVIDING OR UNITING FEATURES

Landscape management and planning theorists have recognized that it is impossible to neglect the social perceptions of landscapes and their features from management initiatives and strategies. Diversity in the perceptions of physical features often exists between different groups of social actors in a given landscape (Buijs *et al*, 2006). A failure to adequately understand often widely diverging perceptions can result in difficulties when instigating management practices for the landscape in question. This project has identified four factors which influence the perceptions of stakeholders with regards to a river‟s role as either a dividing or uniting feature. These factors are: the employment of the river as an administrative or political boundary; local histories and the resulting socio-political landscape; the state of local water resources and the level of utilization; and the effects of topography. This first section of this chapter discusses each of these factors in turn although it must be appreciated that all four of these factors are deeply interconnected and should not be considered in isolation.

River employment as an administrative or political boundary

Within this project rivers have been employed as borders at two levels. Firstly in sites A and B the Orange-Senqu River forms a „first order" border as the river is used to demarcate provincial boundaries. In sites A, B and C the respective rivers from „second order" borders as the rivers mark the administrative boundaries of nine farmers associations. These borders, which operate at significantly different spatial scales, have influenced the role of the rivers as a dividing or uniting feature in a number of unique ways.

In the case of the Orange-Senqu River provincial border, the primary divides between stakeholders are historically based and the continued employment of the river as a provincial border serves to foster the continuation of such divides. In the current practical sense the employment of the river as a border creates a mismatch between water governance structures, which are located within the boundary of the provincial unit, and the limits of the catchment in question. The implications of this mismatch are that if an attempt to establish a water management institution of some kind is made, initially a number of bureaucratic hurdles may need to be dealt with. The fact that the Orange-Senqu River flows through three provinces and has direct stakeholders in three sovereign states further accentuates this mismatch in borders.

The employment of the Orange-Senqu and Caledon rivers as second order borders is what generates the more interesting and pertinent divides in terms of the application of South Africa"s catchment management policy. The results indicated that social networks tend to develop within the limits of the local farmers association. Frequent communication across the river was limited where the river formed the boundary of the farmers" association in question. Site D emphasized this point as it contained significantly more regular occurrences of cross-river interaction than the other three sites, particularly sites C and B, and was the only site which did not employ a river to delineate the boundaries of local farmers associations. The farming communities studied in this project almost always formed strong, close and almost guarded social networks that developed within the limits of the local farmers association. The results of this are that when a river is used to define the borders of that farmers" association, the river itself manifests as a dividing feature in the social landscape.

Local histories and the resulting socio-political landscape

Borders cannot be understood simply in terms of geographic space as local histories and identities are often intimately connected to them (Mol & Law, 2005; Turnbull, 2005). In sites A and B the use of the Orange-Senqu River as a border for over 175 years has meant that social identities have become intrinsically connected to that border and thus to the river. This is especially relevant when considering those stakeholders whose families have occupied land in the area since the 1830s. The employment of the Orange-Senqu River as a border between the OFS and the Cape Colony, the OFS and the Transkei Bantustan, and now between the Free State, Eastern Cape and Northern Cape, has left a number of very significant and very distinct marks on the social landscape of the region.

Boundaries and borders can persist socially as cultural and individual identifiers which are constructed over time (Turnbull, 2005). In this case of the Orange-Senqu River the history of the region is attached to the river in its function, both past and present, as a border between different national, cultural and geopolitical entities. As the river was intentionally used in the past to divide such entities it is not surprising that the river at present acts as a dividing feature in the social landscape. These borders do not only divide geographical spaces but divide communities as a result of the identities, either perceived or genuine, attached to communities on either side even though aspects of these identities formed as a result of the river being employed as a border (Mol & Law, 2005). The use of the Orange-Senqu River as a border, particularly during the Boer War and the Apartheid era, has attached identities to communities on either side of the river and these persist as the river is used as a provincial border and as an administrative border for local farmers associations. The history of a landscape can have a highly significant influence on the nature of the social networks that operate within that landscape and the situations found in sites A and B exemplify this. In this particular case the history of the area has established the river as a dividing feature.

The state of local water resources and level of utilization

The level of river water utilization greatly influences the perceived importance of that river. The greater the degree of dependency on that water resource the higher the interest dependent stakeholders take in that resource. The degree of dependency, state of the resource, and access to alternative water sources all determine if that water resource acts as a common point of interest and therefore unifies affected stakeholders. The results

presented in section 6.3 demonstrate that dependency on the river as a water resource is the primary factor which determines the formation of social networks that extend across the river. This was most apparent in amongst irrigators in site A.

In site A the construction of the Gariep Dam, completed in 1971, allowed for the development of intensive irrigation schemes downstream. This introduced a totally new kind of farming into a region traditionally dominated by extensive livestock ranching. With the growth of irrigated agriculture original farms were subdivided and a new generation of „foreign" farmers moved into the area. The result has been the development of a close community amongst those involved in irrigation on both sides of the river. With the introduction of new stakeholders the social divides generated by the Boer War were no longer relevant and instead a separation between irrigators and livestock farmers developed. New social networks thus developed in alignment with stakeholder dependence on the river itself. Strengthening of this new divide has taken place due to the fact that the two groups of stakeholders face significantly different agricultural challenges and operate at very different spatial scales, and in extremely different ways. There are few common points of interest between the two groups as far as farming is concerned. As local farmers associations are dominated by livestock farmers, the needs of irrigators are not a priority and this leads to deepening of the divide as irrigators feel further marginalized. This has resulted in irrigators placing a lower value on the importance of attending farmers" association meetings while simultaneously increasing their advocacy of an organization focused on water management. The absence of access to sufficient alternative water resources also influences the attitudes of these irrigators. The state of the Caledon River in site C is one of the few reasons for communication amongst stakeholders across the river as there is a vested interest in the condition of that river.

In the confined sites limited access to the rivers as water resources, the absence of evidence for water based cooperation and the low perceived importance of the river, suggests that these rivers do not, and are unlikely in the future, to act as a unifying feature in these sites as levels of utilization, and therefore dependency on them is low. In these sites access to multiple alternative sources of water is also high which further reduces dependency on the river.

The effects of the topographic factor

The effect of topography, in terms of either dividing or uniting stakeholders, is not highly significant when considered as an individual factor but rather enhances or reduces the influences of other factors. The topography of a catchment does however, have two direct effects that will influence both stakeholder perceptions of a river as a dividing or uniting feature and the likelihood of water based collaboration. These two direct effects are the ability of topography to influence the level to which the river is utilized as a water source, and the impact topography has on cooperation and conflict.

When the topography of the area allows for extensive utilization of the river as a water source it becomes closely connected to the wellbeing of stakeholders and therefore promotes dialogue between them, as in the case of irrigation farmers in site A. The highly confined nature of site B, which makes direct utilization of river almost impossible, clearly accentuated the divides between stakeholder communities on each side of the river as it makes communication more problematic and removes the river as a common point of interest. In site C where the community is largely divided along the river the data indicated that this site contained a significantly higher level of social cohesiveness than site B, primarily due to the fact that the river was utilized. Although the Caledon River may not be utilized to the same extent as the Orange-Senqu River in site A, the topography of site C reduced the effect of the river as an administrative boundary for farmers associations. This is simply because the topography of the landscape does not represent a significant physical barrier. In site D the fact that the topography of the region did not allow for extensive use of the river meant that, although social relations were strong, water based relationships were poor and instances of cooperation amongst stakeholders were scarce. The topography of a region therefore significantly reinforces the role that a river plays in uniting or dividing a community through its ability to regulate the degree to which the water from that river is used. This in turn will affect the management of that water resource.

The results concerning cooperation and conflict are an extension of the limits imposed by topography on water use. In the confined sites the physical limitations on water use infer that water conflict is unlikely to arise and therefore institutional measures designed to mitigate conflict are unnecessary. Likewise the potential for cooperation is also limited where the topography of the areas reduces water use. Instances of conflict and cooperation were virtually nonexistent in the confined sites due to the restrictions on agricultural

activities imposed by the topography of the area. In the unconfined sites cases of water cooperation and conflict was found although they were almost exclusive to those involved in irrigation. The link between utilization and conflict and cooperation is obvious but it must be noted that at a fundamental level these are all controlled by the topography of the landscape.

7.3 IMPLICATIONS FOR CATCHMENT MANAGEMENT

IWRM recognizes the importance of integrating all stakeholders as well as environmental interests into decision making and management processes (van der Zaag & Savenije, 2000). Turton and Ashton (2008) argue that basin wide institutions which incorporate all stakeholders be developed in order to ensure that collective management of water resources takes place in a manner which is sustainable and aims for equitable benefit sharing amongst all stakeholders. The results of this study highlight a number of problems that will hinder the attainment of such water management goals as well as a few positive indicators that will aid the proposed style of water management such as the manner in which water conflict scenarios have been resolved. The topography of the catchment as well as the implications of employing a river as a border will effect the ease with which the proposed style of catchment management can be implemented. The current state of water management, status of conflict resolution, organizational structures, attitude towards collective management, information exchange, the availability of local champions and local histories will all have bearing on the success of catchment management initiatives and the development and role of new institutions, while also being affected by topography and the role of the river as a border. Two case studies are included in the section to illustrate; firstly the importance of monitoring and regulation and how these help to greatly reduce the likelihood of conflict; and secondly they illustrate how stakeholder react towards different catchment and collaborative management processes.

The current state of water management

The current state of water management in the study sites provides a number of underlying reasons and explanations as to why stakeholders perceive the rivers in the way that they do. The current state of regulation, the existence of institutions, confidence in government and knowledge of policy all have implications for the future management of the areas and provide insight into the challenges that will be faced by implementers. The ways in which

the rivers are managed at present are relevant in that management practices will contribute to the way in which stakeholders‟ value and utilize these resources. It is also a critical determining factor that drives the views of stakeholders as to how these rivers should be managed in the future. Therefore the current state of water management will have a bearing on stakeholder acceptance of the proposed participatory method and the role that government should have in that process. The topographic factor again plays a role in accentuating or reducing the impact of these factors. The first point that must be raised concerns the monitoring and regulation of the water resources referred to in this study.

The chaotic state of water regulation in the area has a number of severe implications for both stakeholder confidence in government and the effectiveness of any future management initiative. A fundamental principle of any efficient water management structure is the monitoring of withdrawals from that system. The value of monitoring is that it allows for the equitable distribution of the water available amongst stakeholders, this includes environmental requirements and the requirements of stakeholders in downstream catchments. Equity and sustainability are the two fundamental principles within the context of which South Africa‟s NWA is framed (Pollard & du Toit, 2008). Therefore equitable distribution is a core principle and primary goal of the entire decentralized water management strategy of South Africa and is thus of absolute importance. Furthermore equitable distribution also forms one of the core characteristics of effective water allocation treaties (Giordanno & Wolf, 2003). Equitable and sustainable distribution cannot be achieved if extractions from the system are not measured. In cases where the supply of water is a problem, such as in site C, the need for monitoring is even more critical as scarcity is a key driver of water conflict (Ashton, 2008). By equitably distributing the available supply of water amongst stakeholders, and policing abstractions, conflict scenarios are unlikely as each stakeholder is forced to manage his own water use within a prescribed limit. As Table 5 in section 6.2 illustrates there is a complete lack of consistency in how water is paid for and how abstractions are regulated. Instituting uniform water monitoring procedures would be the first step towards achieving a regulated and equitable distribution of water. The second step would be ensuring that stakeholders have a clear understanding of how the regulatory system works as at present a lack of understanding simply exacerbates the negative view that stakeholders have of current water managers. The local context however, must also play a role in the formation of a regulatory system. In the unconfined sites where irrigators in particular are in favor of a water management

scheme, a ridged regulatory system would be suitable as the rivers are heavily utilized water sources and prone to water shortages. In the confined sites where large scale abstraction from the river does not take place and water is predominantly sourced from minor tributaries and ground water, a less precise type of monitoring would be more appropriate and feasible. Just as topography influences the types of water sources that are used, it must also influence the type of monitoring and regulation that takes place. The key is that regardless of what format of regulation is appropriate, it must be universally applied within the given catchment or local area so as to ensure the needs of stakeholders are equitably and sustainably met. The requirements of downstream users must be included when determining appropriate levels of water abstraction.

Conflict resolution

The results concerning conflict resolution offer further insight into stakeholder perceptions of government and its capacity with regards to water management. As discussed previously in chapter 7 stakeholder perceptions of government in general were poor. However with reference to conflict resolution the results were more encouraging. In site C 75% of the recorded cases of water conflict were reported to DWA, all of which were successfully mediated and resolved by the department. Stakeholders stated that they preferred to involve the government body and abide by its rulings rather than go to court. This preference for government intervention indicates a number of interesting attitudes and beliefs held by the stakeholders in question. Firstly it indicates that, despite the general absence of confidence in government, stakeholders are still proponents of government intervention into the resolving of water based contentions. There is still an element of faith in the ability of government to rationally negotiate a solution to a specific problem and stakeholders would rather government settle disputes than an alternative external authority. Stakeholders also clearly stated that they were prepared to uphold decisions made by DWAF regardless of the outcome. In the case of water management it appears that water users do not have a problem with, and even prefer, being give strict directives from a higher authority. This would obviously be dependent on these directives being equitable and the authority being legitimate. It must be noted that there is evidence of nations opting for conflict resolution of this form as opposed to militarized conflict. In 1997 a severe drought and a breakdown in negotiations brought contentions between Namibia and Botswana concerning the Okavango River to a head (De Villiers, 2003). The two states went to a higher authority, the International Court of Justice, to settle the dispute. Conflict resolution by means of a

higher authority is often the preferred form of water conflict resolution and therefore mechanisms that enable this must be created or strengthen. Resolving conflict will depend on the nature and provisions of the water management strategy that is developed for the catchment in question. Giordano and Wolf (2003) state that detailed conflict resolution mechanisms are essential in terms of the resiliency of a water management strategy and for long term effective management. The following two case studies illustrate the importance of explicit conflict resolution mechanisms and the of clearly defined and equitable water allocations.

Case studies

The Gamtoos River case

The Gamtoos River System is located in the Eastern and Western Cape provinces of South Africa and covers an area of 34,350 km^2 including Baviaanskloof , Groot and Kouga catchments, all of which fall within the boundaries of the Fish to Tsitsikamma WMA (Javed, 2009). At the confluence of the Baviaanskloof and Kouga rivers lies the Kouga Dam (formerly the Paul Sauner Dam) constructed in 1968 with the connecting canals and balancing dams being completed in 1970. The Kouga River supplies approximately 80% of water entering the dam while the Baviaanskloof River supplies the balance. Groot River water does not enter the Kouga Dam as it is unsuitable for irrigation or domestic use due to its high salt content (van der Burg, 2008). Water that exits the dam meets flows from the Groot River to form the Gamtoos River which flows through the long winding floodplain of the Gamtoos Valley before discharging into the Indian Ocean just north east of Jeffrey‟s Bay (Javed, 2009). Water from the Kouga dam is transferred throughout the Gamtoos valley via a series of canals measuring 110 km in combined length as well as though 100 km of piping. Although the majority of the water is used for irrigation (53.9 million m^3) some 800 780 m^3 is used by the towns of Patensie and Hankey, which lie in the Gamtoos valley, for domestic use and a further 23 million m^3 is piped to Port Elizabeth (Haigh, 2006).

Until 1991 the entire system was run by a government water board. However in 1991 it became an independent institution and was renamed the Gamtoos Irrigation Board (GIB). . The GIB operates on both sides of the Gamtoos River and the river does not serve as a boundary or border of any kind. Although the river is incised into a valley, sufficient flood plains exist on the banks of the river to allow for intensive agriculture. The catchment is

thus highly contained within the Gamtoos valley. The GIB is responsible for all maintenance and running costs associated with the scheme including the Kouga Dam and canal systems. At present the GIB supplies the 242 farms in the scheme with water to irrigate some 7421 ha of scheduled land. However due to increasingly efficient irrigation techniques nearly 15 000 ha of land is currently irrigated (Haigh, 2006). The irrigation system is highly water efficient as it currently only experiences 4% losses from the system. The success of the GIB lies in its highly effective monitoring systems and detailed water allocation. Each stakeholder in the scheme is allocated a specific annual amount of water and abstractions from the water networks are carefully monitored by some 950 water meters. Once a stakeholder reaches their limit they are cut off from the canal and piping network. As each stakeholder is fully aware of their individual water allocation, to the cubic meter, the onus is on the stakeholder to effectively manage their own allocation. If water levels in the Kouga Dam drop below a stipulated level all stakeholder allocations are equally reduced. Water conflict in the irrigation scheme is thus avoided through detailed monitoring and equitable distribution by a legitimately empowered central institution. The GIB board is comprised of six farmers (two members from each of three wards), one official from DWA, and one from Nelson Mandela Municipality and thus local stakeholders have a direct control over the functioning of the scheme. The Gamtoos irrigation scheme highlights how through effective, localized water management, water conflict can be avoided and high agricultural yields simultaneously achieved. The scheme is, however, highly dependent on well-developed infrastructure but illustrates the benefits of effective monitoring and equitable water management.

The Kat River case

The Kat River valley is also located within the Fish to Tsitsikama WMA and falls exclusively within the Eastern Cape province of South Africa. The 1700 km^2 of the catchment is divided into three primary sub catchments (Mbatha & Antrobus, 2008). These are the upper, middle and lower Kat. The Kat River is a tributary of the Great Fish River and although the catchment receives a relatively high amount of rainfall, much of the catchments climate is sub-humid to semi-arid (Farolfi & Rowntree, 2005). The Kat dam, completed in 1969, is located in the upper section of the catchment, north of the town of Fort Beaufort, and has a storage capacity of 24,892^{x10} m^3 (Mbatha & Antrobus, 2011). The construction of the dam took place in order to provide water for Fort Beaufort and unlock the irrigation potential of the middle and lower Kat. The fertile valley floor is now largely

occupied by citrus farmers who are primarily export orientated. The upper Kat is today dominated by smallholder or cooperative farming although a group of black owned commercial citrus farms are emerging in this section of the catchment (Mbatha & Antrobus, 2011). The Kat valley has a complex and relatively turbulent socio-political history which in 1980 culminated in the forced removal of white farmers in the upper Kat as this area was incorporated into the Ciskei homeland. Post 1994 scheduled irrigated lands have been revitalized in the upper Kat (Farolfi & Rowntree, 2005). In the middle and lower Kat the highly successful citrus industry is almost entirely dependent on water from the Kat River for irrigation; however two systems of access to water are in place. Farmers in the middle Kat irrigate scheduled lands and pay annual water licence fees in proportion to the land scheduled for irrigation. Farmers in the lower Kat do not pay an annual water licence and do not have scheduled water rights, but rather store excess flows in large weirs along the course of the Kat River. Thus there are four distinct groups of stakeholders in the catchment as well as municipal interests.

The Kat River valley is relatively unconfined, however, only the rivers flood plains are suitable to intensive cultivation. The River, during the Apartheid era, did serve as a political border between the South Africa and the Ciskei Bantustan. The Kat River WUA has attempted to overcome the effects of employing the river as a border by being representative of all stakeholders in the catchment. Post 1994 there has been a strong movement towards redressing past inequalities and incorporating black farmers into the commercial system. In order to align with government policy and address these issues the former Kat River irrigation board has transformed in to the Kat River WUA (Farlofi *et al*, 2008). The pilot study for this project, conducted in the Kat Valley in June 2010, revealed that despite the progress made by the WUA, is has been unable to resolve disputes between farmers in the middle and lower section of the Kat. These disputes are centered around accesses and rights to water from the Kat River. The absence of a universal system for water allocation has resulted in perceived inequalities in water abstractions and in turn led to serious tensions being generated between the two commercial farming groups. As demands in the upper Kat continue to grow these tensions appear to be intensifying. In this particular case the participatory management method, which forms the foundations of the Kat River WUA, has proved thus far to be ineffective in resolving this water conflict. In order to resolve the situation stakeholders from both camps are calling on a higher authority to step in and make a decision which will be mutually accepted. What this case

study reveals is that firstly, in the absence of explicit, equitable and universal water rights, the stage is set for confrontation over access to water. And secondly, stakeholders are in such cases, not opposed to a higher authority controlling water allocations.

Membership of organizations and collaborative management

The first significant challenge to the idea of participatory water management concerns the state of farmers‟ association membership and attitudes towards collaborative management as a concept. Membership of farmers associations was high across all four study sites but it must be noted that 77% of stakeholders stated that time constraints seriously affected their ability to attend such meetings even though, in most cases, these only took place quarterly. This poses a practical obstacle to the development of a participatory water management initiative as implementing policy of this kind is exceptionally time consuming (Wester *et al*, 2003). If stakeholders already struggle to find the time to attend farmers‟ association meetings, which many see as important and find highly relevant, it will be extremely difficult to convince stakeholders to be actively involved in lengthy and time consuming catchment management processes. Those stakeholders who were not members of a farmers‟ association were predominantly irrigation farmers. Involving these farmers in a water management scheme will not be challenging as, particularly in site A, stakeholders are crying out for a voice in the management of their section of the Orange-Senqu River. Amongst these famers, whose livelihoods are dependent on the river, attitudes towards collaborative management were pro the idea although opinions as to how this should take place were mixed, see Figure 10. The two most popular suggestions for the development of an institution were the WUA format and through local farmers associations. The problems here are that the majority of stakeholders are not familiar with the WUA program and if farmers associations were used to initiate the development of an institution, the issue of the river being used as a border for farmer‟s association districts would become very apparent. All relevant farmers associations would need to be brought together and possibly integrated to a degree for a WUA to be successful.

Conversely, involving stakeholders who do not irrigate into a participatory system will be challenging. The data clearly indicates that those farming in the confined sites were not interested in the idea of collective water management due to their perceived insignificant water requirements. This attitude was also shared by the few stakeholders in the unconfined sites who did not rely on the river at all. Numerous stakeholders, therefore, simply stated

that they do not see the need for this type of water management. None the less both those farmers drawing directly from the river and those relying on ground water sources are having an impact on local water resources as all of these water sources form part of the same hydrological system. Due to this fact all stakeholders should be part of, or at least represented in, a common water management group. An initial challenge of any catchment management strategy will therefore be to convince all stakeholders, even those in confined regions, that they all draw from and therefore, rely on the same system and so must integrate their water requirements. The point that ground water resources and rivers are not mutually exclusive hydrological systems must be constantly reiterated. The resistance of some stakeholders to the idea of collaborative management also stems from their opinions regarding government.

Overall stakeholder confidence in government was extremely low and in the confined sites this may be a significant factor contributing towards stakeholder attitudes concerning collaborative water management. However the responses of stakeholders in the unconfined sites to the question of proposed forms of collaborative water management may indicate an alternative reaction to government intervention in water management. As Figure 10 indicates a large proportion of stakeholders in sites A and C favored future water management initiatives that follow the WUA format and/or systems which are headed by government. It can therefore be assumed that even though some stakeholders have an exceptionally low opinion of government, in general they are not opposed to participatory government intervention in the water sector where there is a need for formal water management. There are a number of reasons as to why this may be the case. Firstly the water situation may be becoming so serious that any intervention from whatever authority will be preferential to the continuation of the current situation. This could be the case in site C where scarcity is a serious problem. Secondly stakeholders may be looking for any opportunity to voice their opinions and concerns regarding water management in their areas and therefore the participatory method is attractive. This may explain the enthusiasm of irrigators in site A who are desperate for a say in the management of releases from the Gariep Dam. Thirdly stakeholders view the current state of water management as ineffective and are therefore looking for a chance to reorganize and improve their own positions. In the unconfined sites 44% of stakeholder stated that currently water was not being managed effectively. These opinions are a direct result of the management of the Gariep and Welbedacht Dams. In the case of site C the high sedimentation rate of the

Welbedacht Dam, which had reached 65.6% in 2007 (FAO, 2007), and the resulting flushing methods that have been used in an attempt to clear sediment, have caused significant damage to property and significantly reduced the dams ability to supply enough water. In site A an absence of communication between downstream stakeholders and dam managers has also led to property damage. Stakeholder opinions of current management are therefore often critical. Finally the legacy of past government involvement in water management may still retain some faith in current government in this regard as a number of stakeholders continually referred to the support they received in the past. It is however highly probable that these positive reactions will only be found in unconfined sites where particular stakeholders are very much in favor of institutionalizing and formalizing water management. In the confined sites, the vast majority of stakeholders judge the current state of water management to be effective and not in need of reform. This combined with a generally negative view of government will serve only to compound stakeholder disinterest in a collective water management strategy.

Local champions

The mainstreaming of a strategy within a community is „greatly facilitated if active, self-motivated local champions are identified and actively supported" (Knight *et al*, 2011: 207). Conservation planning literature in particular emphasizes the value and importance of including local champions into initiatives as acceptance of an initiative by community leaders could possibly allow for wider acceptance of the initiative (Curran *et al*, 2010). By actively pursuing and including local champions into the initial stages of strategy development in particular, it is probable that the wider community will be more accepting of the intervention and more eager to get be involved in the process. Furthermore Zoubi *et al* (2006) state that the need for local champions is paramount as without a single leader from a stakeholder unit the interests of that unit are likely to be under represented, misunderstood or neglected altogether. Identifying and targeting local champions is a highly effective means through which public participation can be widely engendered amongst local stakeholders. Social cohesion is a further factor that will play a key role in determining the ease with which collaborative strategies can be implemented. Finding a common vision for the management of a catchment, which is an important step towards developing sustainable long term management plans (Rowntree *et al*, 2009), will either be hindered or aided by the levels of social cohesiveness in the given catchment. The prevalence of local champions provides a good indication of levels of social cohesiveness.

Those communities not containing widely recognized local leaders are likely, as the results indicated, to be fractures or highly localized.

Information exchange

The central goal of any participatory initiative is to ensure multi-direction flows of information take place at the local level (Schaap & Nandi, 2005) as unequal access to information can undermine participatory efforts (Farolfi & Rowntree, 2005). Facilitating information exchange is thus critical for a number of reasons. Firstly cooperation amongst stakeholders and the development of agreements cannot take place if all stakeholders are not privy to all available information. Free and unrestricted access to information is vital to the development of equitable water management agreements and institutions (van der Zaag & Savenije, 2000). Secondly many cases of conflicts of interest regarding water resources result from different perceptions of the same issues and top-down management practices (Rabi *et al*, 2005). Effective exchanges in information and therefore exposure to other perspectives assist in resolving and avoiding such differences. Most importantly, information exchange allows stakeholders to learn from each other and develop flexible strategies (Stringer *et al*, 2006). If access to information is guaranteed then the chances of active involvement, which is the end goal in participatory management, rise significantly. Can then effective participation take place where the river itself acts as a physical or administrative barrier to communication and where the topography of a region severely impedes communication and therefore access to information? If the topography of a region forces the river to become a physical barrier to communication, as was the case in site B, the problem of information exchange needs to be tackled at a far more fundamental level. Before issues such as transparency and equitable access to information are addressed, systems or infrastructure must be developed that are capable of physically providing stakeholders with the information available. Across all four sites the state of communication infrastructure was poor. Serious shortfalls in reliability and access were blatantly apparent. The poor awareness of stakeholders regarding government policy may be partially explained by failures in communication infrastructure and therefore this is the first obstacle that will need to be overcome. The effect that a given landscape can have on communication must be carefully considered before an attempt is made to manage the catchment in question as difficulties in communication imply physical difficulties in information exchange.

The development and role of institutions

There is a general consensus that catchment or basin wide institutions which incorporate all stakeholders are paramount to effective and sustainable water management (Uitto & Duda, 2002; Haftendorn, 2000). The development of such institutions will need to carefully consider the topography of the area involved and if the river in question is employed as a border or boundary of any kind. The differences between stakeholder perceptions of water management between the two topographic units were stark and new institutions, and the approaches taken to develop them, will have to reflect these differences. The purpose of developing water management structures through participation is to generate institutions and policy that meets the needs of that specific catchment. Topography is a factor that will direct these developments as it has a substantial effect on the way in which stakeholders perceive and utilize local water resources and therefore the contexts within which an institution will be developed. The role of an institution will also be highly specific to its catchment in that it will be contending with context specific issues. If the river forms a border and/or acts as a dividing feature in the social landscape (as in site B), the role of the local institution will involve mediating and overcoming these complications. In contrast at site D the role of the institution will be focused on dealing with water quality issues, which is the primary water related issue faced by stakeholders in this region. Topography and the role of the river as either a dividing or uniting feature will influence the way in which an institution is developed and role that that institution will play in the management of water in a catchment. Standard prerequisites for institutional success such as adaptive management structures, clear and flexible allocation criteria and equitable distribution of benefits, will also have to be incorporated into policy development within the context of these other factors (Giordano & Wolf, 2003).

New institutions will also have to contend with provincial borders and the associated complications as well as with local institutions that employ rivers as administrative boundaries. Bridging the divide, manifested by the river, between existing institutions will be a key challenge faced by a new water management body. Finally the mismatch between administrative and resource boundaries is one of the key issues that must be taken into account when considering this kind of resource management (Berkes, 2006). The employment of the Orange-Senqu River as a provincial boundary exemplifies this issue. New institutions operating within the confines of the catchment unit will often be forced to administer areas that span two or more administrative or political entities. The

complications associated with this are substantial. The situation is further complicated by the extensive use of IBTs in South Africa and particularly in the Orange-Senqu River basin (Turton, 2003). The use of IBTs complicates the use of the catchment as the basic hydrological unit for water management as now river basins are in many cases interconnected through IBTs.

A further crucial function of water management institutions will be to integrate the needs of their own members with those in downstream and upstream catchments, and to create awareness of the position of the catchment in question in the broader national hydrological network. New institutions need to create a platform from where the impacts of users outside of the catchment can be discussed and resolved. As Perreault (2008) states, water management practices must include an ensemble of institutions operating at a number of spatial scales. Structuring institutions in this manner allows stakeholders at a local level to present concerns pertaining to issues outside of their catchments to authorities whose jurisdictions cover, for example, entire drainage basins. In sites B and C no water based body or institution exists which can argue for the plight of water users in these regions with regard to the potential threats posted by the LHWP and developments upstream of the Welbedacht Dam. Managers, particularly of local dams and transfer schemes, need to be able to justify decisions concerning limitations to abstraction and water availability which will often be connected to broader hydrological networks and, in the case of the Orange-Senqu River, national interests. New institution must therefore be able to bring forward the needs and concerns of local stakeholders to higher levels of basin wide or national planning and create awareness of the role that stakeholders play in the wider hydrological context.

The importance of local histories

The implications of local histories (as discussed in section 7.2) and its role in either dividing or uniting stakeholder groups on either side of a river should be of great importance to those initiating catchment management projects. When attempting to understand the nature and root causes of water conflict, it is imperative that conflicts are considered within their greater political and historical contexts (Giordano *et al*, 2002). In order to avoid conflict and if catchments are to be collectively managed through participation, the impact of local histories cannot be ignored. Perreault (2008) states that historically constituted social identities, systems of meaning and livelihoods must be considered and integrated into new water governance efforts. Where past events have

attached social identities to communities on either side of the river these will have to be carefully navigated during any participatory process. Before such processes can be facilitated it is imperative that facilitators understand how the river in question may have developed into a dividing feature and then carefully discuss the issue with those concerned. Developing a participatory governance system by definition is about generating dialogue between interested and affected parties, and developing social capital amongst diverse groups of stakeholders (Stringer *et al*, 2006). If local histories are not taken into consideration and carefully steered around, implementers may find this extremely difficult to induce dialogue between those parties and engender social learning if, for example, animosity exists between certain stakeholder groups. The process of finding a common vision for managing the catchment and its water resources will also be influenced by local histories. The impacts of past events in the shaping of the social landscape must be accounted for before dialogue is forced. Investigating local histories and building the gained understanding of the social landscape into implementation strategies will enhance the effectiveness of that strategy.

7.4 CONCLUSION AND RECOMENDADTIONS

The chief characteristics of water resources in South Africa and in the Orange-Senqu River basin are scarcity, variability and unequal distribution (Mukheibir & Sparks, 2003). As water resources become increasingly utilized, and as climate change begins to have an adverse effect on the availability and consistency of water supplies, the need for water management institutions becomes ever more evident (DEAT, 2006). The decentralization of water management through a variety of structures operating at different spatial scales, such as CMAs and WUAs, is one significant component of the NWA which aims to deal with these challenges that face South Africa (Rowntree *et al*, 2009). A national rollout of local level participatory water management structures, based on the principles of IWRM, is underway with the aim of effectively balancing economic, social and environmental water requirements. The success of the proposed strategies is based on the concepts of cooperative governance, social learning through participation, and adaptive management. In order to avoid conflict over water, institutions are to be developed multilaterally through joint decision making processes which embody these concepts. To effectively achieve decentralized water management through the participatory method, relationships between all stakeholders within catchments need to be considered and the circumstances that govern

water relations analyzed. This project has endeavored to illustrate and aid this analysis of stakeholder‟s relations, and the implications of them for the management of catchments, by investigating how a river may act as a dividing or uniting feature within the social landscape. It has furthermore introduced topography as another factor which may determine how a river is perceived by local stakeholders and therefore contribute towards the river acting as a dividing or uniting feature. This investigation has determined, by employing a realist research paradigm, the role of a river as a dividing or uniting feature is dependent on a number of interrelated variables, the effects of which are often amplified or reduced by the topography surrounding the river. Whichever case exists will have a significant effect on a catchment‟s potential for water management and on the way in which management initiatives should be introduced and implemented.

In the case of commercial farming this study has identified three variables that will influence the role of the river as a dividing or uniting feature. Firstly, the employment of a river as a political or administrative boundary for local institutions divides communities. This is because social networks tend to develop within the confines of that institution. The use of the river as a provincial border appeared to divide stakeholders when social identities and histories are attached to that border. Secondly, local histories can have an intrinsic impact on the nature and distribution of social relations within and between communities on either side of a river. Borders do not exist purely as marking a physical landscape but also as cultural and individual identifiers which are constructed over time and intimately connected to the history of the area in question. Finally, the state of local water resources and the level to which they are utilized greatly influences the perceived importance of a river. The greater the degree of dependency on a shared water resource, the more enthusiastic the stakeholders are towards the idea of formalized management, especially if the water source in question is stressed. Communal dependency breeds both conflict and cooperation but either way it unites stakeholder due to their common interest and dependency. The impact of the topographic factor is less specific than the three variables already brought forward. The topography of a catchment will rather enhance or reduced the influence of these three variables. The primary way it does this is through its ability to regulate the point to which a river is utilized as a water resource.

Considering the implications of the above in conjunction with the current state of water management, perceptions of government, knowledge of policy, attitudes towards collaborative water management and the state of communication infrastructure, this study

has exposed a number of issues and challenges that implementers of South African catchment management policy will have to contend with. At the most fundamental level efforts to create awareness of national policy must be initiated and the means to facilitate information exchange developed. This includes the improvement of infrastructure with particular reference of the state of communication infrastructure. Secondly, perceptions of government in proposed sites need to be understood and appropriate strategies for stakeholder engagement with government developed. In cases where government involvement in water management is held in high regard this should be exploited and in cases where it is not, such issues need to be carefully addressed. Similarly local histories need to be factored into strategies which aim to engender participatory water management. A failure to comprehensively understand the local social context, and where it stems from, could lead towards a challenging and troublesome participatory process. The exact role of the farmers‟ association also needs to be explicitly defined. These institutions are critical to creating awareness but if they are used during the participatory process they must ultimately be divorced from water management institutions as they do not serve the interest of all stakeholders. Finally, the nature and structure of institutions will reflect the current conditions of the catchment in question and factors such as topography will affect this reflection. Mismatches in borders will be one such challenge that these institutions will face.

Above all, this study highlights the context specific nature of catchments and the complexities that will be involved in facilitating participatory water management. Although the very purpose of South Africa‟s decentralized water management framework is to cater for the individuality of each catchment, it is a strong recommendation of this project that the need for an authoritarian approach to water management, at times, should be investigated. This is specifically with reference to conflict resolution, the ensuring of equitable water distribution and the practical development of water management institutions. Local water management institutions need their policies to be steered by local requirements and conditions but also to be empowered to make absolute decisions affecting the entire catchment.

Recommendations for further research

Based on the findings of this project, and the associated claims made, it recommends that within the context of commercial farming in South Africa the following should be further researched:

- The perspectives of commercial famers in other catchments in South Africa. All four of the study sites were located in the upper Orange WMA and the study gathered its primary data exclusively from commercial farmers all of which were white males. Thus the conclusions expressed are exclusive to a demographic minority contained within a single catchment. The sample size could also be increased if possible.
- Input from regional water managers and government officials. This was not pursued for this project as the study chose to narrow its focus and specifically investigate commercial farmers within the context of the study. It is recognized that this may have limited some of the insights the project has put forward.
- The influence of the scale of the river. The scale of the river in question is also likely to effects its perceived role as either a uniting or dividing feature. A river the size of the Orange-Senqu is likely to provide a far more significant obstruction to communication than a river the size of the Kraai, for example. Investigating if this is the case could provide some useful insight into the issue of rivers as borders.
- Current stakeholder reactions to the process of developing decentralized water management institutions. In catchments where decentralize participatory processes have been instituted, have rivers proved to be an obstacle to such processes by acting as borders?

As an extension of this research it is recommended that the following be investigated:

- The practical limitations and constraints on the process in its current form.
- Stakeholder views on how the process should be modified, streamlined or altered.
- Specific stakeholder attitudes towards different styles of decentralized water management.

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APPENDIX

Semi-structured interview format

Interview Code: _____ Date of interview: _____

Interview location: _____

Name of Interviewee: _____ Contact number: _____

Anonymity and confidentiality are guaranteed.

Background Information

1) Name of Farm:
_____

2) Period as a farmer: _____3) Period owned farm: _____4) Period the farm has been in the family: _____

5) Language spoken at home: _____ 6) Language spoken to labor: _____

7) Do you have direct access to riparian land on the Orange River? **Yes/no**

8) Race_____ 9) Level of education_____

10) Nature of agricultural activity? (e.g., citrus, beef…) _____

11) Approximate farm size_____ 12) River side: _____

Section A: ***Nature of local water resources***

1) a) How Important is the Orange-Senqu Rivers water to your activities?

1 (Not at all NB)	2	3	4	5 (Crucially NB)

1) b) Is water extracted directly from the river?

Yes	No

_____

2) What legal or customary restrictions are there on water use?

Area of irrigation (e.g. Scheduled land), Volume of water (e.g. metering, excess available)

_____

3) Are any alternative water resources available? **Order of importance**

Yes	No

---

4) If so how accessible are they?

1 (Extremely limited)	2	3	4	5 (Easily Accessible)

---

5) Overall has the availability of water changed over your time as a farmer here?

Negative change	No change	Positive change

1 Negative	2	3 No change	4	5 Positive

---

6) What are the most critical water related issues you face at present? **Order of importance**

---

7) Have you noticed or felt the effects of climate change?

1 (No/Don't believe in it)	2	3	4	5 (Absolutely)

---

8) Other critical environmental issues?

Section B: *Communication and social networks*

Show map: Indicate 10 most frequent contacts (Red-social, Blue-work)

1) Outside of your farm who are you most in contact with and why? (social, work related)

---

2) What hinders communication in this area?

_____

3) Do you have access to:

	Yes	No
Cell phone reception		
Email		
Land line telephones		

4) How far is the closest crossing point over the river? (Nature of it: By Vehicle, foot)

_____

5) Would you say that the river is easy to cross? (ie regular crossings)

1 (Yes)	2	3	4	5 (Absolutely not)

_____

6) Are you a member of the local farmers association? Where are meetings located? How regularly?

Yes	No

_____

7) Are you a member of any other business, social or research associations?

_____

8) Are time constraints a serious issue for you? Do these affect you ability to attend meetings?

Yes	No

_____

9) Do you think it is important to attend meetings of local organisations?

1 (Not at all NB)	2	3	4	5 (Absolutely)

10) DO you keep yourself informed about goings-ons in the community and region?

1 (Not at all NB)	2	3	4	5 (Absolutely)

11) Which urban area do you visit most regularly?

_____

12) Do you hold any leadership positions in any local organisation (farmers' association, Conservancy…)

Yes	No	Have Previously

Details: _____

13) Are there any well respected or influential people in the community? (Local Champions)

_____

Section C:*Local sense of belonging*

		Strongly disagree	Disagree	Neutral / unsure	Agree	Strongly Agree
.01	I feel a sense of belonging to my community	1	2	3	4	5
.02	Generally speaking, most people in my community can be trusted	1	2	3	4	5
.03	I do not worry that my home will be broken into	1	2	3	4	5
.04	I do not worry that my stock, game or produce will be stolen	1	2	3	4	5
.05	I was keen to vote in the recent Municipal elections	1	2	3	4	5
.06	If I have a problem, or something is worrying me, I have people outside my family that I can turn to	1	2	3	4	5
.07	If I assist a neighbour in some way, I anticipate that he/she will assist me in the future	1	2	3	4	5
.08	If a neighbour assists me in some way, he/she anticipates that I will assist him/her in the future	1	2	3	4	5

Section D: *Co-operation*

1) Do you have any cooperative agreements or collaborate on projects with farmers either side of the river?

Yes	No

2) How are these enforced?

3) Do you ever share labour or equipment with farmers this side of the river?

Yes	No

4) Why do you/don't you cooperate with either?

Section E: *Conflict*

1) Has there ever been any kind of water related conflict between farmers along the river?

1 (Never)	2	3	4	5 (Highly Frequent)

2) If so how were these conflicts resolved?

3) Do you think that conflict over water is a significant problem that we will face on the near future?

1 (Not at all NB)	2	3	4	5 (Absolutely)

4) What might cause this?

Section F: Confidence in Government

1) What issues regarding government, at any level, concern you the most?

_____

		Strongly disagree	Disagree	Neutral / unsure	Agree	Strongly Agree
.01	My **local municipality** is doing a good job at meeting it's responsibilities to the people in our community	1	2	3	4	5
.02	My **provincial government** is doing a good job at meeting it's responsibilities to the people in our province	1	2	3	4	5
.03	My **national government** is doing a good job at meeting it's responsibilities to South African people	1	2	3	4	5
.04	My **local police force** is doing a good job at meeting it's responsibilities to the people in our community	1	2	3	4	5
.05	I feel that me and other farmers are strongly supported by Government	1	2	3	4	5
.06	I believe that government listens to me if I speak	1	2	3	4	5
.07	I believe that I can influence decisions affecting my community	1	2	3	4	5
.08	By working together, people in my community can influence decisions that affect our community	1	2	3	4	5
.09	My opinion of government has improved over the last 10 years	1	2	3	4	5
.10	If I have a concern regarding a local issue, my local municipality will listen and act upon my concern	1	2	3	4	5
.11	The money I pay through income tax is generally being well spent	1	2	3	4	5
.12	It is important to vote in national and provincial elections	1	2	3	4	5
.13	I am concerned about the direction of the land reform process	1	2	3	4	5

Section G: ***Institutions, policy and water management***

1) Are you a member of the local **WUA** or any other water related organizations?

Yes	No

---

2) Is so what area does this organization cover? (Upstream, downstream or across the river)

---

3) Do any of these extend to the other side of the river?

---

4) If not do similar institutions on the other side ever communicate with yours?

---

5) Do you think water needs to be collaboratively managed?

1 (No)	2	3	4	5 (Absolutely)

---

6) If so how do you think this should happen?

---

7) Would you say the river is a common resource that brings people together?

1 (Not at all)	2	3	4	5 (Absolutely)

---

8) Do you think water is presently being managed effectively and efficiently?

1 (Not at all)	2	3	4	5 (Absolutely)

9) Are you aware of the drive for WUAs?

1 (Not at all)	2	3	4	5 (Absolutely)

10.1) Do you know which water management area you live in?

Yes	No

10.2) Do you know if there is a CMA in place and if so how will it help you?

Yes	No

10.3) How aware are you of national water policy? (Do you ever receive official information on our water situation or policy)

1 (Not at all)	2	3	4	5 (Extremely well informed)

---

11) Where is your water institution based i.e. where you get a water license?

---

12) Who do you answer to in terms of your water use?

---

13) How would you rank your overall confidence in government with regard to water and your farming activities?

1 (Very unconfident)	2	3	4	5 (Extremely confident)

Section H: ***Local history and wider geo-politics***

1) How important do you think the river is to the region?

1 (Not at all NB)	2	3	4	5 (Crucially NB)

2.1) Do upstream activities affect water supply?

1 (Not at all)	2	3	4	5 (Definitely)

_____

2.2) Are you restricted/affected by downstream users?

1 (Not at all)	2	3	4	5 (Definitely)

_____

2.3) Do you think you affect downstream users?

1 (Not at all)	2	3	4	5 (Definitely)

_____

2.4) Would you say you are threatened by any other water users either up or downstream of you?

1 (Not at all)	2	3	4	5 (Definitely)

_____

3) Are there any significant historical events that have shaped the area?

_____

4) Have any past event taken place that may have divided each community?

_____

5) Are there any significant differences between you and farmers on the other side of the river? **(YES, NO)**

_____