CONTRIBUTIONS OF AN ETHICALLY-GROUNDED AND VALUE-BASED APPROACH TO WATER GOVERNANCE – THE CASE OF TWO CONTRASTING CATCHMENTS

Report to the
Water Research Commission

by

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Executive Summary

In South Africa, there is a gradual move towards the governance of water resources in the context of social-ecological systems (SES), which recognises the coupling, interrelationship, and complex interactions between societal and ecological components of the SES. In this regard, there has been a growing body of knowledge that supports the governance and management of water resources in the context of SES. However, there is little parallel research efforts aimed at developing an ethics and value-based approach for distilling ethical criteria and principles for navigating the array of complex issues such a systemic and holistic view of water governance raises.

The envisaged water governance outcomes are a move away from government oriented top-down, interventionist and command-and-control approach, to the development of systems and institutions that allow greater, enhanced and more effective participation of citizens in the decision-making processes affecting water resource management. However, systemic governance failures have been identified as top challenges in the water sector. The nature and characteristics of water, being a resource that affect all aspects of human endeavour, biological and ecosystem health, implies that the consequences of systemic governance failures would likely have ethical and value implications, and thus the need to consider the contributions of ethics and value-based approach to water governance in South Africa. This is critical because values underpin the way people interact with and lay claim to water, and it has been argued that much of the conflict around water are indeed value conflict. Therefore, an ethical approach to water governance is fundamental because it helps to clarify value claims, the implication of interaction of values in specific contexts, as well as enabling a deeper reflection and analysis of the implications of policy and governance decisions on water allocation, ecosystem protection and ways in which water is being governed.

Using the Lower Sundays River catchment and the lower section of the Upper Vaal River catchment as case studies, this project develops an ethical and value-based approach to water governance in South Africa. The intention is to bring ethics and value-based analysis to the domain of water governance, and to shed light on its contribution to realising the foundational values of equity, sustainability and efficiency enshrined in the National Water Act.

Project Aims

The specific aims of the project are as follows:

1. Together with stakeholders, surface key values informing water governance in the selected catchments and undertake a value-based analysis of how the stakeholders go about reconciling/trading off conflicting values and the associated ethical implications.
2. Explore whether an appeal to ethics level context-sensitive principles can foster greater equity, sustainability, and efficiency in water governance in the selected catchments.
3. Explore instances of polycentricity in water governance in the catchments, paying attention to whether/or not in such instances, it contributes to effective and cooperative water governance.

4. Synthesize lessons of the value of ethically grounded and value-based approach for policy, practice, and implementation, while providing comparative data from the selected catchments.

Project approach and methodology

The project uses a case study approach to generate insights and to synthesize knowledge on the contribution of ethically grounded and value-based approach to water governance. Both secondary and primary data were collected through document analysis, workshops, interviews, surveys and focus group discussions.

Project results and discussion

We developed perspectives on water governance challenges and their ethical dimensions. We also conducted an analysis of key values underlying water claims and claimants in the catchments. Regarding water governance challenges in the two catchments, we identified six challenges. These are: challenge 1: effective participation, institutional legacies, and transformational challenge; challenge 2: accountability, cooperative governance, clear roles, and responsibilities; challenge 3: absence/near absence of effective leadership and management; challenge 4: systemic integration failure of the water-land-agriculture (food) nexus, including institutional integration; challenge 5: the regulatory system and failure of implementation; challenge 6: financing, infrastructure and technical capacity. We reflected on the ethical dimensions of these challenges. For example, regarding challenge 1, we reasoned that serious ethical concern exist about perpetuating power differentials on access to water resources within the Lower Sundays River catchment, thus raising issue of distributive justice. For instance, the National Water Act provides that members of irrigation board shall automatically become members of Water Users Association (WUA), inadvertently giving such members powers to set out the constitution, define the functions of the WUA within the ambit of the law. This raises serious ethical challenge as historically powerful interests within irrigation boards retain enormous disproportionate influence over the agenda and trajectory of the Lower Sundays River Water Users Association (LSRWUA).

Building on the perspectives on water governance challenges and their ethical dimensions, we identified efficiency, sustainability, equity, diversity, and inclusivity, transparency, accountability, and social and ecological justice as the key values underpinning water governance in the catchments. We draw on the theories of ethics to reflect on, and reason about value claims. In this regard, we reason about value and morals from the perspectives of consequentialism, deontology, virtue ethics, Ubuntu moral theory and systemic-relational perspectives. By applying thinking from these fields of ethical theories, we were able to clarify value claim about water in the catchments. For example, in both catchments the governance institutions seemed to emphasize efficiency and are thus consequentialist in moral outlook and in design. By drawing on the theories of ethics, we lay the foundation for clarifying value claims to water in the catchments, but the perspectives developed in this study can be applied elsewhere.

To address the question on how greater equity, sustainability and efficiency can be achieved, we develop a framework for analysing value interaction in water governance, and factors that

may impact on such interactions. We identified three dynamic zones of value interactions: i) the conflictual zone, ii) mutually enhancing zone and iii) the neutral zone. We reasoned that greater equity, sustainability and efficiency are better achieved in the mutually enhancing zone. Within this zone, the achievement of one of the values contributes to achieving the remaining two values. However, our empirical assessments suggest that in both catchments, the conflictual zone dynamic dominates. What this means is that the three values of equity, efficiency and sustainability are often in conflict in practical and policy sense, in such a way that practical and policy steps taken to achieve one value, constrain the achievement of the other values. We identified better understanding, appreciation and the role of i) context, ii) governance, iii) time-frame dependence, iv) spatial-scale dependence, v) agent and capability, and vi) resources and investments, as fundamental to shifting current realities away from the conflictual zone interaction to the desired mutually enhancing zone of value interaction. There are fundamental practical and policy implications in this regard. For example, a deeper appreciation of the true meaning of the values of equity, efficiency, and sustainability is needed. In practical and policy sense, equity needs to be better understood as a multidimensional concept involving procedural equity, distributive equity, contextual equity and recognitional equity. Short-sighted policy measures may focus on the distributive dimension, but this may not lead to a holistic achievement of the practical implication of equity. In the same sense, efficiency as we demonstrated is also multidimensional, so is sustainability, which has ecological justice implication.

We consider polycentricity as a governance approach whether it can contribute to effective cooperative governance in the two catchments. Drawing on the key characteristics of polycentricity, we develop an analytical assessment grid to determine the degree of polycentricity in the two catchments. Based on the assessment grid, the degree of polycentricity can be characterised as i) matured polycentricity, ii) x-emerging polycentricity, iii) y-emerging polycentricity, and iv) budding polycentricity. We characterised matured polycentricity as instances where a multiplicity of autonomous or largely autonomous units exists governing a resource in a manner that show effective coordination, displaying interdependence, and varying intensity and frequency of interactions within define set of rules. We define the y-emerging polycentricity as a situation where few governance units are responsible for key governance processes and decision making but having high degree of coordination and interactions between these units, showing high levels of interrelations and interdependence. The x-emerging polycentricity exemplifies a situation whereby a diversity of largely autonomous units is responsible for and participate in the governance processes but show low coordination ability and thus low level of interrelation and interdependence. The fourth degree of polycentricity is what we have termed budding polycentricity typifying a situation where poor coordination and interrelations exist between the few governance units operating within a catchment.

The empirical evidence in the two catchments suggests that none has matured polycentric governance approach. This then raises implication regarding the degree of adaptive capacity of the operating governance approaches in the two catchments. We reasoned that given the complexity of achieving equity, efficiency and sustainability, a high degree of adaptive capacity offered by a polycentric governance approach is desirable. The level of polycentricity

in the two catchments then raises serious policy and implementation questions regarding institutional design and operationalisation in the catchments and by extension in the country. The degree of polycentricity in the two catchments raises concern as to the alignment between institutional fit and social-ecological realities. An alignment is needed to achieve greater equity, efficiency and sustainability as factors impacting on these values operating across multiple social-ecological scales.

Another governance implication that is raised in the catchments in terms of degree of polycentricity is whether there is enough room for learning and experimentation, and whether the current institutional and governance processes benefit from a diversity of knowledge sources and knowledge sharing across scales. For instance, a diversity of knowledge sources and knowledge sharing implies participation by diverse stakeholders across jurisdictional scales in decision making. Such participation give effect to procedural equity, which may in turn accelerate distributive equity imperatives through representation and participation of diverse interest groups, particularly those who have been historically marginalised. We reasoned that the degree of polycentricity in the two catchments may have contributed to the observation that equity imperatives are often in conflict with those of efficiency. Part of the reason for this is that experimentation and knowledge sharing from diverse sources are critical to realise equity goals, yet current institutional designs operating in the two catchments may not give sufficient room for such experimentation and knowledge sharing across scales and from diverse sources.

Recommendations

Policy and implementation

i) This study raises fundamental practical and policy issues. First, there is a need for a deeper appreciation and understanding of the true meaning of the values of equity, efficiency, and sustainability. As we have demonstrated that these values are complex and multidimensional, relevant policies in the water sector need to appreciate these complexities and multidimensionality. For example, in policy matters, equity needs to be positioned in a multidimensional sense as including procedural equity, distributive equity, contextual equity and recognitional equity. This also applies to the multidimensionality of sustainability and efficiency. There is a need for a balance focus on all dimensions of these values as they are inter-linked, avoiding short-sighted policy measures that may focus on just one dimension, e.g. distributive equity or technical efficiency.

ii) Long-term policy instruments are needed to better appreciate how the three values may interact, the context in which such interaction come to play and the factors that may contribute to whether the interactions may be conflictual or mutually enhancing. Specifically, it needs to be made explicit in policy instruments that the pursuit of equity in the water sector is a long-term goal. In this regard, indicators for monitoring equity progress in the short-, medium-, and long-term also need to be developed and implemented in specific contexts. Policy guidance also needs to be given on how the pursuit of the values of equity, efficiency and sustainability may interact in the short-, medium- and long-term, and what needs to be done to

shift these interactions away from conflictual to mutually enhancing. This would require a good understanding of time-frame dependence and spatial-scale dependence on the interactions between these values.

iii) The concurrent achievement of equity, efficiency and sustainability in the water sector is a complex exercise impacted upon by several factors. In this regard, policy guidance is needed on how specific context in the water sector may influence the achievement of these values. Good governance also needs to be strengthened. A clear policy intent and implementation mechanisms need to be mapped on strengthening capabilities in the water sector and setting aside resources for investing into equity, sustainability, and efficiency imperatives over the short-, medium- and long-term.

iv) There is an urgent need for institutional reformation and re-design in the water sector as exemplified in the two catchments to enhance their fit to local social-ecological realities and to enhance their adaptive capacity, promote participation and experimentation, learning, and knowledge sharing from diverse sources and systems. For example, in the case of the Water Users Associations (WUAs) urgent reformation is needed to redesign these institutions so that historical institutional legacies that impede on transformation, effective participation and power differentials are not perpetuated. As at the time of writing, this task has been taken up by the Department of Water and Sanitation, urgent finalisation of this process is needed.

v) Training of policy makers, managers and water sector stakeholders is required across institutional and governance scales on how ethical thinking may contribute to clarifying value claims in the water sector, and its role in water diplomacy and dispute resolution. This is necessary because much of the conflict around water are indeed value conflict.

vi) The National Water Act envisages the gradual realisation of mature polycentricity in the water resources sector. As the current analyses have demonstrated, this is far from being realised. Urgent policy and implementation measures are needed to remove administrative bottlenecks impeding on the establishment of all envisaged water resource management institutions, and their effective coordination and functioning as autonomous units across social-ecological scales.

Further research

The following recommendations are made for future studies

i) Examine and analyse the extent to which current institutional designs and governance processes in the water sector are contributing to the conflictual interactions between the value of equity, sustainability, and efficiency. Such an examination is important to distil important institutional elements necessary for shifting current realities away from conflictual value interaction zone dynamics to the mutually enhancing value interaction zone dynamics.

ii) Undertake a case study-based approach to develop indicators that draw on the multidimensionality of equity, efficiency, and sustainability and to use the

developed indicators to monitor the effectiveness of the implementation mechanisms for the values of equity, efficiency, and sustainability. Such a study should also distil the role of agency and capability on the values of equity, efficiency, and sustainability in specific contexts.

iii) The present study has developed several analytical frameworks i) that for analysing value interactions, ii) ethical theories for reflecting on value claims, iii) analytical grid for assessing the degree of polycentricity, and iv) that for reflecting on ethical dimensions of water governance challenges. Future studies that apply these frameworks in comparative case studies are needed to validate them and to further distil lessons on the role of ethics in water governance for policy and implementation.

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ABBREVIATIONS AND ACRONYMS

CGA	Citrus Growers Association
CMA	Catchment Management Agency
CMF	Catchment Management Forums
DAFF	Department of Agriculture, Forestry and Fisheries
DALRRD	Department of Agriculture, Land Reform and Rural Development
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ERPM	East Rand Proprietary Mine
ERWAT	East Rand Water Care Company
GDP	Gross Domestic Product
KRC	Klip River Catchment
LHDA	Lesotho Highlands Development Authority
LHWC	Lesotho Highlands Water Commission
LHWP	Lesotho Highlands Water Project
LSRC	Lower Sundays River Catchment
LSRCMF	Lower Sundays River Catchment Management Forum
LSRWUA	Lower Sundays River Water User Association
LSUVC	Lower Section of the Upper Vaal River Catchment
NMBM	Nelson Mandela Bay Metropolitan Municipality
NPO	Non-for-profit organisation
NWA	National Water Act No. 36 of 1998
ORASECOM	Orange-Senqu River Commission
RSA	Republic of South Africa
SES	Social-ecological systems
SR	Systemic-relational
SRVM	Sundays River Valley Municipality
STEEP-H	Social, technological, economic, environmental, political and historical
TCTA	Trans-Caledon Tunnel Authority

UN	United Nations
WUA	Water User Association
WSA	Water Services Authority
WWTW	Wastewater Treatment Works

CHAPTER 1: INTRODUCTION TO THE PROJECT

1.1 Motivation

In South Africa, there is a gradual, but steady move towards greater citizens involvement and participation in the governance of water resources. This move is anchored on the realisation that achieving the provisions of the National Water Act (Act No. 36 of 1998) (NWA) would require some forms of decentralisation and democratization of the institutions and processes of decision making that affect water resource management. Thus, the envisaged outcomes of this process are a move away from government oriented top-down, interventionist and command-and-control approaches, to the development of systems and institutions that allow greater, enhanced and more effective participation of citizens in the decision-making processes affecting water resource management (Pollard and Du Toit, 2008; Palmer and Munnik, 2018). However, achieving good governance in ways that ensure sustainability, efficiency, and equity in the water sector in South Africa is impeded by what has been identified as the top three challenges confronting the sector. These challenges are i) the regulatory system ii) accountability and iii) cooperative governance (Weston and Goga, 2016).

Regarding the regulatory system for example, an inefficient regulatory system has led to multiple incidences of illegal discharges of waste into rivers in most parts of the country, and these have negatively impacted on other users who have legitimate rights of access to such water resources. An instance in this regard is the Klip River system in Gauteng – one of the case studies in the current project (Klip River Catchment Forum, 2018). In the Lower Sundays River Catchment (LSRC) in the Eastern Cape, for example, inefficient regulatory enforcement, poor accountability measures and a near absence of cooperative governance have manifested in the form of inequitable allocations of water between multiple user sectors, particularly between the privileged irrigated agriculture and the less privileged sections of the domestic users (Clifford-Holmes, 2015). All these are matters of ethics, particularly because different section(s) or groupings within society may have different fundamental and/or ascribed values regarding water resources, which may not always be compatible, and may thus come into conflict with each other, requiring an ethically grounded approach to bring such values into balance or to facilitate constructive trade-offs (Soderbaum, 2008; Brown and Schmidt, 2010; Odume and De Wet, 2016; De Wet and Odume, 2019; Odume and De Wet, 2019).

The consequences of systemic water governance failures do not only affect society, but also the ecological integrity and functionality of aquatic ecosystems. For this reason, there has been a growing call for the governance and management of water resources to be seen in the context of social-ecological systems (SES), recognising the coupling, interrelationship, and complex interactions between societal and ecological components of the SES. In this regard, there has been a growing body of knowledge in South Africa that supports the governance and management of water resources in the context SES (Folke et al., 2005; Pollard et al. 2011; Palmer and Munnik, 2013). However, there is little parallel research efforts aimed at developing an ethics and value-based approach for distilling ethical criteria and principles for navigating the array of complex issues such a systemic and holistic view of governance raises. It is therefore not surprising that a range of water governance challenges that border on ethics

and values currently plague the water sector (Pegram et al., 2006; Sowman and Kapfudzaruwa, 2009; Weston and Goga, 2016; De Wet and Odume, 2019).

Viewing water from the lens of societal component of the SES, Doorn (2013) argued for five characteristic of water that are germane to the field of water governance and ethics. These characteristics are i) water as a risk, a scarce resource, and a service; ii) the nature of water in terms of goods and property right; iii) peoples' human right to water; iv) the transboundary and global dimension of water; v) value pluralism of water. For example, about the first characteristics of water, natural or human induced flooding, and/or water borne diseases present water as a risk to society (Doorn, 2013). Flooding, whether natural or human-induced may have disproportionate effects on different communities or constituencies of society, with serious ethical implications and the notion of distributive justice. Further, when one considers water as a service, the provision and maintenance of water infrastructure become critical for the reliable supply of water, and it is increasingly becoming evident that in South Africa, water cuts are more common in more improvised communities (StatsSA 2017) – this again raises the question of justice and equity in all dimensions with serious ethical implications.

The nature of water in terms of goods and property rights also has implications for ethical consideration in water governance, particularly in South Africa with imperative for transformation, redress, and equity. In South Africa, water resources can be viewed as both a public good and as a common-pool resource, with the national government as the custodian. However, because water is seen as a scarce resource both in terms of quality and quantity, some exclusion mechanisms have been developed through the value of efficiency, considering the economic value of water manifested in the form of cost recovery for service delivery. However, if one pursues the value of efficiency through the economic value of water with any rigor, serious ethical challenges are likely to be experienced particularly because of the problem of affordability in a country with deeply embedded history of injustices and inequalities. In this regard, efficiency of delivery of water and sanitation services is directly influenced by whether service providers can afford to provide such services and whether users can afford to pay for such services. This increasingly requires charging users for the supply of such services. Charging for services – even if a percentage of the service delivered (such as the first 6,000 litres of water) is free, or is charged at a pro rata rate proportionate to income – does not impact equitably on all households across the income spectrum, and if service providers fail to provide such services efficiently across all water user sectors because of costs, then this raises ethical dilemma as water is a basic human right in South Africa, and also recognised by the UN General Assembly (UN 2010).

The view of water as a human right also raises ethical implications for water governance. In South Africa, this is captured in the concept of the Basic Human Needs Reserve (BHNR), prescribing the quality, quantity, and reliability of supply of water for basic human needs such as water for cooking and hygiene purposes (Republic of South Africa (RSA) 1998). The South African Constitution (Act No 108 of 1996), the National Water Act (RSA 1998), the UN General Assembly resolution (UN 2010) and the Rights Council resolution (2010) placed the obligation and responsibility on the State for the realisation of human rights to water. The implication therefore is that the State has the moral and ethical obligation for the realisation of

the BHNR as a way of addressing issues of equity and redressing historical injustices. The failures of water services delivery at the municipal level, which in most cases disproportionately affect the less privileged and most vulnerable in society, thus impede on the realisation of this right, with serious justice and equity implications (WWF, 2014).

Though not directly relevant for this project, the transboundary nature of most water resources adds another global dimension to the discussion of ethics and water governance (Rossi, 2015). Transboundary river systems are primarily governed and managed through international agreements aligned with the provisions of the UN Convention on the laws of the non-navigational uses of the international watercourses. Of particular importance in this context is the provision dealing with water allocation mandating States in their respective jurisdictions to utilise international water resources in an equitable and reasonable manner (UN 1997). While upstream States often place emphasis on equitable utilisation for developing water resources through the principle of sovereignty, the downstream States place emphasis on reasonable utilisation, and no significant harm to other water resource users for arguing for the retention of historic rights, as currently being exemplified in the Nile River system, between the upstream State of Ethiopia and the downstream States of Egypt and Sudan (Yacoub et al., 2021). Thus, the ethical principles of solidarity between up- and downstream States, and that of subsidiarity become critical for resolving disputes in the transboundary governance of water resources. At the national and sub-national levels, water flows through multiple communities – where upstream use may have significant negative effects on downstream users, potentially constraining downstream users' legitimate right to water as a basic human right but also impacting on the ecological integrity of downstream ecosystems (Odume et al., 2021). Again, ethical principles of solidarity and subsidiarity become relevant for dispute resolution in water governance processes.

Value plays a significant role in the way people interact with water and lay claim to it (De Wet and Odume, 2019). In a pluralistic country such as South Africa, if the foundational values of sustainability, efficiency and equity embedded in the NWA are to be realised, then other values underpinning claims and claimants, associated with and derived from water whether, cultural, economic, ecological, spiritual, must be adequately taken into account and clarified in every decision-making process, and in governance systems (Brown and Schmidt, 2010; Pradhan and Meinzen-Dick, 2010). Thus, in addressing 'wicked problems' such as water governance in South Africa (Weston and Goga, 2016), value pluralism would imply that there will be times when multiple values clashes, necessitating clarification regarding what ought to be done, and what is being done, drawing on ethical criteria and principles (Groenfeldt and Schmidt, 2013). Analysing the way values may interact enables deep reflections on the implications of policy and governance decisions on water allocation, ecosystem protection and ways in which water is being used and governed. Paying attention to value pluralism underpinning different claims to water may provide opportunity for good water governance, and leverage for empowering marginalised groups, and addressing power asymmetry, particularly if the multiple values (such as cultural and spiritual) contribute to water stewardship and wise utilisation (Odume and De Wet, 2016; De Wet and Odume, 2019). However, it is critical to note that different values held by different societal groupings, institutions and/or constituencies may not always be compatible with each other, requiring that such values are ranked, prioritized, balanced and

where necessary, traded-off. The principles by which such ranking and prioritisation is done have serious ethical implications and is thus relevant for the field of water governance and ethics. We take values to mean what specific societal groupings or constituencies express at a generalised level to be good or bad conduct, and ethics as a systematic concern with the principles by which conducts, morals and values are clarified and justified (Odume and De Wet, 2016).

The idea that water is a necessity for all life-forms implies that it is not only humans that could reasonably be said to have claims to water, as a good and a service. Non-human species in as much as they need water to thrive, reproduce and flourish in their environment could thus have justifiable claims to water (Baxter, 2004). Within the category of distributive justice, Baxter (2004) in his book on *A Theory of Ecological Justice* argues that "we (humans) must do right by other life-forms, but in a precise kind of way, namely by recognising their claim to a fair share of the environmental resources which all life-forms need to survive and to flourish" (Baxter, 2004: pp 4). Thus, the notion of ecological justice extends the notion of distributive justice to non-humans in terms of fair allocation/ distribution of environmental benefits and burdens (Baxter, 2004). Simply put, ecological justice is a form of distributive justice that recognises fairness in the allocation of environmental resources between humans and the rest of nature. It emphasises that in a human-non-human relation, without good moral reasons, moral agents have obligations not to deprive other species of their fair share of environmental resources needed to reproduce and thrive. From a philosophical viewpoint, Baxter (2004) provided arguments for why all non-humans should be part of the justice community and thus should also be part of the distributive justice community. Given the increasing recognition that water is embedded in SES, the notion of ecological justice offers an insightful entry point for ethical judgement and analysis that goes beyond the social realm, to the wider SES.

Using the Lower Sundays River catchment and the Lower section of the Upper Vaal River catchment as case studies, this project develops an ethical and value-based approach to water governance in South Africa. The intention is to bring ethics and value-based analysis to the domain of water governance, and to shed light on its contribution to realising the foundational principles of equity, sustainability and efficiency enshrined in the National Water Act.

1.2 Project Aims

The specific aims of the project are as follows:

1. Together with stakeholders, surface key values informing water governance in the selected catchments and undertake a value-based analysis of how the stakeholders go about reconciling/trading off conflicting values and the associated ethical implications.
2. Explore whether an appeal to ethics level context-sensitive principles can foster greater equity, sustainability, and efficiency in water governance in the selected catchments.
3. Explore instances of polycentricity in water governance in the catchments, paying attention to whether/or not in such instances, it contributes to effective and cooperative water governance.

4. Synthesize lessons of the value of ethically grounded and value-based approach for policy, practice, and implementation, while providing comparative data from the selected catchments.

1.3 Project Approach and Methodology

The project uses a case study approach to generate insights and to synthesize knowledge on the contribution of ethically grounded and value-based approach to water governance. Both secondary and primary data were collected through document analysis, workshops, interviews, surveys and focus group discussion.

CHAPTER 2: CASE STUDY CATCHMENTS DESCRIPTION

2.1 Introduction

The Lower Sundays River catchment is situated in the Eastern Cape province of South Africa. The catchment is approximately 80 km northeast of the Nelson Mandela Bay Metropolitan Municipality. Steep mountainous valleys characterise the northern and eastern portions of the catchment. The climatic condition in the catchment is dry and generally regarded as semi-arid. Rainfall is low, about 404 mm per year. Since the catchment is largely dominated by commercial agriculture, irrigation water demand is met through extensive and elaborate inter-basin transfer schemes.

The Sundays River is about 481 km long, originating in the Sneeuberg mountains. The river catchment is divided into three sub-catchments: the Lower Sundays, Middle Sundays, and the Upper Sundays. The Lower Sundays is the focus of the present study. The Orange-Fish River – Sundays River Inter-Basin Transfer Scheme supports extensive agriculture within the lower Sundays River catchment (LSRC). The natural soils within the LSRC are saline, but water from the Orange River has a positive effect on the soils salinity, thereby making the soils suitable for irrigated agriculture.

The 2011 Statistics South Africa (StatsSA) census placed the population of the Sundays River Valley Municipality at 54 503, growing marginally by 1.85%, to 59 793 by 2016 (StatsSA, 2011; SRVM IDP, 2019). Growths in informal settlements are mainly responsible for the population increases. The main economic drivers within the catchment are commercial farming and local tourism via eco-tourism. Apart from these two primary economic activities, informal trading also contributes to the economy of the catchment. Nevertheless, unemployment is rife (Clifford-Holmes et al., 2012) among the economically active population within the catchment. Many of the commercial farmers are white and receive the bulk of the water allocation for commercial agriculture. About 90% of allocated water goes to the commercial farmers, while only about 4% is allocated to the Sundays River Valley Municipality for domestic and industrial uses.

2.2 Key Water governance institutions in the Lower Sundays River Catchment (LSRC)

The water governance within the LSRC, is undertaken by a range of institutions (both formal and informal) and actors within and outside of the catchment. Some of these institutions and actors, e.g. the Lower Sundays River Water User Association (LSRWUA) derive their powers and authority from legislative provisions. Others, such as the emerging Lower Sundays River Catchment Management Forum (LSRCF), derive their steering ability through trust. In this chapter, only governance systems having a critical influencing role within the catchment are presented.

The Lower Sundays River Water User Association

The Lower Sundays River catchment is one of few in South Africa with a well-established and functioning Water User Association (WUA). The Lower Sundays River Water User

Association (LSRWUA) was established in 1917 as an Irrigation Board, primarily serving the purpose of large-scale commercial farmers requiring irrigation water to grow and sustain their crops (LSRWUA 2005). However, with the enactment of the National Water Act, the Board was transformed into the current LSRWUA. Water User Associations are conceptualised in the NWA as one of the institutions and mechanisms through which the water governance processes can be democratised by enhancing a diversity of representations, interests, and participation by citizens in decision making processes that affect water resources at the local scale. The NWA sets out several principal functions for WUAs which include: i) prevent water wastage, ii) protect water resources, iii) prevent unlawful water use, iv) removal of unlawful obstruction on the course of a water resource, iv) prevent unlawful activities likely to impact on water quality, v) supervise water resources as well as vi) several regulatory, monitoring and compliance functions (RSA 1998).

The LSRWUA is the primary bulk water supplier within the LSRC. The LSRWUA operates and maintains extensive canal systems with which it delivers raw water to a range of water users including the Sundays River Valley Municipality (SRVM), commercial farmers, the tourism sector as well as emerging farmers. The LSRWUA also delivers water to the Nelson Mandela Bay Metropolitan Municipality via the Scheepersvlakte Dam. Water supply in the Nelson Mandela Metropolitan Municipality is becoming increasingly reliant on bulk water supplied by the LSRWUA, particularly after the drought of 2017. Bulk water is supplied according to a weekly calculated demand by users, and water is then delivered to users through a sluice delivery system via canals and network system that runs the length of the irrigated farming areas within the Sundays River Valley (Clifford-Holmes, 2015). Water users within the Valley are expected to secure individual storage systems to ensure that they have enough water when the LSRWUA is not operating, particularly during weekends and public holidays (Clifford-Holmes, 2015).

The LSRWUA sets out several principal and ancillary functions aligned with the provision of the NWA. The principal functions according to its constitution (LSRWUA 2005) are:

- To prevent the wasteful use of water and to adequately maintain the waterworks to minimise any water waste.
- To protect the water resources and to exercise general control and supervision over the water resources and waterworks.
- To prevent any unlawful water use and to remove any obstruction unlawfully placed in a watercourse or waterworks.
- To construct, purchase or otherwise acquire, operate and maintain waterworks considered to be necessary for supplying water to land for domestic, stock watering and irrigation purposes.
- To supervise and regulate the distribution and use of water from a water resource according to the relevant water use entitlements, by erecting and maintaining devices for the measuring and division of water.
- To construct, purchase or otherwise acquire, operate, and maintain waterworks considered to be necessary for draining land.

- To ensure the reduction of risk of damage to any land in the event of floods by the clearing channel.
- To change a watercourse back to its previous course where it has been altered through natural causes.
- To ensure the removal of alien plants in the area of jurisdiction of the Association
- To administer all financial matters, as well as all administration for efficient functioning of the Association.

Given that the LSRWUA has the responsibility of delivering bulk raw water to users, and of maintaining the water infrastructure for delivery the bulk water, it is thus a critical water management institution whose operation and functioning can influence the governance of water resources within the catchment areas. The question becomes, how does the LSRWUA achieve or participate in water governance, i.e. its water governance mode.

Using the three water governance modes indicated in Pahl-Wostl (2019), a critical view of the operation, structure, and function of the LSRWUA suggests that the organisation has elements of both the hierarchical governance mode, and the market governance mode. For example, the LSRWUA derives its legitimacy primarily from the provision of the NWA, even though representation also count as a way of legitimising its function (RSA 1998; LSRWUA 2005). To achieve efficiency, technocratic knowledge is valued and prioritised, while ensuring that operation generates sufficient income for financial sustainability. Funding for the LSRWUA is in the form of levies and charges paid by bulk water users and most of the income comes from the commercial farmers. Monitoring and compliance are often in terms of set regulations, standards, rules, and norms as well as a careful cost-benefit analysis of operations. The implication of the LSRWUA taking the hierarchical and market governance modes is discussed in Chapter 3 later as part of the ethical implications of water governance challenges in the LSRC.

Sundays River Valley Municipality

The Sundays River Valley Municipality (SRVM) serves as the Water Services Provider (WSP) and Water Services Authority (WSA) within the study catchment. It receives raw water from the LSRWUA and then treats it before distributing the treated water to the domestic population within the study catchment. The raw water from the LSRWUA is stored in four reservoirs and an old storage canal, from which the water is delivered into the water treatment works (WTW) (Clifford-Holmes, 2015). Treated water is then delivered to the urban areas of Kirkwood, Bergsig, Aquapark, Moses Mabidha and Emsengeni. It is critical to note that Kirkwood is a low-lying area, thus water is mostly fed to it through gravity, whereas other areas require that water is pumped. The pumping system is designed in such a way that it stops working when water in the reservoirs falls below the 20% mark and must be filled up to the 50% mark before the systems kicks off again (Clifford-Holmes, 2015). The implication of this engineering design is that towns in relatively high-lying areas are the first to be cut off from water supply and the last to receive water when the pumping system resumes, while Kirkwood, which is fed by gravity continues to enjoy water supply. From a demand perspective, the SRVM orders raw water twice a week (Monday and Thursday) from the LSRWUA based on actual demand from

the domestic sector. The SRVM owns and maintains the technical infrastructure for the domestic water supply. The functionality and operation of the SRVM are thus critical for access to domestic water supply within the catchment.

The SRVM as both a WSP and WSA derives its function from the Water Services Act (Act No. 108 of 1997) (RSA 1997). It is mandated to provide water services in ways that are equitable, efficient, and economically sustainable, considering the duty of customers to pay for such services. The LRVC being an area with high level of unemployment and poverty, raises serious concerns about the ability of the SRVM to recover costs on services provided, and to sustain the supply of water. In this regard, much of the payments for water services come in the form of equitable share allocation that comes from the national treasury.

Given the dual role of the SRVM as both a WSP and WSA, it values hierarchical mode of water governance and to a lesser degree, the market style. As a hierarchical mode, the SRVM must ensure that there is sufficient technical knowledge and capacity to deal with daily operational issues as well as ensuring that appropriate standards, norms and principles are set out in terms of the municipal bye-laws. While the technocratic and bureaucratic system within the municipality is responsible for the operation of water services delivery, it is largely subject to political decision and influence, further cementing a hierarchical mode of water governance.

Lower Sundays River Catchment Management Forum (LSRCMF)

The NWA envisaged catchment management forums (CMFs) as grass roots, non-statutory water institutions meant to deepen the democratic space in terms of water resource management. They are seen as vehicles for stakeholder participation regarding decision making on water resource management, and serve as the conduit for diverse interests, stakeholders, and debate. Despite the significance of the LSRC in its contribution to the production and export of citrus in South Africa, and a well-developed inter-basin transfer scheme, it previously had no CMF. However, there is an on-going process led by the Eastern Cape regional office of the Department of Water and Sanitation (DWS) to establish the LSRCMF (DWS 2019). Given that the LSRCMF is not a statutory institution, its objectives are centred around promoting stakeholders' participation in water resource matters, facilitating inclusivity and cooperative governance, as well as providing an avenue for influencing decision and supporting the establishment of the proposed Mzimvubu to Tsitsikamma Catchment Management Agency (CMA). Nevertheless, the terms of reference of the CMF, which are still being debated, cover issues such as operation, strategy and planning, consolidating, and facilitating implementation of water uses as well as accountability. The establishment of the CMF in the LSRC is likely to contribute to and strengthen water governance within the catchment, through a network governance style favouring knowledge co-creation, consensus decision making, debates, mediation and trust building as well as accountability and valuing diverse knowledge and knowledge sources. It is not clear how the CMF will become financially viable as this is not currently addressed in its interim constitution. If financial viability becomes a problem, then the utility of the CMF as a grass root forum for participation may become undermined in the long term.

Citrus Growers Association

The Lower Sundays River catchment supports large scale commercial irrigated agriculture. Majority of the farmers within the catchment are citrus growers, and the inter-basin water transfer scheme was originally established to support the irrigated agriculture sector. The Citrus Growers Association (CGA), which is made up of both commercial and emerging farmers, can be seen as powerful and influential stakeholder grouping regarding water resource governance within the catchment. It came into existence in the wake of the deregulation in 1997 and its revenue comes primarily from levies paid by all growers of export citrus. Its primary objective is to represent the interest of the citrus industry and to ensure profitability and sustainability of the citrus industry, considered as the backbone of the Sundays River Valley economy. The CGA is driven mainly by a market governance orientation to water, and it is thus critical that its roles are balanced by other water management institution in terms of equity and social justice.

Commercial farmers

The commercial farmers within the LSRC are a critical stakeholder as they constitute one of the main water user sectors within the valley. The bulk of the levies and charges paid to the LSRWUA come from the commercial farmers within the valley and are thus very influential in the governance of water resources within the catchment.

The Regional Department of Water and Sanitation – in the absence of a fully established Catchment Management Agency (CMA), the function of a CMA is currently undertaken by the regional office of DWS.

2.3 The Lower section of the Upper Vaal River catchment (with emphasis on the Klip catchment)

The Klip River has been described as one of the most impacted water systems in the country. The main sources of impact include mining, agriculture, and industrial activities as well as municipal wastewater effluent discharges (Wepener et al., 2015). These activities have led to serious deterioration in the river water quality, alteration of flow regime as well other biophysical conditions and characteristics of the river system. Despite these serious threats to the Klip River, it serves competing water user groups within the catchment: domestic, industrial, agriculture, recreation, and aquatic ecosystems (DWA 2012). The bulk of potable water supplied for domestic purposes in the catchment comes from Rand Water through municipalities. Agriculture use a substantial amount of water from the Klip River, estimated to be about 11 Mm^3/annum (Klip River Forum, 2016). Wastewater treatment works own and operated by the East Rand Water Care Company (ERWAT) constitute the main point sources of effluent discharges into the river system. Historically, the Klip River has serviced the mining sector, but in recent years, following the closure of gold mines, the East Rand Proprietary Mine (ERPM) remain the major point source pollution from mines. Various processing industries as well as NAMPAK and EVERITE use water from the river. Recreational and spiritual use of the water include swimming, fishing, canoeing and water baptism by immersion (Wepener, 2015).

The importance of the Klip River system to the South African economy is exemplified by the fact that the river, together with the portion of the Vaal River upstream of the Dam contribute about 46% of surface flow in the Upper Vaal Water Management Area, from which bulk water is supplied to the city of Johannesburg and Pretoria and their surrounding areas. These cities contribute about 20% of the Gross Domestic Product (GDP) of the South African economy (DWAF 2003).

Several formal and informal institutions impact upon the governance of water resources within the lower section of the Upper Vaal River catchment (LSUVC). These institutions operate across multiple scales and jurisdictions. Much of the water within the broader Vaal River catchment comes through international transboundary transfer scheme, managed by national and local institutions within the catchment. It is therefore important that institutional consideration within the catchment considers the international dimensions. Critical institutions to consider here include the Orange-Senqu River Commission (ORASECOM), the Lesotho Highlands Water Commission (LHWC), Trans-Caledon Tunnel Authority (TCTA), Department of Water and Sanitation (DWS), Rand Water, East Rand Water Care Company (ERWAT), local municipalities within the catchment, catchment management forums (CMFs), Save the Vaal Environment (NPO), Vaal Action Group (Voluntary association), Sasol, and ESKOM.

2.4 Key water governance institutions in the lower section of the Upper Vaal River catchment

Orange-Senqu River Commission (ORASECOM)

The Vaal River is one of the major tributaries of the Orange River system. The Vaal River system relies on water transfer through inter-basin transfer scheme from the Lesotho Highlands, and thus the governance processes of water within the Vaal stretched beyond the administrative boundaries of the Republic to include other riparian States of the main Orange-Senqu River system. Realising the imperative for cooperation, consultation and collaboration, the riparian states of the Orange-Senqu River system signed the Agreement for the establishment of the Orange-Senqu Commission (ORASECOM) on November 3, 2000. ORASECOM is the transboundary institution responsible for ensuring that water resources of the Orange-Senqu River systems are sustainably, equitably developed, utilised, and shared among the riparian States.

The Lesotho Highlands Water Commission (LHWC)

The Lesotho Highlands Water Commission (LHWC) was established to facilitate the implementation of the Lesotho Highlands Water Project (LHWP) (Mirumachi and Van Wyk, 2010). The LHWC was formally known as the Joint Permanent Technical Commission through a treaty signed in 1986 by the Apartheid government of South Africa and the military regime in Lesotho.

Trans-Caledon Tunnel Authority (TCTA)

The TCTA is an agency of the Department of Water and Sanitation and is responsible for infrastructure development of LHWP on the South African side. It was established initially to finance, and develop infrastructure related to South African commitment to the LHWP. Its mandate has since been expanded since the year 2000 and is now able to finance and develop water-related infrastructure outside of its original mandate related to the LHWP. It is considered an important water governance institution as it manages the tunnels that deliver water from Lesotho into the Vaal River system.

Department of Water and Sanitation

In the absence of a catchment management agency, the regional office of the DWS plays a key role in the management of water resources within the LSUVC. In addition to its oversight and regulatory function, it is engaged in data collection, facilitating consultation, and coordinating stakeholders as well as water quality monitoring, water use authorisation, compliance, and enforcement monitoring in the catchment.

Rand Water and East Rand Water Care Company (ERWAT)

Rand Water is the primary bulk water services provider within the catchment. It is responsible for bulk water abstraction, treatment, and delivery to municipalities for onward supply to residents. Rand Water has also continued to play active role in water resources management within the catchment. It is currently involved in water quality data collection and monitoring of water flow/volume within the Vaal system.

The ERWAT is responsible for wastewater related services, including conveying, treating, and disposing off treated wastewater as well as sludges. Its activities are of critical importance due to their likely effects on the receiving river resources.

Catchment Management Forums

Active catchment forums within the broader lower section of the Upper Vaal include the Blesbokspruit catchment management forum, Klip catchment management forum, Leeu-Taaiboschspruit catchment management forum and Rietspruit catchment management forum (https://www.reservoir.co.za/).

Non-government institutions

Within the Upper Vaal River catchment, critical non-governmental, organised institutions exist through which civil society and citizens play active role in water resources governance. Critical among these institutions are the Save the Vaal Environment and the Vaal Action Group. Both organisations have similar aims – the protection of the Vaal River system, awareness raising about the danger of pollution, and mobilising citizens to hold government to account through the instrument of the law. The Save the Vaal Environment organised itself as a non-for-profit organisation (NPO), whereas the Vaal Action Group is an association of volunteers.

Industries and mines

The catchment of the lower section of the Upper Vaal is highly industrialised and contains many industrial bulks water users. Critical among them are ESKOM and Sasol.

CHAPTER 3: WATER GOVERNANCE CHALLENGES AND THEIR ETHICAL DIMENSIONS

3.1 Introduction

In South Africa, deepening citizens participation in water governance is being increasingly recognised as a critical process for the realisation of the provisions of the National Water Act (Act No. 36 of 1998). The National Water Act (NWA) provides for the governance of water resources through processes that call for democratisation and deepening of citizen's participation in water resource management. The provisions of the Act are anchored on the need to achieve greater equity, efficiency, and sustainability in the water resource management sector. Achieving good water governance would thus require some forms of decentralization and democratization of the institutions and processes of decision making that affect water resource management, considering the social-ecological context within which water resources are being managed (Folke, 2006; 2007).

The water governance concept is increasingly becoming popular both in the academic and policy literature. This popularity has also led to a diversity of meaning, interpretation and definition of what water governance is all about. For example, the United Nations argues that "*The governance of water in particular can be said to be made up of the range of political, social, economic and administrative systems that are in place, which directly or indirectly affect the use, development and management of water resources and the delivery of water services at different levels of society*" (United Nations, 2002, p 47). This descriptive definition highlights water governance as a complex, multi-faceted, and multi-actor as well as multi-institutional process, operating across multiple scales and domains (economic, social, political, and administrative) of society. Pahl-Wostl (2015a,b; 2019) distinguishes between water governance and water governance systems. According to Pahl-Wostl (2015b, p 26), "*Water governance is the social function that regulates development and management of water resources and provisions of water services at different levels of society and guiding the resource towards a desirable state and away from the undesirable state"* whereas, "w*ater governance system as the interconnected ensemble of political, social, economic and administrative elements that performs that function of water governance. These elements embrace the institutions as well as actors and their interactions"* (Pahl-Wostl, 2019). When one reflects on the latter definition, it becomes clear that a key purpose of water governance is to guide the resource towards a desirable state, critical for the functionality of the social-ecological system (SES). The realisation of good water governance, which ensures that water resources are directed toward a desirable state, is thus anchored on the realisation of the optimal functioning of the water governance system within any SES setting.

There is a growing call for the governance of water resources within SES. This amounts to a call to ensure the interconnectedness, interdependence, and cross-scale dynamics between the ecological and human (social) subsystems are realised (Folke et al., 2005; Pollard et al., 2011). However, the governance of water resources within SES raises complex ethical challenges as water is not only viewed through the lenses of society alone, but also through that of the environment and thus the imperative for balancing the use and protection of water ecosystems. To this end, there has been little research efforts aimed at developing an ethics and value-based

approach for distilling ethical criteria and principles for navigating the array of complex issues such a systemic and holistic view of governance within SES raises.

For example, even though viewing water governance in holistic SES perspective brings about questions of ethics, the relationship between water governance and ethics has not received considerable attention. In arguing for an ethics of water governance Doorn (2013) provides five characteristics of water that need to be considered in developing water ethics (see Chapter 1). When one critiques each of these characteristics alluded to by Doorn (2013), several questions of ethics are raised. For example, the idea of water as a scarce resource, service and risk raises question about distributive justice as effects of water scarcity and service delivery failure may not affect different social groupings in the same way. In South Africa, empirical evidence suggests that the historically marginalised section of society tends to experience more water cuts compared to the more affluent sections of society (Clifford-Holmes, 2014). Within the agriculture sector, emerging farmers tend to succumb easily to the burden occasioned by drought-related risk as they have little coping and adaptive mechanisms. What these illustrate is inequitable distribution of risk, burden and benefits associated with water as scarce resource, risk, and service – raising the need for ethical considerations of water governance challenges. Thus, the objective of this chapter is to review and present water governance challenges as well as their ethical implications in the two case study catchments: the Lower Sundays River catchment (LSRC) and the Lower section of the Upper Vaal River catchment, with particular emphasis on the Klip River catchment (KRC).

3.2 Data collection and sampling strategy

To gain insight into the range of water governance challenges in the LSRC and the Lower section of the Upper Vaal River catchment (emphasis on the Klip), four methods of data collection were deployed: i) document analysis ii) workshop iii) focus group discussion and iv) interviews.

Document analysis

Document analysis involves a methodical engagement with relevant literature with a view to distilling and analysing such literature regarding the subject of interest. Document analysis is a widely used technique for data collection in the social sciences (Madigele, 2018). One of the main advantages of using document analysis as a way of collecting data is that it allows one to gain historical perspectives into current issues, enabling critical reflection of the past, while considering current realities. A systematic review of the literature was undertaken by searching academic databases and relevant government department websites. For the lower section of the Upper Vaal River catchment, the Reservoir website (http://www.reservoir.co.za/) was useful as it hosts minutes of CMF meetings. Specific keywords were used to retrieve documents. The selected keywords included: “Water governance”; water governance challenges”; “water resource management”; “water institutions”; “water user association”; “catchment management forum”; among others. To contextualise the search, depending on the catchment for which the literature was being searched, the keywords “Lower Sundays River” or Klip River or “Upper Vaal” were appended. The retrieved literature included academic thesis,

published papers, relevant catchment documents, minutes of catchment management forum meetings, water policy documents, maps, and archived data.

One of the primary archival documents relied upon for the Klip River catchment and other catchments within the lower section of the Upper Vaal River catchment is minutes of catchment management forum meetings. The reason for this is that the forums serve as a participatory platform where issues relating to water governance and management are discussed by stakeholders within the catchment. The Klip River forum for example is well established, and minutes exist publicly online from 2002-2019. These minutes were thus analysed, searching for themes as well as patterns of re-occurrence of dominant themes to establish trends.

Workshop

Workshops are being increasingly used as data collection techniques as they allow for co-learning, co-creation of knowledge as well critical interrogation of specific domain issues (Ørngreen and Levinsen, 2017). The way in which a workshop is designed and facilitated is critical to the realisation of the objective of research data collection. It is therefore important that workshops are designed to address specific research questions/objectives. In designing the workshop for this study, several factors were considered i) power differentials among participants, ii) diversity of interests and values, iii) sectoral representation iv) openness and open engagement, iv) an environment that favours critical debate rather than being judgemental or discriminatory as well as the need to gain both breadth and depth regarding the subject matter (Canham et al., 2019).

The first workshop, which was on water governance challenges in the lower section of the Upper Vaal River catchment was held on the 21 August 2019 at the Sarabi Country Lodge in Kempton Park, Johannesburg. The workshop was entitled "workshop on ethics and water governance in the Lower section of the Upper Vaal River catchment".

The second workshop on ethics and water governance challenges in the Lower Sundays River catchment was held on 15 October 2019 at the Offices of the Lower Sundays River Water User Association, Main Street, Sunland. The workshop was entitled "Ethics and water governance in the lower Sundays River Valley catchment".

The two workshops were designed to gain both depth and breadth, while also being used as a social engagement instrument with the research participants. At the beginning of the workshop, research ethics matters where clarified with the participants, and informed consent obtained orally. Thereafter, workshop participants took turn to introduce themselves, focusing on their names as well as organisation, specialisation, and interests in the sector. The two workshops had the same format, not because the intent is to compare results from both catchments but to standardize the research process and methodology.

Prior to the presentation by the project team in both workshops, the participants were asked the following questions: i) *what does ethics and value mean to you?* ii) *what are the main benefits you or the sector in which you work, want from the water resources of the catchment?* (Lower

section of the Upper Vaal River catchment for the first workshop and the LSRC for the second workshop) iii) *why do you want those benefits*? iv) *are these benefits currently being supplied in ways that are satisfactory to you? If not, why?* The participants wrote their responses on stickers, the responses were then collated and later reflected to participants in the plenary session. The intended outcome of this exercise was to shed light on participants' view and understanding of the concepts of ethics and values.

At the end of the first exercise, the research team then presented the project with specific focus on the relationship between ethics and water governance, and ways in which ethics could potentially contribute to addressing water governance challenges in the two catchments. After the project presentation, participants were given the opportunity to reflect and ask questions intended to clarify areas that remained uncertain and unclear to them.

To gain critical insights and depth about the water governance challenges facing the two catchments, in both workshops, participants were divided into two groups – constituting two focus group discussions. Each group comprised a minimum of five participants. Participants in each group were carefully selected considering diversity in terms of organisation, background, and interests. Each group had a rapporteur who took notes of the group discussion. In each group, a member of the research team facilitated the discussion, but groups were led by another research participant appointed by the group members. Each group was handed plain A0 papers, stickers, and markers to write down key issues. In both workshops, groups were handed four topics to discuss and these were: i) *Water governance challenges in the study catchment (i.e. what are the water governance challenges in the catchment?)*, *ii) Causes and effects of the challenges (what are the causes and effects of the identified water governance challenges?), iii) How such challenges may be addressed (what needs to be done to address the challenges?, i.e. possible solutions), iv) Possible ethical implications of the identified challenges in the catchment.* All discussions were recorded using a voice recorder (TASCAM, Linear PCM recorder) with consent from the workshop participants. Finally, online interviews were held with catchment stakeholders between August 2019 and September 2020. The interviews were structured to gain better understanding into i) the key governance challenges in the catchments, ii) the key values underpinning water governance in the catchments, iii) an elaboration of the value of equity, efficiency, and sustainability in the catchment and iv) and key water governance institutions operating in the catchments.

3.3 Sampling strategy

A purposive sampling strategy was deployed by targeting people who are knowledgeable about water governance issues and are actively involved in decision making processes as well as being interested in the catchments. The sampling strategy allows for the identification and selection of information rich-cases and is a widely used sampling technique in the social sciences (Palinkas et al., 2016). A month to each of the workshop, an invitation via email was sent to the respective catchment stakeholders via an emailing list maintain by the research leader as well as those of the respective CMF in each of the catchments. Workshop invitations contained an attachment with a comprehensive description of the scope and nature of the

workshop as well as an overall introduction to the main project. A week to the workshop, a reminder email and follow up calls were made to encourage participation.

3.4 Data analysis

The workshop data were analysed using thematic analysis (Braun and Clarke, 2006; Creswell, 1998). Thematic analysis allows the coding of patterns and establishing of a framework for presenting hidden meaning within the data. The framework used followed the six steps described by Braun and Clarke (2006).

3.5 Developing an ethics analytical framework for reflecting on the ethical dimensions of identified water governance challenges

To distil the ethical implications of the identified water governance challenges, we developed an analytic framework based on a brief and synthetic review of the water ethics literature. Water ethics is an emerging discipline, and most of the accounts have been taken from related disciplines such as environmental ethics, climate ethics, and development ethic (e.g. Schockley, 2016; Thompson, 2016). However, the developed framework draws mostly on the work of i) Odume and De Wet (2019) and De Wet and Odume (2019) on environmental ethics, ii) Doorn (2013) on water and justice, iii) Grunwald (2016) on water ethics and Brown and Schmidt (2010) on the value dimension of water.

As earlier indicated in Chapter 1, Doorn (2013) argued for five characteristic of water governance that are critical water governance and ethics. These characteristics include i) water as a risk, a scarce resource, and a service; ii) the nature of water in terms of goods and property right); iii) peoples' human right to water; iv) the transboundary and global dimension of water; v) value pluralism of water. When one considers water as a risk, extensive period of drought – whether natural or human-induced present water as a risk to society (Doorn, 2013). Drought, whether natural or human-induced may have disproportionate effects on different social groupings influence in part by the level of preparedness. This disproportionate effect raises serious ethical implications regarding the question of distributive justice. As a scarce resource, effects of water availability in terms of appropriate quantity and quality, as well as reliability of supply present water as a critical scarce resource, particularly as water is unevenly distributed in nature and across societal constituencies. When one considers water as a service, the assurance of water services provision to all societal groupings irrespective of affordability is the domain of ethics in as much as affordability cannot be used as a justifiable exclusion instrument from the benefits of water services provision.

In South Africa, water resources can be viewed both as a public good and common-pool resource. However, because water is seen as a scarce resource both in terms of quality, quantity and service delivery, some exclusion mechanisms have been developed through the value of efficiency, considering the economic value of water manifested in the form of cost recovery for services delivered. However, if one pursues the value of efficiency through the economic value of water with any rigor, serious ethical challenges are likely to be experienced particularly because of the problem of affordability in a country with a deeply embedded history of injustices and inequalities.

The human right dimension of water has ethical implications for water governance. Viewed this way, the failures of water services providers and water services authority at municipal level imply that these institutions are impeding on the rights of citizens as envisaged in the National Water Act. The distributive justice dimension manifest when failure in water services delivery is more common in less privileged and most vulnerable societal groupings compared to the more affluent suburbs. The recognition of water as a human right has normative content (Doorn, 2013), which includes i) physical accessibility (quantity and quality of water), ii) affordability (i.e. economic accessibility), iii) non-discrimination, iv) access to water information and v) reliability of supply. Thus, analysing the ethics of water governance from a human rights perspective requires that these normative dimensions be given adequate attention.

The transboundary nature of most water resources adds another global dimension to the discussion on ethics and water governance (Rossi, 2015). Transboundary river systems are primarily governed and managed through international agreements aligned with the provisions of the UN Convention on the laws of the non-navigational uses of the international watercourses. Of particular importance in this context is the provision dealing with water allocation mandating States in their respective jurisdictions to utilize international water resources in an equitable and reasonable manner (UN 1997). While upstream States often place emphasis on equitable utilisation for developing water resources through the principle of sovereignty, the downstream States place emphasis on reasonable utilization, and no significant harm to other water resource users for arguing for the retention of historic rights, as currently being exemplified in the Nile River system, between the upstream State of Egypt and the downstream State of Ethiopia. Thus, the ethical principles of solidarity between up- and downstream States, and that of subsidiarity become critical for resolving disputes in the transboundary governance of water resources. Further, at the national and sub-national levels, water flows through multiple catchments, all housing different users – where upstream use may have significant negative effects on downstream users, potentially constraining downstream users' legitimate rights to water as a basic human right. Again, ethical principles of solidarity and subsidiarity become relevant for dispute resolution in water governance processes.

As already argued in Chapter 1, value plays a significant role in the way people interact with water and lay claim to it (De Wet and Odume, 2019). In a pluralistic country such as South Africa, value pluralism would imply that there will be times when multiple values clashes, necessitating the potentially difficult task of ranking, prioritisation, and trade-off (Groenfeldt and Schmidt, 2013). This is particularly true as different values held by different societal groups and/or constituencies may not always be compatible with each other. The principles by which such ranking and prioritization are done have serious ethical implications, and thus are relevant for the field of water governance and ethics. Table 3.1 provides an analytical summary of the dimension of water and the respective ethical implications later synthesised into a more coherent analytical framework.

Table 3.1 Social dimensions of water (adapted from Doorn, 2013) and their ethical implications

Water governance characteristics	**Ethical implications and dimensions**
Water as a risk, a scarce resource, and a service	Risk associated with water may not be proportionately distributed, and even so, not all societal constituencies may have the capacity to cope with and tolerate such risk. Similarly, the effect of water scarcity whether in terms of quantity, quality and reliability of supply may disproportionately affect societal groupings compared to others. The location of water infrastructure, their maintenance as well as refurbishment, including provision of adequate financing and human capacity for infrastructural requirements may necessitate secondary scarcity, which in turn may have disproportionate effects on different societal groupings. Overall, there are significant ethical implications with regards to distributive justice.
Type of good and property rights	The ownership of water and the property right attached to it has significant ethical dimensions. If water is seen as a common-pool resource or a public good with no form of exclusion, then it is likely that the value of water would not be fully recognised, which may lead to over exploitation and ultimately tragedy of the commons. However, attaching economic value to water as a means of exclusion also raises significant ethical challenges particularly that of affordability. Thus, economic value can only be attached to water commensurate to added value by the responsible authority, bearing in mind the imperative for equity in terms of water access.
The human right to water	Guaranteed access to water in all dimensions such as quantity, quality, reliability of supply, affordability, location and maintenance of water infrastructure, access to information and participation in water governance process, is critical to realising the human right to water. The non-achievement, or partial achievement of any of the normative content would impede on the realisation of water as a human right with serious ethical implications.
Transboundary dimension of water	Equitable, fair and reasonable use of water between riparian countries, underpinned by the principles of no harm and that of solidarity, are necessary for agreeing on how transboundary water resources should be managed and governed. At the national and subnational levels, the same principle may also apply, together with that of subsidiarity. If attention is not paid to the above matters, the likelihood of conflict over transboundary water resources is heightened. The

Water governance characteristics	Ethical implications and dimensions
	consequences of such conflict may have disproportionate environmental, social and economic effects among riparian countries as well as communities.
Value pluralism of water	Water may be viewed differently by different societal constituencies depending on the value at play. The single-minded pursuit of one or a few values, without such values being explicitly analysed, debated, interrogated, and clarified, may lead to conflict with other values. For example, the single-minded pursuit of the value of efficiency may lead to conflict with that of equity in the long run – a situation described as normative uncertainty by Grunwald (2016). Since value influences attitude, perception and behaviour towards water, the value dimension needs to be considered, but values must not be taken on the surface, but scrutinised, and clarified, and when necessary, carefully traded-off, or constructively balanced using a set of agreed upon ethical principles and criteria.

Grunwald (2016) argues for substantive and procedural aspects of water ethics. Whereas the substantial aspect has to do with a set of principles that should guide ethical interventions into water systems, and clarify different courses of actions and their implications, the procedural aspect deals with the deliberative aspects of contextualising the principles and deciding on a set of principles best suited for the context, considering the value of fairness and equity during such deliberations. Regarding the substantial aspects of water ethics, Grunwald (2016) sets out four ethical principles to guide water discourses and to be used as heuristics for analysing and reflecting on the ethical implications of human interventions into water systems. These principles are i) human right to water and sanitation, ii) sustaining ecosystem functions, iii) responsible use of water and iv) participatory water governance. Grunwald (2016) argues that ethical principles need to be sufficiently flexible to be adapted to specific contexts.

On the procedural aspect of water ethics, Grunwald (2016) argues for a process of identifying, debating, clarifying, and contextualising the principles in a deliberative manner with interested and affected stakeholders. Deliberative arguments are guided by strict rules on fairness and equity. Processes need to be in place to ensure that issues of power, asymmetrical access to powerful knowledge and information do not become barriers to open and honest deliberations. Further, the procedural aspect calls for openness to debate, and willingness to accept a superior argument, which involves risk taking in as much as one may never know at the beginning the outcome of the discourse. Overall, the deliberative aspect addresses questions of procedural justice, fairness, and equity in the discourse process.

When one engages with the procedural aspects of water ethics with any seriousness, particularly in the context of the law, as a foundational pillar defining how water resources ought to be governed and managed, then the issues of ethics in water management and governance may not be limited to the way water is managed – such as access to water, but also to how laws governing water management were made in the first place. Questions that may be asked in this regard include: was there any intentional participatory environment created during the legislative processes? Who had access to voice their contributions? Who made inputs into the green paper? Whose contributions made it to the final legislation on water management? These questions are particularly useful in the context of South Africa in which transformation, redress and equity are central imperatives for the water sector. We argue that unless the issue of participation in the legislative processes is addressed, the existing power dynamics in the sector is skewed in favour of the powerful players and mediated by a '*compliant state*'.

There is a growing realisation that water needs to be managed and governed within SES context, with explicit recognition of the interdependence, dynamics and relationships between the components and constituencies of the SES. The conceptualisation of water within SES calls for water ethics that is sufficiently systemic, recognising the complexity and inherent uncertainties characterising the SES. The implication, therefore, is that an ethical approach to water governance in South Africa, must be sufficiently systemic (taking account of the complexity of the SES) and relational (taking account of the inherent coupling, relationships, and feedbacks between the components of the SES). Odume and De Wet (2019) and De Wet and Odume (2019) develop the systemic-relational (SR) approach to environmental ethics clearly recognising the complexity of the SES.

The SR approach is innovative because it conceptualises the governance and management of water and associated values beyond the social domain, to include the entire SES, its components, and the relationships between the components. It recognises the mutually constitutive, on-going complementary and co-supportive interactions of the components (and their constituencies) within the SES (De Wet and Odume, 2019). Eleven principles have been developed to help surface values associated with the components, clarify the implications of different claims and claimants, and courses of actions, and to navigate the potentially difficult inescapable element of ranking and trade-off of values, and by implication, of rights related to those values in water governance.

The SR approach postulates that the primary value, and the unit of worth is the entire SES, i.e. the primary value is located at the system level, implying that no analytical or policy weighting is to be made in the first instance, with subsequent weighting influenced by context and agenda (De Wet and Odume, 2019). The 11 SR ethical principles can be interpreted thus; i) the SES is an integrated unit ii) locus of primary value is the entire SES rather than the components (human and environment), iii) equitable treatment of the components, i.e. human and environment, iv) integration of both components cum their instrumental and intrinsic values, v) principle of respect – upholding the intrinsic value and claims of all components as long as possible, vi) principle of inclusiveness, vii) principle of careful balancing and trade-off of values in ways that the health and functionality of the SES is upheld, viii) principle of context ix) principle of active search for relationship and interconnectedness within the SES, x) a recognition of the inadequacy of any singular approach to addressing the complexity of water management, and xi) principle of humility.

Odume and De Wet (2019) develop an SR framework for aquatic ecosystem heath research and management, clearly recognising the interactions of values, institutions, management, and governance context as critical factors determining the direction of flow of ecosystem services and associated benefits as well as ecosystem disservices and associated costs. The framework clearly raises issues of distributive justice (space and time) and externalisation of costs and their ethical implications. The ethics analytical framework, which was used as the basis for reflecting on the ethical implications of the identified water governance challenges is shown in Table 3.2.

Table 3.2 Ethics analytical framework for distilling the ethical implications of the water governance challenges.

Social dimension of water	
Key features	**Example of ethics analytical question(s)**
Water as a risk, a scarce resource, and a service	How is risk associated with water governance, including those of infrastructural failures, maintenance and safety distributed? Who carries the costs of water scarcity in terms of quantity, quality, and reliability of supply? Are these costs proportionate, considering capacity to adapt and cope? Is there evidence of secondary water scarcity and is it (water scarcity) disproportionately affecting some societal groupings? Who carries the costs of water infrastructure failure – including safety issues?
Participatory and inclusive governance	Are platforms supportive of inclusivity in water governance? How is power asymmetry dealt with, including epistemic injustice? Are stakeholder's voices heard? And are they able to influence decisions? Are all concerned and affected stakeholders represented in the governance processes? What are the harms of exclusion? How do we guarantee that everyone is heard or has the capacity to articulate their viewpoint and be heard?
Responsible use of water	Is current use of water compromising possible future use and ecosystem integrity? Are competing uses of water in the catchment fairly and equitably balanced?

	How is responsible use defined? Does the definition consider disadvantages that necessitate some end users must continue to use water in ways deemed irresponsible?
Type of good and property rights	Is the economic value attached to the water resources equitably distributed across various population spectra? Is there evidence of exclusion from the benefits of water resources and services through economic means, i.e. issues of affordability? Are the financial costs attached to the water resources commensurate with the added value by the responsible authority?
Water and sanitation as human rights	How is access to water in all dimensions such as quantity, quality, reliability of supply, and affordability equitably guaranteed and assured? Are the location and maintenance of water infrastructure making it difficult for certain societal groupings to enjoy the full benefit of water as a human right? How should the pursuit of guaranteeing the protection of this right be structured? Is the best approach to eschew all the reasons that are based on economic calculation? How is access to relevant water information to make informed decisions regarding water resources within their catchment guaranteed?
Transboundary aspects (international, national, and subnational)	Is upstream use significantly impeding on downstream users? What are the pieces of evidence of conflict between riparian countries over transboundary water resources?

	Is there evidence of conflict between communities at the national and subnational level over access to water resources? Should global best practices set the tone for water resource governance? To what extent should context shape the future of water governance?
Cultural dimension	
Ritual grounds, sites of worship, identity shaping narratives, sentimental attachment to the ecosystem	How can claims of cultural attachments and implications be balanced with practical challenges and economic claims?
Ecological/environmental dimension	
Sustaining ecosystem function	Are current uses of water resources compromising any component of the ecosystems, e.g. biodiversity, water quality, flow regime, habitats, etc.? Given that there is no consensus about the best approach to achieving sustainability, what are the key factors to consider? Are there sufficient mechanisms in place to protect the aquatic ecosystem from over exploitation? If mechanisms are in place, are they being effectively implemented?
Environmental value of water	Are we humans at liberty to consider water from a perspective that is purely focused on satisfying our needs? To what extent should we consider other species in the environment?
A holistic social-ecological view	
Primary value at the system, i.e. SES level	Is the governance of water resources taking a SES view of the catchment?

	Is more policy weighting given to a particular component and constituencies of the SES over others? Is influence of context sufficiently considered in the policy weighting of the components and constituencies of the SES? Is the governance process and institutional arrangement suitable for the SES context – considering short and long-term agendas? Is due consideration given to the intrinsic value and claims of all components of the SES in policy and managerial matters? How is the idea of relationships and interconnectedness between components of the SES, and their respective constituencies, embedded in water governance processes and relevant policy and management instruments?
Distribution of costs and benefits associated with ecosystem services in terms of space and time (intergeneration)	How are costs and benefits associated with ecosystem (dis)services equitably distributed between societal constituencies in terms of space and time (intergenerational)? Should the disadvantaged and vulnerable members of the community bear less cost? What form of distributive arrangement is just in circumstances where there is already pre-existing inequality?
Value pluralism – careful balancing and trade-off of values when in conflict	Are all values, including environmental values, underpinning claim to water made explicit in the governance process? Is there evidence of single-minded pursuit of a few values to the detriment of others? What are the implications of value trade-off about water governance processes in the catchment?

	How are multiple values brought to constructive balance with regards to water governance?
Equitable treatment of the component of the SES	Is there evidence that a particular component, or constituencies of the SES is being prioritised without due consideration of the implication of such actions on the remaining component and constituencies, including issues of power and voice?
Relationship and interconnectedness within the SES	What is the cost in terms of values, such as trust and integrity, of misalignment of the SES?
Respect of the SES components – upholding the intrinsic value and claims of all components as long as possible	What are the limits of formalistic approach to questions about values? Does it suffice to implement policies and rules?

3.6 Results and Discussion

3.6.1 Conceptualisation of ethics and values by catchment stakeholders

During the workshops the project team sought to understand the conceptualisation and interpretation of ethics and values by workshop participants. This was important as a better understanding of ethics and values would allow participants to engage meaningfully regarding the potential contribution of an ethics and value-based approach to water governance challenges in South Africa. What was clear is that ethics and value may be conceived differently and may mean different things to different people. However, a common thread in the conceptualisation of ethics by both workshop participants was that of "something good". Thus, what was clear was that ethics and values had multivariate meanings. For example, one of the participants in the lower section of the Upper Vaal River catchment indicated that ethics means "*right or wrong*", yet in the same workshop, another participant mentioned that it means "*honourable behaviour*", and still one referred to values as "*morals*", Another workshop participant indicated that ethics means "*integrity, honesty, excellence*".

The responses from participants in the LSRC workshop also indicated the divergent understanding of ethics and value by workshop participants. In the LSRC workshop, ethics was likened to values such as transparency and commitment. For example, one of the participants describes ethics as *"Ethics in the water sector means transparency about the whole value chain of water use and commitment to use water for all stakeholders"*. Further, another participant associated ethics with the values of fairness and non-biasness, manner of conduct, standard of doing things, discipline, and morality as well as the elimination of corruption. Only one participant viewed ethics as principles "*Ethics, principles that we use to distinguish between the good and bad and value, what we consider to be right or wrong*". What is clear from all the responses is that ethics is often associated with something good, although the distinction between values and ethics was not always clear to the stakeholders. However, participants attempted to view ethics in ways that can make a practical contribution to water governance, as alluded to by one of the participants: "*the fair and just manner that all water institutions and individuals need to perform their duties responsibly*".

While ethics and values may have philosophical foundations (Grunwald, 2016; De Wet and Odume, 2019), it is important that these concepts are presented in ways that are accessible to actors within the water governance space to allow for both meaningful engagement and reflection. During the workshop, the project team clarified values and ethics, referring to the former as what specific societal groupings or constituencies express at a generalised level to be good or bad conduct, and the latter as a systematic concern with the principles by which conducts, morals and values are clarified and justified, as we seek to distinguish between right and wrong in our behaviour towards other people and towards nature (De Wet and Odume, 2019). What is clear is that ethics is here conceptualised within the SES, but participants mostly construed ethics from a social/human dimension, and the implications of the unidirectional construction in terms of water governance challenges are reflected and discussed later.

3.6.2 Water resources benefits and values

Thinking about water is value-laden, and values, though not often explicit, influence our conceptualisation and perception of what we consider beneficial, and thus our behaviour towards water (De Wet and Odume, 2019). Depending on ontological commitment, different societal groupings may hold and prioritise different values in relation to water. This in turn may inform their conception of the value and importance of water. Since values often seem abstract, to interrogate the values influencing water governance within the catchments, participants were asked what benefits they (the sector/grouping they represent) want from the water resources in their respective catchments. We recognise here that we are conceptualising values primarily from an assigned value perspective (Schulz et al., 2016). The assumption was that by interrogating the kind of benefits societal groupings wanted from the water resources, one can indirectly interrogate dominant values likely to influence water resource governance, at least from the perspectives of the workshop participants. Responses from participants in both workshops indicated that social-economic value of water dominate the conceptualisation of water and ways in which people are likely to relate to water resources within the catchments. (Table 3.3).

In the Lower section of the Upper Vaal catchment for example, social-economic values indicated by participants include tourism, recreational value, water supply, social-economic growth, but one of the groupings indicated the need for sustained aquatic ecosystem as well as ecologically sustainable development. Similar results were obtained in the LSRC, where participants indicated benefits such as fair and equitable distribution of water resources and services (the value of equity and justice), economic growth (economic value of water), sustainable water services (sustainability as a value), poverty alleviation (economic value of water) as well as clean and treated water for consumption (social justice) (Table 3.3)

Table 3.3 Benefits stakeholders wanted from the catchments and their associated values.

The lower section of the Upper Vaal (emphasis on Klip catchment)		**The Lower Sunday River Catchment**	
Benefit	**Associated value**	**Benefit**	**Associated value**
Recreational	Cultural and economic	Fair and equitable distribution, sustainability of water resources and water services	Equity and justice
Tourism	Economic	Economic growth	Economic
Sustain aquatic ecosystem	Ecological	Water use education	
Good water quality	Ecological, economic, and social	Water is not tied to certain groups	Equity and justice
Socio-economic growth	Economic	Equitable distribution of the resource in a cost effective and sustainable manner	Equity and efficiency

The lower section of the Upper Vaal (emphasis on Klip catchment)		The Lower Sunday River Catchment	
Benefit	**Associated value**	**Benefit**	**Associated value**
Water to supply demand	Social	Poverty alleviation	Social – distributive justice
Ecologically-sustainable development	Relational	Redress imbalance	Social – distributive justice
		Increased wealth creation	Economic and social
		Water use efficiency	Efficiency
		Clean water, especially for rural poor	Social justice

Analytically, the workshop results seemed to suggest that participants mainly viewed water from the social component of the SES. Apart from two instances where environmental/ecological sustainability is indicated as a key benefit or value, benefits associated with the social dimension of water dominated the conceptualisation of water resources within the catchments, indicating that governance processes are likely to give more weighting to the social dimension of water rather than seeking to balance both components of the SES (De Wet and Odume, 2019; Odume and De Wet, 2019). As argued by De Wet and Odume (2019), if we are to take the SES concept seriously, then values do not only reside in the component of the SES, but also in the relationships and interactions between the components and their constituencies, as well as the emergent properties of these dynamic interactions. Nevertheless, values are dynamic and may change over time (Pignatti, 2013). Since this project was the first-time catchment stakeholders were being engaged on the matter of ethics and values, it will be interesting to track the evolution of values, and thus gauge the impact of the project on water governance processes in the respective catchments.

3.6.3 Water governance challenges in the lower section of the upper Vaal River catchment and the lower Sundays River catchment

A systematic review of the literature and workshop, interviews and focus group discussion results indicated that several challenges confront the governance of water resources within the two studied catchments. The key challenges are thus discussed, and their ethical implications distilled thereafter.

Challenge 1: Effective participation, institutional legacies, and transformational challenge

The NWA envisages participation and representation as key values within water management institutions, which should ideally influence the governance of water resources, steering the resource from an undesirable state to a desirable one. Several grassroots institutions are envisaged to give effect to stakeholder participation and representation. One such non-statutory institution is the catchment management forums (CMF). Catchment management forums create platforms for the public and stakeholders to participate in the management of water resources

within a catchment. However, what remain is whether a CMF is an enabling institution for effective participation that can influence water governance and decision making. CMFs can be seen as a network governance mode, but evidence from the forums within the lower section of the upper Vaal River catchment suggests that many stakeholders do not see a CMF as effective because decisions made are not binding, and key government officials responsible for decision making are not attending CMF meetings regularly. For example, in the lower section of the upper Vaal River workshop, one of the participants claimed that "*if there is a problem like pump failure at a pump station, it takes long time for the municipality to react and fix the pump and they cannot complain to the government, because no one from the government is attending the forum*, *but there is a big failure from the government side, because first of all, I have my quarterly meetings with the stakeholders and without fail the representative from the local municipality never pitch up so we can't even talk with them about the issue"*. The participants indicated that stakeholders and the public rely on the government to fix and address water related problems in the catchment, "*but it is a challenge if the government is not involved in the forum because that's where these issues are being raised and ideas on how to solve the issues"*. While the intent behind the conceptualisation of CMF is commendable, it seems that the water sector in South Africa, dominated by a hierarchical governance mode, still has not realised the value of a network governance mode, which provides an opportunity for peer accountability, trust building, participation, knowledge co-creation and mediation – all of which are critical characteristics of network governance (Pahl-Wostl, 2019).

Water User Associations (WUA) are conceptualised as institutions for the management of water resources at the local scale, and are supposed to be inclusive, equitable, efficient, and representing diverse interests of water users in their respective catchments. However, where irrigation boards formally existed, the NWA provides that such irrigation boards are to be transformed into WUAs, reflecting the diverse interest of users, away from the primary interest of irrigators. The Act further provides that members of irrigation boards shall automatically become members of the newly formed WUAs, inadvertently giving such members powers to set out the constitution, define the function of the WUA within the ambit of the law. The implication of transforming irrigation boards into WUAs is the problem of institutional legacies (of inequity, separation, and oppression) and transformational challenges, deepening power differentials, locked-in authority, while slowing imperatives toward more equitable representation and distribution of water resources as evident in the LSRWUA (Madigele, 2018).

A review of the constitution of the LSRWUA indicates that there are provisions for equitable representation within the management committee of the association, considering geographical coverage, sectors, and emerging farmers (LSRWUA 2005). However, for representation to be effective, it must be able to influence decision making. The constitution stimulates a pro-rata system of voting, where voting quota is tied to the quantity of water ordered from and authorised by the WUA as well as the size of land under irrigation (LSRWUA 2005). Given the LSRWUA has historically been dominated by the commercial farmers and have also served the interest of these powerful stakeholders, these provisions seemed to suggest that WUAs are not able to serve diverse interests, to engineer broad-base representation and reduce power differentials between the powerful and marginalised. As noted by Roy (1981:1289) institutions

do not only exist because they perform certain functions, but also because they serve certain interests, and in most cases the interests of certain powerful groupings. This view was supported by participants in the LSRC workshop, in which one of the participants bluntly echoed "*review your constitution… that constitution is racist".* Further elaborating, the participant indicated "*the reason for this issue of emerging farmers or black people (*emerging farmers not participating in meetings of the LSRWUA), *this association was extremely racist before now*…". The view that the LSRWUA is still very much exclusive and inequitable is still very much widespread among emerging farmers within the valley as acknowledged by one of the workshop participants "*uhh, I won't sugar coat it, we do come from a very racist background…. We need to break that barrier down, now…".* It is hoped that breaking down *that barrier* would engineer equitable representation in decision making. A good starting point would be the review of the constitution as already alluded to by the workshop participants.

The various policy thrusts that flow from the NWA entrust a strong political agenda to WUAs, conceived as vehicles for redressing apartheid era legacies of inequalities, inequities, skewed representation, and social justice. However, empirical evidence suggests that WUAs are being impeded in their mandate of redress by institutional legacies of vested interests and power relations inherent in irrigation boards (Orne-Gliemann, 2008). Nevertheless, compared to other WUAs operating in similar catchments, the LSRWUA can be said to be relatively efficient in its operations.

Challenge 2: Accountability, cooperative governance, clear roles, and responsibilities

Accountability and cooperative governance failures have been identified as a serious governance challenge plaguing the water sector in South Africa (Weston and Goga, 2016). In South Africa, policies and laws exist whose intentions are to strengthen cooperative governance and inter-governmental relations, but as noted by participants in both workshops, cooperative governance exist in principle but not in practice because of silo mind-sets. One of the participants mentioned that *"the different government departments do not work together because they see working together as interference when other departments come to help, especially amongst the ministers*". The results suggest duplication and inefficiency in terms of resource wastage as a critical governance challenge. For example, one of the participants indicated that "*the implication of non-implementation of cooperative governance is the duplication of work and resource use efficiency. For example, the Department of Agriculture and Rural Development have a lot of things that they do which are similar like agriculture stuff, but do not work together*".

Linked to failure of accountability and cooperative governance is clarifications of roles and responsibilities. The OECD water governance initiative identified 12 principles for good water governance (OECD 2015). Clear roles and responsibilities within water institutions and governance systems are seen as indicators of good water governance (Berg, 2016). However, frustration was evident among workshop participants indicating a lack of clarity regarding roles and responsibilities within the regulatory and management systems. For example, one of the workshop participants noted "*there is definitely a miscommunication in the chain of responsibility between the water management institutions, the regional and national. I would be 100% frank, I'm not always convinced that the person I'm speaking to is the correct person*

because, it's a little bit convoluted". The implication of lack of clarity regarding roles and responsibility is the difficulty of achieving accountability in the governance of water resources within the catchments.

What also emerged is that the non-implementation of cooperative governance has led to the DWS not acting on municipalities when they discharge raw or partially treated sewage into the river systems, because the DWS has to prove that they have exploited every other avenue to help the municipalities in addressing the problem. A further implication of non-cooperative governance implementation in the catchments is the perception that municipalities are not accountable for their actions, as evident in the high levels of pollution due to municipal wastewater treatment works failures in the water resources within the lower section of the Upper Vaal River catchment.

Challenge 3 Absence/near absence of effective leadership and management

Berg (2016) argued that an often overlooked, but very important factor for good water governance is the individual, what the author termed leadership. According to Berg (2016), even in dysfunctional and inefficient arrangements, some people still stand to gain. The author argues that strong and visionary leadership is necessary to steer organisations in the right direction, as policies are not self-implementing. There is a general perception that absence or near absence of effective leadership was a major challenge for water governance in the lower section of the upper Vaal River catchment. This perception was particularly acute regarding the top leadership responsible for water resource management. There was also a perception of inadequately skilled personnel within the top leadership across sectors connected to water resource governance and management within the catchment. For example, one of the participants mentioned that "*When both the top echelons are failing, it means that down there it become a vacuum because the juniors if they are not getting support will struggle to do the work [as] they are supposed to*". Regarding management, there was also the belief that the top management is the engine and driver that ensures the smooth operations of Departmental functions. As pointed out by one of the participants in the lower section of the Upper Vaal workshop, "*for example, in the DWS if they have a mandate and the manager of that department does not drive that mandate and make sure it is measured and acted upon, the department will not meet the set goal or targets".* There was a serious concern about skills and experiences, and the importance of having highly skilled and experienced people in management and leadership positions within the sector. This was stressed as experienced leadership and management can provide direction for effective water governance processes and outcomes. These views were echoed by one of the participants who indicated that "*If the top managerial people do not know what to do, how do we expect the people from the bottom to know".* These views are not in isolation of the governance literature, as a number of governance studies have stressed the relevance of capacity and professionalism as critical for effective water governance (OECD 2015; Berg, 2016).

Challenge 4: Systemic integration failure of the water-land-agriculture (food) nexus, including institutional integration

Despite the growing recognition that water be governed and managed within SES, emphasising relationships between the components, including the link between water and land (De Wet and Odume, 2019), in practice, silo thinking still pervade the water sector. Water policy instruments seem to focus on water without accounting for the inherent relationship between water and land, and between water, land, and agriculture. The non-systemic view of water in the context of the water-land-agricultural nexus has led to policy fragmentation and piecemeal management strategies. These views were particularly strong in the LSRC where agriculture is the main economic driver within the catchment – as one of the workshop participants pointed out "*…silo thinking, silo mentality, in the department, and various departments, we can't work together"* and "*…and this silo mentality has led to delinking of water and land, but you can't produce food without land*"

Among the participants, there was a strong feeling about what is here described as *legislative overcrowding* within the water, land, and agriculture sectors. The workshop participants felt that because of too many pieces of legislation, there are too many role players with regulatory functions, making it difficult to coordinate and integrate both horizontally and vertically. This specific view was particularly strong in the LSRC where one of the workshop participants indicated *"and that again has to do with lack of co-ordination, because there is too much legislation…"* As will be seen in the next section, legislative overcrowding, and the regulatory system failure are linked, as participants were of the view that they were being overwhelmed with directives from various institutions, making compliance and even interpretation of such directives difficult.

Challenge 5: The regulatory system and the failure of implementation

South Africa is often hailed as being progressive in terms of the National Water Act. However, progress on implementation is lagging. Several challenges slowing implementation have been identified, which include issues related to policy, institutions, and the legislation (Weston and Goga, 2016). Regarding legislation, the delay in the ongoing revision of the NWA, and the amalgamation of the NWA and the Water Services Act (Act 108 of 1997), which is intended to streamline regulatory processes and systems across the entire water value chain is seen as a major challenge within the regulatory environment. Further, participants in the lower section of the Upper Vaal workshop argued that implementation was a major impediment to any meaningful progress with regards to the regulatory environment. The workshop participants believed that failure of implementation of the available regulatory system is one of the main water governance challenges, which has resulted in multiple illegal waste discharges into the water resources of the lower section of the Upper Vaal River catchment. One of the participants argued that "*we have many regulations, but they are not implemented, they just do the surface stuff but the deeper stuff they are not doing*".

An effective regulatory environment requires strong, agile, and effective water management institutions (Berg, 2016). For water management institutions to be effective, there needs to be clarity of mandates, roles, and responsibilities as well as certainty regarding the functionality

and structure of such institutions. The frequent reshuffling of the national department of water, has led to a state of constant flux, bringing about uncertainty in water governance. Linked to the idea of clarity of mandate is communication between water management institutions, particularly where one such institution has a regulatory function, and the other an implementing function. In the LSRC workshop, clarity in terms of regulatory communication was highlighted as a major water governance challenge. "*...the department issue a whole lot of directives, in terms of measuring water, transfers, permanent transfers…From an organisation [LSRWUA] view, it is very hard to see the intention of the particular directive, makes it difficult for us to understand what is required in the implementation of it [the directives]. I don't only speak for this particular water users, because other water user associations have the same problem, if you speak to great fish [the Great Fish River Water User Association], we might all receive the same directive but different ways we're interpreting it, so the interpretation could be completely different".* These observations regarding clarity in terms of communication between water management institutions is critical if we are to accelerate implementation of the relevant regulatory provisions.

To address the identified communication challenges within the regulatory environment, it was suggested that the principle of prior participation be implemented for affected water management institutions. Prior participation entails the involvement of the implementing agencies or water management institutions in the formulation and design of specific regulatory instruments, including directives. For example, referring to the challenges of communication, one of the LSRC workshop participants indicated that *"...there isn't good and effective communication within the different departments and the various institutions, and may be there isn't a prior participation and engagement of intended institutions for which directives are being formulated, because if you have been engaged before, even before the formulation of the directive, you would have better understanding of where the intention is coming from*" These observations highlight the importance of cooperation and collaboration within and between water management institutions as critical elements for addressing water governance challenges. Meene et al. (2011) indicated that urban water practitioners viewed cooperation and collaboration within and between institutions as ingredients that are likely to facilitate actor's positive engagement with other actors whether within or between water management institutions.

The delays in the establishment of catchment management agencies (CMAs) meant that the water sector is losing out on the value of decentralisation and having water management institutions closer to the people and the catchments that are being managed. In the workshop of the LSRC, there was a general feeling that part of the implementation challenge was because of a top-down, command and control approach, typical of the hierarchical mode of governance. The implication is that on the ground realities are not adequately captured in the formulation of regulatory instruments, making the implementation of such instruments challenging and difficult. This sentiment was echoed by one of the LSRC workshop participants *"...part of the problem, the government is a top down, control and command. Where in reality any sustainable resolution must be a ground up, so the people who this thing (regulatory instrument, e.g. directives) is intended for have not been consulted…the water users are expected to implement something [regulatory instrument] but in practice, it does not reflect what is happening in the*

*environmen*t." What is clear from these observations is the need to accelerate the establishment of CMAs, for the decentralisation of water resource management function, contributing to a hybrid governance mode (Meene et al., 2011).

Challenge 6: Financing, infrastructure, and technical capacity

A sustainable financing mechanism is critical to the realisation of good water governance (Neto et al., 2018). One of the 12 OECD principles speaks to mobilising and transparently allocating finance for effective and efficient water operations and management, including the maintenance, refurbishing, and upgrading of water infrastructure (OECD 2015). The principle recognises the value of sustainable financing for the delivery of water services as well as managing, conserving, and protecting water resources. The principle calls for transparent and effective allocation of financial resources, something that can only be achieved when mandates, roles, and responsibilities regarding ownership of water infrastructure is clear. While water services delivery and operation of water resources management are significantly constrained by aging infrastructure nation-wide, this is particularly significant in the LSRC as indicated during the workshop. Aging water resource infrastructure, particularly the canals, was identified as grey areas regarding institutional responsibility for upgrading, refurbishing, and minor maintenance – all of which have significant implications for budgeting and transparent allocation of water finance. One of the workshop participants lamented thus "*the challenge from my point of view is system deterioration and infrastructure deterioration, that to me is a massive and serious matter*". Corroborating the infrastructure and financing challenges, and the confusion about mandates and responsibilities further, another workshop participant indicated that "*mm that whole point [infrastructure financing and maintenance] in terms of the contract is very vague, there are clauses in there that say no, the Water User Association is responsible for maintenance and minor refurbishment, so the department [Department of Water and Sanitation] for initial construction and refurbishment, but there is no definition exactly what is meant and what the parameters are…I have legal opinion that says no the Water User Association is not responsible for fencing, in terms of the contract with the Department it falls within their regime, but when I speak to someone from the department, they say whoa hang on you need to speak to someone in maintenance, but my point of view is how can I maintain, what is out there, it's really a grey area in terms of the contract that needs to be clarified…so it's a, b and c that I'm responsible for, and not a and b.*" There is on the ground evidence that suggests that the lack of contractual clarity between the Department and the LSRWUA has led to the collapse and deterioration of water resource infrastructure as indicated by one of the workshop participants "*…here for example, we have lost a section of the canal…the bureaucracy and the red tape that we had to go through to get it replaced is ridiculous, and it's over two years now, and repair and construction work is going at a snail pace"*

Technical capacity is needed for effective and efficient water resource management. One of the 12 OECD principles of water governance speaks to the imperative for technical capacity and adapting same for the complexity involved in water resource governance and management. Good water governance can only be implemented by skilled and competent professionals, but inadequate technical capacity within the LSRC and the lower section of the Upper Vaal River

catchment, was identified as a critical challenge on the realisation of water governance within the catchments.

3.6.4 The ethical dimensions of the water governance challenge

Using Table 3.1 as a heuristic, the ethical implications of the identified governance challenges are summarised in Table 3.4.

Table 3.4 Ethical implications of the identified water governance challenges.

Water governance challenges	**Ethical implications**
Effective participation, institutional legacies, and transformational challenge	The ineffectiveness of participatory platforms such as CMFs in the lower section of the upper Vaal River catchment raises a range of ethical concerns including limiting citizen's ability to influence water management and governance processes, as well as dealing with water issues of urgent concern to catchment stakeholders. Delays in dealing with pollution incidences for example, have disproportionately contributed to deterioration in the system water quality, as well as the health of the most vulnerable segments of the stakeholders within the lower section of the Upper Vaal River catchment. Participatory platforms are meant to foster peer accountability, trust building, mediation in cases of dispute as well as valuing and respecting diverse knowledge sources and systems. Their ineffectiveness raises serious ethical concerns regarding ways in which catchment stakeholders hold themselves and the authority to account, as well as ways in which they influence water resource decisions. Serious ethical concerns exist regarding perpetuating power differentials regarding access to water resources within the Lower Sunday's River catchment. For example, the National Water Act provides that members of irrigation board shall automatically become members of WUA, inadvertently giving such members powers to set out the constitution, define the functions of the WUA within the ambit of the law. This raises serious ethical challenge as historically powerful interests within irrigation boards retain enormous disproportionate influence over the agenda and trajectory of the LSRWUA. The LSRWUA constitution stimulates a pro-rata system of voting, where quota is tied to the quantity of water ordered from and authorised by the WUA as well as the size of land under irrigation (LSRWUA 2005). The ethical implications are that the commercial farmers who over the years have power over decision making of the LSRWUA continue to do so, with very little room for the late comers, who are mostly emerging

	farmers and other water user groups. Serious ethical challenges are further raised regarding transforming irrigation boards into WUAs, in the form of institutional legacies (of inequity, separation and oppression) and transformational challenges, deepening power differentials, while slowing imperatives toward more equitable representation and distribution of water resources within the LSRC.
Accountability, cooperative governance, clear roles, and responsibilities	In a country where most people live in poverty, resource use optimisation should ideally be prioritised. However, a serious ethical concern is the sense of resource use inefficiency and wastage among government departments because of poor intergovernmental relations and cooperation. Accountability is blurred because of a lack of clarity regarding various roles and responsibilities within the water governance system within both catchments. A serious ethical challenge is that stakeholders are often not clear who to hold responsible for system and infrastructural failure, thus diminishing stakeholder influence over decision making, and the governance of water resources within the catchments. For example, it was not often clear who the responsible institution was for certain infrastructural refurbishment within the LSRC. From an environmental point of view, poor accountability and cooperative governance has led to serious pollution in the form of effluent from municipal wastewater treatment works (WWTWs) in the water resources of the lower section of the Upper Vaal – raising serious ethical questions around responsible use of water, and ecosystem integrity within the catchment.
Absence/near absence of effective leadership and management	Effective leadership is necessary to steer water resource governance and management in the right direction. The ethical dimension is the externalisation of the negative consequences of poor leadership outcomes such as poor decision and inability to make decisions, to the entire catchment stakeholders as well as the environment. For example, stakeholders blame top leadership for the poor operational state of water institutions within the lower sector of the Upper Vaal, which has led to serious environmental pollution of the systems. This further raises the question of equitably treating all components (and their constituencies) within the SES.
Systemic integration failure of the water-land-agriculture(food)	Ethical approaches to water resource management calls for an explicit system view, clearly recognising complexities, relationship, feedbacks and interconnectedness. Institutions responsible for water resources management within the LSRC

nexus, including institutional integration	seem not to have sufficiently adopted a system view in their practices and operation, raising serious ethical concerns as to whether implications of their actions and decisions are fully appreciated in the broader context of the water-land-agriculture nexus. This is particularly pertinent in the LSRC where emerging farmers continue to battle with fragmented policies and practices, delaying operational take-offs of farms, with serious implications for farmers who depend on farming for their livelihoods. Further, the non-systemic view of water in the SES context implies that relational values are not made explicit in decision making, with negative consequences for relationships and interconnectedness between components of the SES. Further, a review of the constitution of LSRWU suggests that emphasis is placed on the social dimensions of water over the cultural and environmental dimensions – again raising serious relational questions in terms of social and environmental sustainability.
The regulatory system and the failure of implementation	Failure in the implementation of appropriate regulatory instruments such as the discharge charge system, the resource quality objectives, the reserve and compliance with water use licences, particularly by municipal WTWW have compromised people's access to the full benefits of water resources in the lower section of the Upper Vaal River catchment as well as ecosystem functionality. Further, failure of the regulatory system has led to multiple illegal waste discharges into the water resources of the Upper Vaal with significant ethical implications for the rights of other users to the water resources. Subsidiarity is an ethical principle anchored on the realisation that water governance and management must be rooted in realities on the ground. To do so, water management institutions need to be closer to the people and the catchment where such water resources are to be managed. The delays in the establishment of catchment management agencies (CMAs) mean that on the ground realities are not adequately captured in the formulation of regulatory instruments and policy measures, leading to a mismatch and difficulty in implementation and a stakeholder sense of ownership of such policies.
Financing, infrastructure, and technical capacity	A serious safety concern is raised regarding the water canals in the LSRC. The safety concern is mostly related to canals near residential areas of historically marginalised social groupings in the catchment. The canals transport water mostly to

	commercial farmers, and other users. The question of distribution of risk and benefits associated with canal safety is a serious ethical matter, as those who seem to benefit less from the canals, are the ones most at risk to their safety occasioned by the location of the canals. A review of the LSRWUA's constitution reveal that it does not make explicit provision for canal safety, education and awareness raising among communities. It is important to note that the canals existed even before some of the settlements around them were built, however more needs to be done to address safety concerns as an urgent matter of distributive justice. Financing challenges, clarity of mandates and roles between water management institutions in the LSRC are aggravating the effects of aging water infrastructure regarding maintenance and safety. Effects of aging and non-maintenance of water resources infrastructure are mostly felt in poor areas, where people have little means to either adapt or cope with water supply interruptions – raising ethical concern regarding equitable interventions and support systems within the LSRC. On the ground evidence suggest that lack of contractual clarity between the Department and the LSRWUA has led to the collapse and deterioration of water resources infrastructure as indicated within the Valley, raising serious concern about water resource use efficiency as well as sustainability. Several ethical concerns exist regarding inadequate technical capacities (highly skilled and competent professionals) within the two catchments. Firstly, wastewater operational failure, leading to frequent sewage spills and pollution, posing a health hazard to people relying on the water resources, as well as compromising the functionality of the ecosystems – thereby raising concerns about long term environmental sustainability. Secondly, impacts of operational failure because of lack of technical skills aggravates the challenges of water supply services within the LSRC, with disproportionate effects on the poor (Clifford-Holmes, 2015). Thirdly, inefficiency in the operation of water services supply systems within the LSRC, compromises long term sustainability of service delivery.

3.7 Conclusion

This chapter develops an analytical framework for reflecting on the ethical implications of the water governance challenges in the two catchments. The framework developed has multiple

dimensions which can serve as a heuristic when thinking about the ethical dimensions of water governance challenges. The results presented in this chapter indicate that stakeholders often link values of good behaviour to ethics, and do not always have a complete understanding of the distinction between ethics and values. If water governance is to yield normative fruits within the catchments, then the identified water governance challenges need urgent attention with particular focus on their ethical dimensions. In some instances, new institutional designs or alterations of the design of existing institutions may be necessary, e.g. the notion of transforming irrigation boards to water users' associations, which has proved difficult in addressing the transformative and equity imperatives set out in the Constitution and the National Water Act.

CHAPTER 4: ETHICS AND INTERACTIONS OF VALUES IN WATER GOVERNANCE – TOWARDS GREATER EQUITY, SUSTAINABILITY AND EFFICIENCY

4.1 Introduction

Good water governance is being increasingly recognised as a process that could address critical water challenges such as those of scarcity, risk, service delivery, infrastructure maintenance, ecosystem degradation, deepening citizen participation and negotiating multiple values associated with water resources and related services (Pahl-Wostl, 2015a,b; 2019; Berg, 2016). The growing call for the governance of water resources from a complex social-ecological system (SES) perspective amounts to explicit recognition of the interconnectedness, interdependence, and cross-scale dynamics between the ecological and human (social) subsystems. This also amounts to explicit recognition and taking account of values within the components and relationships of the SES and their emergent properties (Folke et al., 2007; Pollard et al., 2011; De Wet and Odume, 2019). However, the governance of water resources within SES raises complex ethical challenges as water is not only viewed through the lenses of society alone, but also through that of the environment and thus the imperative for balancing the use and protection of water ecosystems. Values are said to underpin water governance processes, decisions, and institutional arrangements.

Values play a significant role in the way water is governed, managed, used, and protected (Brown and Schmidt, 2010; Odume and De Wet, 2016; De Wet and Odume, 2019). Some authors such as Schulz et al. (2017) have argued that many of the conflicts around water are indeed value conflicts, in which the actors or stakeholders involved are unable to reconcile their different value standpoints. In South Africa for example, the three values of equity, sustainability and efficiency are enshrined in the National Water Act as though they were principles, assuming the level of "*de facto"* status in the way that water is viewed, managed, protected, and governed (RSA 1998). Therefore, an analytical study of values is critical to thinking about water resources, the multiples ways in which values may interact with each other and how such interactions may influence water governance processes and decisions, and the implications thereof.

The study of values is complex and multidisciplinary in nature. In developing a conceptual framework relating values to water governance, Schulz et al. (2017) provided a succinct account of the multidisciplinary nature of values. The authors distilled three categories of values viz fundamental values, assigned values and governance-related values. Fundamental values are those related to abstract trans-situational goals and are more enduring (Schwartz et al., 1996). Assigned values are those that humans ascribe to the rest of nature such as intrinsic versus instrumental values (e.g. economic, and aesthetic values) of water. Governance-related values are derived from the normative view of governance and are mostly the characteristics of good governance, which may include efficiency, sustainability, accountability, transparency, and equity (OECD 2015; Neto et al., 2018).

The conceptualisation of values differs depending on the discipline. For example, in the field of environmental ethics, much attention has been paid to the debate around assigned values in the form of intrinsic versus instrumental values of nature (water) and how such ascription of values should form the basis of human-environment relationships and actions (Kronlid and Öhman, 2013; Thompson, 2016). The dichotomy between intrinsic and instrumental values has led to some authors such as Gruen and Gaard (2003) to introduce the concept of relational values, which emphasises relationships between humans and the rest of nature. More recently, De Wet and Odume (2019) argue that while relational values can be seen as a step forward in terms of bridging the dichotomy between anthropocentrism and non-anthropocentrism, the concept of relational values is not sufficiently systemic as it seems not to emphasise the importance of the system at which values may relate with one another. These authors introduce the concept of systemic-relational values such as interconnectedness and interdependency, arguing that values are to be in three domains viz: the component of a system, the relationships between the components and their sub-components, as well as the system (encompassing the multiplicity of interactions, cross-scale dynamics, and feedbacks).

In ecological economics for example, the benefits people derive from nature are valued in both monetary and non-monetary terms. Ecological economics departs from environmental economics in the sense that it emphasises multiple ways in which the environment is valued, e.g. the economic and ecological values of water, whereas the environmental economics is concerned with human well-being because of the services or goods derived from nature. In environmental economics therefore, the unit of value is human well-being rather than the service or goods being consumed. The Millennium Ecosystem Assessment report (MEA 2005) has popularised concepts in ecological economics and are pervasive in the ecosystem services literature as well as related policy documents (Muller et al., 2010; Muller and Burkhard, 2012).

The concept of value pluralism is inherent in water and its governance. For example, in some communities, people see water more from a spiritual perspective, whereas in other societal groupings, the economic value of water is supreme (UN 2008). The practices, actions, and behaviour of institutions responsible for water governance are also largely influenced by values being promoted at the institutional level. Given that water holds multiple values, and such values may interact in different ways, it is critical to develop an analytical/regulatory framework for thinking about value interactions and the ethical implications thereof.

In this chapter, we recognise the multidisciplinary meaning of values. First from a philosophical conception, in which we take value to mean what specific societal groupings or constituencies express at a generalized level to be good or bad conduct (De Wet and Odume, 2019). This definition of value is akin to what Schulz et al. (2017) refer to as fundamental values, underpinning our attitude and behaviour towards other people and the rest of nature. However, in as much as fundamental values are important in influencing claims and claimants towards water, values ascribe to water by individuals or societal groupings are also important. Such values manifest as spiritual, ecological, economic, and aesthetic value of water. Thus, following Schulz et al. (2017), in this chapter, we take account of both fundamental and assign values as we consider both important. Good governance is critical to the realization of

sustainable water resources management in ways that are ethical. We also accept the notion of governance-related values as the normative characteristics of good governance. Overall, the analysis and reflection provided in this chapter take account of all conceptions of values. Therefore, the objectives of this chapter are to i) identify the key values informing water governance, claims and claimants in the two catchments and ii) develop an ethical framework for analysing the interactions of these values and iii) use the framework to analyse and reflect deeply on the interactions between the value of equity, efficiency and sustainability and the ethical implications of these interactions and iv) demonstrate how greater equity, sustainability and efficiency can be realised in the catchments.

4.2 The value of equity, sustainability, and efficiency

Equity

The values of equity, sustainability and efficiency are construed as fundamental in the National Water Act. In the Guide to the National Water Act (No date) equity was interpreted as everyone having access to water and its benefit as well as ensuring fairness to all in the decision process of allocating water. However, this conceptualisation of equity is not sufficiently encompassing as it only identifies two dimensions of equity: distributive equity and procedural equity. A third and fourth dimensions of equity, namely contextual equity and recognitional equity, are ignored in this definition yet are critical for South Africa given its history of contexts that impede many people from acquiring the capabilities to engage meaningfully in decisions of resource allocation and access (McDermott et al., 2013; Loft et al., 2017).

Distributive equity focuses on how costs, benefits, risks, and burden are shared/allocated among people and social groups arising from resource governance, policy, and implementation practices (Leach et al., 2018). Distributive equity is one of the dominant forms of thinking and of mobilising for equity over the past few decades (Schloberg, 2007; Fraser, 2009). Flowing from the theories of justice, one can apply both the consequence-based and rule-based theories of justice to equity (McDermott et al., 2013). Utilitarianism and welfare economics are the two dominant theories of consequence-based conception of distributive justice, which can be applied to equity. While utilitarianism seeks to achieve the greatest good for the greatest number of people, welfare economics concerns itself with maximising individual utilities as a function of aggregate social welfare (McDermott et al., 2013). For both utilitarianisms and welfare economics, efficiency in the distribution of costs and benefits is important for realising utilities (Loft et al., 2017).

Rule-based theories of distributive justice applicable to equity (McDermott et al., 2013) place emphasis on the application of fair rules in the sharing and allocation of costs, risks and benefits among people and social groups (Loft et al., 2017). These theories do not focus on the outcomes per se, but on the rules applied leading to the outcomes. Here, the guiding question is whether the rules are fair. Rule-based theories of distributive justice include libertarianism, egalitarianism, merit-based and need-based. Libertarianism emphasises freedom of equal right to opportunities for all members of the society (McDermott et al., 2013). Provided the outcomes for members of the society are accruing from the exercise of equality of right, then such

outcomes should be considered as just and fair, irrespective of whether some members gain to the detriment of others because of their unique and unequal circumstances. In an egalitarian system, benefits and costs are distributed equally to individuals regardless of their starting point (Leach et al., 2018), whereas merit-based system promotes the proportional allocation/sharing of benefits based on the relative contribution of the individual to the productive activity from which the benefits are derived/accrued (Konow, 2003). Under need-based systems, it is argued that justice ought to recognise and be sensitive to the different needs of people because of inherent disadvantages imposed upon them by societal structures (Rawls, 1971). Thus, under the need-based system, a just social allocation is that which reflects individual needs.

Political and governance processes are important considerations in terms of how people participate in and influence the decisions affecting water resources and related services. Procedural equity emphasises fairness in how decisions are made, in how people participate in those decisions making processes, as well as fairness in representation of social groups of involved and affected parties (Loft et al., 2017; Leach et al., 2018). It pays attention to issues of power dynamics, access to information and powerful knowledge. It also pays attention to discourses that may result in unequal participation and influence over decision making processes that determine the allocation/sharing of benefits, costs, risks, and burdens. Procedural equity is fundamental to water governance as it addresses inclusivity, participation, and representation.

Culture, identity, and values influence people's conception of and relationship with water. Recognitional equity stresses the relevance of respect and due regard for people's identity, culture, and values. It sheds light on vices such as discrimination, oppression and domination based on one's identity (e.g. race, ethnicity, sex, nationality, religion), values and culture as injustices and unfair practices (Fraser, 1995).

Several authors such as Sandel (1990) and Pelletier (2010) argue that context matters in the pursuit of equity and that equity is situated in contextually contiguous phenomena. Thus, equity ought to pay attention to and be sensitive to pre-existing conditions that create an unequal playing field and starting point for people. The pre-existing social, technical, economic, environmental, political, and historical (STEEP-H) conditions can facilitate or constrain people's capabilities to effectively participate in and influence the governance processes on the distribution of benefits, costs and risk associated with water and related services. Contextual equity pays attention to contextually relevant factors that impact on people's ability to effectively participate in and influence the distribution of costs and benefits. Contextual equity seeks to level the playing field for all, and to address such pre-existing conditions that brings about injustices and unfairness.

McDermott et al. (2013) argue that unless the goal of equity is defined, it may become impossible to measure, monitor and track equity-related improvements or otherwise. Equity may operate at different social scales, e.g. the individual, communities, sub-national, national, and global. Therefore, a focus on the scale and goals of equity may thus help to identify and define the necessary parameters of equity (McDermott et al., 2013).

In analysing the ethical implications of equity as a value influencing water governance in the catchments, we pay attention to the following:

- Dimensions of equity – i.e. distributive, procedural, contextual and recognition.
- The target of equity – i.e. who counts as a subject of equity and why?
- The scale of analysis of the equity – i.e. at what social scale is equity operating in the catchments?
- The goals of equity – i.e. what goals are equity intended to achieve in the catchments, e.g. in the Lower Sundays River catchment.

Sustainability

Leach et al. (2018) distinguish between sustainable development and sustainability, referring to the former as a process and the latter as an outcome or property. Sustainability is conceptualized as having three interrelated, and interconnected dimensions of environmental, social, and economic. When viewed from these three pillars, it implies that sustainability is an integrative, all-encompassing concept spanning beyond environmental sustainability alone. When viewed from the perspective of SES, sustainability can thus be a life-support system coupled with social processes, both of which are dynamic, and on-going interactions across multiple spatial-temporal scales (Leach et al., 2018 Odume and De Wet, 2016). Within this context, sustainability is thus about the sustainability of the SES, its components, relationships, and emergent properties, defined and bounded at an appropriate analytical scale (De Wet and Odume, 2019). For example, the value of environmental sustainability features prominently in the NWA and has been given considerable attention through the Ecological Reserve (RSA 1998). Environmental sustainability has been conceptualized as protecting the environment both now and for the future (De Wet and Odume, 2019). This view of environmental sustainability raises another dimension of justice, namely ecological justice.

The idea that water is a necessity for all life-forms implies that it is not only humans that could reasonably be said to have claims to water, as a good and service. Non-human species in as much as they need water to thrive, reproduce and flourish in their environment could thus have justifiable claims to water (Baxter, 2004). Within the category of distributive justice, Baxter (2004) in his book on *A Theory of Ecological Justice* argues that "we (humans) must do right by other life-forms, but in a precise kind of way, namely by recognising their claim to a fair share of the environmental resources which all life-forms need to survive and to flourish" (Baxter, 2004: pp 4). Thus, the notion of ecological justice extends the notion of distributive justice to non-humans in terms of fair allocation/ distribution of environmental benefits and burdens (Baxter, 2004). Simply put, ecological justice is a form of distributive justice that recognises fairness in the allocation of environmental resources between humans and the rest of nature. It emphasises that in a human-non-human relation, without good moral reasons, moral agents have obligations not to deprive other species their fair share of environmental resources needed to reproduce and thrive. From a philosophical viewpoint, Baxter (2004) provides arguments for why all non-humans should be part of the justice community and thus should also be part of the distributive justice community. Given the increasing recognition that

water is embedded in SES, the notion of ecological justice offers an insightful entry point for ethical judgement and analysis that goes beyond the social realm, to the wider SES.

Efficiency

Efficiency has its history in economics. In the Guide to the National Water Act (No date) the former Department of Water Affairs (now the Department of Water and Sanitation) understands efficiency to mean minimising or avoiding wastage of water and channelling water and associated resources for the best possible social and economic development. This conceptualisation of efficiency has been criticised by De Wet and Odume (2019) as it does not encompass the different types of efficiency (Palmer and Torgerson, 1999). However, when one considers this definition of efficiency it seems to imply socially responsible and an economically prudent way of using, controlling, conserving, and protecting water resources – which are the objects of the National Water Act itself. Palmer and Torgerson (1999) and De Graaf and Paanakker (2015) construed efficiency as a performance value, which is concerned with the relationship between input resources (time, capital, labour, etc.) and either intermediate outputs or final outcomes. When framed this way, an efficient water governance system is that which produces the greatest results or has the greatest possible outcome with the least number of resources. If viewed within the lens of social justice, an efficient water governance is that which impact the greatest number of people with the lowest input of resources. In terms of the ethical framework, the value of efficiency is consequential in the sense that it is utilitarian in outlook.

Palmer and Torgerson (1999) distinguish three types of efficiency i) technical efficiency, ii) productive efficiency and iii) allocative efficiency. The authors argue that technical efficiency is the physical relation between an input resource and an outcome. In this sense, an efficient system is that in which no greater possible outcome can be achieved by using less or more input resources, as this would amount to inefficiency. A key characteristic of technical efficiency is that the intervention or input resources are the same or similar. Consider the disinfection of 20 litres of water with chlorine. Provided the water is taken from the same source and is being disinfected at the same time, if for example 200 mg of chlorine is sufficient to disinfect the 20 litres of water, applying 250 mg of chlorine amount to inefficiency. However, the comparison of different interventions resulting in comparable outcomes is the domain of productive efficiency (Palmer and Torgerson, 1999). Productive efficiency is concerned with interrogating the relative costs of different input resources to achieve comparable outcomes. It emphasises maximising outcomes for a given cost, or minimising costs for a given outcome (Palmer and Torgerson, 1999). In the context of water governance, a productively efficient system is that in which water resources outcomes are maximised by using less costly input resources. The efficiency in which outcomes flow from productive efficiency are distributed or allocated to communities is the domain of allocative efficiency. In a sense, an efficient allocative system is that in which the distribution of outcomes is maximised for members of the community so that an alternative allocation system leaves one or more-person worse-off compared to the efficient allocative system. It needs to be noted that the three dimensions of efficiency interact and in a way that they impact one another (Palmer and Torgerson, 1999).

When one reflects on the conceptualisation of efficiency in terms of water governance, the following become evident:

i) Efficiency concerns itself with optimisation of input resources for the greatest possible outcomes, i.e. it concerns itself with the end.
ii) Efficiency does not concern itself so much about procedures or processes in as much as the end justifies the means. Thus, according to De Graaf and Paanakker (2015) efficiency is not a procedural value, rather, it is a performance/outcome-based value.

For analytical purpose, we distil the following dimensions for efficiency analysis in water governance

- Type of efficiency, i.e. what type of efficiency is the focus of the analysis, that is technical, productive, or allocative efficiency?
- The objective of the efficiency analysis – what is the target (system) that is being analysed and why?
- The scale of efficiency analysis – i.e. at what social scale is the target being analysed?
- The parameters of efficiency judgement – how are the input and outcome being assessed, measured at the appropriate scale? How is efficiency judged, that is what are the parameters used in judging efficiency?
- Unit of analysis – comparative analysis, what unit of measurement or analysis is being used?, e.g. chlorination of 20 L of water per minutes.

4.3 Methods

4.3.1 Identifying key values influencing water governance in the two catchments

To identify the key values influencing water governance, claims and claimants, four broad methods were applied i) document content analysis and ii) workshops and iii) focus group discussions and iv) interviews. These methods have been elaborated upon in Chapter 3. Briefly, a systematic review of critical literature in the two catchments was undertaken. For the Lower Sundays River catchment, literature reviewed included the Constitution of the Lower Sundays River Water Users Association (LSRWUA 2005), terms of reference of the evolving Lower Sundays River Catchment Management Forum, academic thesis (Clifford-Holmes, 2015) and published and unpublished reports (DWAF 2004). For the lower section of the Upper Vaal, literature reviewed included reports regarding the Vaal Water Management Area (DWAF 2004), constitutions of the relevant catchment management forums (CMF), minutes of CMFs (http://www.reservoir.co.za/), published and unpublished reports related to water resource management and governance in the catchment.

The data generated from the two workshops and focus group discussions held on 21 August 2019 at the Sarabi Country Lodge in Kempton Park, Johannesburg (Lower section of the Upper Vaal catchment) and 15 October 2019 at the Offices of the Lower Sundays River Water User Association, Main Street, Sunland (Lower Sundays River catchment) were analysed with a

view to surfacing key values influencing water governance and the potential interactions between the values as well as their implications.

Since values are mostly implicit rather than explicit, and often seem abstract, to identify and assign values to water resources in the catchments, workshop participants were asked to write down and reflect on the benefits they or the sector they represent, gain from water resources within the catchment. Specifically, the questions were phrased as i) *what are the main benefits you or the sector in which you work want from the water resources of the catchment?* ii) *why do you want these benefits*? iii) *are these benefits currently being supplied in ways that are satisfactory to you? If not, why?* The participants wrote their responses on stickers, and the responses were collated and later reflected to participants in plenary. The intended outcome of this exercise was to elicit participants assigned values to water resources and unpack the motivations behind the assigned values. In the focus group discussions, the questions of value claim, as well as values embedded in water governance processes in the two catchments were discussed. Overall, through the systematic review of the literature as well as focus group discussion and interviews, values influencing water governance, claims and claimants in the catchments were surfaced.

4.3.2 Ethical framework for analysing value claims

To analyse the values underlying water claims and claimants in the catchment and assess how these values may interact necessitates a deeper probing into the nature of ethics. It is important to discuss in some details an analytical framework that will guide judgement about the values in this context. The question to ask is why and how the claims advanced in the catchments amount to value claims and the implications of how these values may interact. Why, for instance, is the claim of accessibility a value claim and what distinguishes it from any other kind of claim? Furthermore, what does it mean that the claim of accessibility is in constant conflict with the value of sustainability or efficiency? To address these and related questions, the most viable approach is to consider the broader field of ethics and develop on that basis a detailed analytical framework of analysis. In what follows below, we will discuss the nature of ethics to contextualise the different ethical theoretical frameworks that are useful in determining the values underlying water claims and claimants in the catchments.

Ethics is a field of inquiry constituting a central part of the field of philosophy. As such, it is a field with a unique approach to exploration of its subject matter. To see what this specificity amounts to, we need to explore the nature of ethics against the background of its philosophical origins. Philosophy generally differs from other fields of inquiry because of the nature of the questions it addresses. Predominantly, the field focuses on examining fundamental questions of reality, especially in the context of human experience. Thus, philosophical questions can be seen as ‘why’ questions. This contrasts with other disciplines that raise and answer questions we can describe as ‘what, how and where’ questions. By focusing on the study of ‘why’ questions, philosophy attempts to uncover the purpose of human experience in different areas. It does not aim to present us with facts we must accept as axioms. Instead, the aim is to propose ways of thinking and assessing human thought. In doing this, the goal is to procced step by step towards uncovering the most justified and plausible answer to fundamental questions.

Seen in the light of this general focus of philosophy, ethics attempts to uncover the nature of moral life. It is the field concerned with exploration of reasons that explain how we should act towards other human beings, the environment, and other non-human components of the world. By asking, for instance, why it is justified to demand that human beings should not commit murder, ethics aims to uncover not just the meaning of the concepts employed in the statement, it also aims to justify why this expectation is plausible and holds for every human being. From the purview of our project, ethics is essential specifically because it provides the means to uncover the nature of the value-claims raised in relation to water as a scarce resource which is essential for human survival and ecological balance. Using the tools of ethics to further our exploration in this project implies acceptance of interdisciplinarity as a formidable approach to research on water resource governance.

Although ethics asks fundamental questions about reality as already noted, the inquiry does not proceed in an arbitrary fashion. It is a coherent field of exploration in the sense that it contains a body of thought against which further development of thought can be evaluated. To attain the goal of this aspect of the project, therefore, we will rely on insights embedded in the history of ethics. This means that we will leverage the theories of moral action developed in the history of the field in conceptualizing our analytical framework of analysis. Dominant theories of ethics are consequentialism, deontological ethics, virtue ethics, ubuntu relational ethics, supernaturalism and more recently in the field of environmental ethics, the systemic-relational ethics.

Consequentialism is a framework of analysis of right action for many reasons. These reasons are evident in the nature of the theory. As a moral theory, consequentialism is the view that morally right action can be determined by looking at their consequences. This is the reason utilitarianism, which is the main consequentialist moral theory, proposes that morally correct actions maximize benefits for the greatest number of people. A maxim that expresses the core tenet of utilitarianism can be stated in the following terms: ‘a morally right action should aim to produce the greatest values for the greatest number of people’. Seen from this perspective, consequentialist moral theories propose that we should always act with a view to generating the greatest value for the majority of those affected by our action. First developed by the philosopher, Jeremy Bentham (1748-1832), this framework of moral analysis was enriched because of the nuances and refinements introduced by John Stuart Mills (1806-1873). The two relevant issues for consequentialism are: 1) that judgment about morality of action depends on the consequences, 2) we ought to aim at generating greatest value for the number of people affected. Part of the reason for consequentialist moral theory’s focus on the consequence of an action to determine its rightness or wrongness has to do with the focus of Bentham and Mill on legal and social reforms. Both were interested in finding a way to reform their society and position it for better efficiency.

Consequentialist moral theory proposes that the rightness of an action can be shown through measurement of utility. Actions should aim to maximize happiness. This is what will make the valuable because it is by measuring the amount of happiness or utility produced for the greatest

number that we ought to make judgements about rightness of actions. The nature of good action consists in the pleasure produced for the greatest number of people affected.

In consequentialist moral theory, a distinction is made between two types of values, namely, neutral value and relative value. A neutral value refers to the type of value that is not dependent on any agent for validity. For instance, the utilitarian view that an action is right insofar it produces the greatest happiness for the greatest number of people reflects a neutral value. The reason is that the happiness in question does not have to refer to any human being to make sense. Its meaning is generic. This contrasts with relative value that refer to specific individuals. For instance, in acting to produce the greatest happiness for my religious group, we will be acting on the basis of a conception of value that is relative. Consequentialist theorists mostly disavow relative values for obvious reasons. The main reason is that the moral theory seems to work only when we can be sure that everyone's happiness counts equal. Thus, it is of little consequence whether those for whom my action is supposed to produce the greatest amount of happiness belong to my family, religion, community, or school. What is important is that I act in such a way that will maximize the greatest amount of happiness for the greatest number of people.

Deontological theories of ethics are generally the opposite of consequentialist theories. For this family of moral ideas, actions are right insofar they cohere with the expectation about what we ought to do. Etymologically, it is the study of duty – *deon* being the Greek word for duty and *logos*, the science or study of something. It is the view that evaluation of actions or moral problems should proceed from the perspective of duty, where duty refers to the sorts of obligation that hold for every human being unconditionally. Deontological moral theories are often related in some ways to the moral philosophy of the German philosopher, Immanuel Kant. In Kant's view, actions are not right or wrong in virtue of their consequences. His view is that the principles or maxims that guide one's actions are of central importance if we want to evaluate the rightness or wrongness of one's actions. Kant proposes that human beings are ends in themselves, meaning that no human being should be treated as a means to an end. A central aspect of what it means to be a person for this moral theory is to possess autonomy. It is generally because we all are autonomous, rational persons that forbids our being used as a means to an end. Rather than focus on the consequences of an action to judge whether the action is right, what we ought to do is to consider the actions themselves in light of the rules, principles or maxims that motivate them.

In deontological moral theory, value inheres in the actions that we carry out because of respect for duty. We have to act for the right reasons or motivations for our action to truly be morally worthy and commendable. The motivation and nature of our action matter for the evaluation of their rightness or wrongness. Acting out of regard for duty means to act out of a conviction that we are fulfilling an obligation we owe to others.

Virtue ethics refer to the theories that propose we ought to act with reference to who we should become as persons. The emphasis is on acting out of respect for virtues, such as charity, generosity, benevolence, honesty, etc. By making virtues central to judgment of the morally right or wrong action, virtue ethics shows predominant concern with the coherence of our

actions to basic human traits everyone ought to cultivate. Virtues in this regard are the characters human beings develop over time as a result of constant practice. Virtues are like habits because they become part of us due to constant practice. However, they are more than mere habits as they define our outlook and nature as persons. An honest person embodies the virtue of honesty, for instance, because it disposes them to a certain way of perceiving reality. According to virtue ethics, therefore, value inheres in those actions that are carried out due to regard for human virtues.

Ubuntu moral theory refers to the family of ideas that propose morally right actions are so in virtue of their capacity to further interpersonal relationships among people. For this perspective on judgment about human actions, it is essential to act in ways that preserve and further interpersonal relationships because harmonious co-existence is a value that is not just worth aspiring towards. It is a value that our very nature as human beings demand. Thus, we are human precisely because we embody a relational nature, hence the maxim of ubuntu that 'I am because we are'. To evaluate therefore the moral rightness or wrongness of an action, it is essential to consider to what extent the action cultivates and advances community. Ubuntu moral vision demands that we act to promote harmonious co-existence of people because it is by promoting this value that our action reflects our nature as dependent beings. Harmony is thus essential because it promotes community and community is important because it reflects who we are as persons.

Values for this paradigm of moral thought inheres therefore in those actions that aim to realize the core of relational personhood – such as mutual assistance, benevolence, care for the weak, respect for consensual decisions, etc. Because the goal is to advance collective life, Ubuntu-based values place a lot of emphasis on duties. It is generally the case in this paradigm to consider as vital those duties we owe to other people and the community. This, however, does not mean that it does not have a place for rights. One's rights in this scheme accrue from the duties of other members of the community. In sum, "the main idea is that the harmonious relationship of all within the community is the basis of the decision regarding the correctness or plausibility of the norms of conduct or the good life" (Okeja, 2018, 217).

Systemic-relational (SR) ethics has recently been developed with the environment in mind (Odume and De Wet, 2006; De Wet and Odume, 2019). It postulates that humans are part of the rest of nature in ongoing complex, systemic and mutually constitutive relationship in social-ecological systems (SES). It argues that the component of the SES, and their constituencies all have values in as much as they are in on-going complex interactions, but that the primary value is to be located at the system level as an integrated unit in as much as the system supports the component parts. From an SR perspective, human actions are judged in terms of whether the unity of the system is respected. Action that seeks to undermine the unity of the SES system, such as those that lead to, for example, destruction or serious alteration of the aquatic ecosystems may thus be qualified as morally undesirable whether they are utilitarian in nature.

From the foregoing, there is diversity of perspectives on how to evaluate a morally right action. This means that developing a framework of analysis of value claims in the catchment under analysis requires adoption of a multiple analytical track. That is the only way to capture the

nature and of the justification offered for the different claims advanced. In this regard, we sort the different value claims into categories, corresponding to the diverse ethical frameworks considered above. This is important because, whereas some of the claims arise against the background of consequentialist thought, there are others we can understand only when considered from the perspective of the other frameworks of ethics. Once the claims are sorted out in this way, it becomes easy to see where the conflicts arise and the possible ways to resolve these conflicts.

4.3.3 Framework for analysing value interactions in water governance – towards greater equity, sustainability, and efficiency

Water governance is value laden (Brown and Schmidt, 2010; Berg, 2016). For example, the normative view of water governance and associated characteristics of good governance are expression of desired values that should steer both the procedural and substantive aspects of water governance. However, despite the increased recognition of values in water governance, not much research has gone into analysing how different values may interact and the ethical implications of such interactions. To analyse the ways in which values may interact, we develop a framework for thinking about value interactions and the implication thereof. Our framework is based on the concept of *value interaction zones dynamics*. Value interaction zone dynamics refers to the dynamic ways in which the values, e.g. the value of equity, efficiency and sustainability are intertwined, which can be depicted as zones of interaction. The framework is based on three value interaction zones dynamics: i) mutually enhancing zone dynamic, ii) conflictual zone dynamic, ii) neutral zone dynamic (Figure 4.1).

The mutually enhancing zone dynamics refers to the zone of value interactions in which the goals of one value are concurrently realised with those of other values, e.g. that of sustainability, equity, and efficiency, leading to co-benefits. The outcome of the dynamic interactions of the values in this zone are co-supportive, co-enabling and co-reinforcing leading to the achievement of greater equity, sustainability, and efficiency in the long-term. This is the desirable zone to strive for.

Values may often come into conflict, in which the pursuit of one value may lead to negative effects on the other value. It has long been recognised that the pursuit of one value, may inherently limit the pursuit of other equally important values (De Graaf and Paanakker, 2015). For example, De Graaf and Paanakker (2015) demonstrate the dilemma face by public administrators in the pursuit of the value of efficiency and that of lawfulness. The conflictual zone dynamics refers precisely to a situation where the goals of equity, efficiency, and sustainability for example, come into conflict, leading to trade-offs. Trade-off implies that the pursuit of say equity may come at the expense of efficiency or sustainability or vice versa. Within the conflictual interaction zone, outcomes of one value may constrain, counteract, and even reverse the achievement of another value.

The third zone of interaction is the neutral one. The neutral zone dynamics refers to instances in which the pursuit of one value do not have either negative or positive effect on the outcome of another value. The three zones do not stand in complete isolation rather movement between

the zones is facilitated by a range of factors that determine which zone plays out in specific circumstances. For example, it is the choices, actions, and decisions of rational agent/actor in the governance process that make real the ways value may interact, whether mutual, conflictual, or neutral.

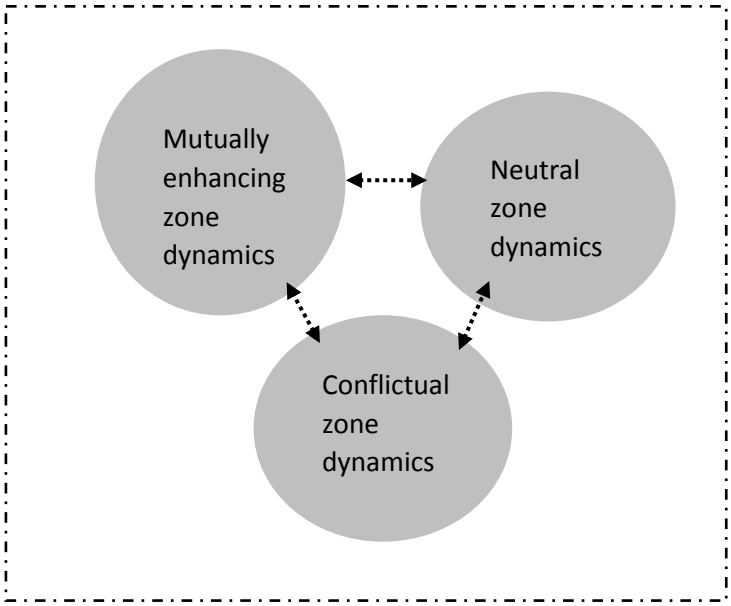

Figure 4.1: Value interaction zones dynamics as a framework for analysing interactions of values in water governance

4.3.4 Factors that determine which interaction zone dynamics playout in specific context

Several factors affect and determine which interaction zone dynamics plays out in specific context. These factors are i) the context, ii) governance, iii) time-frame dependence iv) spatial-scale dependence v) agent and capability, and vi) resources and investment.

Context

The social, technological, economic, environmental, political, and historical (STEEP-H) context plays vital roles in determining which interaction zone plays out in specific cases. These contextual factors can impact on the interactions between for example, the values efficiency, sustainability, and equity in varied ways. For instance, the political environment may emphasis equity imperative in specific localities due to historical social injustices. However, without corresponding emphasis on efficiency and sustainability, in the long-term the equity goal may remain elusive. There are other ways context may influence the interaction zone dynamics. For example, environmental spatial planning/settlements that make access to water and water-related services for certain social groups difficult can impact on the pursuit of equity (spatial inequity) and efficiency – think of the Apartheid spatial planning policy.

Governance

Governance plays a vital role in the ways interactions between values plays out. Poor governance can deepen existing inequalities and inequities, while concentrating resources in the hands of a few elites (Leach et al., 2018). For example, when decisions are made about water allocation for emerging farmers to address equity imperative without due consultation or involvement of such emerging farmers in the decision-making process, such an enterprise is bound to fail because inputs and perspectives that reflect the realities of emerging farmers have not been adequately considered.

Agent and capability

The concentration of power in the hands of a few can lead to exploitation of water resources to the detriment of most people, knowing fully when that they have the power and capability to influence the decision-making processes. This in turn can deepen inequity and unsustainable environmental practices (Leach et al., 2018). Addressing power dynamics as well as factors that constrain people from effectively participating and influencing the governance processes is key. If this is not done, powerful interests tend to manipulate the game to their advantage, thus perpetuating inequity, inefficiency, and unsustainable practices.

Time-frame dependence

The outcomes of the interactions between values develop and manifest over time. Some may have immediate short-term results, while other may take longer to manifest. For example, an efficient irrigation system servicing historically marginalised people may produce immediate short-term equity outcome, advancing both the goals of efficiency and equity. However, say the historically marginalised farmers have no proper market access, leading to wastage across the value chain, even if the goal of efficiency, narrowly defined as irrigation efficiency is realised, that of equity may not be realised in the long-term until such a time when challenges of access to market have been addressed. Similarly, as emerging famers grow their operations, they may apply fertilisers to increase farm produce, providing better income for the emerging farmers in the short-term. However, such fertilisers application may impact on the quality of receiving water resources in the long-term due to lag between when fertilisers are applied and when environmental consequences manifest. Thus, in designing projects or policies the time-frame dependence of the interactions between values is an important consideration.

Spatial and jurisdictional-scale dependence

The complexity of the interaction between the values increases with increasing spatial and jurisdictional scale. Accounting for multi-spatial dynamics that impact on the outcome of the interaction is critical for policy and project design. This would include both administrative, e.g. from local to national, and biophysical scales, e.g. from reach site to catchment level. As the scale increases more factors impact on the interactions, and the complexity increases, potentially making it more difficult to stay within the mutually enhancing zone dynamics.

Whatever the case, it is important to clearly demarcate the spatial scale of interest, e.g. equity for the individuals, households, or community at the river basin level, within a locality.

Resources and investment.

To achieve any of the values require considerable on-going investments in policy reforms, human capital development, training, infrastructural development, and maintenance as well as measures to protect freshwater ecosystems from excessive exploitation. Adequate resources, including financial and human resources thus need to be set aside for the pursuit of the desirable mutually enhancing zone dynamics, where the interactions between the three values of equity, sustainability and efficiency are mutually enhancing, re-enforcing, co-enabling, producing co-benefits.

4.4 Results and discussion

4.4.1 Key values influencing water governance, claims and claimants in the two catchments

Through the systematic review of the literature as well as focus group discussion, and interviews, the key values influencing water governance, claims and claimants in the catchments were surfaced. Tables 4.1 indicates the key values influencing water governance and claims as well as their conceptualisations in the two catchments by the research participants.

Table 4.1: Key values influencing water governance and claims in the Lower Sundays River and in the lower section of the Upper Vaal catchments

Value	**Value conceptualisation by research participants or in relevant catchment documents**
Efficiency	Efficiency is conceptualised mainly in terms of water use efficiency, water distribution, cost recovery and administrative efficiency.
Sustainability	Sustainability is conceptualised in terms of economic and social development as well as protecting aquatic ecosystems.
Equity	Equity is conceptualised in terms of fairness in regulating and distributing water resources and associated services within the catchment. Redressing historical imbalances in terms of access to water resources and participation in water governance processes.
Diversity and inclusiveness	Diversity has been conceptualised in terms of representation of diverse interest groups, social groupings in water governance processes, whereas inclusiveness refers to an attitude that seeks to incorporate all social

Value	Value conceptualisation by research participants or in relevant catchment documents
	groupings in social-economic-political systems as it affects water governance in the catchments.
Transparency	Transparency seems to be conceptualised as an attitude of openness in decision making processes regarding water in the catchments.
Justice (social)	Justice has been conceptualised in terms of fairness in the distribution and allocation of water related benefits and costs, with the aim of redressing historical injustices in the catchments.
Accountability	This value seems to be conceptualised in the emerging Lower Sunday Catchment Management Forum, the Constitution of the Lower Sundays River Water User Association as well as minutes of meetings from the catchments in the lower section of the Upper Vaal as holding actors in the governance process responsible for their actions/inactions as well as decisions.
Cultural	This relates to cultural claims that shape identity, sense of place, emotions, as well as spirituality of people within the catchments.
Ecological	This relates to the value of worth place on the non-human species, the ecosystems, and its components as vital in sustaining lives but also as ends in themselves.

4.4.2 Value interactions

Case study 1: Interaction between the value of efficiency, equity, and sustainability in the Lower Sundays River catchment (towards mutually enhancing zone dynamics)

The Lower Sundays River catchment is known for extensive citrus farming on a commercial scale. An equity agenda was to support the establishment of the so-called resource poor farmers, also known as emerging farmers, to become viable commercial farmers in the catchment. To achieve this equity goal, one of the interviewee remarks, "*the then Minister of Water and Forestry (Kader Asmal) set aside water for irrigation of 3000 ha of land for emerging farmers within the Lower Sundays River catchment".* However, the then Department of Water Affairs and Forestry, in its internal strategic perspective of the Fish-Sundays River catchment, noted that nearly all emerging farmers irrigation schemes have not been successful because the emerging farmers have not been able to run a successful operation to pay for their operating and variable costs (DWAF 2005). The difficulty of successfully supporting emerging farmers in the catchment attest to what might be required to achieve the value of equity in the water sector. The inability to realise the value of efficiency in operation by emerging farmers thus impact on the broader goal of equity. However, one emerging farmer, who was one of the research participants puts it this way: "*once you are allocated land and water, the bills begin*

to run, and whether you use it or not, you are still required to pay. This is not helping" This assertion illustrates the complexity involved in realising equity. While it may be possible to blame the emerging farmers for failing, it seems that the prioritisation of efficiency in terms of cost recovery may have also impacted negatively on emerging farmers, and thus their inability to run a successful operation. Here, the value of efficiency (cost recovery) and that of equity (redressing historical injustice through support to emerging farmers) are in conflict, i.e. the conflictual interaction zone dynamics is at play.

Recounting the practical complexity of equity goal in terms of access to water and land (distributive and procedural equities), one of the interviewees provided a detailed account as follows: "*what they (government) don't understand is one, are the practical factors that they need to follow to be actually productive. The first one is access to land, no land was identified and made available for Black farmers that would apply for those 3000 hectares. So, what was the use of you just making 3000 hectares of water available, yet you don't make the practical means for them to attain the water, meaning the land. If you don't have the land to use for production purposes that water is going to stay in the air. Then if you have got the land, then you must understand that you need R250 000 a hectare to put in the infrastructure, the dams, the pumps, the irrigation system, the trees, the fertilizers, the soil preparation which is your bull dozing… All those things, then you must nurse that tree up until it gets to full production. Those things are not understood because the people inside of government have never ventured practically in that industry. So, then they start to appoint consultants and consultants will cut corners to give you the product if he safeguards his money. So, a consultant might do the job, but he might not do the job 100%. Meaning, now you might have problems 8 years down the line, then after 8 years the product does not meet international standards because it has particular sickness, because there is a process that they might have overlooked during the procurement of the trees."*

What is clear is that equity, which would lend itself to efficiency and then sustainability requires a range of considerations i) a system and nexus approach (land-water-agricultural nexus), a value-chain perspective (farm to market-income-farm), addressing agent capability (e.g. through technical training and capability development), and a thorough appreciation of reasonable time frame for sustained, nurtured investment. For example, Hollington and Matsetela (2012) argued that for emerging farmers to succeed in South Africa, in addition to financial and infrastructural support, technical training, networks, access to market, credits, land and the right attitudes must be in place. Reflecting on how efficiency could be achieved while striving for equity, and the importance of understanding time-frame dependence, another interviewee remarked "*And the issue of efficiency is very tricky because if you don't have the skills, you're not going to be efficient. It's tricky because it goes to how are you utilizing your irrigation water, what knowledge do you have. And the issue of efficiency it's not like it's going to be efficient now, it's going to take years to be efficient in terms of the water usage. Because just like the … the commercial farmers, they are efficient now because they have been there in the space of agriculture for long".* Achieving the type of equity sought in the LSRC in the irrigation sector would require substantial upfront investments, over the short, medium, and

long terms. The challenges of such investments, particularly financial, were captured by the research participants in the quote below:

" ...the condition for emerging farmers was that for them not to be a burden on the existing irrigation board and water user association they should have some financial assistance that come with them. The Department (Water and Sanitation) use to support them but in the past three years renewal of funding has caused a lot of problems for these emerging farmers. Because of that we (LSRWUA) no longer support them, we no longer budget for those people, which is a challenge all over the system in the water user association" In addition to the funding challenge, which seem to hinder the realisation of equity in the catchment, training, infrastructure and payment for water utilised were also identified as critical barriers to equity as indicated here " *the issue with training was there, the issue of infrastructure was there and the issue of support was also there. The issue of payment of the water resource management charges is another one."*

What the analysis of the interaction between the values of efficiency and equity indicates is that the interactions between values are dynamic and can be influenced by the specific context, the actors involved, time scale, available resources for investment, etc. For example, to address the goal of equity, the emerging farmers needs to be efficient in their operations, but to be efficient, they need to be supported far more than is currently being done and given the time and resources that may be involved to provide such support, over a short period, this may seem inefficient, but however, in the long-term, it is necessary to address equity and operational efficiency. In summary, depending on the context and involved actors and situation, the interaction between the value of equity and efficiency can be mutually enhancing, leading to co-benefit and/or conflicting leading to trade-off.

Regarding sustainability in the context of equity and efficiency, the main challenge is that of infrastructure sustainability and development. Aging water resources infrastructure particularly the canals were identified as a critical barrier to expansion and inclusion of new water users that required regular water supply. One of the workshop participants lamented thus "*the challenge from my point of view is system deterioration and infrastructure deterioration, that to me is a massive and serious matter*". The deterioration of the infrastructure for example has led to collapse of a part of the canal system as indicated by a workshop participant "*...here for example, we have lost a section of the canal…the bureaucracy and the red tape that we had to go through to get it replaced is ridiculous, and it's over two years now, and repair and construction work is going at a snail pace"* The implication of aging infrastructure and non-maintenance is that it constrain the delivery of water to additional emerging farmers and expansion of the delivery system as remarked "*our canal system does not cover the entire catchment, so there is limit to what we can supply, because if you have emerging farmers where the canals do not reach, we cannot supply them water".*

To move from the conflictual interaction zone dynamics, which seems to be dominating in the Lower Sundays River catchment, our analysis suggests that the following would need to be considered:

i) ***Agent and capability development*** **–** On the value of efficiency and equity the interaction is mediated by a range of factors, e.g. the context and agent/capability. For example, to address the goal of equity, the emerging farmers needs to be efficient in their operations, but to be efficient, they need to be supported far more than is currently being done both in terms of their agency and capability development. Such development could take the form of technical training on farming, water use efficiency as well as mentorship/partnership that address procedural equity in relation to governance processes within the catchment. This was indicated by one of the participants as follows "*The issue there with the water allocation again is this issue that people right now, they have been given water, the water rights, but in terms of the other issues like the support, it's not there, the skills are not there, the markets they don't have"*. What this implies is that for equity, efficiency and sustainability to be co-enabling within the catchment, attention would need to be paid to agency and capability development.

ii) **Time-scale dependence –** The interactions between the values are complex and dynamic and are mediated by timeframe. What is clear from the results of this study is that time scale plays a critical role in terms of setting realistic equity, efficiency and sustainability goals. The achievement of equity goals in the context of ensuring efficient and sustainable production by emerging farmers is difficult and require time as already indicated by one of the research participants. Having the right expectations in terms of time is a necessary ingredient to ensuring that the right investment is made for equity goals, efficiency, and sustainability. Lending itself to this is the imperatives for having short, medium- and long-term goals to track and monitor progress towards the mutually enhancing zone dynamics. This is critical because given the time and resources that may be involved to provide all the necessary support to emerging farmers, over a short period of time, it may seems inefficient, but in the long-term, it may prove both efficient and sustainable, and thus achieving greater equity, efficiency and sustainability.

iii) ***Resources and investment***. To move towards the mutually enhancing zone dynamics in the Lower Sundays River catchment, where all three values would become co-enabling, and so-supportive, adequate resources would have to be set aside for investment into emerging farmers practices. For example, the following assertion demonstrate the scale of resources and investment needed both at a practice and policy level, "*when you get land, when you get water, the first aspect of equity you have now got. Then you move on to the next one which is the factors of production. The first factor of production you have got is the land, the second production factor is water, then you need capital, then you need the technical expertise of the chronological process of what you must undergo when you're planting, when you're growing the tree to get the tree to meet commercial and international standards. You must deal with issues of cash-flow because for the first 5 years you're not going to get any income. Also, as I am saying this, technical expertise you don't have because you are not coming from that background, you are not a Black boy who grew up in a farm that is owned by your dad who was a commercial farmer. So, the question then becomes, how do you supplement that*

lack of knowledge and expertise? Meaning now you are jump starting the equity agenda." As reflected in this assertion by one of the research participants, to achieve any of the three values require considerable on-going investments in policy reforms, human capital development, training, infrastructural development, and maintenance as well as measures to protect freshwater ecosystems from excessive exploitation.

iv) ***Strengthen multi-level governance system*** – participatory, multi-governance systems across social and ecological scales is critical to realising the three values of equity, sustainability, and efficiency in the Lower Sundays River catchment. This is particularly so because experience from previous interventions suggest that emerging farmers were not adequately consulted, or those in decision making positions do not have a full grasp of local issues. Multi-level governance system ensures that at the local level, emerging farmers participate fully and can influence the decision-making process, feeding dynamically into higher governance scale and vice versa. This way, issues related to procedural, recognitional, distributive and contextual equities would be addressed, which would in turn accelerate efficiency and sustainability (environmental, social, and economic).

Case study 2: Interactions between the values of participation, diversity, and efficiency in the Lower Sundays River catchment

Participation and diversity are important values promoted in the National Water Act (NWA) (Act No. 36 of 1998). The two important statutory institutions envisaged through which participation and diversity were to be promoted are Catchment Management Agencies (CMAs) and Water User Associations (WUAs). Since a CMA was yet to be in existence in the LSRC, the analysis in this section is focused on WUAs. Water Users Associations are conceptualised as institutions for water resource management at the local scale and are given transformational mandate to address and enhance participation, efficiency, sustainability, equity, and diversity (RSA 1998). The Act provides that where irrigation board exist, such irrigation boards are to be transformed into WUAs so that water users other than irrigators can equally participate in the management of water resources within their catchments. The intention was that through participation of all water users within a catchment, diversity and equity would be promoted. However, in the process of transforming irrigation board into WUAs, it seems that the Act unintentionally promoted the value of administrative and economic efficiency over that of participation, equity, and diversity, which are currently playing out as trade-offs in the Lower Sundays River catchment, and elsewhere where irrigation boards have transformed into WUAs (Hollingworth and Matsetela, 2012). It was both economically and administratively efficient to transform existing irrigation boards into WUAs, but, given that irrigation boards historically serve vested interests of commercial farmers, participation and diversity have not been adequately achieved. For instance, the provision of the Act was such that existing members of irrigation board shall automatically become members of the newly formed WUA. What this provision did was to inadvertently give existing members of irrigation board powers to set out the constitution, define the function of the WUA, without the participation of new members who were to join the WUAs later. While it was efficient to transform irrigation board to WUAs,

empirical evidence suggests that this has come at a great cost to the achievement of participation, diversity, and equity – the very reasons why irrigation boards were to be transformed. What this analysis demonstrates is that it is critical to consider the potential interactions of values, the context of the interaction, key actors likely to influence the ways value interact and the short and long-term implications of such interactions.

In the Lower Sundays River catchment, the interaction between the value of efficiency on the one hand, and that of participation and diversity on the other hand seemed to play out in the form of trade-off. There is evidence to suggest that the transformation of the Sundays Irrigation Board to the LSWUA was administrative efficient, and the subsequent LSWUA has been relatively efficient in its operations, e.g. water distribution, water use efficiency, and costs recovery (Clifford-Holmes, 2015). Part of this efficiency stems from the retention of staff, who have worked for the old irrigation board, as noted by one of the participants in the workshop *"… you know these people have been here for long and they know the system very well, so even if I don't want them, there is nothing I can do because we need them as they know the system*".

Although LSRWUA has proved economically and operationally efficient, it has not engendered broad base participation and diversity, which seem to suggest a trade-off between efficiency, and participation and diversity. For example, one of the workshop participants lamented that emerging farmers and other historically disadvantaged groups were underrepresented in all structures of the LSRWUA and therefore their participation has been poor "*I don't have a forum where I can approach emerging farmers, where I can be like right guys how can I help, this is what I'm able to do, this is what I'm allowed to do in terms of the (LSWUA) constitution, in terms of the Water Act, in terms of regulation. If there is a way, how can I, I'm sitting with a level of ignorance because I don't know what your problems are"* Further, another participant blamed the constitution of the LSRWUA as the reason why broad-based participation and diversity has been poor "*review your constitution… that constitution is racist"*." *The reason for this issue of emerging farmers or black people (*emerging farmers not participating in meetings of the LSRWUA), *this association was extremely racist before you came here*…"

To achieve the value of participation and diversity alongside efficiency require considerable resources. For example, historically disadvantage group may be unable to participate not out of unwillingness, but due to lack of capacity and capability to do so. In the LSRWUA for example, the current leadership seems to recognise the imperative for capacity and capability building as a necessary precursor to achieving participation and diversity, and this was reflected in the view of one of the workshop participants:

"…*but we now have a succession plan in terms of, as you know, our proposed staff, in terms of my control staff as you know it's only white, as one person retires, I've been giving preference to people of colour to replace them, if I could find a suitable candidate. We have got a colored gentleman who has now taken over in Kirkwood, I've got a junior officer coming in, I'm training them so that in years to come when my other gentleman goes on pension, he (the colour person) can move into that position fully. And as my senior staff move up, I will train those people (the colour people), so that we have a succession plan. We need to, the main*

problem is, is going to take time, there is no quick fix on this, there is a specific skill, a specific attitude and you need a very technical background".

What the above quote suggest is that realising the values of participation and diversity requires substantial time, resources, and effort, and may not happen without prior investment. The short-term, investments may not seat well with the value of efficiency, but over time, provided enabling conditions and resources are provided, it may become possible for values of participation and efficiency to be mutually enhancing.

Case study 3: Achieving greater efficiency, equity, and sustainability in the lower section of the Upper Vaal catchment

The Upper Vaal River catchment is highly developed and contributes about 30% of South Africa's Gross Domestic Product (GDP) (DWAF 2004). Manufacturing, trade, financial services, and mining are key contributors of Gross Geographic Products (GGP) within the catchment. For example, manufacturing alone is responsible for about 30% GGP, while trade and mining about `15% and 10%, respectively. Agriculture, despite its footprint within the catchment, contributes only about 2% of the GGP. The catchment is complex from a water management/governance perspective because of the growing human population, increasing industrial activities, the many and complex inter-basin transfer schemes and the persistent problems of pollution, and ecological degradation (Turton et al., 2006; Odume et al., 2018). Within the lower section of the Upper Vaal catchment, the interaction between environmental sustainability, economic efficiency, and equity (distributive and procedural equities) have been mostly conflictual, resulting in significant trade-offs (DWAF 2004; Odume et al., 2018).

One of the ways in which the conflictual zone dynamics plays out in the catchment is the contestation of water quality management applicable tools in the Lower section of the Upper Vaal catchment (Odume et al., 2018). Water use licencing is a source directed controls (SDCs) instrument imposed on water users to limit their uses and to control their impact to maintain acceptable water resource quality assessed through the resource quality objectives (RQOs). The RQOs are descriptive and quantitative measurable goals aimed at protecting water resources, whereas the SDCs are regulatory measures such as licences, permit and authorisation put in place to achieve the RQOs. However, water resource users within the catchment have contested the scientific credibility and defensibility of standards set by the regulators in their water use licences in terms of effluent quality standards permitted to be discharged into the receiving water resources. Some of the users have argued that the standards in their water quality licenses are not realistic and not economically viable, as meeting them would come "*at a great economic cost to their operation"*. The regulators on the other hand have insisted that water users must meet standards in their licences to ensure environmental sustainability.

In a survey conducted by the project team, all stakeholders who participated in the surveyed agreed that water resources within the catchment are very important, but when asked if the water quality component of the RQOs, which are intended to ensure environmental sustainability would be met in their current form, more than 70% of the respondent indicated that it was unlikely that the RQOs would be achieved. When probed further, responses reflected

the intricacies and complexity involved in concurrently meeting environmental sustainability as operationalised through RQOs (and enforced through impact control via water use licences) and economic efficiency:

"There is lack of commitment from the Department (DWS) in bringing all the role players in the CMFs so, to achieve RQOs purposes, big farmers are still missing in the CMFs and a lot of mines operate without WULs (water use licences), there are a lot of abattoirs that impacts the Vaal Barrage daily and don't even have Water Use Licences, etc. So, looking at the manner of approach to public participation(s) that took place with regards to RQOs and how positive progress will be achieved?"

"Clearly water resources are already polluted with water qualities worsening.

Increasing vandalism of water infrastructure and reticulation, the non-payment for water services and the filling of technical positions with unsuitably qualified/ experienced staff are contributing factors, pointing to serious socio-economic challenges, an unsustainable culture of non-payment for services, and the creation of serious essential technical skills shortages, e.g. the performance of WWTWs is getting poorer. WWTWs that previously complied, are finding it more and more difficult to complying, etc."

The water quality challenges of the lower section of the Upper Vaal do not only affect environmental sustainability but also impact on equity. In the Upper Vaal, spiritual water users have seriously been impacted due to water pollution arising from industrial and urban activities, which they have no control over. This equity concern was echoed by one of the research participants as "*…pollution in the lower section of the Upper Vaal is also affecting our people, the Sangomas, I mean people who use the water for rituals and other spiritual activities"*. This equity concern pertains to distributive equity of the sharing of benefit and risk associated with access to water resources. Another equity concern pertaining to procedural and contextual equities was raised by yet another research participant with regard to participation in CMFs within the catchment "*some of us are paid by our office to participate in CMFs, they pay our transport, and participation is part of our official duties, but many people in the communities cannot participate because they cannot afford the costs, for example of transportation*"

What is clear from the conflictual zone dynamics playing out in the catchment is that there seems to be continuing emphasis on economic benefits of water, e.g. water for industrial and urban development, but this has come at a great environmental cost, with equity concerns. However, continued emphasis on economic benefit as is the case of the lower section of the Upper Vaal, without considerable emphasis on environmental sustainability and equity concern may in the long-term undermine the achievement of economic efficiency, e.g. through costs required to treat heavily polluted raw water to an acceptable quality across user sectors. On the other hand, without efficiency in operations, environmental sustainability and distributive equity would also be undermined both in the short- and long-terms. For example, one of the participants reasoned that environmental sustainability was being compromised because of inefficiencies in the operation of wastewater treatment works in the catchment. These inefficiencies manifested in the form of *non-payment for water services (inefficiency in cost*

recovery) and the filling of technical positions with unsuitably qualified staff… and the creation of serious essential technical skills shortages (inefficiency in human resources process and thus impacting on overall operation of WWTWs), resulting in significant pollution of the waters of the lower section of the Upper Vaal. What is clear is that short-term considerations, without due regard to long-term goals and implications are likely to lead to value conflict and thus trade-offs.

To move from the conflictual interaction zone dynamics, which seems to be dominating in the Lower section of the Upper Vaal catchment, our analysis suggests that i) spatial-scale dependence, ii) multi-level participatory governance, iii) time-scale dependence, and iv) agent and capability are important factors that would need to be considered.

i) Spatial-scale and time-frame dependencies

Spatial complexity is an important factor determining the way in which the values of environmental sustainability, efficiency and equity are playing out in the catchment. For example, atmospheric deposition of sulphur, inter-basin transfer schemes and large-scale industrial water users and agriculture across multiple spatial scales are important contributors to water quality deterioration, impacting on the three values in ways that are scale dependent. Planning and governance processes that consider cross-scale dynamics are thus important for moving towards the mutually enhancing interaction zone dynamics.

The dominant zone of interactions is mediated not only by the spatial scale, but also the timeframe. Short-term emphasis on economic efficiency over both environmental sustainability and equity concerns would in the long-term undermine continuing efficiency. This would in turn impact environmental sustainability and equity. The implication is that a system level planning and implementation strategies are necessary to monitor progress towards the mutually enhancing interactive zone, away from conflictual zone. To do so, as with the lower Sundays River catchment case, short, medium- and long-term goals are necessary to track and monitor progress towards the mutually enhancing zone dynamics.

ii) Strengthening multi-level participatory governance

Top-down centralised governance system has been criticised for being exclusionary, command and control in outlook. Participatory, multi-level governance system is stressed as an alternative to deepening citizens participations. Within the lower section of the Upper Vaal, CMFs are among the platforms for multi-level governance, bringing stakeholders together across scales. However, as pointed out by one of the research participants, CMF remains ineffective governance platform "*if there is a problem like pump failure at a pump station, it takes long time for the municipality to react and fix the pump and they cannot complain to the government, because no one from the government is attending the forum*, *but there is a big failure from the government side, because first of all, I have my quarterly meetings with the stakeholders and without fail the representative from the local municipality never pitch up so we can't even talk with them about the issue"* Even though local municipalities have been implicated as key contributors to pollution in the lower section of the Upper Vaal, their non-

participation in CMF points to the need to explore ways for effective and coordinated participations in CMFs or in alternative multi-level structure.

iii) **Agent and capability**

The interactions between efficiency, equity and environmental sustainability in the catchment is mediated by agent/capabilities. Operational inefficiencies within local wastewater treatment works, for example, were identified as contributing to discharges of untreated/poorly treated wastewater effluents into water resources. Addressing these would require capability development, both at a technical, and operational scales. Regarding equity, participatory parity would have to be strengthened by addressing contextual factors that constrain participation of certain groups in the governance system and thus addressing procedural and contextual equities.

4.5 Conclusion

In this chapter we identified three dynamic zones of value interactions: i) the conflictual zone, ii) mutually enhancing zone and iii) the neutral zone. We reasoned that greater equity, sustainability and efficiency are better achieved in the mutually enhancing zone. Within this zone, the achievement of one of the values contributes to achieving the remaining two values. However, our empirical assessments suggest that in both catchments, the conflictual zone dominate. What this means is that the three values of equity, efficiency and sustainability are often in conflict in practical and policy sense, in such a way that practical and policy steps taken to achieve one value, constrain the achievement of the other values. We identified better understanding and the role of i) the context, ii) governance, iii) time-frame dependence iv) spatial-scale dependence v) agent and capability, and vi) resources and investment, as fundamental to shifting current realities of the conflictual zone interaction to the desired mutually enhancing zone of value interaction.

CHAPTER 5: POLYCENTRICITY IN WATER GOVERNANCE IN THE LOWER SUNDAYS RIVER AND LOWER SECTION OF THE UPPER RIVER CATCHMENTS

5.1 Introduction

The aim in this project is to consider the contributions of an ethically grounded and value-based approach to water governance, focusing on the case of two contrasting catchments. In chapters 3 and 4, we developed perspectives on water governance challenges and their ethical dimensions as well as analysis of key values underlying water claims and claimants in the catchments and how they come into conflict. Building on these, we also delivered an assessment of the ethical dimensions on values underlying water governance in the two catchments, considering specifically the ways in which greater equity, sustainability and efficiency can be achieved. This provides the background for consideration of the integrating approach that can help to improve value-based water governance in the two catchments. To this end, the present chapter aims to explain how polycentricity is instantiated in water governance in the catchments and what this could mean for policy instruments put in place to address substantive challenges. We consider in this chapter whether polycentricity in water governance contributes to effective cooperative governance in the two catchments under investigation.

The chapter is divided into four parts. In the first part, we provide a discussion of polycentricity as a concept and approach to governance. We move beyond this in part two to contextualise the need for polycentricity in the analysis of the contributions of an ethically grounded and value-based approach to water governance in the two catchment areas investigated. In part three, we present and discuss the key institutions in the catchments. Finally, we consider in part the degree of polycentricity and the implications for water governance in the catchment.

5.2 Polycentricity as a governance concept

Polycentricity as a governance concept has evolved in response to complex societal challenges (Ostrom et al., 1961; Folke, 2007). It was first conceived by Polanyi (1951), but further and extensively developed by Ostrom et al. (1961). The conceptualisation of polycentric water governance speaks to the realisation of the need for governance innovation and transformative changes to deal with complex water-related challenges in complex social-ecological systems (SES) (Pollard et al., 2011).

Like many concepts, polycentricity is contested in terms of its meaning, scope, and correct domain of application. This is not surprising, given that the concept recently became a prominent approach to interpreting phenomena in the social sciences. The promise of the concept is seen in the fact of its application in diverse contexts such as economics, politics, urban studies, and architecture to explain the modes of integration possible and the kinds of (re)organisation of governance that optimises the use of available resources. Among the many contexts in which the concept has gained in significance is the European Union where it was adapted as way of dealing with the Union's specific political concerns about integration and competitiveness (Meijers and Sanberg, 2008). One thing the deployment of the concept within the context of the European Union has shown is the possibility to rethink the mutual exclusivity

often assumed to obtain between social cohesion and economic competition of different clusters of power within a region.

For the sake of conceptual clarity, it is pertinent to distinguish between polycentricity and polycentrism. In this regard, the perspective put forward by Daniel Rauhut seems most adequate. He considers polycentrism "as something to aim for, a sort of doctrine, which is something normative." In contrast, polycentricity "is an analytical concept, a sort of tool-box, which can be used to achieve polycentrism" (Rauhut, 2017, 333). On this view, polycentricity is key to attaining polycentrism. It can be likened to the means that should lead one to achieve a particular end. When one attempts to bring about polycentrism, which is a situation in which an integrated governance system where power is decentralised is key, one must proceed by means of polycentricity. Said in another way, the prerequisite for realisation of polycentrism is the deployment of the analytical tools of polycentricity.

The history of polycentricity goes back to concerns about the inadequacy of monocentric as an approach to organisation of cities. Rauhut (2017) recounts that these concerns go back to the findings of Lynch and Rodwin (1958), Lynch (1961) and Wurster (1963). The main issue here is that, unlike the claims of monocentric which indicates that cities can be organized around single clusters, the reality is that multiple clusters define cities. Thus, relying on polycentricity became a way to better understand and deal with the complex systems that make up cities. Indeed, "during the 1980s, a shift in our understanding of urban structure took place in the wake of the rise of 'the economics of agglomeration' and 'clusters of activity'" (Rauhut, 2017, 334). This shift accounts in part for the rise of polycentricity as an analytical concept in the social sciences. The success of the concept can be traced to its operationalisation in dealing with complex issues related to optimising governance structures and efficient deployment of resources.

Building on research conducted in the 1960s and 1970s, scholars were able to demonstrate the usefulness of polycentricity in social science research on urbanism. To optimise systems and processes in urban areas, researchers turned to polycentricity to make sense of regions and not just particular cities (Davoudi, 2003). This focus on regions indicates a sense of polycentricity as main feature of contexts in which there are multiple centres of power or activity (Anas et al., 1998). One thing that is clear in the way the concept is characterised is that it emerges from developments that fit within the literature on globalisation. Davoudi put the point across succinctly when he suggested that "decentralisation of economic activities, increased mobility, complex cross-commuting and fragmented spatial distribution of activities" are the main features of modern cities studied through the deployment of the concept of polycentricity (Davoudi, 2003, 994).

Proponents of polycentric governance believe that it is suitable for dealing with complex natural resource governance challenges because i) of its enhanced adaptive capacity, ii) it offers institutional fit, iii) it mitigate risk through redundancy via overlapping functions and structures, iv) it provides opportunities for learning through enhanced experimentation, v) it creates room for a diversity of knowledge sources and knowledge sharing across scales (Baltutis and Moore, 2019; Gruby and Carlisle, 2019).

The idea that functional polycentric governance systems are more adaptive stems from their design structure, a system that has multiple, largely autonomous decision-making centres. As empirical evidence suggests that social-ecological systems are complex, behave in non-linear, largely non-predictable fashion (Gruby and Carlisle, 2019), proponents of polycentric governance argue that its multiple decision-making centres can independently experiment with different rules across multiple scales in the face of changing social-ecological conditions (Ostrom, 2005). Thus, the supposed agility of the multiple decision-making centres, and their largely autonomous nature, which can facilitate their ability to rapidly change their rules, are attributes that enhance the adaptive capacity of polycentric governance systems. Pahl-Wostl (2009) defines governance adaptive capacity as "the ability of a resource governance system to first alter processes and if required convert structural elements as response to experienced or expected changes in the societal or natural environment" (p. 355).

Polycentric governance system is said to offer institutional fit or sometime refers to as context-sensitive institution due to what some scholars have termed "near decomposability" which refers to a multi-level subsystem within larger systems in a hierarchical governance system (Gruby and Carlisle, 2019). The argument is that within each sub-system, largely autonomous decision-making centres can design institutions that reflect local social-ecological realities. Such institutions are functionally linked vertically and horizontally across and within the larger systems (Schroder, 2018). The largely autonomous decision-making centre at each system level implies that they can make decision and judgement of appropriate institutional fit or congruence at that level, while retaining some authority to influence the larger systems across the natural resource governance setting (Boaman, 2018). In the context of social-ecological systems, institutional fit implies that institutions are matched with the spatial, temporal, and functional dimensions/characteristics of the ecological challenge/problem, while reflecting the values, aspirations, and interests of the social grouping the institution is designed to represent or govern. Institutional fit is thus theorised as an important advantage of polycentric governance systems, allowing it to address complex water governance challenges across scales.

Polycentric governance systems have been claimed to mitigate risk of institutional failure and natural resource governance collapse (Ostrom, 2001). This claim stems from that fact that polycentric governance systems constitute multiple decision-making centres with overlapping functions across multiple levels of jurisdiction and scales (Gruby and Carlisle, 2019). Redundancy in a polycentric system takes two dimensions: i) duplication of functions by decision-making centres and ii) a diversity of institutions oriented towards the governance of a common problem. The basic assumption behind the redundancy claim is that as more than one centres may be responsible for governing a particular resource, it decreases the likelihood of policy failure (Ostrom, 2001). For instance, in a system where one centre is responsible for natural resource management, e.g. a monocentric top-down governance system, policy failure at the national level may have devastating effect on the entire nature resources being managed or governed. A good example of this is how the dysfunctionality of DWS had a substantial effect on the whole sector and beyond, because other institutions (e.g. CMAs, WUAs) meant to be in place, and that could have compensated for some of the DWS failures, were not yet in existence. However, if multiple autonomous centres, which are largely independent but functionally redundant are responsible for natural resource management across scales and

jurisdiction, such a national policy failure can be mitigated at the local level through local interventions facilitated by decision-making centres or institutions at such levels. Although redundancy can be conceived as an important strength of a polycentric governance system, care must be taken to reduce costs due to mandate overlap and duplication of functions (Baltutis and Moore, 2019).

Polycentric governance systems by their nature favour multiplicity of units, institutions and centres of decision making. Due to the large numbers of largely autonomous centres, units, and institutions across multiple scale, it is believed that the potential of experimentation is enhanced compared to a single, large centre. The increased experimentations by different units across social-ecological scales and jurisdiction lead to enhanced learning due to higher degree of exposure to new ideas, challenges, concepts, methods, and potential to experiment with new and emerging set of rules (Baltutis and Moore, 2019). The idea that polycentric governance system facilitated enhanced learning based on the assumption of information and knowledge flow across the largely autonomous units or centre. Without such information flow, learning can be constrained and restricted to units where experimentation is undertaken. It has been argued that enhanced learning due to experimentation can improve overall governance systems and reduce the risk of failure across the system (Baltutis and Moore, 2019).

The growing recognition of the complexity of water governance challenges has led to the believe that governance systems able to accommodate diverse knowledge systems and knowledge sources are better suited to tackling complex sustainability challenges. By design, polycentric systems are more amenable to accommodating local and diverse knowledge systems and sources because of the multiplicity of autonomous units and centres of decision-making. Accommodation or inclusion of diverse knowledge systems, including traditional knowledge, can lead to better natural resource governance as decision making processes can better reflect local interests, values and aspirations.

How then has the operationalization of polycentricity occurred? One important reason why we should consider this question is the fact that the features of polycentricity become evident when we consider the ways in which it is deployed. Generally, the operationalization of the concept has largely proceeded through efforts at measurement. The features of this concept, considered from this perspective, circles back to the views about what makes contexts polycentric. Thus, Champion (2001, 664; Green 2007, 2081) suggests that the three features of a polycentric urban context are a) a collection of settlements in a region, b) interactions between settlements and c) specialist function within each region. Harking back to Spiekermann and Wegener (2004), Green points out four basic requirements necessary for the measurement of polycentricity. These are as follows:

- In a polycentric urban system, there is a distribution of large and small cities
- In a polycentric urban system, the rank-size distribution is log-linear
- A flat ran-size distribution is more polycentric than a steep one
- A polycentric urban system is not dominated by one large city

All this point to the fact that certain features of a region must obtain for such a context to be viewed not just as polycentric but also for the concept to be successfully applied as a means of explanation, optimization and maximization of resources.

In the literature on polycentricity, especially with regard to its measurement and features, a crucial distinction is made between morphological and functional polycentricity. Martijn Burger and Wvert Meijers distinguished between the two forms of polycentricity. For the exponents of the morphological sense of the concept, "the term polycentricity basically refers to the plurality of urban centers in a given territory". The functional understanding of the concept seeks to do more than is possible through the morphological perspective. As Burger and Meijers pointed out, "those who adhere to the relational or functional dimension of polycentricity do not dismiss the morphological approach, but rather, extend it to include also the pattern of functional interaction between the urban centers" (Burger and Meijers, 2012, 1133). We can consider a uniting point of the two views the understanding that polycentricity enables effective interaction of various centers of power or activity. The aim is to attain polycentrism which is generally characterized by reduced conflict and increased effectiveness.

From this discussion, we can see that polycentricity is particularly useful in a situation like the two catchments that form the core of this study. To see why this is the case, it is necessary for us to revisit the governance configuration in the catchment and the distinctive water governance issues that arise in both contexts. This will enable us then to consider in fuller details the extent and possibilities of polycentricity and the governance implications in the catchments.

5.3 Water governance configuration in the Lower Sunday River and lower section of the Upper Vaal catchments

To procced with our analysis and reflection of polycentricity in the two catchments, we first present the prevailing water governance configurations and key institutions or decision-making centres in the catchments. The rationale is that by presenting the prevailing governance configuration, one can use the identified attributes of polycentricity to explore the degree of polycentricity within the governance systems in the two catchments.

5.4 Water governance configuration in the Lower Sunday River catchment (LSRC)

The governance of water resources in the LSRC is undertaken by a range of institutions (both formal and informal) and actors within and outside the catchment. Some of these institutions and actors, e.g. the Lower Sundays River Water User Association (LSRWUA), the Department of Water and Sanitation and the Sundays River Valley Municipality (SRVM) derived their powers and authority from legislative provisions. However, other key institutions such as Lower Sundays River Catchment Management Forum (LSRCF), farmers associations and other formal, non-statutory bodies derive their steering power through trust. To this end, only critical institutions are presented as part of the governance configuration within the LSRC.

The Lower Sundays River Water User Association (LSRWUA)

The LSRWUA was established in 1917 as an Irrigation Board, primarily serving the purpose of large-scale commercial farmers requiring irrigation water to grow and sustain their crops

(LSRWUA 2005). However, with the enactment of the National Water Act, Act No. 36 of 1998, the Board was transformed into the current LSRWUA. The LSRWUA is the primary bulk water supplier within the LSRC. The LSRWUA operates and maintain extensive canal systems with which it delivers bulk raw water to a range of water users including the Sunday River Valley Municipality (SRVM), commercial farmers, the tourism sector as well as emerging farmers. The LSRWUA also delivers bulk water to the Nelson Mandela Bay Metro via the Scheepersvlakte Dam.

The LSRWUA sets out several principal and ancillary functions aligned with the provision of the NWA

Sundays River Valley Municipality

The Sundays River Valley Municipality (SRVM) serves as the water services provider (WSP) and water services authority (WSA) within the catchment. It receives raw water from the LSRWUA and then treats it before distributing the treated water to the domestic population within the catchment. The raw water from the LSRWUA is stored in four reservoirs and an old storage canal, from which the water is delivered into the water treatment works (WTW) (Clifford-Holmes, 2015). Treated water is then delivered to the urban areas of Kirkwood, Bergsig, Aquapark, Moses Mabidha and Emsengeni. The SRVM owns and maintain the technical infrastructure for the domestic water supply. The functionality and operation of the SRVM are thus critical for access to domestic water supply within the catchment and overall water resources governance.

The SRVM as both a WSP and WSA derives its function from the Water Services Act (Act No. 108 of 1997) (RSA 1997). It is mandated to provide water services in ways that are equitable, efficient, and economically sustainable. The LRVC being an area with high level of unemployment and poverty, raises serious concern about the ability of the SRVM to recover costs on services provided, and to sustain the supply of water.

Lower Sunday's River Catchment Management Forum (LSRCMF)

The NWA envisaged catchment management forums (CMFs) as grass root, non-statutory water institutions meant to deepen the democratic space in terms of water resource management. They are vehicles for stakeholder participation about decision making on water resource management, and serves as the conduit for diverse interests, values, stakeholders, debates, and aspirations. Despite the significance of the LSRC in its contribution to the production and export of citrus in South Africa, and a well-developed inter-basin transfer scheme, it previously had no CMF. However, there is an on-going process led by the Eastern Cape regional office of the Department of Water and Sanitation (DWS) to establish the LSRCMF (DWS 2019). Given that the LSRCMF is not a statutory institution, its objectives are centred around promoting stakeholder's participation in water resources matters, facilitating inclusivity and cooperative governance, as well as providing an avenue for influencing decision and supporting the establishment of the proposed Mzimvubu-Tsitsikamma Catchment Management Agency (CMA). Nevertheless, the terms of reference of the CMF, which are still being debated covers such issue such as operational, strategy and planning, coordination, and facilitating implementation of water uses as well as accountability. Given that substantive progress has

been made before the onset of the COVID-19 pandemic, we presented the LSRCMF as a critical water governance institution within the LSRC.

Department of Water and Sanitation (DWS)

The DWS is the national government department responsible for the overall management of water resources in South Africa. Through the Department, the national government act as the custodian of water resources in the Republic as enshrined in the NWA. The Department ensures that the purposes of the NWA, which include the protection, use, development, conservation, management, and control of water resources are fulfilled across the Republic. The DWS is thus the umbrella regulatory institution responsible for water resources protection, management, development, conservation, management, and control. Within the LSRC, the DWS manages the inter-basin transfer scheme and associated infrastructure. The Orange-Fish-Sundays Rivers inter-basin transfer scheme (IBT) is a made up of a series of tunnels and canals that allow the transfer of water from the Orange River to the Great Fish River and then the Little Fish and finally into the Darlington Dam in the Lower Sundays River. The DWS is responsible for the management of the IBT and associated infrastructure up to the Darlington Dam, but from the Darlington Dam and below, the bulk water infrastructure is managed by the LSWUA.

Department of Agriculture, Land Reform and Rural Development (DALRRD)

The largest water user sector in the Lower Sunday River catchment is irrigated agriculture and DALRRD is responsible for the development of policies and strategies for the agricultural sector. In 2012 the then Department of Agriculture, forestry and fisheries (DAFF) published a draft business plan on the revitalisation of irrigation schemes and identifies water allocation reforms and water quality as critical elements to the successful implementation of the business plan (DAFF 2012). The business plan targets small-scale irrigation schemes and emerging or resource poor farmers. It identifies several existing challenges for failure of existing irrigation scheme or their below optimum performance. These reasons include i) financial viability of the irrigation schemes, ii) land ownership/tenure, crop-soil suitability, iii) model of business operation, iv) a lack system approach to planning and implementation, v) governance and institutional measures needed for successful implementation of viable irrigation scheme vi) the imperative for capacity development for emerging/resource poor farmers in terms of water use efficiency, farm operation and business model, including access to credit and market. The DALRRD is thus an affected and interested party when it comes to water governance as water is a critical element to fulfilling its mandate, and its policies have serious implications for the governance of water resources within the LSRC.

Citrus Growers Association

The Lower Sunday River catchment supports large scale commercial irrigated agriculture. Majority of the farmers within the catchment are citrus growers, and the inter-basin water transfer scheme was originally established to support the irrigated agriculture sector. The Citrus Growers Association (CGS), which is made up of both commercial and emerging farmers, can be seen as powerful and influential stakeholder grouping about water resource governance within the catchment. Its primary objective is to represent the interest of the citrus industry and to ensure profitability and sustainability of the citrus industry, considered as the backbone of

the Sundays River Valley economy. Given that it is likely to view water governance from a market perspective, where the primary goal is profitability, market penetration, pricing and input efficiency and output effectives, its role need to be balanced by other water management institution in terms of equity and social justice.

Commercial and emerging farmers

The commercial and emerging farmers within the LSRC are a critical stakeholder as they constitute one of the main water user sectors within the valley. Further, the bulk of levies and charges paid to the LSRWUA come from the farmers within the valley and are thus very influential in the governance of water resources within the catchment.

Nelson Mandela Bay Metropolitan Municipality (NMBM)

Although physically outside the LSRC area, the NMBM rely on raw water from the LSRC for its domestic supply to residents. The LSRWUA supply bulk water to NMBM from the Darlington Dam via the Scheepersvlakte Dam, which is then treated at the Nooitgedacht water treatment works (WTW). The NMBM serves as the water services provider (WSP) and water services authority (WSA) within the Nelson Mandala Bay Metro. The raw water it receives from the LSRC is treated before it is distributed to the domestic population. Even though the NMBM does not rely entirely on water from the LSRC, its share of water from the catchment is 7-folds greater than the raw water receives by the SRVM. From 2010-2011, Clifford-Holmes (2015) reported that raw water supplied to NMBM was over 28 million m^3 compared to just over 3.6 million m^3 of water supplied to the SRVM. The NMBM can thus be an important water institution that influence the governance of water, to the extent that it depends on water resources from within the catchment for its needs.

5.5 Water governance configuration in the lower section of the Upper Vaal River catchment (LSUVC)

Several formal and informal institutions impact upon the governance of water resources within the LSUVC. These institutions operate across multiple scales and jurisdictions. Much of the water within the broader Vaal catchment comes through international transboundary transfer scheme, managed by national and local institutions within the catchment. It is therefore important that institutional consideration within the catchment considers the international dimensions. Critical institutions consider here include the Orange-Senqu River Commission (ORASECOM), the Lesotho Highlands Water Commission (LHWC), Trans-Caledon Tunnel Authority (TCTA), Department of Water and Sanitation (DWS), Rand Water, East Rand Water Care Company (ERWAT), local municipalities within the catchment, catchment management forums (CMFs), Save the Vaal Environment (NPO), Vaal Action Group (Voluntary association), Sasol, and ESKOM.

Orange-Senqu River Commission (ORASECOM)

The Vaal River is one of the major tributaries of the Orange River system. The Vaal River system relies on water transfer through inter-basin transfer scheme from the Lesotho Highlands, and thus the governance processes of water within the Vaal stretched beyond the administrative boundaries of the Republic to include other riparian States of the main Orange-

Senqu River system. Realising the imperative for cooperation, consultation and collaboration, the riparian states of the Orange-Senqu River system signed the Agreement for the establishment of the Orange-Senqu Commission (ORASECOM) on November 3, 2000. ORASECOM is the transboundary institution responsible for ensuring that water resources of the Orange-Senqu River systems are sustainably, equitably developed, utilised, and shared among the riparian States through coordination, cooperation and consultation. It is thus an important institution to the extent that its function may impact on water resources within the Upper Vaal that receives water from Lesotho.

The Lesotho Highlands Water Commission (LHWC)

The Lesotho Highlands Water Commission (LHWC) was established to facilitate the implementation of the Lesotho Highlands Water Project (LHWP) (Mirumachi and Van Wyk, 2010). The LHWC was formally known as the Joint Permanent Technical Commission through a treaty signed in 1986 by the Apartheid government of South Africa and the military regime in Lesotho. South Africa and Lesotho each have a delegation through the TCTA and the Lesotho Highlands Development Authority (LHDA), respectively.

Trans-Caledon Tunnel Authority (TCTA)

The TCTA is an agency of the National Department of Water and Sanitation and is responsible for infrastructure development of LHWP on the South African side. It was established initially to finance, and development infrastructure related to South African commitment to the LHWP. Its mandate has since been expanded since the year 2000 and is now able to finance and develop water-related infrastructure outside of its original mandate related to the LHWP. It is considered an important water governance institution as it manages the tunnels that deliver water from Lesotho into the Vaal River system.

Department of Water and Sanitation

In the absence of a catchment management agency, the regional office of the DWS plays a key role in the management of water resources within the LSUVC. In addition to its oversight and regulatory function, it is engaged in data collection, facilitating consultation, and coordinating stakeholders as well as water quality monitoring, water use authorisation, compliance, and enforcement monitoring in the catchment.

Rand Water and East Rand Water Care Company (ERWAT)

Rand Water is the primary bulk water services provider within the catchment. It is responsible for bulk water abstraction, treatment, and delivery to municipalities for onward supply to residents. Rand Water has also continued to play active role in water resources management within the catchment. It is currently involved in water quality data collection and monitoring of water flow/volume within the Vaal system.

The ERWAT is responsible for wastewater related services, including conveying, treating, and disposing off treated wastewater as well as sludges. Its activities are of critical importance due to their likely effects on the receiving river resources

Catchment management forums

As earlier discussed, catchment management forums (CMFs) are envisaged in the NWA as non-statutory grass-root institutions for inclusive and participatory governance and management of water resources at the catchment, and sub-catchment scale. Active catchment forums within the broader lower section of the Upper Vaal include the Blesbokspruit catchment management forum, Klip catchment management forum, Leeu-Taaiboschspruit catchment management forum and Rietspruit catchment management forum (https://www.reservoir.co.za/).

Non-government institutions

Within the Vaal catchment, critical non-governmental, organised institutions exist through which civil society and citizens play active role in water resources governance. Critical among these institutions are the Save the Vaal Environment and the Vaal Action Group. Both organisations have similar aims – the protection of the Vaal River system, awareness raising about the danger of pollution, and mobilising citizens to hold government to account through the instrument of the law. The Save the Vaal Environment organised itself as a non-for-profit organisation (NPO), whereas the Vaal Action Group is an association of volunteers.

Industries and mines

The catchment of the lower section of the Upper Vaal is highly industrialised and contains many industrial bulks water users. Critical among them are ESKOM and Sasol.

5.6 Insights from cultural theory on the water governance institutions in the catchments

Polycentricity is not just about a diversity of institutions, autonomous decision-making centre that are coordinating among themselves, but it also ought to pay attention to the motivation, aspiration, and collective voices of these institutions. Cultural theory, in particular the theory of plural rationality shed light on the never-ending struggles that exist between four primary institutions and in a way, the outcome of these struggle manifest in terms of the distribution of risk and benefit, and in this context, those of water resource governance. The plural rationality theory postulates four kinds of social solidarity around natural resource governance and these are i) the individualism (which are driven primarily by market forces and do favour privatisation), ii) the hierarchists (that favours hierarchical governance mode, i.e. the government), the egalitarians (whose work are mostly advocacy, e.g. civil society) and the fatalists (the often voiceless, marginalised groups) (Umejesi et al., 2018).

In ideal situations, different actors/stakeholders come to the negotiating table with diverse, often self-serving demands on other actors. Each actor tries to appropriate as many goods and leeway as possible from the other contending actors. For instance, while the government often insists on loyalty to its regulatory oversights from other actors, the egalitarians insist on the treatment of all stakeholders as equal. On the other hand, the individualists (or the market actors), who are self-serving and profiteering, resist regulatory oversights of the government. Finally, the voiceless fatalists, who have no reach on policymaking, often retreat under the intense contestations of the three powerful actors – the hierarchists, the individualists and egalitarians. Cultural theory of plural rationality assumes that in order to be heard the loudest

in policy making, stakeholders build alliances (i.e. solidarities). For instance, it is not often out of place to see government aligning with business on environmental policy matters such as mining, water governance, and other environment-related questions. While these two actors may not often agree, their solidarity ('alliance of convenience', sort of) gives them upper hand in their 'fight' with the egalitarian actors. The egalitarians, as their name suggests, advocates for equality and strong legislation to protect the environment and society. Cultural theory sees the egalitarians as advocates for the rights of the voiceless (fatalists), and their right to participate in policymaking. In other words, both the egalitarian actors and the fatalists are natural allies for fending off the combined weight of government and business.

Viewed from a cultural theory of plural rationality perspectives, in both catchments, particularly in the Lower Sundays River catchment, there seems to be not strong enough egalitarian institutions participating in water governance. This has serious questions as to how the fatalists are effectively factored into decision making, and how the risks arising from such decisions are minimised for the fatalists in the catchments. Think about the problem of drowning of children in the water canal systems in the Lower Sundays River catchment.

5.7 Instances and degree of polycentricity in water governance in the two catchments – developing an analytical framework

In the previous section, we presented the water governance institutional context in the two catchments. To address the question of whether theses institutional arrangement constitute polycentric governance system, we first develop a simple analytical framework. The framework is based on the attributes of polycentric governance system derived from an extensive literature review. We use the framework to reflect on the current institutional arrangements in the catchment to determine the instances and degree of polycentricity operating in the catchments. Having reviewed and presented the conceptual dimensions of polycentric governance, here for analytical purpose, we summarised its key attributes as distilled from the literature (Table 5.1).

Table 5.1: Key attributes of polycentric governance system applied to reflect on polycentricity in the two catchments

Key attributes	**Description**
Presence of multiple, largely autonomous decision-making centres (or governance units) across scales	As espoused earlier, a key characteristics of a polycentric governance system is the presence of multiple governance units, which are largely autonomous and can act on their own behalf regarding the governance of a particular good or problem. Ideally, these governance unit exist across multiple spatial and jurisdictional scales. Autonomy in this context implies some measures of independence. These governance unit may be formal, informal – whether statutory or not, but operates under sets of rules.
Interaction, coordination, and interrelation between the governance units across scales	The presence of multiple governance units does not necessary qualifies a system to be termed polycentric, unless the multiple units are engaged in some coordinated interactions, showing some measures of interrelations and interdependence. The coordinated interaction and interrelation can take the form of cooperation, competition, conflict, and conflict resolution (Schronder, 2018).
Common collective problem or good	Schronder (2018) argued that for analytical purpose, to identify a polycentric system, then the question of what is being governed is very important to distil not only the system boundary but also to identify the key governance units within the boundary of the system. Here, following Schronder, we refer to what is being governed as the common collective problem or good.
Defining operating rules (rules-in-use)	A key distinction between a polycentric governance system from a fragmented one is that governance units act to take account of each other within well-defined sets of rules – these rules may be in-use or in-form. Therefore, in reflecting on the instances of polycentricity in the catchments, we consider whether there are rules-in-use that guide the interactions between the governance units.

Using the attributes of polycentric governance system, we develop an assessment grid (Figure 5.1) to qualify the instances and degree of polycentricity in the two catchment systems. Based on the assessment grid, four degrees of polycentricity are identified: i) matured polycentricity, ii) x-emerging polycentricity, iii) y-emerging polycentricity and iv) budding polycentricity. We characterised matured polycentricity as instances where a multiplicity of autonomous or largely autonomous units exists governing a resource in such a manner that show effective coordination, displaying interdependence, high frequency, and varying intensity of interactions within define set of rules.

Two types of emerging polycentricity are identifiable, the first exemplifies a situation where few governance units are responsible for key governance processes and decision making, but there is high degree of coordination and interactions between these units, showing high levels of interrelations and interdependence. We termed it y-emerging polycentricity. The x-emerging polycentricity exemplifies a situation whereby a diversity of largely autonomous units is responsible for and participate in the governance processes but show low coordination ability and thus low level of interrelation and interdependence. The fourth degree of polycentricity is what we have termed budding polycentricity typifying a situation where poor coordination and interrelations exist between the few governance units operating within a catchment.

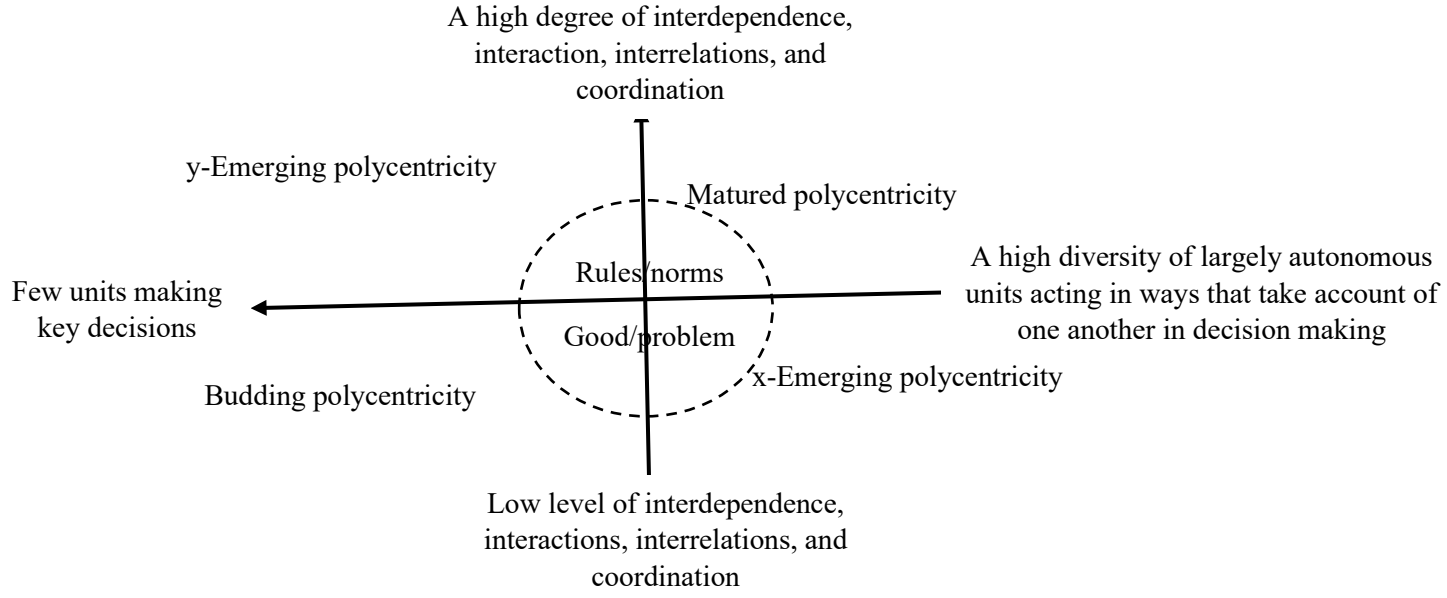

Figure 5.1: Analytical framework for assessing the degree of polycentricity in the two catchments

5.8 Reflecting on the instances and degree of polycentricity and governance implications for the LSRC and LSUVC

The two pieces of legislation pertinent to the water sector (resources and services) seemed to conceptualise a polycentric water governance system for the Republic (Figure 5.2). The governance institutional arrangements provide for largely autonomous governance units across scales that are inter-dependent with some degree of redundancy in terms of both territorial and

functional overlap. For example, Water Users Association are local institutions and in terms of schedule 5 of the NWA, their principal functions are diverse including water resource protection, water use efficiency, regulation of flow, infrastructure maintenance, prevention of unlawful use of water. Nearly all function identified for WUAs can also be performed by a catchment management agency (CMA) when one exists, showing redundancy both in terms of territorial and functional dimensions. However, implementing the provisions of the NWA in terms of governance and institutional arrangement has proved difficult, particularly in relation to the establishment of CMAs. In both catchments, i.e. LSRC and LSUVC, CMAs are yet to be formally established and functional.

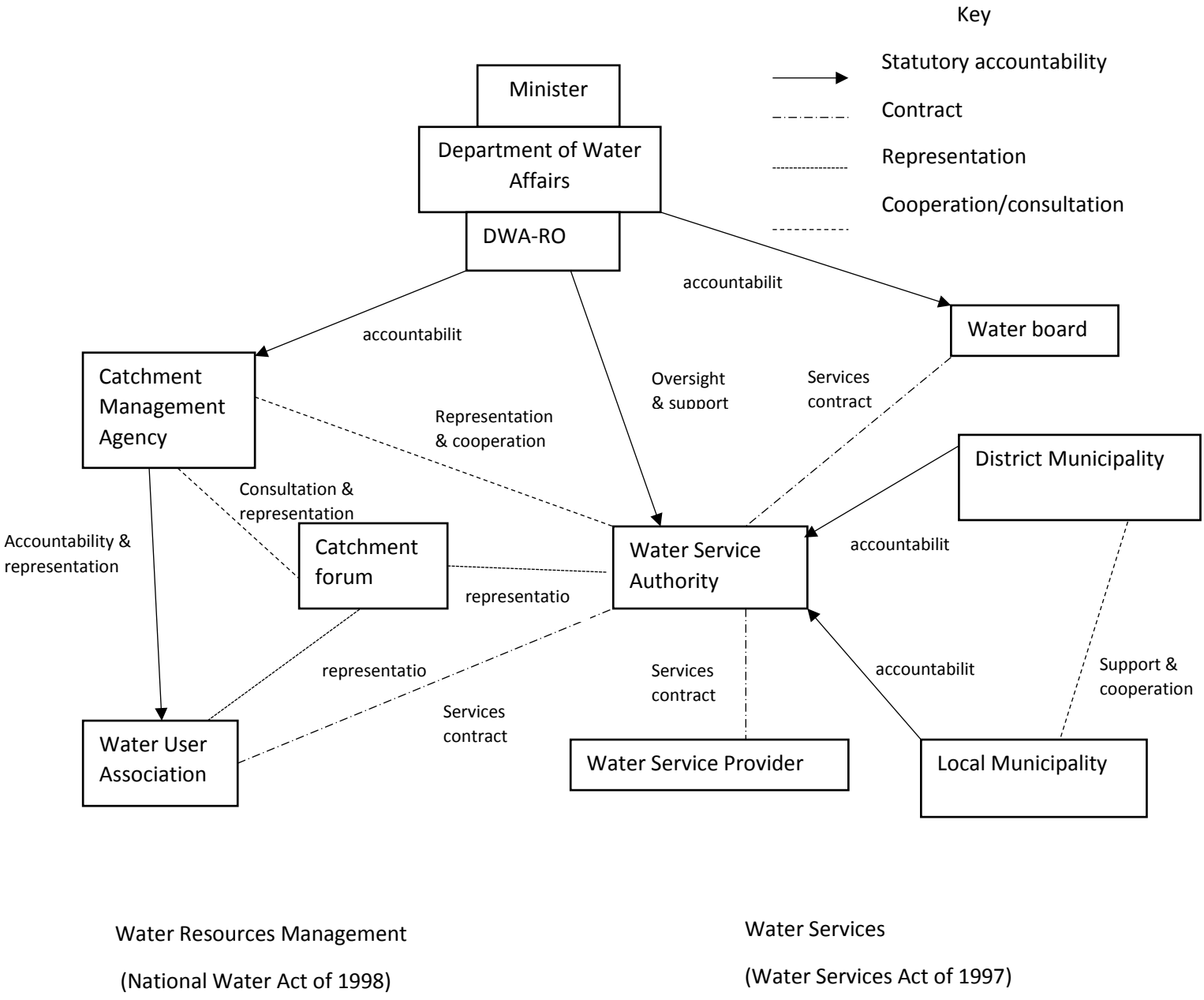

Figure 5.2: Institutional arrangements for the key institutions within the water sector (Source: Clifford-Holmes, 2015).

In the LSRC, key water governance processes, including decision making rest with the DWS and the LSRWUA, although the organised private sector particularly the commercial famers have largely influenced such decisions. The agricultural sector plays a critical role in the catchment, influencing water governance processes. The DALRRD is seen as a key decision-making centre that influence water governance, even though coordination between it and DWS and LSWUA has been poor. CMFs which are conceptualised to democratise decision making within the water resources sector are only being established in the LSRC. Thus, an assessment of water governance within the catchment show evidence of budding polycentricity (Figure 5.3) with only a few governance units, i.e. the DWS and LSRWUA making key water resources decision, with evidence of low level of coordination and inter-dependence between the DWS, LSRWUA, SRVM, citrus farmers associations and other governance units identified earlier.

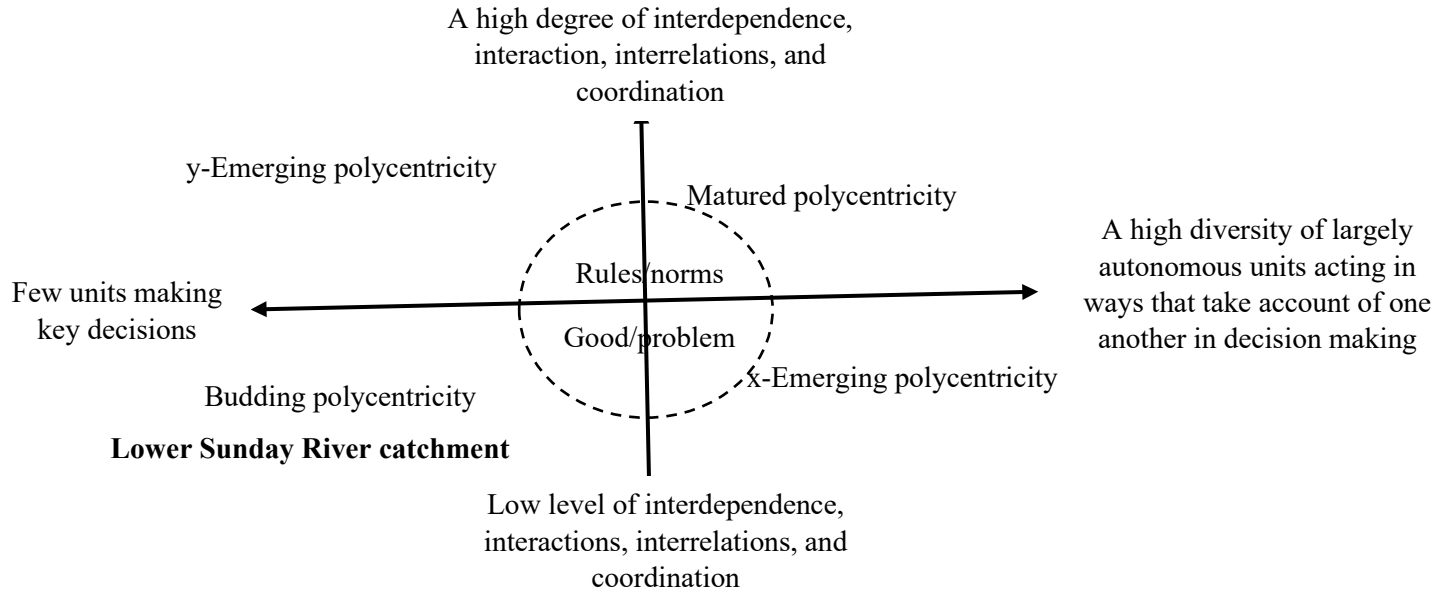

Figure 5.3: Application of the polycentric analytical assessment grid placing the Lower Sunday River catchment in the budding polycentricity quadrant.

Proponents of polycentric governance system argue that the presence of multiple decision-making centres, that are largely autonomous, operating at the same or different scales, has the potential to enhance accountability as each independent, autonomous units act to hold one another to account through competition, conflict resolution or cooperation. In South Africa, accountability and cooperative governance failures have been identified as serious governance challenges plaguing the water sector (Weston and Goga, 2016). In the LSRVC polycentricity is only evolving, with few key governance units making decision, with low coordination across multiple governance units. For example, one of the workshop participants noted about accountability and cooperative governance that *"the different government departments do not work together because they see working together as interference when other departments come to help, especially amongst the ministers*".

The diversity of institutions at multiple scales can facilitate participation in polycentric governance systems. The NWA envisages participation and representation as key values within water management institutions, which should ideally influence the governance of water resources, steering the resource from an undesirable state to a desirable one. A number of grassroots institutions are envisaged to give effect to stakeholder participation and representation. One of such non-statutory institution is catchment management forums (CMF). Catchment management forums (CMF) create platforms for the public and stakeholders to participate in the management of water resources within a catchment. In the LSRVC a CMF is only beginning to emerge and despite the water user association being a grassroot institution, participation and representation within this institution has been found to be poor. This view was supported by participants in the LSRC workshop, in which one of the participants bluntly echoed "*review your constitution… that constitution is racist".* Further elaborating, the participant indicated" the *reason for this issue of emerging farmers or black people (*emerging farmers not participating in meetings of the LSRWUA), *this association was extremely racist before you came here*…". The view that the LSRWUA is still very much exclusive and inequitable is still very much widespread among emerging farmers within the valley as acknowledged by one of the workshop participants "*uhh, I won't sugar coat it, we do come from a very racist background…. We need to break that barrier down, now…".*

In the lower section of the Upper Vaal, a diversity of water governance institution exists at multiple scales. One of the reasons for this is that the Vaal River system receives water through a trans-boundary inter-basin transfer scheme. The implication is that governance units exist from international to local level. The existence of non-governmental, private sector driven institutions within the catchment further strengthens accountability mechanism, although most official decisions are made largely by a few government-institutions such as the DWS, TCTA and Rand Water. As discussed and presented, a diversity of institutions exists in the Upper Vaal system, but empirical evidence suggest low level of coordination, interrelations and inter-dependence between the various governance institutions and units, implying an x-emerging polycentricity in the catchment (Figure 5.4). The implication of the existence of x-emerging polycentricity is the need to strengthen coordination, accountability, and interrelations between the various institutions. An important mechanism for this is to accelerate the establishment of a CMA for the Upper Vaal to champion institutional coordination within the catchment.

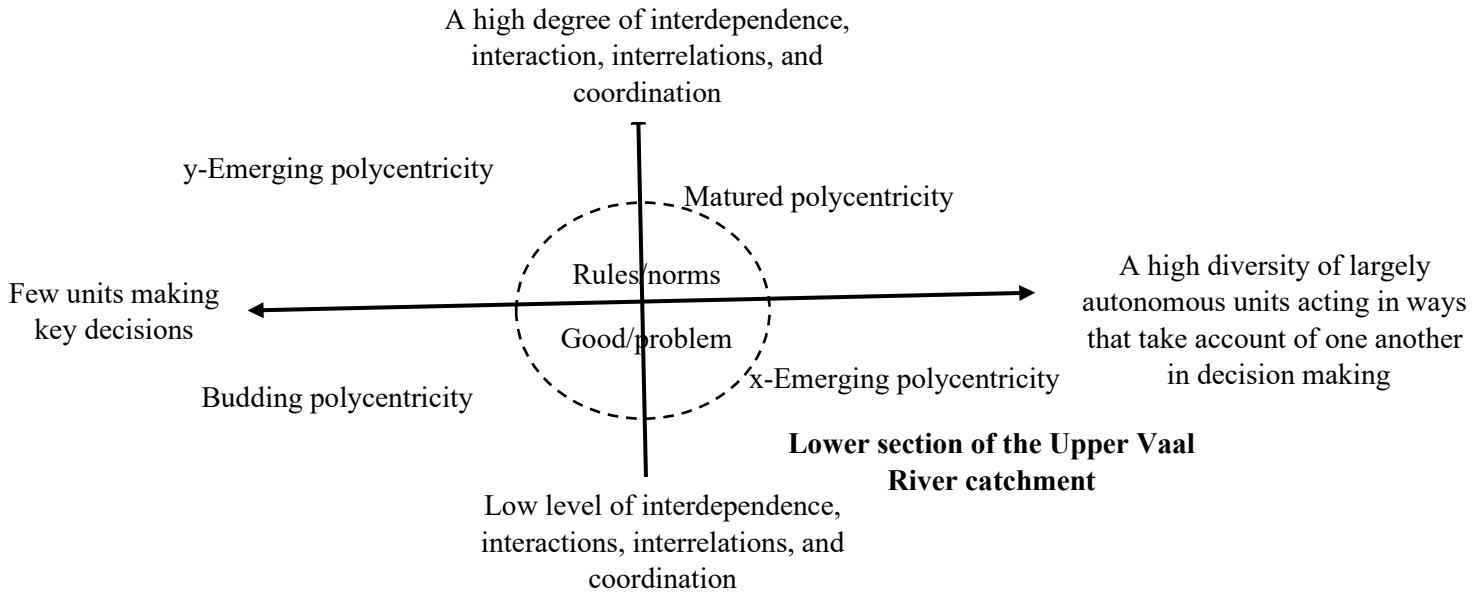

Figure 5.4: Application of the polycentric assessment grid placing the Lower section of the Upper Vaal catchment into x-emerging polycentricity quadrant.

5.9 Conclusion

In both catchments, we found no evidence for matured polycentricity, instead our analysis revealed varying degree of polycentricity. In the Lower Sunday River catchment, polycentricity was characterised as budding, whereas in the lower section of the Upper Vaal catchment, due to the presence of a diversity of governance units, it was characterised as x-emerging polycentricity. The absence of matured polycentric governance systems in the two catchment implies that a top-down approach to governance still dominates, in which decision may not largely reflect social-ecological realities. Further, institutional adaptive capacity may be diminished due to the absence of a matured polycentric system within the catchment, as does the governance system to mitigate risk accruing from policy failure at one level or due to a single governance unit. We suggest the acceleration of the establishment of CMAs, and strengthening of coordination among existing institutions, while enhancing the capacity of organised, non-statutory institutions to participate and influence the governance processes in the two catchments.

CHPATER 6: SYNTHESIS, CONCLUSION AND RECOMMENDATIONS

6.1 Synthesis and conclusion

Water governance is a concept that has gained increasing acceptance in the academic circle. It purports to be suitable for addressing complex sustainability challenges confronting the water sector such as increasing water scarcity, pollution, biodiversity loss, and infrastructure decay. This project aims to consider the contributions of an ethically grounded and value-based approach to water governance, focusing on the case of two contrasting catchments. In doing so, we develop an ethics framework for analysing and reflecting on the ethical dimensions of water governance challenges in the two catchments. For example, effective participation, institutional legacies, and transformational challenges were identified as a key governance challenge in the Lower Sundays River catchment. We reasoned that serious ethical concern exist about perpetuating power differentials regarding access to water resources within the Lower Sunday's River catchment, thus raising issue of distributive justice. For example, the National Water Act provides that members of irrigation board shall automatically become members of WUA, inadvertently giving such members powers to set out the constitution, define the functions of the WUA within the ambit of the law. This raises serious ethical challenge as historically powerful interests within irrigation boards retain enormous disproportionate influence over the agenda and trajectory of the LSRWUA.

Accountability, cooperative governance, clear roles, and responsibilities are also identified as governance challenges within the catchments. We argued that these are matters of ethics in as much as in a country where most people live in poverty, resource use optimisation should ideally be prioritised. However, accountability is blurred because of a lack of clarity regarding various roles and responsibilities within the water governance systems within both catchments. A serious ethical challenge is that stakeholders are often not clear who to hold responsible for system and infrastructural failure, thus diminishing stakeholder influence over decision making, and the governance of water resources within the catchments.

Building on the perspectives on water governance challenges and their ethical dimensions, we undertook an analysis of key values underlying water claims and claimants in the catchments and how the values of equity, efficiency and sustainability may interact. To be analytically piercing, we draw on the theories of ethics to reflect on and reason about values. In this regard, one may reason about value and morals from the perspective of consequentialism, deontology, virtue ethics, Ubuntu moral theory and systemic-relational perspectives. Each of these strands of ethical thoughts consider morally acceptable actions from different perspectives. By applying thinking from these field of ethical theories, one can clarify value claim about water in the catchment. For example, governance institution emphasising efficiency are said to be consequentialist in moral outlook and in design, whereas those laying claim to water because of equity consideration may be better judged from the perspectives of Ubuntu moral theory. In the same sense, a wider respectful consideration of all components of the social-ecological system are best interpreted from the systemic relational perspective. By drawing on the theories of ethics, in this study we lay the foundation for clarifying value claims to water in the catchments, but the perspectives developed in this study can be applicable elsewhere.

Building on the ethics theories for clarifying values, we then ask the question – how can greater equity, sustainability and efficiency be achieved in the two catchments? This is critical because the values of equity, sustainability and efficiency assumed *de facto* status in the National Water Act. To address this question, we develop a framework for analysing value interaction in water governance, and factors that may impact on such interactions. We identified three dynamic zones of value interactions: i) the conflictual zone, ii) mutually enhancing zone and iii) the neutral zone. We reasoned that greater equity, sustainability and efficiency are better achieved in the mutually enhancing zone. Within this zone, the achievement of one of the values contributes to achieving the remaining two values. However, our empirical assessments suggest that in both catchments, the conflictual zone dynamic dominates. What this means is that the three values of equity, efficiency and sustainability are often in conflict in practical and policy sense, in such a way that practical and policy steps taken to achieve one value, constrain the achievement of the other values.

We identified better understanding of and the role of i) the context, ii) governance, iii) time-frame dependence iv) spatial-scale dependence v) agent and capability, and vi) resources and investment, as fundamental to shifting current realities of the conflictual zone interaction to the desired mutually enhancing zone of value interaction. There are fundamental practical and policy implications in this regard. The first is a deeper appreciation of the true meaning of the values of equity, efficiency, and sustainability. For example, in practical and policy sense, equity needs to be better understood as a multidimensional concept involving procedural equity, distributive equity, contextual equity and recognitional equity. Short-sighted policy measures may focus on the distributive dimension, but this may not lead to a holistic achievement of the practical implication of equity. In the same sense, efficiency as we have demonstrated is also multidimensional, so is sustainability, which has ecological justice implication.

Second, long-term policy instruments are needed to better appreciate how the three values may interact, the context in which such interaction come to play and the factors that may contribute to whether the interactions may be conflictual or mutually enhancing. For example, we have demonstrated in Chapter 4 of this report that equity needs to be construed as a long-term goal, but requiring short-term, medium, and long-term indicators for monitoring. In the short-term, the pursuit of equity may negatively impact on efficiency as return on investment, e.g. irrigation water set aside for emerging farmers as in the case of lower Sunday River catchment, may not need yield the desired investment returns. This may necessitate the question of whether emerging farmers are efficient. But we have argued that if equity is construed as a long-term goal, with short-term, medium, and long-term indicators, then policy measures and implementation mechanism have to be formulated to show better appreciation of the complexity of how i) the context, ii) governance, iii) time-frame dependence iv) spatial-scale dependence v) agent and capability, and vi) resources and investment, impact on the achievement of equity in the face of efficiency and sustainability. The converse is also true, e.g. how efficiency can be achieved in the face of equity, and sustainability. One of such policy measures is mechanisms to strengthen good governance – here we take the normative view of governance (see Chapter 3).

Third, we reasoned that the achievement of greater equity, efficiency and sustainability is a complex policy, managerial and practical exercise particularly in a country with a unique history in which most of the population were excluded from access to fundamental resources such as water and land ownership right. There are no quick fixes in this regard. In all their dimensions, policy and managerial actions must consider how these three values interact in practical sense in specific contexts.

We consider polycentricity as a governance approach whether it can contribute to effective cooperative governance in the two catchments under investigation and thus a value-based approach to water governance. Polycentricity as a governance concept has evolved in response to complex societal challenges (Ostrom et al., 1961; Folke, 2007). Its proponents believe that it is suitable for dealing with complex natural resource governance challenges because i) of its enhanced adaptive capacity, ii) it offers institutional fit, iii) it mitigates risk through redundancy via overlapping functions and structures, iv) it provides opportunities for learning through enhanced experimentation, v) it creates room for a diversity of knowledge sources and knowledge sharing across scales (Baltutis and Moore, 2019; Gruby and Carlisle, 2019). To this end, we consider in part the degree and instances of polycentricity and the implications for water governance in the catchments. Drawing on the key characteristics of polycentricity, we develop an analytical assessment grid to determine the degree of polycentricity in the two catchments. We use i) presence of multiple, largely autonomous decision-making centres (or governance units) across scales, ii) interaction, coordination, and interrelation between the governance units across scales, iii) common collective problem or good, and iv) defining operating rules (rules-in-use), as the basis of the analytical grid. Based on the assessment grid, four degrees of polycentricity are identified: i) matured polycentricity, ii) x-emerging polycentricity, iii) y-emerging polycentricity and iv) budding polycentricity. We characterised matured polycentricity as instances where a multiplicity of autonomous or largely autonomous units exists governing a resource in such a manner that show effective coordination, displaying interdependence, high frequency, and varying intensity of interactions within define set of rules.

Two types of emerging polycentricity are identifiable, the first exemplifies a situation where few governance units are responsible for key governance processes and decision making, but there is high degree of coordination and interactions between these units, showing high levels of interrelations and interdependence. We termed it y-emerging polycentricity. The x-emerging polycentricity exemplifies a situation whereby a diversity of largely autonomous units is responsible for and participate in the governance processes but show low coordination ability and thus low level of interrelation and interdependence. The fourth degree of polycentricity is what we have termed budding polycentricity typifying a situation where poor coordination and interrelations exist between the few governance units operating within a catchment.

The empirical evidence in the two catchments suggest that none has matured polycentric governance approach. This then raise implication regarding the degree of adaptive capacity of the operating governance approaches in the two catchments. We reasoned that given the complexity of achieving equity, efficiency and sustainability, a high degree of adaptive capacity offered by a polycentric governance approach is desirable. The level of polycentricity

in the two catchments then raises serious policy and implementation question regarding institutional designed and operationalisation in the catchments and by extension in the country. As we have argued, the governance of water in the context of social-ecological system is complex. Institutional fit across the social-ecological scale is thus required. The degree of polycentricity in the two catchment raises concern as to the alignment between institutional fit and social-ecological realities. Such an alignment is needed to achieve greater equity, efficiency and sustainability as factors impacting on these values operate across social-ecological scales.

Another governance implication that is raised in the catchment in terms of degree of polycentricity is whether there is enough room for learning and experimentation, and whether the current institutional and governance processes benefit from a diversity of knowledge sources and knowledge sharing across scales (Baltutis and Moore, 2019; Gruby and Carlisle, 2019). For instance, diversity of knowledge sources and knowledge sharing imply participation by diverse stakeholders across jurisdictional scales in decision making. Such participation give effect to procedural equity, which may in turn accelerate distributive equity imperative through representation and participation of diverse interest groups, particularly those who have been historically marginalised. We reasoned that the degree of polycentricity in the two catchments may have contributed to the observation that equity imperatives are often in conflict with those of efficiency. Part of the reason for this is that experimentation and knowledge sharing from diverse sources are critical to realise equity goals, yet current institutional design operating in the two catchments may not give sufficient room for such experimentation and knowledge sharing across scale and from diverse sources.

6.2 Recommendations

6.2.1 Policy and implementation

i) This study raises fundamental practical and policy issue. First there is a need for a deeper appreciation and understanding of the true meaning of the values of equity, efficiency, and sustainability. As we have demonstrated that these values are complex and multidimensional, relevant policies in the water sector need to appreciate these complexities and multidimensionality. For example, in policy matters, equity needs to be positioned in a multidimensional sense as including procedural equity, distributive equity, contextual equity and recognitional equity. This also applies to the multidimensionality of sustainability and efficiency. There is a need for a balance focus on all dimensions of these values as they are inter-linked, avoiding short-sighted policy measures that may focus on just one dimension, e.g. distributive equity or technical efficiency.

ii) Long-term policy instruments are needed to better appreciate how the three values may interact, the context in which such interaction come to play and the factors that may contribute to whether the interactions may be conflictual or mutually enhancing. Specifically, it needs to be made explicit in policy instruments that the pursuit of equity in the water sector is a long-term gaol. In this regard, indicators for monitoring equity progress in the short-, medium-, and long-terms also needs to

be developed and implemented in specific context. Policy guidance also needs to be given on how the pursuit of the values of equity, efficiency and sustainability may interact in the short-, medium- and long-term, and what needs to be done to shift these interactions away from conflictual to mutually enhancing. This would require a good understanding of time-frame dependence and spatial-scale dependence on the interactions between these values.

iii) The concurrent achievement of equity, efficiency and sustainability in the water sector is a complex exercise impact upon by several factors. In this regard, policy guidance is needed on how specific context in the water sector may influence the achievement of these value. Good governance also needs to be strengthened. A clear policy intent and implementation mechanisms need to be mapped on strengthening capabilities in the water sector and setting aside resources for investing into equity, sustainability, and efficiency imperatives over the short-, medium- and long-terms.

iv) There is an urgent need for institutional reformation and re-design in the water sector as exemplified in the two catchments to enhance their fit to local social-ecological realities and adaptive capacity, promote participation and experimentation, learning, knowledge sharing from diverse sources and systems. For example, in the case of the Water Users Associations (WUAs) urgent reformation is needed to redesign these institutions so that historical institutional legacies that impede on transformation, effective participation and power differentials are not perpetuated. As at the time of writing, this task has been taken up by the Department of Water and Sanitation, urgent finalisation of this process is needed.

v) The National Water Act envisages the gradual realisation of mature polycentricity in the water resource sector. As the current analyses have demonstrated, this is far from being realised. Urgent policy and implementation measures are needed to remove administrative and other bottlenecks impeding on the establishment of all envisaged water resource management institutions, and their effective coordination and functioning as autonomous units across social-ecological, spatial, and jurisdictional scales.

vi) Training of policy makers, managers and water sector stakeholders is required across institutional and governance scales on how ethical thinking may contribute to clarifying value claims in the water sector, and its role in water diplomacy and dispute resolution. This is necessary because much of the conflict around water are indeed value conflict.

6.2.2 Further research

The following recommendation are made for future studies

i) Examine and analyse the extent to which current institutional designs and governance processes in the water sector are contributing to the conflictual interactions between the value of equity, sustainability, and efficiency. Such an examination is important to distil important institutional elements necessary for

shifting current realities away from conflictual value interaction zone dynamics to the mutually enhancing value interaction zone dynamics.

ii) Undertake a case study-based approach to develop indicators that draw on the multidimensionality of equity, efficiency, and sustainability and to use the developed indicators to monitor the effectiveness of the implementation mechanisms for the values of equity, efficiency, and sustainability. Such study should also distil the role of agency and capability on the values of equity, efficiency, and sustainability in diverse contexts.

iii) The present study has developed a several analytical frameworks i) that of value interactions, ii) ethical theories for reflecting on value claims, and iii) analytical grid for assessing the degree of polycentricity and iv) that for reflecting on ethical dimensions of water governance challenges. Future studies that apply these frameworks in comparative case studies are needed to validate them and to further distil lessons on the role of ethics in water governance for policy and implementation.

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